DONALDSONCOAL
Part of the Yancoal Australia Group
ABN: 87 073 088 945

YANCOAL
兖煤澳大利亚有限公司

# Annual Review

## Abel Underground Coal Mine
1 January 2022 – 31 December 2022

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# DONALDSON COAL

PTY LTD

ABN: 87 073 088 945

# Annual Review

for the

# Abel Underground Coal Mine

1 January 2022 – 31 December 2022


**Prepared for:**

Donaldson Coal Pty Ltd
ABN 87 073 088 945

1132 John Renshaw Drive
BLACKHILL NSW 2322

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Email: donaldson@doncoal.com.au

**Prepared by:**

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Ref No. 737/28b

March 2023


DONALDSONCOAL
Part of the Yancoal Australia Group

# TITLE BLOCK

| | |
|---|---|
| **Name of Operation** | Abel Underground Coal Mine |
| **Name of Operator** | Donaldson Coal Pty Ltd |
| **Development consent / project approval #** | 05_0136 |
| **Name of holder of development consent / project approval** | Donaldson Coal Pty Ltd |
| **Mining Lease #** | ML1618 and ML 1653 |
| **Name of holder of mining lease** | Donaldson Coal Pty Ltd |
| **Water licence #** | 20WA218986 and WAL41525 |
| **Name of holder of water licence** | Donaldson Coal Pty Ltd |
| **RMP start date** | 1 August 2022 |
| **RMP end date** | Not Applicable |
| **Annual Review start date** | 01/01/2022 |
| **Annual Review end date** | 31/12/2022 |

**I, Phillip Brown, certify that to the best of my knowledge this report is a true and accurate record of the compliance status of the Abel Underground Coal Mine for the period 1 January 2022 to 31 December 2022 and that I am authorised to make this statement of behalf of Donaldson Coal Pty Ltd.**

*Note.*

*a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

*b) The Crimes Act 1900 contains other offences relating to false and misleading information: Section 192G (Intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); Section 307A, 307B and 307C (false or misleading application/information/documents – maximum penalty 2 years imprisonment or $22,000, or both).*

| | |
|---|---|
| **Name of authorised reporting officer** | Phillip Brown |
| **Title of authorised reporting officer** | Environment and Community Relations Superintendent |
| **Signature of authorised reporting officer** | Phil Brown |
| **Date** | 29 March 2023 |

# CONTENTS

**Page**

# CONTENTS

**Page**

# 1. STATEMENT OF COMPLIANCE

The compliance status of relevant approvals was reviewed for the reporting period and is summarised in **Table 1.1**. It was determined that there were no non-compliances relevant to the reporting period.

**Table 1.1**
**Statement of Compliance**

| **Were all conditions of the relevant approval(s) complied with?** | **Yes / No** |
|---|---|
| Project Approval 05_0136 | Yes |
| Mining Lease 1618 | Yes |
| Mining Lease 1653 | Yes |
| Water Supply Works Approval 20WA218986 and Water Access Licence 41525 | Yes |

# 2. INTRODUCTION

## 2.1 OVERVIEW OF OPERATIONS

The Abel Underground Coal Mine ("Abel Mine") is located approximately 23km northwest of Newcastle, New South Wales (see **Figure 2.1**). Following the grant of Project Approval 05_0136 in June 2007, the Company undertook construction and mining activities until the mine was placed in care and maintenance from 2 May 2016. Activities undertaken to date include the following.

i) Construction of surface infrastructure and facilities, including the administration offices, amenities, service and storage facilities and car parking area, within the surface infrastructure area.

ii) Initial mine construction involving the formation of three mining portals and underground roadways and construction of the ventilation, conveying and coal stockpiling systems.

iii) Coal recovery using bord and pillar methods including first and second workings.

iv) Processing of recovered coal at the Bloomfield Colliery CHPP and transportation via the Bloomfield Rail Loop and Spur and subsequently via the Main Northern Railway.

Several of the earlier activities relating to the mine, involving the formation of the box cut within which the surface facilities and ROM stockpiles are located, were undertaken as part of the approved Donaldson Open Cut Coal Mine.

## 2.2 SCOPE AND FORMAT

This Annual Review for the Abel Underground Coal Mine has been compiled by R.W. Corkery & Co. Pty Limited (RWC) on behalf of Donaldson Coal Pty Ltd (the "Company"). Donaldson Coal Pty Ltd became part of Yancoal Australia Limited in July 2012.

This is the seventh Annual Review submitted for the mine, following nine Annual Environmental Management Reports, and is applicable for the period 1 January to 31 December 2022 ("the reporting period"). The information presented within this Annual Review has been compiled based on information and advice provided by the Company.

This Annual Review generally follows the format and content requirements identified in the Department of Planning and Environment's (DPE) *Annual Review Guideline* dated October 2015 and meets the requirements of Condition 4, Schedule 6 of PA 05_0136.

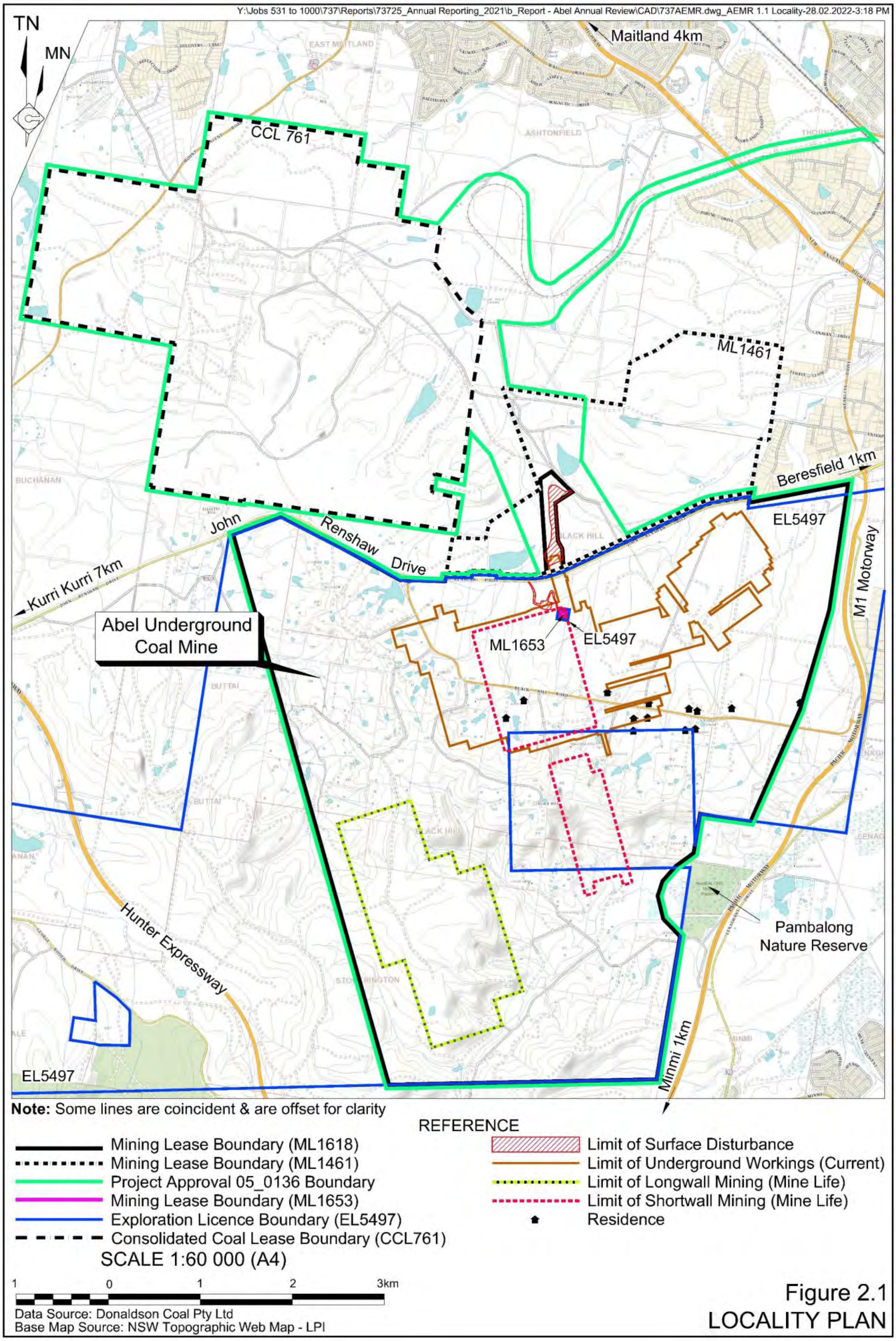



Figure 2.1
LOCALITY PLAN

## 2.3 KEY PERSONNEL CONTACT DETAILS

The Manager, Mining Engineering, Mr William Farnworth is the primary mine contact (Tel: 02 4993 7356). Mr Farnworth is currently the Manager Mining Engineering for legislative purposes and as such, is responsible for the environmental management of the mine and ensuring compliance with all relevant legislative obligations. Mr Phillip Brown (Tel: 02 6570 9219) is the nominated Environment & Community Relations Superintendent and is also responsible for the environmental management of the mine. The contact details for the mine office are as follows.

| | | |
|---|---|---|
| Postal Address: | Donaldson Coal Pty Ltd | Tel: 02 4015 1100 |
| | PO Box 2216<br>GREENHILLS NSW 2323 | Fax: 02 4015 1159 |
| Email: | donaldson@doncoal.com.au | |
| Physical Address: | Abel Underground Coal Mine | |
| | 1132 John Renshaw Drive<br>BLACKHILL NSW 2322 | |

A 24-hour Environmental Hotline (Tel: 1800 111 271) is maintained by the Company. Details of calls taken on this number are forwarded to the Environment and Community Relations Superintendent for further actioning, if required.

# 3. APPROVALS

The Company has operated the approved activities at the mine under the approvals listed in **Table 3.1**.

**Table 3.1**
**Abel Underground Coal Mine – Consents, Leases and Licences**

| Consent/Lease/Licence | Issue Date | Expiry Date | Details / Comments |
|---|---|---|---|
| Project Approval 05_0136 | 7 June 2007 | 31 December 2030 | Granted by the (then) Minister for Planning and last modified on 04 December 2013. |
| Mining Lease ML 1618* | 15 May 2008 | 15 May 2029 | Granted by the Minister for Primary Industries. Incorporates 2 755ha of surface area. |
| Mining Lease ML 1653* | 21 January 2011 | 21 January 2032 | Granted by the Minister for Primary Industries. Incorporates 0.25ha of surface area. Issued construction of ventilation shaft. |
| Environment Protection Licence No. 12856 | 9 July 2008<br>(licence version date<br>(1 October 2021) | Not applicable | Issued by the (then) Department of Environment and Climate Change (EPA).<br>EPL 12856 has previously been consolidated with updated conditions applicable to both the Donaldson Coal Mine and Abel Underground Coal Mine. |
| Water Supply Works Approval 20WA218986 | 01/07/2016 | 30/06/2029 | Bore Licence 20BL171935 was issued for the interception and inflow of groundwater due to the underground mining operations. Following commencement of the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016* in July 2016 20BL171935 was converted to a water supply works approval and water access licence with an allocation of 500ML/year. |
| Water Access Licence (WAL) 41525 | 01/07/2016 | Continuing | |
| * See **Figure 2.1** | | | |

It is noted that this Annual Review has been prepared to fulfil the annual reporting requirements of Project Approval 05_0136 and WAL 41525. A separate Annual Return has continued to be submitted to the NSW EPA in accordance with the requirements of Environment Protection Licence (EPL) 12856.

During the reporting period, the conditions of the Mining Leases were updated by the Department of Regional NSW (DRNSW) in accordance with the amendments to the *Mining Regulation 2016* and the Operational Rehabilitation Reform. As a result, separate annual reporting requirements now also apply to the Mining Leases. These reports will be lodged directly with DRNSW in accordance with the latest requirements and guidance.

The Company also holds Exploration Licence 5497 (see **Figure 2.1**) incorporating a 4687ha surface area. Exploration Licence 5497 was originally granted on 22 July 1998, was renewed on 7 October 2022 and has a current expiry date of 22 July 2025.

# 4. OPERATIONS SUMMARY

## 4.1 MINING OPERATIONS

Coal mining activities were suspended on 2 May 2016 when the site was placed into care and maintenance. No coal mining was undertaken during the reporting period or is planned during the next reporting period. **Table 4.1** presents a summary of the production statistics.

**Table 4.1**
**Production Summary**

| Material | Approved limit (specify source) | Previous reporting period (actual) | This reporting period (actual) | Next reporting period (forecast) |
|---|---|---|---|---|
| Waste Rock / Overburden ($m^3$) | None specified | 0 | 0 | 0 |
| ROM Coal / Ore (t) | 6 100 000 (PA 05_0136 Cond 2/6) | 0 | 0 | 0 |
| Coarse Reject (t) | None specified | 0 | 0 | 0 |
| Fine Reject (Tailings) (t) | None specified | 0 | 0 | 0 |
| Saleable Product (t) | None specified | 0 | 0 | 0 |

## 4.2 OTHER OPERATIONS DURING THE REPORTING PERIOD

No exploration, land preparation, construction or processing activities were undertaken during the reporting period.

Environmental monitoring activities continued throughout the reporting period in accordance with the approved management plans. Results of this monitoring is summarised in Sections 6 and 7.

A Rehabilitation Management Plan (RMP) and Forward Program were prepared during the reporting period in accordance with the Operational Rehabilitation Reforms and amendments to the *Mining Regulation 2016*.

## 4.3 NEXT REPORTING PERIOD

The activities proposed for 2023 will principally involve continued monitoring and, if required, maintenance activities. The following provides a summary of the planned activities.

### Exploration

No exploration is currently planned to be undertaken during the 2023 reporting period.

### Mining

No mining is currently planned to be undertaken during the 2023 reporting period.

### Rehabilitation

No specific rehabilitation activities are currently planned for the 2023 reporting period as all existing disturbance areas are associated with active surface infrastructure. However, work will continue to be undertaken in development of the closure strategy, including commencement of a rehabilitation materials balance report, and reflected in updates to the Rehabilitation Management Plan, as appropriate. Any rehabilitation works undertaken will relate to rehabilitation of any subsidence impacts or to ongoing maintenance, principally erosion and sediment control.

### Monitoring

The following monitoring will be undertaken during the next reporting period.

- Air Quality – ongoing $PM_{10}$ monitoring will continue to be undertaken.
- Surface water – ongoing surface water quality at a range of routine monitoring sites located within Blue Gum Creek, Viney Creek, Buttai Creek, Four Mile Creek and a number of local water storages. This monitoring will be undertaken as part of the integrated monitoring with the Bloomfield, Donaldson and Tasman Extended Mines.
- Groundwater – ongoing groundwater quality and level monitoring will be undertaken as part of the integrated network of monitoring bores for the Bloomfield, Donaldson and Tasman Mines. Measurement of the quality and volume of inflow water to the underground workings will also continue to be undertaken.
- Noise – Bi-annual noise monitoring will continue whilst the mine remains on care and maintenance.
- Flora and Fauna – flora and fauna surveys and reporting will continue to be undertaken in accordance with approved Flora and Fauna Management Plan. It is noted that, whilst the mine is on care and maintenance, the Pambalong Nature Reserve, dam monitoring and sub-tropical rainforest monitoring will be deferred pending the recommencement of mining.
- Meteorological – the on-site meteorological station at the Abel Mine will be maintained and data collated.
- Subsidence monitoring will continue to be undertaken in accordance with the approved subsidence monitoring programs.

### Community Consultation and Liaison

The Community Consultative Committee (CCC) will continue to be convened during the next reporting period. In accordance with CCC feedback, it is expected that meetings will now be held annually unless otherwise agreed with the Committee. The 24hr environmental hotline will be maintained and a register retained of any complaints received.

# 5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The 2021 Annual Review was submitted to the Resources Regulator and the Department of Planning and Environment (DPE) on 30 March 2022. Feedback was received from the Resources Regulator compliance coordination unit dated 4 April 2022 and DPE dated 27 May 2022. No further action was required to be undertaken.

In addition to feedback on the Annual Review, correspondence from DPE on 16 December 2022 outlined additional reporting content for future Annual Reviews. This additional reporting content is required for all coal mines and includes reporting on the following.

1. Biodiversity offsets – reporting on the long-term security arrangements for biodiversity offsets including information on the type of long-term security arrangements that have been/are to be implemented. – *Refer to Section 6.6.*
2. Greenhouse gas – reporting on the greenhouse gases for the reporting period and comparison of actual emissions against the predictions in the environmental assessment. Reporting of all reasonable and feasible steps undertaken during the reporting period to improve energy efficiency and reduce greenhouse gas emissions. – *Refer to Section 6.5*.

# 6. ENVIRONMENTAL PERFORMANCE

## 6.1 SUMMARY OF ENVIRONMENTAL PERFORMANCE

A summary of environmental performance for the principal environmental aspects is provided in **Table 6.1**. Further detail regarding specific environmental aspects is also provided in the following subsections. It is noted that a range of monitoring activities are integrated with the Donaldson Open Cut Coal Mine and Bloomfield Colliery. The following subsections present results specific to the Abel Mine with data relevant to other operations presented in their respective Annual Reviews.

**Table 6.1**
**Environmental performance**

| Aspect | Approval criteria / EIS prediction | Performance during the reporting period | Trend/key management implications | Implemented/proposed management actions |
|---|---|---|---|---|
| Noise | No exceedance of applicable noise criteria. | No exceedances and no complaints. | Implies management measures are currently adequate. | No additional management action required. |
| Blasting | No exceedance of applicable blast criteria. | No blasts undertaken. No complaints. | Implies management measures are currently adequate. | No additional management action required. |
| Air Quality | No exceedances of applicable air quality criteria. | No exceedances and no complaints. | Implies management measures are currently adequate. | No additional management action required. |
| Biodiversity | No significant impacts upon flora, fauna species, populations, communities or habitat. | No impacts upon flora, fauna species, populations, communities or habitat were recorded. No effect upon Pambalong Nature Reserve or Sub-tropical rainforest. | Implies current mining design and safeguards are currently adequate. | No additional management action required. |
| Heritage | Management in accordance with approved Aboriginal Heritage Management Plan. | No heritage items undermined during the reporting period. No subsidence impacts. | Implies no specific management actions were necessary. | No additional management action required. |
| Subsidence | Subsidence management in accordance with approved Subsidence Management Plan / Extraction Plan. | No notifiable events occurred. | Implies management measures are currently adequate and predictions sufficiently accurate. | No additional management action required. |

## 6.2 METEOROLOGICAL MONITORING

An automated weather station, installed for the Donaldson Mine, has been approved by the (then) Department of Planning as also meeting the requirements for the Abel Mine. The weather station records wind speed and direction, temperature, rainfall and solar radiation. This station was subsequently relocated in March 2015 to adjacent the Helipad near the Abel surface facilities (see **Figure 6.1**). A summary of the rainfall data since commencement of the Abel Mine in 2007 is presented in **Table 6.2**.

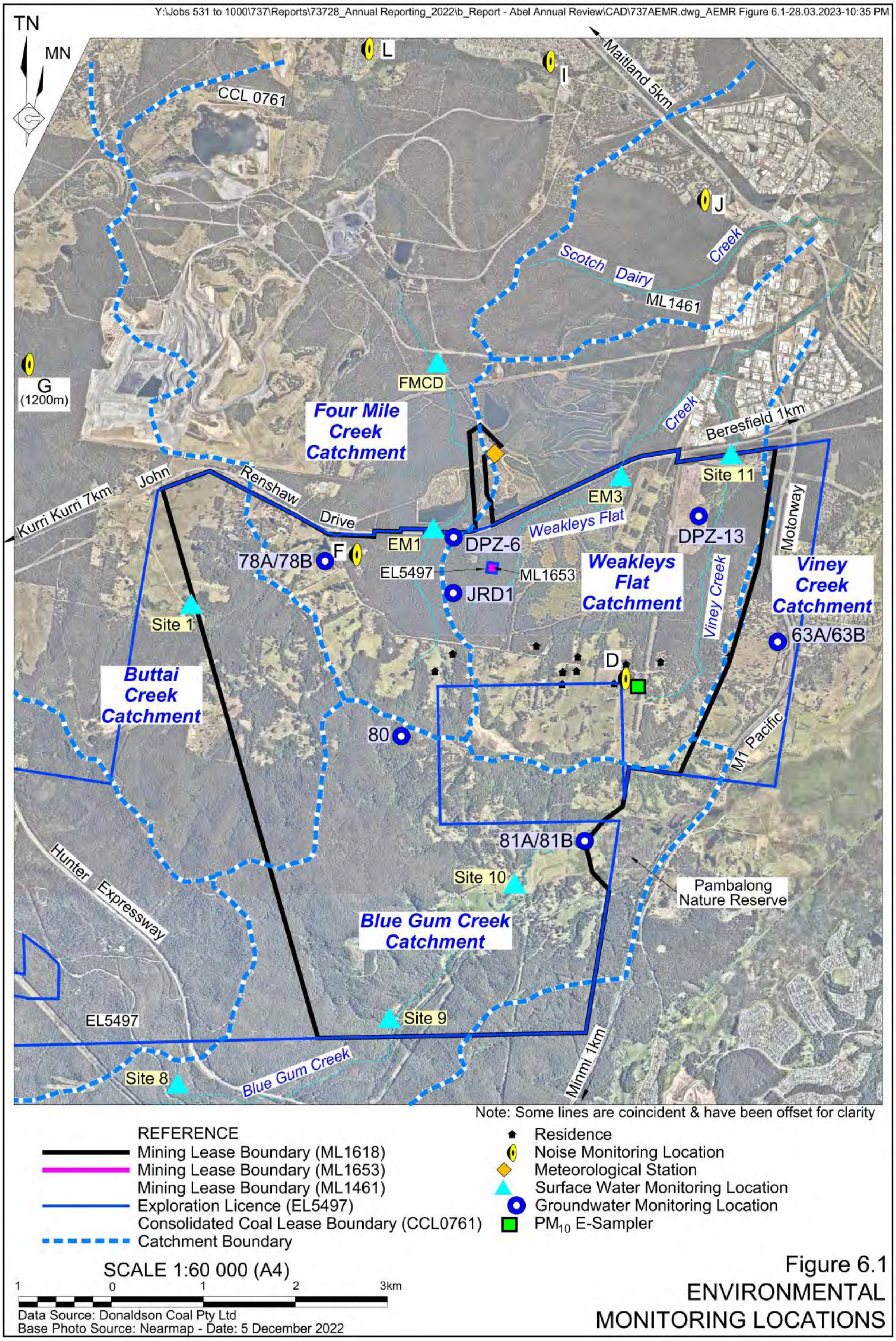



Figure 6.1
ENVIRONMENTAL MONITORING LOCATIONS

**Table 6.2**
**Monthly Rainfall Records – 2007 to 2022**

| Period | Average Monthly Rainfall (mm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Total |
| 2007 | 13.4 | 87.6 | 102.4 | 85.6 | 60 | 253 | 16.5 | 79.6 | 28.3 | 35 | 163.8 | 49.5 | 974.7 |
| 2008 | 153.4 | 191.8 | 46 | 237.6 | 2.2 | 122.9 | 30 | 28.5 | 195.3 | 62.2 | 73.3 | 62.6 | 1205.8 |
| 2009 | 11.3 | 340.7 | 136.5 | 189 | 143.8 | 75.7 | 32.1 | 1.8 | 29.2 | 59.8 | 51.4 | 62 | 1133.3 |
| 2010 | 89 | 52.1 | 83.9 | 37.1 | 89.4 | 112.8 | 65.3 | 38.5 | 26 | 80.6 | 171.1 | 55.9 | 901.7 |
| 2011 | 25.6 | 34.5 | 65.6 | 138 | 98.8 | 152.2 | 128.7 | 48.9 | 103.2 | 100 | 171.9 | 75.9 | 1143.2 |
| 2012 | 96.1 | 207 | 137.6 | 114.7 | 11.8 | 172.3 | 53.8 | 26.6 | 18.7 | 5.7 | 47.9 | 47.9 | 944.1 |
| 2013 | 166.7 | 226.6 | 97.9 | 89.4 | 60.9 | 96.5 | 11.2 | 9.7 | 21.2 | 49.5 | 261.8 | 2.6 | 1094 |
| 2014 | 15.6 | 108.3 | 112.8 | 99.3 | 44.3 | 31.4 | 24.6 | 104 | 42.4 | 55 | 38.4 | 133.4 | 809.5 |
| 2015 | 167 | 48 | 73.3 | 412 | 89.4 | 44.6 | 17.9 | 30.6 | 56.8 | 59 | 69.8 | 103.8 | 1172.2 |
| 2016 | 430.8 | 26 | 78 | 31.8 | 13.4 | 113 | 44.2 | 74.2 | 60 | 43.8 | 33.2 | 58.6 | 1007 |
| 2017 | 66.9 | 71.7 | 150.4 | 94.5 | 12.7 | 128.5 | 3.2 | 6 | 12.6 | 77.7 | 66.8 | 41.6 | 732.6 |
| 2018 | 6.6 | 120 | 191.4 | 52.8 | 7 | 107.4 | 4.2 | 21.4 | 55.4 | 109 | 92.6 | 91.8 | 859.6 |
| 2019 | 17.2 | 32.8 | 158 | 27 | 19.4 | 97.4 | 26 | 66.6 | 69.4 | 22 | 28.2 | 0 | 564 |
| 2020 | 55.2 | 214.8 | 106.4 | 52 | 45.4 | 80.2 | 166.6 | 41 | 35.6 | 146.6 | 53 | 118.4 | 1115.2 |
| 2021 | 89.4 | 101.8 | 234.8 | 48.6 | 31.4 | 72.0 | 20.6 | 20.6 | 31.0 | 67.4 | 198.6 | 55.4 | 971.6 |
| **2022** | **78.8** | **102.2** | **271.4** | **107.4** | **86.2** | **12.6** | **304.8** | **43.0** | **111.2** | **97.2** | **47.0** | **18.4** | **1280.2** |
| *Average* | *92.7* | *122.9* | *127.9* | *113.6* | *51.0* | *104.5* | *59.4* | *40.1* | *56.0* | *66.9* | *98.1* | *61.1* | *994.3* |
| Note: | Results relevant to this reporting period are in bold. | | | | | | | | | | | | |

Total rainfall during the 2022 calendar year was 1,280.2mm, representing an annual rainfall above the average annual rainfall of 994.3mm. Approximately 24% of the total rainfall over the reporting period occurred in July (304.8mm), of which approximately 90% (277mm) fell between 3 and 6 July.

## 6.3 NOISE

### Environmental Management

The principal noise control prior to the site entering care and maintenance was the continued use of low modulated frequency reversing alarms on mobile equipment used on the surface. As mobile equipment usage during care and maintenance was minimal, this remains the principal noise management measure.

### Environmental Performance

Quarterly noise monitoring applicable to the Abel Mine commenced in December 2008 as an extension of the monitoring survey previously undertaken for the Donaldson Open Cut Coal Mine. Following the results of previous monitoring, the frequency of noise monitoring for the mine was reduced from quarterly to bi-annually for the current and future Annual Reports.

Bi-annual attended and unattended noise monitoring was undertaken during the reporting period at six monitoring locations relevant to the Abel Mine (see **Figure 6.1**) for half-yearly periods ending June (H1) and December (H2) 2022. Monitoring results are presented in **Table 6.3** and copies of the monitoring reports are presented within **Appendix 1**.

**Table 6.3**
**Summary of Attended Noise Monitoring Results – 2022**

| Location | Time | Noise Criteria | Attended Monitoring[1] H1 | Attended Monitoring[1] H2 | Noise generated by Abel Mine |
|---|---|---|---|---|---|
| **D** Black Hill School, Black Hill | Day ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Evening ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A1(1min)}$) | 45 | NA | NA | Operations inaudible at all times |
| **F** Black Hill Rd, Black Hill | Day ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Evening ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A1(1min)}$) | 45 | NA | NA | Operations inaudible at all times |
| **G** Buchanan Rd, Buchanan | Day ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Evening ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A1(1min)}$) | 45 | NA | NA | Operations inaudible at all times |
| **I** Magnetic Drive, Ashtonfield | Day ($L_{A\,eq\,(15\,min)}$) | 36 | 33 | NA | CHPP operations audible in June monitoring |
| | Evening ($L_{A\,eq\,(15\,min)}$) | 36 | 33 | NA | CHPP operations audible in June monitoring |
| | Night ($L_{A\,eq\,(15\,min)}$) | 36 | NA | 30 | CHPP operations audible in December monitoring |
| | Night ($L_{A1(1min)}$) | 45 | NA | 33 | CHPP operations audible in December monitoring |
| **J** Parish Drive, Thornton | Day ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Evening ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A\,eq\,(15\,min)}$) | 35 | NA | NA | Operations inaudible at all times |
| | Night ($L_{A1(1min)}$) | 45 | NA | NA | Operations inaudible at all times |
| **L** 65 Tipperary Dr, Ashtonfield | Day ($L_{A\,eq\,(15\,min)}$) | 40 | 39 | 36 | Operations audible at all times |
| | Evening ($L_{A\,eq\,(15\,min)}$) | 40 | NA | 38 | CHPP operations audible in December monitoring |
| | Night ($L_{A\,eq\,(15\,min)}$) | 40 | NA | 25 | CHPP operations audible in December monitoring |
| | Night ($L_{A1(1min)}$) | 47 | NA | 26 | CHPP operations audible in December monitoring |

NA – Not able to be calculated as operations inaudible at all times. CHPP – Bloomfield Coal Handling Processing Plant.
Note 1: Estimated Abel Contribution ($LAeq_{(15min)}$ dBA).
Source: SLR Consulting Australia Pty Ltd (2022).

Noise monitoring concluded that operations were generally inaudible or below the relevant noise criteria at all monitoring locations during both noise monitoring events. Notably, all monitoring events were undertaken whilst the Abel Mine was under care and maintenance and therefore not audibly contributing to received noise with audible noise occurring from the Bloomfield CHPP, which operates under the Abel Mine PA 05_0136. Further discussion regarding the Bloomfield CHPP is provided in their respective annual reporting.

Whilst PA 05_0136 provides for cumulative noise criteria, no cumulative effects are considered to have occurred given that the Abel operations were inaudible or below the relevant criteria at all times, the Donaldson Coal Mine is also on care and maintenance, and noise from the Bloomfield CHPP was either inaudible or well below the relevant criteria.

### Reportable Incidents

No reportable incidents were recorded during the reporting period.

### Further Improvements

Other than ongoing plant maintenance and noise monitoring, no additional management measures are planned or considered necessary during the next reporting period.

## 6.4 BLASTING

No blasts were undertaken during the reporting period.

## 6.5 AIR QUALITY

### Environmental Management

As the Abel Mine is on care and maintenance the principal air quality management measure during the reporting period was maintenance of mobile equipment and on-site vehicles to reduce greenhouse and particulate emissions.

### Environmental Performance

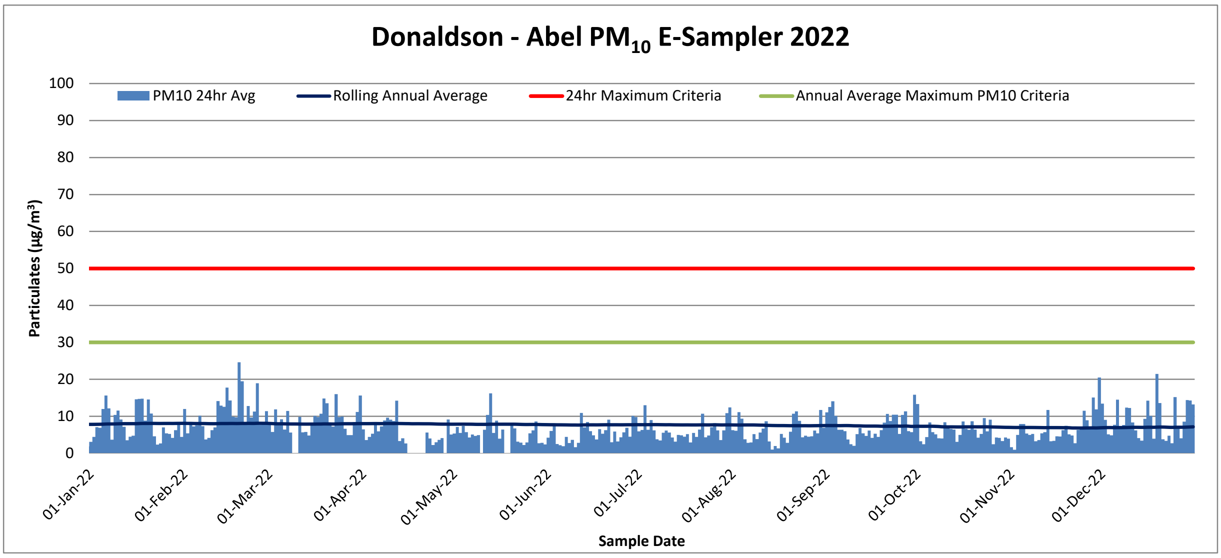
*Particulates*

Monthly deposited dust monitoring for the Abel Mine ceased in December 2021 together with monitoring for $PM_{10}$ and TSP utilising the High Volume Air Sampler (HVAS). These monitors were decommissioned in accordance with the revised monitoring requirements in the approved 2019 Air Quality and Greenhouse Gas Management Plan and consolidated EPL 12856. Air quality monitoring during the reporting period consisted of continuous $PM_{10}$ monitoring by the E-Sampler.

Current monitoring locations are shown on **Figure 6.1** and results from the continuous E-Sampler are summarised in **Figure 6.2**. Previous deposited dust monitoring and $PM_{10}$ and TSP results from the HVAS can be viewed in the respective Annual Review reports available on the Donaldson Coal website.

The highest 24-hour average $PM_{10}$ concentration during the reporting period was 24.6µg/$m^3$on 19 February 2022. As such, there were no exceedances of the 50µg/$m^3$ 24-hour criteria for $PM_{10}$ as specified in Schedule 3 Condition 9 of PA 05_0136. The annual average $PM_{10}$ concentration was 7.2µg/$m^3$ for the 12 months to 31 December 2022, i.e. below the annual average criteria of 30µg/$m^3$.

Other than an annual trend of lower 24-hour average $PM_{10}$ during the winter months and higher 24-hour averages during the summer months, no other long-term $PM_{10}$ trends are apparent. Similarly, rolling annual average $PM_{10}$ levels have remained relatively consistent with the exception of elevated levels associated with the widespread regional bushfire events during 2019/2020.



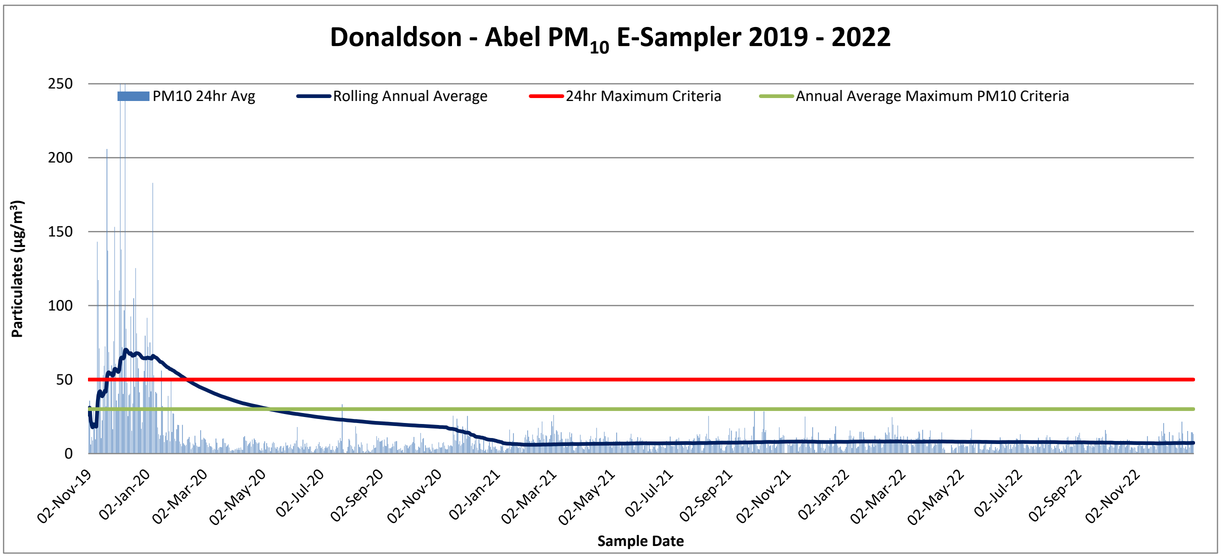




**Figure 6.2 PM$_{10}$ Monitoring Results**

*Greenhouse Gas Emissions*

The original Environmental Assessment for the mine was prepared in 2006 and estimated that annual emissions of $CO_2$-equivalent would range between 5,807 tonnes/year to 709,560 tonnes/year. Estimates were not provided as Scope 1, 2 or 3 emissions, as appropriate to the assessment requirements at that time. However, the range provided would be equivalent to total Scope 1 and 2 emissions.

As part of the 2013 modification, to include the use of longwall and shortwall mining in addition to existing bord and pillar mining methods and to increase the amount of ROM coal received from the Tasman Extension Project, a further assessment of greenhouse gases was completed. It is noted that the changes approved through the 2013 modification have not commenced given the mine remains on care and maintenance. A summary of the predicted greenhouse gas emissions from this assessment is provided in **Table 6.4**.

**Table 6.4**
**Summary of Predicted $CO_2$ equivalent Emissions per Scope**

| Year | Scope 1 | Scope 2 | Scope 3 | Scope 1+2 |
|---|---|---|---|---|
| 1 | 56,442 | 36,732 | 5,266,506 | 93,174 |
| 2 | 93,443 | 58,836 | 8,718,530 | 152,278 |
| 3 | 126,820 | 79,586 | 11,832,654 | 206,406 |
| 4 | 125,577 | 79,008 | 11,716,780 | 204,585 |
| 5 | 112,015 | 70,954 | 10,451,498 | 182,969 |
| 6 | 116,902 | 73,943 | 10,907,403 | 190,845 |
| 7 | 118,682 | 75,033 | 11,073,538 | 193,715 |
| 8 | 111,456 | 70,676 | 10,399,352 | 182,132 |
| 9 | 88,163 | 56,426 | 8,226,078 | 144,589 |
| 10 | 73,959 | 47,737 | 6,900,863 | 121,696 |
| 11 | 74,208 | 46,732 | 6,923,824 | 120,940 |
| 12 | 34,474 | 22,361 | 3,216,689 | 56,835 |
| 13 | 30,892 | 20,169 | 2,882,487 | 51,062 |
| 14 | 21,513 | 14,431 | 2,007,382 | 35,944 |
| 15 | 22,672 | 14,775 | 2,115,493 | 37,447 |
| 16 | 40,210 | 25,011 | 3,751,633 | 65,221 |
| 17 | 17,620 | 11,190 | 1,644,040 | 28,811 |
| **TOTAL** | **1,265,048** | **803,600** | **118,034,750** | **2,068,649** |
| Source: Todoroski Air Sciences (2012) - Table 12-6 | | | | |

Abel Mine reports Scope 1 and Scope 2 greenhouse gas emissions in accordance with the National Greenhouse and Energy Report System (NGERS). In summary, Scope 1 emissions associated with the Abel Mine totalled 52,182t$CO_{2\text{-}e}$ (tonnes $CO_2$ equivalent) for the 2021/2022 reporting period compared to 50,748t$CO_{2\text{-}e}$ for the previous 2020/2021 reporting period. Scope 2 emissions associated with the Abel during the 2021/2022 reporting period totalled 2,751t$CO_{2\text{-}e}$ compared to 2,702t$CO_{2\text{-}e}$ during the previous 2020/2021 reporting period.

Beyond maintenance of vehicles, no specific management measures were implemented or feasible during the reporting period.

### Reportable Incidents

No reportable incidents relating to air quality occurred during the reporting period.

### Further Improvements

No other improvements relating to air quality management are planned or considered necessary.

## 6.6 BIODIVERSITY

### Environmental Management

No underground mining occurred during the reporting period and no mining has previously been undertaken within areas that would lead to subsidence under or near the Pambalong Nature Reserve, or under sub-tropical rainforest. Hence, no specific flora or fauna management measures have been required to date above these areas.

### Biodiversity Offsets

Schedule 4 Condition 18 of PA 05_0136 requires the establishment of a total of 20ha of biodiversity offsets prior to the commencement of construction of the coal conveyor or the associated vegetation clearing. As construction of the coal conveyor or any associated vegetation clearing has not been undertaken, there is currently no biodiversity offset requirement for the Abel Underground Coal Mine.

### Environmental Performance

In accordance with the Flora and Fauna Management Plan (Version 4 – dated 3 June 2019), presented as Appendix 3 of the Rehabilitation Management Plan – Care and Maintenance (Version 2 – dated 3 June 2019), the monitoring of the Pambalong Nature Reserve, dam monitoring and management survey, and monitoring of the sub-tropical rainforest was not required during the reporting period. Additionally, aquatic monitoring of macroinvertebrate assemblages in Blue Gum Creek was not undertaken during the reporting period following a review of the need for this monitoring as recommended by Niche Environment and Heritage. Monitoring of flora and fauna present in these areas will recommence following the recommencement of mining operations.

A summary of previous monitoring results is provided as follows with further detail regarding each monitoring period presented in the respective Annual Review.

*Pambalong Nature Reserve Monitoring*

The most recent monitoring for the Pambalong Nature Reserve was undertaken during 2018/2019 and represented the 11th year of baseline monitoring with no underground mining associated with the Abel Underground Coal Mine having been undertaken within the catchment for the reserve. The monitoring was aimed at building a picture of what constitutes normal variation so that any impacts from mining in the future can be identified, should they occur.

A total of 200 flora species have been identified since monitoring commenced in 2008. No significant changes to the spatial extent of vegetation communities were observed. A yearly average of 105 fauna species have been recorded with the yearly breakdown provided in **Figure 6.5**.

*Sub-tropical Rainforest Monitoring*

Annual monitoring was conducted at Long Gully Creek for 11 years (2008 to 2018). The Subtropical Rainforest Monitoring Plan (SRMP) was designed to examine the stability of the rainforest/dry forest interface and floristic and faunal diversity. The information collected is to be used to allow best practice measures to be incorporated into the future Subsidence Management Plan(s) to be developed for this area. No underground mining associated with the Abel Underground Coal Mine has yet been undertaken beneath the Sub-tropical Rainforest areas.

A summary of the species diversity recorded over all monitoring periods is provided in **Figure 6.5**. Since commencement of survey in 2008 the area of transition between dry and moist forest at Transect 1 expanded, with the width of the moist forest increasing. Along both Transect 1 and Transect 2, particularly at the end of each transect, there was also an increase in the number of moist species recorded and a decline in the number of dry species within each 5m segment. The reduction in the occurrence of Lantana contributed to the reduction in dry species.

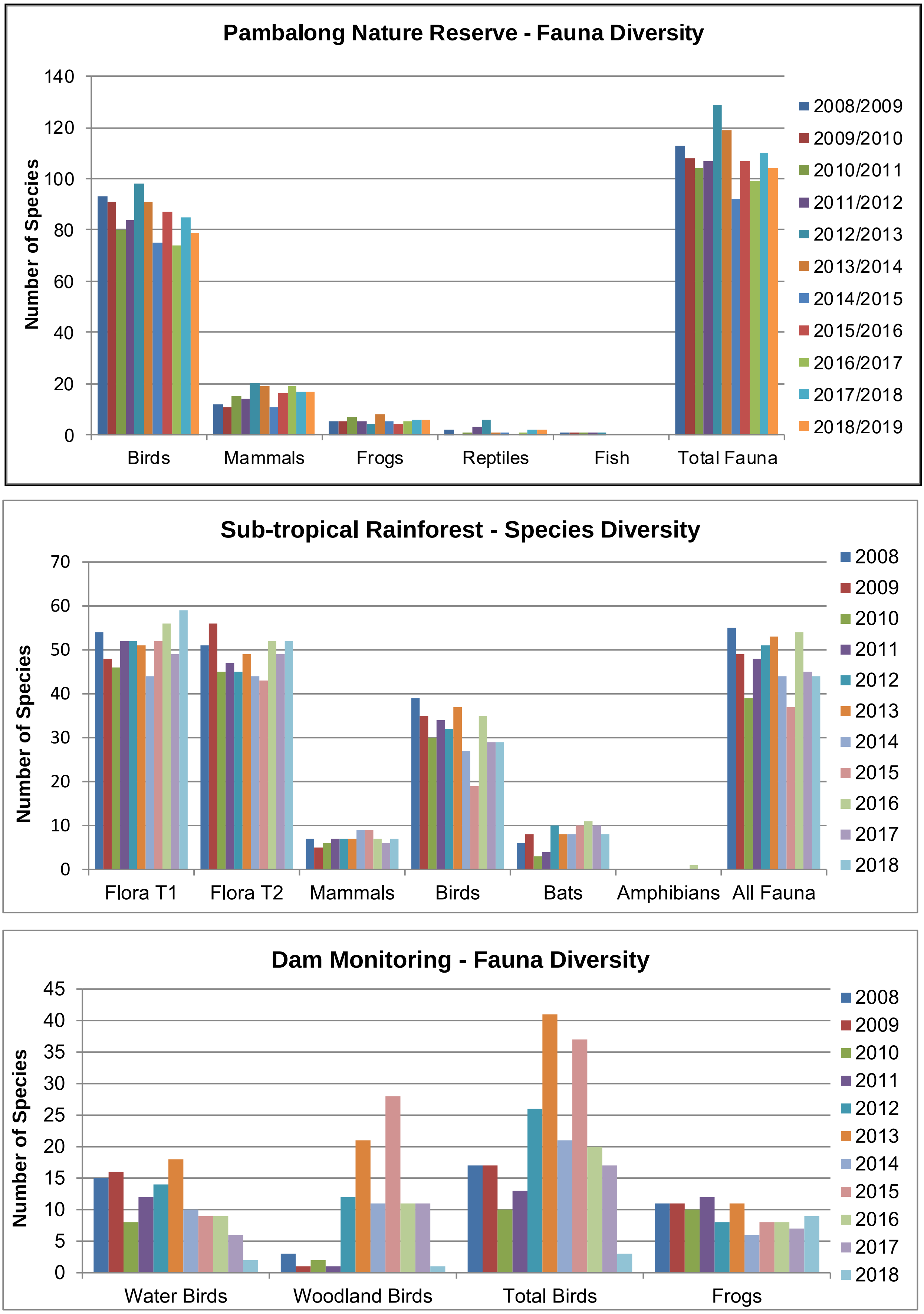



**Figure 6.3 Selected Ecological Monitoring Results**

Along both Transect 1 and Transect 2 there was also a decline in Foliage Projection Cover (FPC) since the 2008 baseline survey. Whilst severe storms occurred around Newcastle in 2015, which has likely reduced canopy cover, reduced levels of ground, shrub and midstorey cover since the baseline survey may reflect natural loss in vegetation between periods of disturbance, such as the lack of fire disturbance over a prolonged period.

*Dam Monitoring*

A summary of the species diversity recorded over all monitoring periods is provided in **Figure 6.5**.

No individuals of the threatened plant, *Maundia triglochinoides*, Blue-billed duck or listed frog species were identified during any of the survey periods. It is noted that a total of nine species of frog were detected across all dams during the 2018 surveys, representing a slight increase following a general pattern of decline in total frog species recorded since 2011 (see **Figure 6.5**). Following statistical analysis, the overall decline appears to be correlated to average temperature in the 3 months preceding the survey but is not correlated to rainfall.

A total of 63 bird species, including 23 waterbirds and 40 woodland/forest birds have been recorded between 2008 and 2018 across all of the dams surveyed. Notably, prior to 2018 the diversity and abundance of waterbirds has been relatively constant over the survey years whilst woodland/forest birds have fluctuated. Results from the 2018 survey were below averages across all survey years, however this is likely a product the survey being conducted across a single dam due to access restrictions. The high diversity of woodland/forest birds in 2015 was considered an anomaly and may have been due to increased bird activity following the cessation of a major rain event. This fluctuation as a result of rainfall prior to surveys has also been observed throughout the previous surveys.

*Macroinvertebrate – Blue Gum Creek*

Macroinvertebrate surveys were undertaken within Blue Gum Creek at Stockrington Road and Dog Hole Road between 2009 and 2008 respectively and 2019. A summary of the monitoring results for all periods is provided in **Table 6.5**.

It is noted that the use of the SIGNAL2 index was adopted in 2015 and results in a lower score that the original SIGNAL index utilised in previous monitoring. The higher a SIGNAL score the more pollution sensitive taxa are present, indicating lower pollution, whilst a lower score indicates more pollution tolerant taxa are present, indicating greater pollution. SIGNAL2 scores of 5 and above indicate dominance of pollution sensitive taxa whilst scores of 4 and below indicate dominance of pollution tolerant taxa.

Based upon the weighted SIGNAL2 scores, the sites are subject to moderate pollution, potentially the result of pollution from erosion, siltation, weeds and elevated salinity. Additionally, taxa present indicate a dominance of pollution tolerant macroinvertebrate families. Despite the weighted SIGNAL2 scores, sensitive mayfly taxa (*Leptophlebiida*) and caddis fly taxa (*Leptoceridae*) were recorded at both upstream and downstream sites.

This poor stream health appears unrelated to the Abel or previous Tasman mining operations and is more likely related to disturbance from roadways, agriculture, and past high flow events as well as ongoing land use management issues and low flows associated with dry conditions during the reporting period.

**Table 6.5**
**Summary of Biological Characteristics (Macroinvertebrates)**

| Parameter | Date | Blue Gum Creek at Stockrington Road (upstream) | Blue Gum Creek at Dog Hole Road (downstream) |
|---|---|---|---|
| Number of Taxa | 01/08/08 | - | 22 |
| | 20/05/09 | 29 | 25 |
| | 16/11/09 | 20 | 22 |
| | 27/04/10 | - | 11 |
| | 14/12/10 | 33 | 35 |
| | 01/04/11 | 24 | 20 |
| | 18/10/11 | 24 | 16 |
| | 12/04/12 | - | 23 |
| | 01/11/12 | 28 | 20 |
| | 21/03/13 | 10 | 12 |
| | 29/09/13 | 22 | 16 |
| | 24/03/14 | 9 | 8 |
| | 15/09/14 | 20 | 13 |
| | 12/06/15 | 17 | 16 |
| | 07/10/15 | 15 | 2 |
| | 03/03/16 | 15 | 20 |
| | 08/09/16 | 22 | 5 |
| | May 17 | 13 | 8 |
| | Sep 17 | - | 9 |
| | 08/05/18 | 11 | 16 |
| | 14/11/18 | 19 | 11 |
| | 28/05/19 | 19 | 13 |
| | 16/09/19 | 12 | 21 |
| SIGNAL Index | 01/08/08 | - | 5.1 |
| | 20/05/09 | 5.7 | 5.8 |
| | 16/11/09 | 4.6 | 4.6 |
| | 27/04/10 | - | 3.4 |
| | 14/12/10 | 4.7 | 4.7 |
| | 01/04/11 | 4.7 | 4.4 |
| | 18/10/11 | 5.0 | 5.3 |
| | 12/04/12 | - | 5.6 |
| | 01/11/12 | 4.4 | 5.0 |
| | 21/03/13 | 4.9 | 5.6 |
| | 29/09/13 | 4.8 | 5.3 |
| | 24/03/14 | 4.8 | 3.2 |
| | 15/09/14 | 5.2 | 4.8 |
| SIGNAL2 (weighted) Index | 12/06/15 | 4.45 | 4.10 |
| | 07/10/15 | 3.29 | 3.17 |
| | 03/03/16 | 3.75 | 3.76 |
| | 08/09/16 | 3.98 | 2.73 |
| | May 17 | 3.41 | 2.94 |
| | Sep 17 | - | 3.43 |
| | 08/05/18 | 3.96 | 3.81 |
| | 14/11/18 | 3.18 | 3.54 |
| | 28/05/19 | 4.28 | 4.44 |
| | 16/09/19 | 4.05 | 4.11 |

Source: Niche Environment & Heritage and Robyn Tuft Associates

### Reportable Incidents

No reportable incidents were recorded during the reporting period.

### Further Improvements

In accordance with the Flora and Fauna Management Plan, further monitoring of dams, sub-tropical rainforest and the Pambalong Nature Reserve will not be undertaken until the recommencement of mining activities. Additionally, macroinvertebrate sampling will not be undertaken until the recommencement of mining activities.

Prior to the recommencement of mining operations, relevant dams will be reassessed for frog habitat to account for changes such as eutrophication from stock, fertiliser applications or other farming practices as opposed to changes resulting from mining.

## 6.7 HERITAGE

In accordance with the June 2019 *Abel Underground Mine: Aboriginal Heritage Management Plan* (Donaldson Coal, 2019), annual reporting will be undertaken through the Annual Reviews with a 5 yearly report documenting the results of monitoring undertaken in accordance with the plan to be prepared and provided to either the Mindaribba or Awabakal Local Aboriginal Land Councils (LALCs) (as applicable to the area monitored), DPE and Heritage NSW. Given that no mining was undertaken during the 2022 reporting period, no specific monitoring was completed. The first of the 5 yearly reports is planned following the recommencement of mining operations.

## 6.8 SUBSIDENCE

### Environmental Management

Four Subsidence Management Plan (SMP) / Extraction Plans have been prepared for the mine to date. As part of each SMP/Extraction Plan, subsidence monitoring programs have been prepared together with required environmental and public safety management plans. Copies of all relevant SMP / Extraction Plan assessment reports and management plans are available on the Company's website.

### Environmental Performance and Further Improvements

No mining occurred during the reporting period and no further quantitative monitoring of previous undermined panels occurred. However, photographic monitoring and visual inspections continued during the reporting period. A summary of the outcomes of this monitoring and any actions taken is outlined as follows.

- No further impacts to Blackhill Road were observed and the infrastructure remained within a safe and serviceable condition.
- No further impacts on the Hunter Water Corporation Waterline, Ausgrid Powerlines and TransGrid Transmission Towers. Subsidence was within predicted levels with no subsidence impacts or management actions required during the reporting period.

- There have been no other observed and/or reported subsidence impacts, incidents, service difficulties or community complaints during the reporting period that would require notification under the SMP/Extraction Plan approvals or plans.

A comparison of previously surveyed subsidence levels against predicted levels for all panels within which extraction has been completed to date is provided within the annual Subsidence Management Report (see **Appendix 3**). A summary of subsidence impacts against the performance measures outlined in PA 05_0136 *Schedule 3 Condition 1* is also provided in **Table 6.6**.

During the next reporting period monitoring will be continued in accordance with the approved or any new SMP/Extraction Plans.

**Table 6.6**
**Review of Subsidence Impact Performance Measures**

| Performance Measure | | Status |
|---|---|---|
| *Table 2: Subsidence Impact Performance Measures* | | |
| ***Water Resources*** | | Mining to date has occurred substantially north of these features. Groundwater level monitoring has also not recorded any drawdown of surficial aquifers (see Section 7.3).<br>Subsidence monitoring has not recorded any impacts upon other watercourses. |
| • Hexham Swamp;<br>• Blue Gum Creek and Alluvium; and<br>• Long Gully. | • Negligible environmental consequences, including:<br>– *negligible* reduction in the quantity of water entering the swamp or the creeks (ie baseflow or environmental flows);<br>– *negligible* reduction in the quality of water entering the swamp or the creeks; and<br>– *negligible* reduction in creek bed or bank stability.<br>• No connective cracking between the surface and the mine. | |
| • All other watercourses in the mining area. | • No greater environmental consequences than predicted in the EA and EA (MOD 3). | |
| ***Land*** | | Mining has not yet occurred under any major cliff areas. Subsidence monitoring has not recorded any rock falls or other impacts.<br>No mining related impacts upon Pambalong Nature Reserve have been recorded. |
| • Cliffs. | • Minor environmental consequences (that is, occasional rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face area of cliffs within the mining area). | |
| • Minor cliffs<br>• Rock face features; and<br>• Steep slopes. | • Minor environmental consequences (that is, occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of feature within the mining area). | |
| • Pambalong Nature Reserve. | • Negligible environmental consequences. | |
| ***Biodiversity*** | | No mining related impacts have been recorded to date (see Section 6.6). |
| • Threatened species; and<br>• Endangered ecological communities (including unspecified Lowland Rainforest EEC). | • Negligible environmental consequences. | |
| ***Heritage Sites*** | | No impacts upon Aboriginal or historical heritage have been recorded to date. |
| • Aboriginal heritage sites. | • No greater subsidence impacts or environmental consequences than predicted in the EA and EA (MOD 3). | |
| • Historic heritage. | • No greater subsidence impacts or environmental consequences than predicted in the EA and EA (MOD 3). | |
| ***Mine workings*** | | Subsidence control zones and second workings have been implemented in accordance with the approved Subsidence Management Plans. |
| • First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible subsidence impacts, negligible environmental consequences. | • To remain long-term stable and non-subsiding. | |
| • Second workings. | • To be carried out only in accordance with an approved Extraction Plan. | |

## 6.9 WASTE MANAGEMENT

In accordance with *Schedule 3 Condition 25* of PA 05_0136, a summary of waste management during the reporting period is provided as follows.

Wastes generated on site during the reporting period included the following.

- Hazardous (Recycled) - lead acid batteries and oil.
- Non-Hazardous (Recycled) – paper and cardboard, confidential documents, scrap steel.
- Hazardous (Disposal) – medical and sanitary waste, oily rags.
- Non-Hazardous (Disposal) – mixed solid waste.

Waste oil was stored within 205L drums, 1 000L IBCs or the waste oil tank within the oil store before being removed from site, along with used oil filters and oily rags, by J R Richards & Sons. A purpose built bunded storage container is also utilised to ensure adequate bunded storage is available. Used tyres are removed from site during servicing by Marathon Tyres Pty Ltd for repair or disposal.

Paper, cardboard, steel, aluminium and any other recyclable material was stored separately in 1.5m$^3$ and 3.0m$^3$ skip bins for recycling. Paper, cardboard and general waste material continued to be collected by J R Richards & Sons on a weekly basis whilst scrap metal was also collected by J R Richards & Sons on an as-needs basis. The scrap steel/drum crusher continued to be used.

All general wastes were stored in skip bins and removed by J R Richards & Sons.

The approximate volume of each waste stream generated during the reporting period is presented in **Table 6.7** together with the proportion of waste recycled. The proportion of waste recycled decreased from 69.87% in 2021 to 31.47% in 2022, largely due to a slight increase in hazardous waste disposal and a 37% reduction in total waste. As is expected, the total volume of wastes has continued to remain relatively low since the mine entered care and maintenance.

As part of the Company's Environmental Management Strategy, it is a requirement for contractors and employees to minimise waste generation wherever possible and to dispose of all waste in a satisfactory matter. Whilst waste volumes during care and maintenance will remain relatively low, waste volumes will continue to be monitored into the future and opportunities to minimise waste or increase recycling implemented, where appropriate.

**Table 6.7**
**Approximate Waste Volumes 2016 to 2022**

| Waste Class | Waste Stream | Total Volume (kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| **Hazardous (Recycled)** | Effluent | 43 500 | 0 | 0 | 0 | 0 | 28 000 | 0 |
| | Lead Acid Batteries | 0 | 0 | 220 | 0 | 0 | 0 | 476 |
| | Empty Drums | 0 | 88 | 0 | 16 | 74 | 1 436 | 9 |
| | Waste Oil & Oil Filters | 6 046 | 2 900 | 800 | 1 100 | 1 400 | 0 | 2,200 |
| | Oily Water (Off Site) | 0 | 0 | 0 | 0 | 970 | 0 | 298 |
| | % of Total Waste | 20.55% | 6.31% | 1.11% | 5.17% | 4.13% | 46.98% | 15.30% |
| **Non-Hazardous (Recycled)** | Paper and Cardboard | 1 960 | 1 170 | 545 | 1 200 | 1 205 | 905 | 330 |
| | Confidential Documents | 0 | 0 | 420 | 466 | 228 | 260 | 245 |
| | Scrap Steel | 116 560 | 14 100 | 66 271 | 0 | 16 380 | 13 180 | 0 |
| | Timber | 4 560 | 0 | 0 | 0 | 0 | 0 | 3,200 |
| | % of Total Waste | 51.05% | 32.24% | 73.19% | 7.72% | 30.11% | 22.89% | 16.16% |
| **Hazardous (Disposal)** | Medical and Sanitary Waste | 359 | 138 | 161 | 238 | 112 | 144 | 303 |
| | Oily Rags | 408 | 258 | 54 | 72 | 0 | 0 | 146 |
| | % of Total Waste | 0.35% | 0.84% | 0.23% | 1.44% | 0 | 0.23% | 3.20% |
| **Non-Hazardous (Disposal)** | Mixed Solid Waste | 67 595 | 28 715 | 23 390 | 18 499 | 38 795 | 18 735 | 15,000 |
| | % of Total Waste | 28.04% | 60.62% | 25.46% | 85.68% | 65.57% | 29.90% | 65.34% |
| | **Total Waste** | **241,077** | **47,369** | **91,861** | **21,591** | **59,164** | **62,660** | **23,359** |
| | **Recycled Waste** | **172,633** | **18,258** | **68,256** | **2,782** | **20,257** | **43,781** | **7,350** |
| | **Recycled Waste (%)** | **71.61%** | **38.54%** | **74.30%** | **12.88%** | **34.24%** | **69.87%** | **31.47%** |

# 7. WATER MANAGEMENT

## 7.1 WATER TAKE

Applicable water licencing held for the Abel Mine operations include Water Supply Works and Use Approval 20WA218986 and Water Access Licence (WAL) 41525, which provide for up to 500ML of water take annually. The Abel Mine is not actively dewatered in advance of mining, rather passive inflows into the mine workings are transferred to completed mine workings or to the surface.

The net groundwater inflow volume has been estimated to be 255ML for the current water year 01 July 2021 to 30 June 2022. No take of water from the overlying alluvial aquifers has occurred to date.

No compensatory water has been required to be supplied throughout the life of the mine.

## 7.2 SURFACE WATER

### Environmental Management

As part of the Water Management Plan, Abel Mine transfers water off site to the Big Kahuna Dam and then to Bloomfield CHPP, as required. During the reporting period, a total of 250.8ML was transferred from the Abel Mine to the Big Kahuna Dam (consisting of groundwater inflows to the underground working and surface flows from the Square Pit, West Pit and Surface Infrastructure Area) and a total of 491.5ML was transferred from the Big Kahuna Dam to the Bloomfield CHPP dams.

Surface water monitoring sites specified for the Abel Mine are aimed at detecting indirect impacts such as from underground mining activities and activities in the surface infrastructure area. The mine's Water Management Plan (version dated June 2019) specifies surface water monitoring be undertaken at the following monitoring locations (see **Figure 6.1**).

- EM1 (previously referred to as Four Mile Creek Upstream or FMCU): monitoring commenced in July 2000 and mining in the Four Mile Creek Catchment commenced in July 2013.
- EM3: monitoring commenced in July 2000 and mining in the Weakleys Flat Creek Catchment commenced in July 2010.
- Site 1: monitoring commenced in June 2007 and mining has not been undertaken in the Buttai Creek Catchment.
- Site 91: monitoring commenced in June 2007 and mining has not been undertaken in the Blue Gum Creek Catchment.
- Site 10: monitoring commenced in June 2007 and mining has not been undertaken in the Blue Gum Creek Catchment.
- Site 11: monitoring commenced in June 2007 and mining in the Viney Creek Catchment commenced in July 2010.

[1] Site 9 has been inaccessible since January 2011 due to a road closure. Surrogate monitoring is undertaken at Site 8, located upstream of Site 9 and within the Blue Gum Creek Catchment (see **Figure 6.1**).

Where more than two years' worth of monitoring data is available for individual monitoring locations, site specific trigger vales based on the 20th and 80th percentile values have been developed as recommended in the ANZECC *Guidelines for Fresh and Marine Water Quality 2000*. These values represent anticipated value ranges rather than limits and are expected to prompt data reviews and further investigation into potential mine-related impacts where recorded values fall outside of the expected range.

Additional assessment would be undertaken in the event that significant changes in water quality are recorded, these changes are attributable to land use effects and they are recorded in a catchment where mining has occurred. Additionally, the Water Management Plan specifies that an exceedance of the upper trigger value for EC for three consecutive months represents a trigger for further assessment of metal concentrations (iron, aluminium and manganese).

### Environmental Performance

Surface water monitoring data for the reporting period is summarised in **Table 7.1** and presented graphically in **Figure 7.1**. Surface water monitoring data recorded since 2008 is presented in **Figure 7.2** and the data set is provided in **Appendix 2**.

#### *pH*

Recorded pH values during the reporting period exceeded the lower trigger value at Site EM3 on one occasion and the upper trigger values at Site 11, Site EM1 and Site EM3 on a number of occasions during the reporting period. It is noted that, as the site-specific trigger values developed in the Water management Plan are based on the 20th and 80th percentile values for each site, it is expected that these values will occasionally be exceeded. It is also clear that, where site-specific trigger values have been developed, the acceptable pH value range is typically narrow (e.g. a range equivalent to 0.3 units for Site 11) and the upper value is low relative to the ANZECC trigger value for lowland rivers in NSW (8.5). Notably, the highest pH level recorded was 8.09 at Site 11, with all other recorded pH values near neutral.

Average pH levels for all sites during the reporting period are generally consistent with the long-term average. Notwithstanding, a correlation in pH with rainfall is apparent (see **Figure 7.2**) with slightly lower pH recorded during the relatively drier 2018 and 2019 period and trending back up to the long-term average during the corresponding high rainfall throughout 2020 to 2022. Given that no operational activities occurred at either the Abel Mine or the Donaldson Open Cut Mine, it is considered that the mine did not contribute to any variation in pH values recorded during this time.

#### *Electrical Conductivity*

The electrical conductivity (EC) ranged between 155µS/cm and 2950µS/cm at all monitoring sites during the reporting period. Lower trigger values were exceeded at Sites 8 and 10 (upstream) and Sites 11 and EM3 (downstream) during the reporting period. Upper trigger values for EC were exceeded at Site 1 (upstream) and Sites 11 and EM1 (downstream). However, the trigger for additional investigations (i.e., EC results of representative samples above the upper trigger value for three consecutive months) was not activated during the reporting period.

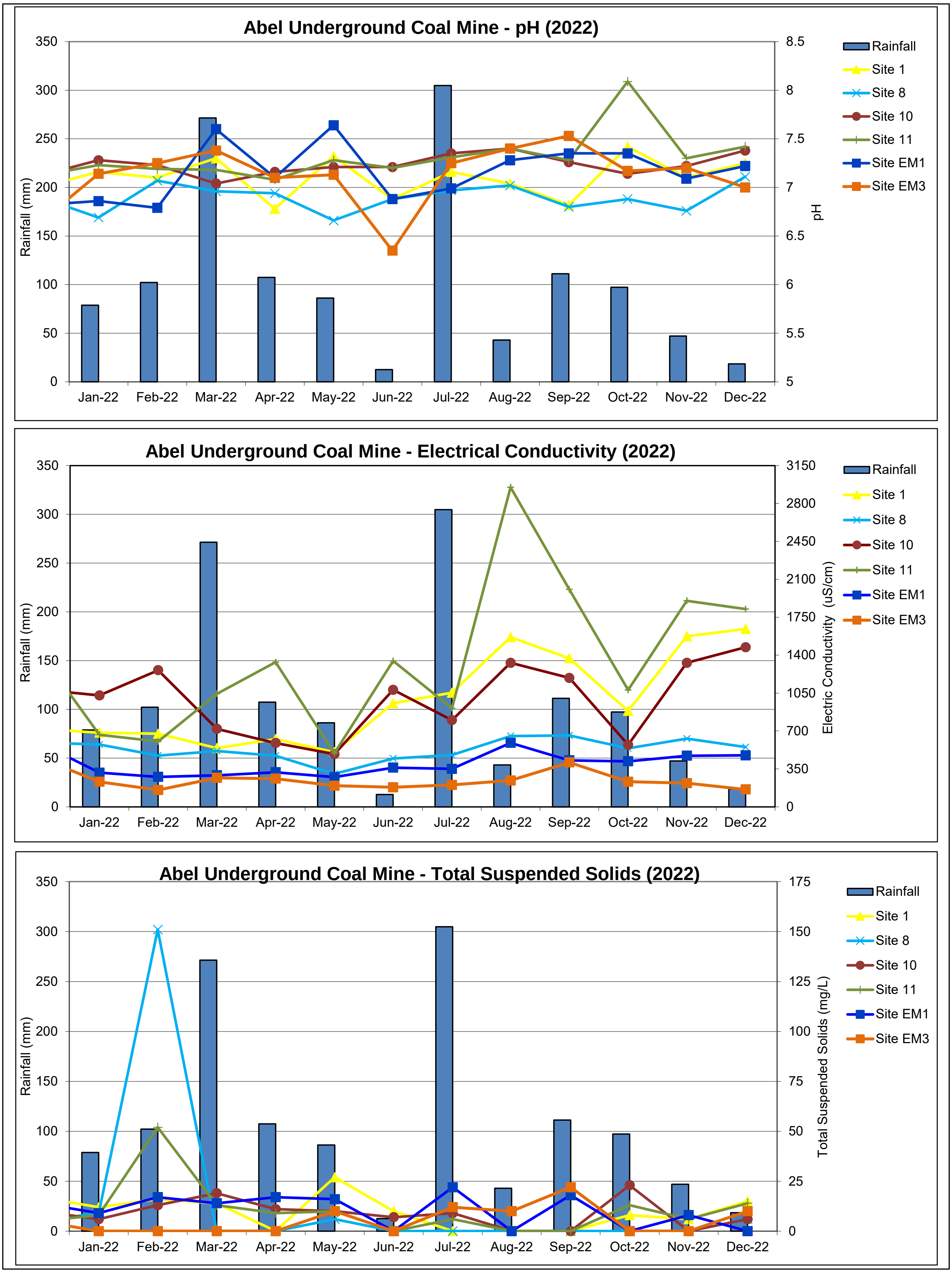



**Figure 7.1 Surface Water Quality Monitoring Results – 2022**

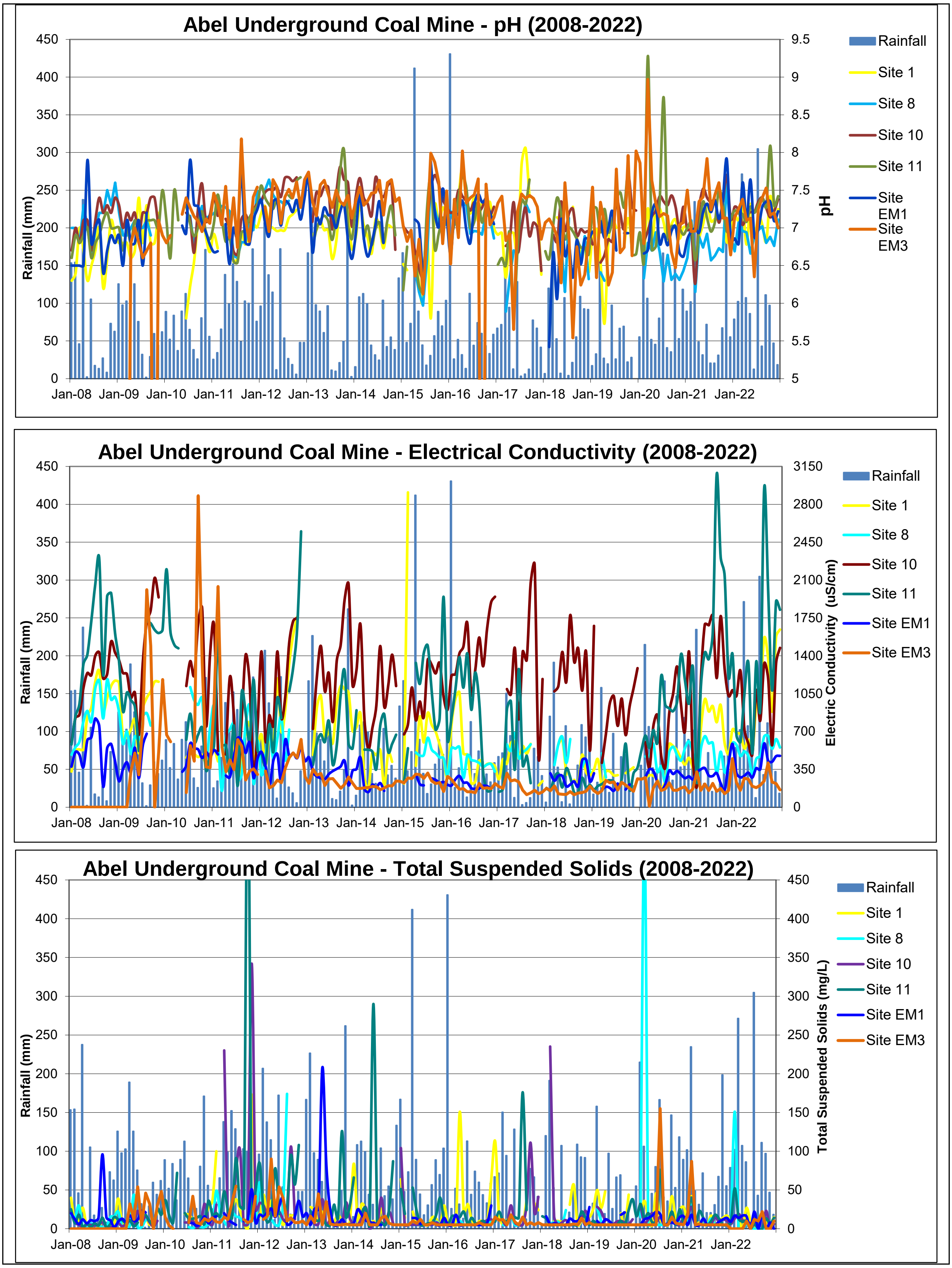



**Figure 7.2 Surface Water Quality Monitoring Results – 2008 to 2022**

**Table 7.1**
**Summary of Surface Water Quality Monitoring Results – 2022**

| Sample Site | Triggers | 2022 | | | | | | | | | | | | *Total / Mean 2022* | *Long-term Mean* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
| **Rainfall (mm)** | | | | | | | | | | | | | | | |
| - | - | 78.8 | 102.2 | 271.4 | 107.4 | 86.2 | 12.6 | 304.8 | 43 | 111.2 | 97.2 | 47 | 18.4 | *1,280.2* | *994.3* |
| **Flow#** | | | | | | | | | | | | | | | |
| 1^ | - | Still | Still | Trickle | Slow | Slow | Slow | Trickle | Still | Still | Slow | Still | Still | - | - |
| 8^ | - | Still | Trickle | Trickle | Slow | Slow | Trickle | Steady | Trickle | Trickle | Steady | Trickle | Still | - | - |
| 10^ | - | Still | Trickle | Trickle | Slow | Slow | Trickle | Slow | Trickle | Slow | Slow | Trickle | Still | - | - |
| 11* | - | Still | Still | Trickle | Slow | Steady | Trickle | Steady | Trickle | Trickle | Slow | Still | Still | - | - |
| EM1* | - | Still | Still | Steady | Trickle | Steady | Trickle | Slow | Steady | Steady | Slow | Still | Still | - | - |
| EM3* | - | Trickle | Trickle | Slow | Trickle | Steady | Trickle | Slow | Steady | Steady | Slow | Trickle | Still | - | - |
| **pH** | | | | | | | | | | | | | | | |
| 1^ | *6.6 - 7.7* | 7.16 | 7.1 | 7.3 | 6.78 | 7.32 | 6.88 | 7.16 | 7.04 | 6.82 | 7.42 | 7.1 | 7.25 | 7.11 | 6.93 |
| 8^ | *6.6 - 7.3* | 6.69 | 7.07 | 6.96 | 6.94 | 6.66 | 6.88 | 6.97 | 7.02 | 6.8 | 6.88 | 6.76 | 7.11 | 6.85 | 6.91 |
| 10^ | *7.0 - 7.5* | 7.28 | 7.23 | 7.04 | 7.16 | 7.21 | 7.21 | 7.35 | 7.4 | 7.26 | 7.14 | 7.22 | 7.38 | 7.30 | 7.19 |
| 11* | *6.8 - 7.1* | 7.23 | 7.19 | 7.18 | 7.08 | 7.28 | 7.2 | 7.31 | 7.4 | 7.28 | 8.09 | 7.3 | 7.42 | 7.17 | 7.08 |
| EM1* | *6.5 - 7.1* | 6.86 | 6.79 | 7.6 | 7.1 | 7.64 | 6.88 | 6.99 | 7.28 | 7.35 | 7.35 | 7.09 | 7.22 | 7.22 | 7.01 |
| EM3* | *6.6 - 7.2* | 7.14 | 7.25 | 7.38 | 7.1 | 7.13 | 6.35 | 7.25 | 7.4 | 7.53 | 7.17 | 7.2 | 7 | 7.13 | 7.18 |
| **Electrical Conductivity (mS/cm)** | | | | | | | | | | | | | | | |
| 1^ | 498 - 1 060 | 684 | 674 | 542 | 625 | 505 | 956 | 1,053 | 1,565 | 1,371 | 885 | 1,574 | 1,642 | 1,006 | 651 |
| 8^ | 395 - 746 | 575 | 473 | 515 | 471 | 304 | 447 | 478 | 653 | 659 | 540 | 629 | 552 | 487 | 564 |
| 10^ | 798 - 1 496 | 1,028 | 1,261 | 720 | 589 | 487 | 1,080 | 800 | 1,329 | 1,190 | 572 | 1,329 | 1,473 | 1,258 | 1,152 |
| 11* | 920 - 1 704 | 665 | 603 | 1,044 | 1,335 | 495 | 1,347 | 910 | 2,950 | 2,006 | 1,078 | 1,902 | 1,825 | 1,517 | 909 |
| EM1* | 235 - 580 | 315 | 276 | 291 | 319 | 274 | 361 | 351 | 590 | 429 | 420 | 471 | 475 | 319 | 346 |
| EM3* | 235 - 1 116 | 231 | 155 | 268 | 260 | 195 | 180 | 203 | 243 | 410 | 232 | 218 | 160 | 213 | 311 |
| **Total Suspended Solids (mg/L)** | | | | | | | | | | | | | | | |
| 1^ | 28 | 12 | 16 | 14 | 5 | 27 | 10 | 5 | 5 | 5 | 8 | 6 | 15 | 14 | 20 |
| 8^ | 16 | 9 | 151 | 5 | 5 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 20 | 17 |
| 10^ | 24 | 6 | 13 | 19 | 11 | 10 | 7 | 9 | 5 | 5 | 23 | 5 | 6 | 10 | 19 |
| 11* | 18 | 8 | 52 | 13 | 9 | 10 | 5 | 6 | 5 | 5 | 13 | 6 | 14 | 15 | 26 |
| EM1* | 34 | 9 | 17 | 14 | 17 | 16 | 5 | 22 | 5 | 18 | 5 | 8 | 5 | 10 | 15 |
| EM3* | 30 | 5 | 5 | 5 | 5 | 10 | 5 | 12 | 10 | 22 | 5 | 5 | 10 | 6 | 13 |

Red values exceed Trigger Levels ^Upstream of Underground Workings *Downstream of Underground Workings #No Flow / Still – Result not representative

Source: Donaldson Coal Pty Ltd

The average EC levels during the reporting period are generally consistent with the long-term average for all sites excluding Site 1 and Site 11. For Site 1 (upstream location), the average EC during the reporting period was 1,006µS/cm compared with the long-term average of 651µS/cm. For Site 11 (downstream location), the average EC during the reporting period was 1,517µS/cm compared with the long-term average of 909µS/cm. Notably, EC levels at Sites 1, 10 and 11 have been highly variable since commencement of monitoring and, whilst average EC for the reporting period is above the long-term average, the variability is generally consistent with previous variation (see **Figure 7.2**).

Overall, no significant difference is apparent between upstream and downstream monitoring locations.

*Total Suspended Solids*

The relevant upper total suspended solids (TSS) trigger values were exceeded at Site 8 (151mg/L) and Site 11 (52 mg/L) during February 2022. Given that the exceedances did not persist across multiple sampling rounds, it is considered that short-term, localised conditions rather contributed to these levels. It is noted that development activities not related to the Abel Mine commenced later during the reporting period in the vicinity of Site 11 and may influence future monitoring results.

No long-term trends are apparent in the TSS monitoring data and spikes in TSS are not always correlated with high monthly rainfall. Baseline monitoring for both upstream and downstream monitoring sites have previously recorded significantly elevated TSS results which are considered to form part of the natural variation within these creek systems.

The Environmental Assessment (Donaldson Coal, 2006) predicted no significant impacts upon surface water as a result of the mine activities. The monitoring results to date support that assessment.

### Reportable Incidents

No reportable incidents occurred during the reporting period.

### Further Improvements

No other surface water control measures are planned or considered necessary.

## 7.3 GROUNDWATER

### Environmental Management

Monthly monitoring of regional groundwater levels and groundwater quality was undertaken, where possible, throughout the reporting period in accordance with the Water Management Plan and Integrated Environmental Monitoring Program.

### Environmental Performance

*Groundwater Levels*

A graphical summary of groundwater level monitoring results relevant to the Abel Underground Coal Mine is provided in **Figure 7.3** and an interpretation of these results is provided as follows.

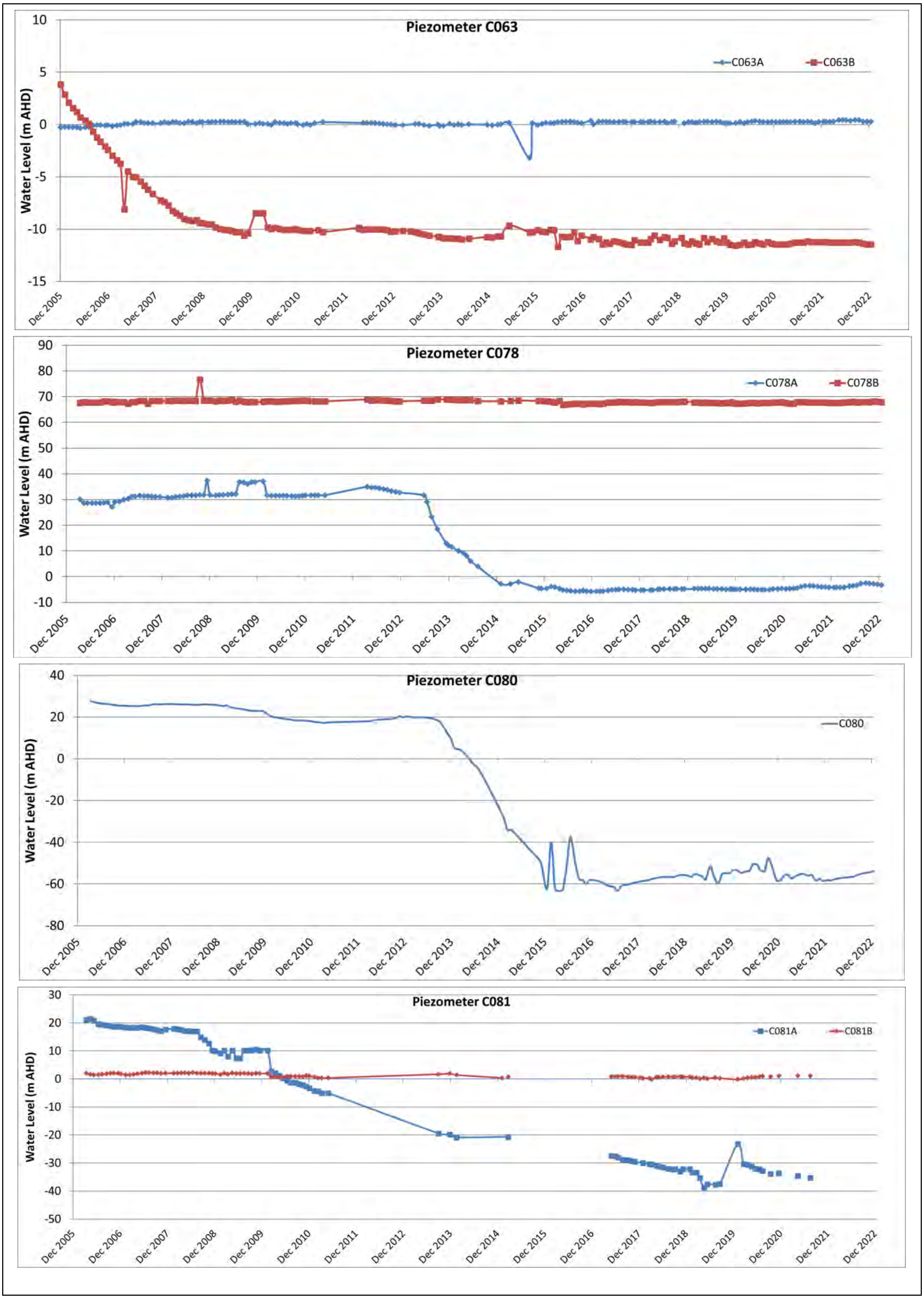



**Figure 7.3 Groundwater Level Results – All Data**

Monitoring indicates that there is little evidence of any drawdown response in the alluvium or regolith groundwater. In particular Piezometers 81A and 81B are located adjacent to the Pambalong Nature Reserve (see **Figure 6.1**). Monitoring results from 81A (single vibrating wire transducer placed within the Lower Donaldson Seam) showed a drawdown response to mining the Donaldson Seam within the Abel Mine. However, Piezometer 81B is screened within overlying shallow Permian strata with water levels remaining stable or increasing during the reporting period. The lack of response in the shallow piezometer indicates minimal mining impact on the Pambalong Nature Reserve.

Piezometers 63A and 63B are located to the east of the Abel Mine adjacent to the F3 Freeway and near the Hexham Swamp (see **Figure 6.1**). It appears that the shallow Piezometer 63B has failed or the bore has collapsed and therefore this piezometer no longer provides useful data. However, Piezometer 63A is screened in the Lower Donaldson Seam and remains operational. Monitoring results from Piezometer 63A remained consistent throughout the reporting period indicating minimal impact from previous mining activities.

Similarly, monitoring results from 78A (standpipe piezometer within the Donaldson Seam) indicated minimal impact until the start of secondary extraction in Panel 23 in June 2013. Drawdown rates stabilised during 2016 and have since remained steady. As for the other nested piezometers, 78B located within the overlaying regolith indicates minimal drawdown response and remained consistent during the reporting period.

Piezometer 80 is screened in the Donaldson Seam and located to the south of the mining activities completed to date. An expected drawdown commenced during secondary extraction in Panel 23 June 2013. The decline has steadied since the cessation of mining activities with a steady but modest recovery since mid-2017, although variability in this recovery continued during the reporting period.

The results indicate that groundwater pressure reduction within the Lower Donaldson Seam resulting from mining has occurred as anticipated and is insulated from shallow and surficial groundwater systems in this area. This is consistent with the predictions within the Environmental Assessment.

*Groundwater Inflows*

As reported for 2015, between August 2013 and October 2015 inflow volumes could not be accurately estimated as a significant portion of mine water was accumulating in isolated in-mine storages. From 1 October 2015 water began reporting from the overflow of the storage areas. Based on a total in-mine storage volume of 459ML, it is calculated that average groundwater inflow ranged from 120ML/year to 240ML/year during that time.

During the 2021/2022 water year, groundwater inflows are estimated at 255ML. Since the mine was placed on care and maintenance, water has continued to be pumped from the underground workings, however, there have been smaller volumes of inflow and declining outflows. Groundwater model predictions for this stage of mining were for between 800ML and 1 000ML/year. Therefore, the actual inflow rates remain well below the predicted maximum rate.

*Groundwater Quality*

Groundwater quality monitoring results are presented in **Appendix 2**. A summary of three representative bores located within the Abel underground mine area is presented in **Table 7.2** and **Figure 7.4** with the full graphical presentation since 2008 presented in **Figure 7.5**.

**Table 7.2**
**Summary of Groundwater Quality Monitoring Results**

| Sampling Site# | All Results | 2022 |
|---|---|---|
| **pH** | | |
| DPZ – 6 | 5.44 – 7.58 (6.6) | 6.51 - 6.71 (6.62) |
| DPZ – 13* | No Access | No Access |
| JRD2 | 5.23 – 8.06 (6.9) | 5.76 - 6.71 (6.11) |
| **Electrical Conductivity** | | |
| DPZ – 6 | 120 – 4,960 (2660) | 1452 – 2,197 (1966) |
| DPZ – 13* | No Access | No Access |
| JRD2 | 146 – 2,660 (1,476) | 313 – 1,917 (618) |
| ( ) = Average | # see **Figure 6.1** | *DPZ – 13 inaccessible during 2022 |
| Source: Donaldson Coal Pty Ltd | | |

During the reporting period pH values ranged from acidic to near neutral (5.76-6.71) and remained within previously recorded ranges. The average pH at site DPZ – 6 was equivalent to the average of all results whilst the pH at JRD2 was slightly below the average of all results. EC values ranged between 313µS/cm and 2,197µS/cm and remained within previously recorded ranges, however, average EC at both sites was below the average of all results.

A downward trend in EC has previously been observed at bore DPZ13 (**Figure 7.5**) starting in 2010 / 2011, which may be due to enhanced recharge following drawdowns in the coal measures as a result of mining. Landholder access was unable to be obtained to enable sampling from DPZ-13 during the reporting period to confirm whether this trend had continued or plateaued. Conversely, EC has been relatively consistent within DPZ-6 and JRD2, with monitoring indicating occasional 'outliers' of significantly lower EC. This is likely due to ingress of rainwater temporarily lowering the salinity

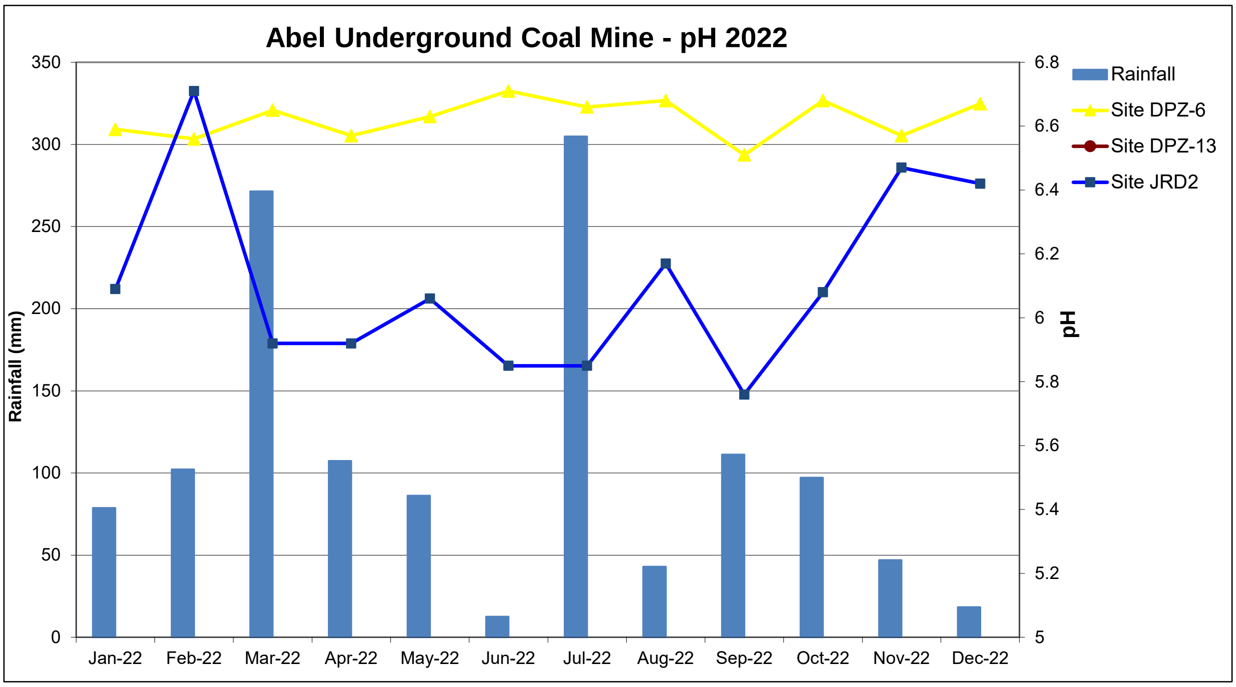
For comparison, the Environmental Assessment baseline monitoring reported that the quality of groundwater sampled within the underground mining area of the Abel Mine was variable with total dissolved solids (TDS) ranging from less than 518mg/L to 13,000mg/L, which is approximately equivalent to EC readings of between 865µS/cm and 21,700µS/cm.

### Reportable Incidents

No reportable incidents occurred during the reporting period.

### Further Improvements

Monitoring will continue in accordance with the current Water Management Plan (WMP). During the next reporting period the Water Management Plan will be reviewed and revised in consideration of consolidated EPL 12856.



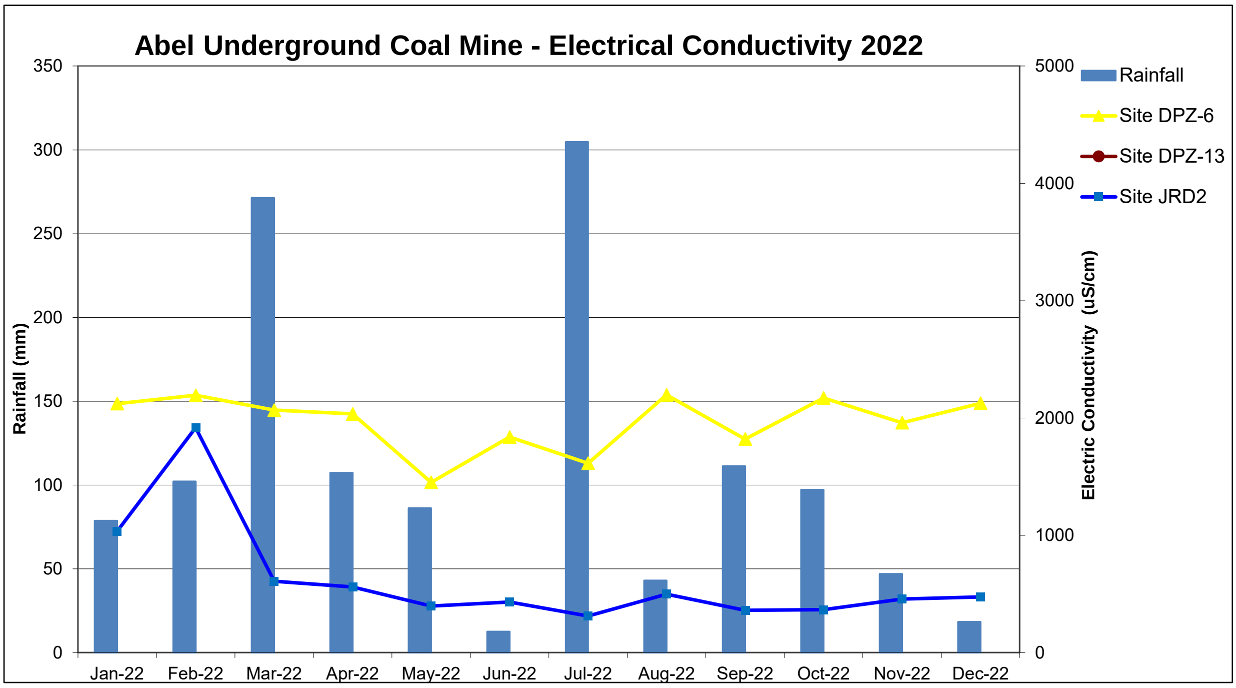
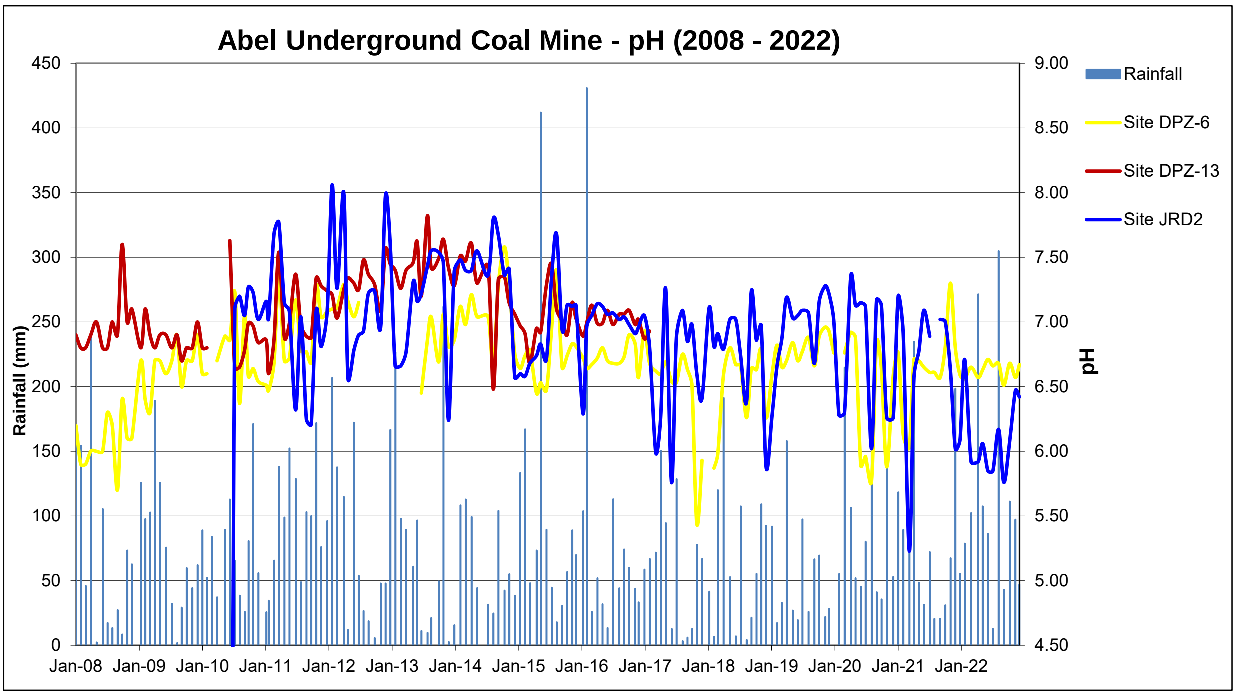




**Figure 7.4 Groundwater Quality Monitoring Results – 2022**



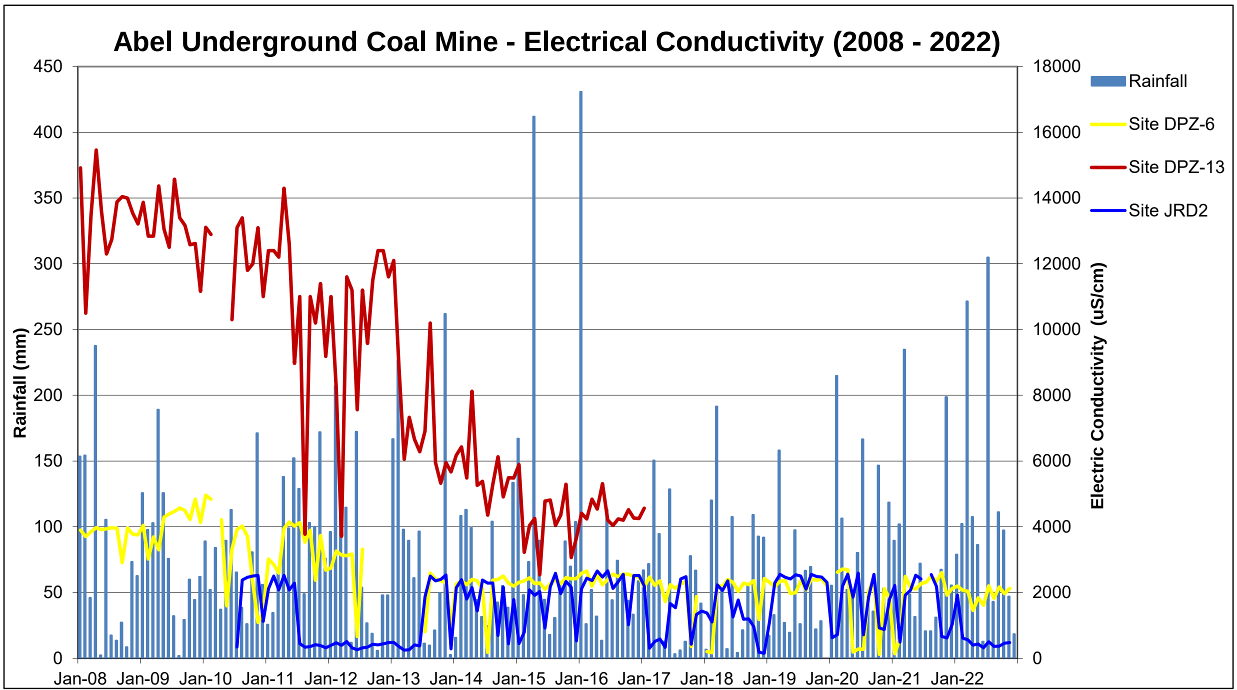




**Figure 7.5 Groundwater Quality Monitoring Results – 2008 – 2022**

# 8. REHABILITATION

## 8.1 REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

**Figure 8.1** shows the status of rehabilitation and a summary of the areas of rehabilitation is provided in **Table 8.1**.

**Table 8.1**
**Rehabilitation Summary**

| | Previous Reporting Period (Actual) | This Reporting Period (Actual) | Next Reporting Period (Forecast) |
|---|---|---|---|
| **Mine Area Type** | **Year 11 (ha)** | **Year 12 (ha)** | **Year 13 (ha)** |
| Total mine footprint | 13.81[1] | 13.81[1] | 13.81[1] |
| Total active disturbance | 13.81[2] | 13.81[2] | 13.81[2] |
| Land being prepared for rehabilitation | 0 | 0 | 0 |
| Land under active rehabilitation | 0 | 0 | |
| Completed rehabilitation | 0 | 0 | 0 |

Notes:

1: Includes 0.41ha associated with the extended light vehicle car park, 0.23ha for the downcast ventilation shaft and 0.58ha relating to the upcast ventilation shaft but excludes underground mining areas. Areas that have been temporarily rehabilitated also included.

2: Whilst some areas have been temporarily rehabilitated, all areas within ML1618 surface infrastructure area are considered to be 'active'.

A wild dog and fox baiting program was undertaken by Enright Land Management between October and November 2022 in consultation with surrounding landholders.

Within the surface infrastructure area, no permanent buildings were structurally altered, renovated or removed during the reporting period and, other than regular inspection and maintenance of previously temporarily rehabilitated areas (i.e. batter slopes) and retained vegetation, no specific rehabilitation activities were undertaken. Maintenance activities completed included scheduled equipment maintenance, regular security patrols of boundary fencing to prevent unauthorised access, and ongoing control of weeds (e.g. Pampas Grass) across the entire surface infrastructure area.

No rehabilitation trials or research was undertaken during the reporting period and there were no variations to the rehabilitation activities as outlined within the approved Rehabilitation Management Plan.

There are currently no specific issues affecting the ability to successfully rehabilitate the site and therefore no specific management measures.

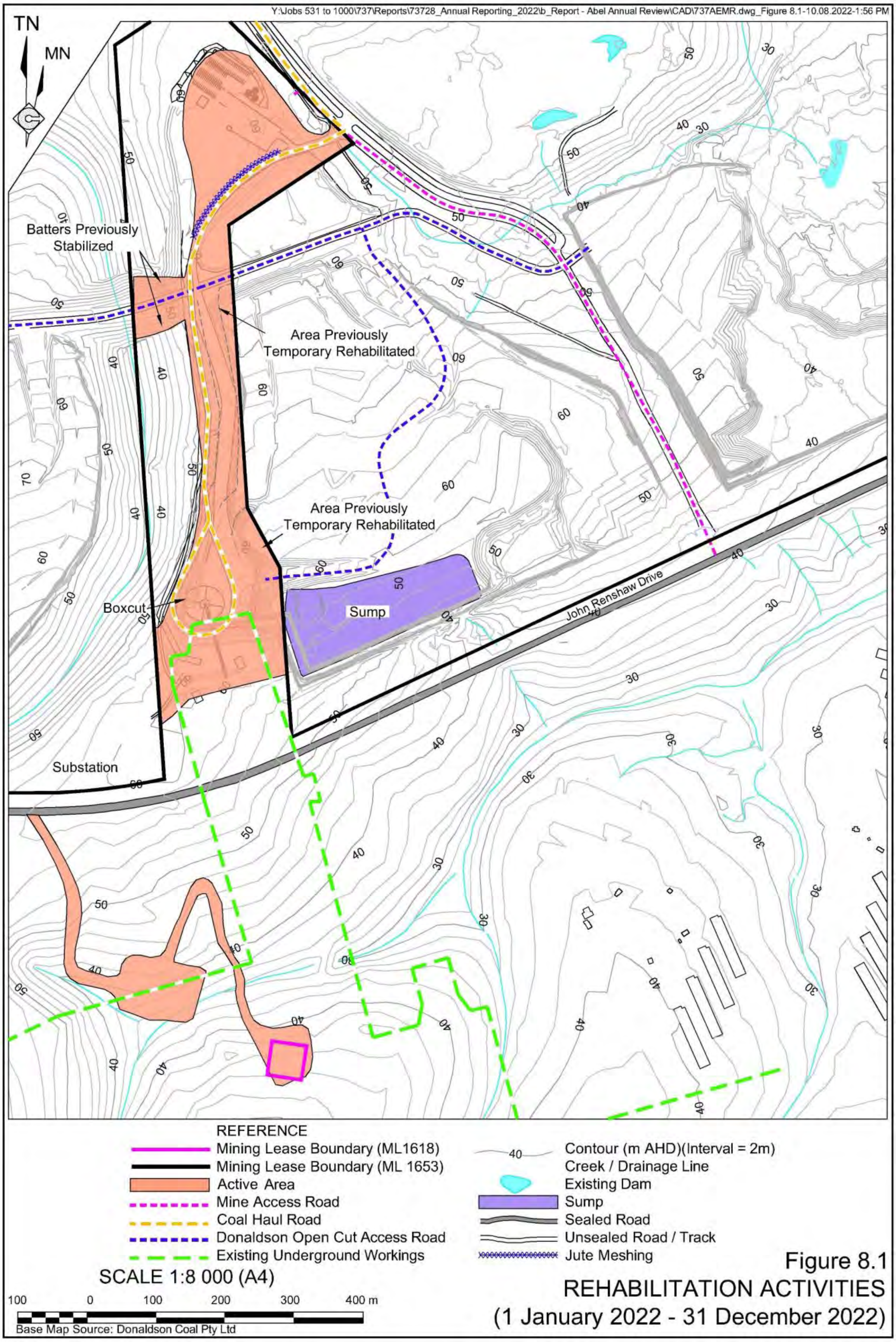



Figure 8.1
REHABILITATION ACTIVITIES
(1 January 2022 - 31 December 2022)

No rehabilitation areas became available for sign off by the Resources Regulator and no final land use objectives were met during the reporting period. As the Abel Mine is an underground operation, the only significant rehabilitation will be during mine closure and decommissioning.

As outlined within the approved Rehabilitation Management Plan and Forward Program, during decommissioning the creation of the final landform will involve blasting of the western side of the Abel Box Cut (as part of final landform creation within the West Pit) followed by grading using a dozer to create a maximum slope of 18°. The northern side of the Abel Box Cut will also be blasted and graded to a maximum of 10°, with a permanent vehicle access and egress ramp constructed to allow access to the final void for ongoing monitoring and management.

Surface infrastructure areas located within existing forested areas, such as the substation and ventilation shafts, will be returned to native vegetation. In both closure scenarios presented in the *Abel Underground Mine and Donaldson Open Cut Mine – Closure Strategy for the West and Square Pits*, the current post-mining land use goal for the Abel Box Cut is for use as water storage suitable for use in surrounding mining operations.

The Rehabilitation Management Plan (RMP) and Forward Program were prepared during the 2022 reporting period in accordance with the Operational Rehabilitation Reforms and amendments to the *Mining Regulation 2016*.

## 8.2 ACTIONS FOR THE NEXT REPORTING PERIOD

No specific rehabilitation works are planned during the next reporting period and no major rehabilitation work will be able to be undertaken until closure and decommissioning of the site. However, work will continue to be undertaken in development of the closure strategy, including commencement of a rehabilitation materials balance report, and reflected in updates to the Rehabilitation Management Plan, as appropriate.

In the event that any surface cracks appear these will be backfilled, compacted, topsoiled and seeded and ongoing repairs to any subsidence damage to public roads will be completed in accordance with the approved subsidence monitoring and management plans. Notably, any further rehabilitation works to Blackhill Road will be completed by the Subsidence Advisory NSW.

Maintenance works, such as erosion and sediment control, and ongoing control of weeds and feral pests will also be undertaken as required.

# 9. COMMUNITY

## 9.1 COMMUNITY COMPLAINTS

No complaints were received during the 2022 reporting period. The last complaint was received on 9 October 2017. Since commencement of the Abel Mine, a total of seven complaints have been received which are summarised in **Table 9.1** and presented on the Donaldson website. Given that no further complaints have been received and the Abel Mine is currently under care and maintenance, no specific actions are currently deemed necessary.

**Table 9.1**
**Community Complaints Summary**

| Location | Date of Complaint | Comments |
|---|---|---|
| Blackhill | 24/04/2009 | Light from Donaldson Open Cut/Abel shining towards house and is very bright. Light was turned down. |
| EPA | 22/06/2015 | Complaint about noise from trucks on 5th and 18th June 2015. Advised the EPA officer that there had been no change to truck movements on site and that the recent noise monitoring in May 2015 showed compliance with Licence limits. |
| Browns Road, Black Hill | 17/07/2015 | A resident in Brown's Road Black Hill lodged a complaint with the EPA regarding truck noise on 16/07/15 at 20:30hrs. Quebe provided data that trucks were parked up at that time. Advised the EPA officer. No further action. |
| John Renshaw Drive | 3/09/2015 | Complaint received regarding sulphur smell for the last month. Complainant told the EPA that it was the mine on John Renshaw Drive that was owned by Ashton company. Advised EPA that there was no odour emanating from site. |
| Meredith Road Black Hill | 1/10/2015 | Concerned about subsidence to his property and Meredith Road. Repairs undertaken in accordance with the Property Subsidence Management Plan. |
| 210 Meredith Road Black Hill | 2/10/2015 | Concerned about subsidence damage to Meredith Road/Blackhill Road. Repairs undertaken in accordance with Property Subsidence Management Plan. |
| Avalon Drive, Thornton | 9/10/2017 | Complainant has experienced a "dramatic increase" in coal dust around her property since moving there 4 years ago. Provided response to complainant indicating that this corresponded with the closure and rehabilitation of Donaldson Open Cut. Abel Underground has been placed in Care and Maintenance with no coal mined, processed or transported since mid-2016. |
| Source: Donaldson Coal | | |

## 9.2 COMMUNITY LIAISON AND CONTRIBUTIONS

The principal formal community consultation undertaken is the Community Consultative Committee. In accordance with *Schedule 6 Condition 6* of PA 05_0136, the Company has established a Community Consultative Committee for the Abel Mine. During the reporting period, the committee consisted of:

- four representatives of the local community (Mr Alan Brown, Mr Allan Jennings, Mr Terry Lewin, Mr Brad Ure); and
- three representatives from the Company (Mr William (Bill) Farnworth, Mr James Benson and Mr Phillip Brown).

The committee was chaired by Mrs Margaret MacDonald-Hill, an independent chairperson appointed as the independent Chair by the Secretary, DPE. It is noted that Cessnock and Maitland City Councils have been invited to meetings but have elected not to attend.

The committee held two meetings during the reporting period (7 March and 12 September 2022). The meetings have continued to provide an opportunity for the Company to keep the community up to date with activities undertaken and programmed at the Abel Mine and for community members to table issues relating to the Abel Mine for the Company's consideration. It is noted that the Company provided presentations during each meeting to provide updates on the mine development / care and maintenance, environmental monitoring, subsidence management, planning, and other relevant matters.

Copies of minutes and presentations are available on the Donaldson Coal Website at www.doncoal.com.au.

During the reporting period the CCC determined that the frequency of meetings could be reduced to annually due to the Mine being in Care and Maintenance.

During the reporting period no additional community contributions were made.

# 10. INDEPENDENT AUDIT

The last independent environmental audit of the mine was undertaken in February 2022, in accordance with *Schedule 5 Condition 5* of PA 05_0136 for the period 21 December 2018 to 31 December 2021. The independent audit report was finalised in April 2022 and confirmed that the Company was generally compliant in terms of environmental performance without any serious incidents.

The audit identified a total of four (4) non-compliances (deemed to be administrative) against PA 05_0136 for the audit period. Four non-compliances (two administrative and two low risk) were also identified associated with EPL 12856, and which were reported in the respective Annual Returns with no further corrective action required. No non-compliances were recorded against ML 1653 and ML 1618. Recorded no-compliances apply to the period prior to the current reporting period.

A range of recommendations were provided within the audit and a response plan prepared. A status review of these responses is provided in **Table 10.1** and will continue to be updated as part of the Annual Review for the next reporting period.

The next independent environmental audit is due to commissioned during 2024.

**Table 10.1**
**Independent Audit Action Response Plan Status**



| Condition | Description | Donaldson Response | Timeline | Status Update |
|---|---|---|---|---|
| **PA 05_0136 Corrective Actions** | | | | |
| Schedule 6 Condition 1 | Ensure the Integrated Environmental Management Program, which has not been revised since 2007, is updated to reflect the current status of mining operations and associated monitoring on site. | The Abel Project Approval 05_0136 previously required a standalone Environmental Management Program. This condition has since been removed.<br>Schedule 6 Condition 1 of Project Approval 05_0136 requires the implementation of an Environmental Management Strategy (EMS) that includes a plan depicting all monitoring required.<br>Donaldson Coal will update the EMS to remove the existing Appendix D – 'Integrated Environmental Monitoring Plan and include all monitoring conducted under Project Approval 05_0136 in Chapter 12 of the EMS. | 29 July 2022 | The EMS has been reviewed and updated. However, final submission requires the update of the Bloomfield CHPP programs (required to be included as an appendix). The Bloomfield Group has received an extension to July 2023 for update of the Bloomfield plans. Therefore the EMS will be submitted for approval following finalisation of the Bloomfield plans. |
| Schedule 6 Condition 11 | Whilst the mining lease has been uploaded following the audit, noise monitoring results for 2021 should be uploaded to the website as soon as practicable. | All noise monitoring reports for 2021 have been uploaded to the Donaldson Coal website. | Completed | **Completed.** Further data will also be uploaded to the website when available. |
| **EPL12856 Compliance Recommendations** | | | | |
| P1.1, P1.3 | As management plans prepared for the project were prepared prior to approval of the EPL variation on 1 October 2021, a review of the relevant management plans should be undertaken to ensure monitoring location names are updated to either be consistent with the EPL or ensure location names identified in the EPL are identified in relevant plans. As an example, reduction of noise monitoring from quarterly to biannually should be captured in the NMP. | Donaldson Coal will review and update all relevant Management Plans required under the Abel Development Consent to ensure consistency with the current version of the Abel Environmental Protection Licence. | 29 July 2022 | Submission of the updated management plans to be undertaken during the 2023 reporting period. As noted above, final update of management plans is reliant upon completion of the respective Bloomfield CHPP management plan. |
| P1.3 | Ensure the licensed discharge point is provided appropriate signage to identify it as an EPL discharge point. | Donaldson Coal will install signage at the discharge point by the 30 June 2022 | 30 June 2022 | **Completed.** Signage was installed in June 2022. |
| P1.4 | Provide an update to the NMP and AQGGMP to provide relevant location of meteorological Station relied upon for monitoring purposes. | Donaldson Coal will review and update the Noise Management Plan and Air Quality and Greenhouse Gas Management Plan to include the location of the Abel meteorological Station. | 29 July 2022 | Submission of the updated management plans to be undertaken during the 2023 reporting period. As noted above, final update of management plans is reliant upon completion of the respective Bloomfield CHPP management plan. |

**Table 10.1 (Cont'd)**
**Independent Audit Action Response Plan Status**



| Condition | Description | Donaldson Response | Timeline | Status Update |
|---|---|---|---|---|
| **PA 05_0136 Compliance Recommendations** | | | | |
| Schedule 3, Condition 1 | If mining is to recommence, ensure monitoring frequency of surface water and groundwater is determined in consultation with NRAR and DPE. | The environmental monitoring schedule will be updated in consultation with relevant stakeholders prior to the recommencement of mining. | Prior to the recommencement of mining | **Not yet applicable**. Mining has not yet recommenced or planned to recommence during the next reporting period. |
| Schedule 4, Condition 5 | Ensure the NMP is updated to identify times where relevant noise limits do not apply, as identified in Condition L4.4 of EPL 12856. | Donaldson Coal will review and update the Noise Management Plan to include times when relevant noise limits do not apply. | 29 July 2022 | Submission of the updated management plan to be undertaken during the 2023 reporting period. As noted above, final update of management plan is reliant upon completion of the respective Bloomfield CHPP management plan. |
| | Discuss additional measures of noise mitigation during times where noise limits do not apply due to meteorological conditions. | Donaldson Coal will review and update the Noise Management Plan to include additional measures of noise mitigation during times where noise limits do not apply due to meteorological conditions. | 29 July 2022 | |
| Schedule 4, Condition 6 | A process should be documented in relevant plans (i.e. AQGGMP and NMP) for both Bloomfield Colliery and Abel Coal Mine to ensure that Abel personnel are formally notified as soon as possible by Bloomfield in relation to any potential exceedances due to operations at the CHPP, rail loadout facility, rail loop and rail spur. | Donaldson Coal will review and update all relevant Management Plans to include the agreed process for communicating potential exceedances and incidents at the Bloomfield CHPP, rail loadout facility, rail loop and rail spur. | 29 July 2022 | Submission of the updated management plans to be undertaken during the 2023 reporting period. As noted above, final update of management plans is reliant upon completion of the respective Bloomfield CHPP management plan. |
| Schedule 4, Condition 27 | The previous audit recommended that at next review of MOP (now known as an RMP and Annual Rehabilitation Report and Forward Program) to remove any requirements that are not required for care and maintenance status. This should be considered during the updates currently being completed. In addition, this update should consider the need for a rehabilitation care and maintenance program in consultation with the NSW Resources Regulator. | The Abel Rehabilitation Management Plan is currently being compiled. This document will be a contemporary management plan that covers the site being in care and maintenance as well as account for the possibility of the recommencement of mining. | 2 July 2022 | **Completed**.<br>The Abel Rehabilitation Management Plan was finalised during the 2022 reporting period and has been uploaded onto the website. |
| | Ensure the RMP required by DA 05_0136 is updated to consider the requirements of the RMP and Annual Rehabilitation Report and Forward Program currently being prepared (as now required by the NSW Resources Regulator instead of a MOP) and documents where topsoil will be stored and the estimated volumes required for rehabilitation. | The Abel Rehabilitation Management Plan (RMP) currently being developed will comply with the NSW Resources Regulator's RMP Guidelines as well as including topsoil storage locations. | 2 July 2022 | The Abel RMP was developed in accordance with the relevant guidelines.<br>A rehabilitation materials balance report will also be commenced during the 2023 reporting period. |

**Table 10.1 (Cont'd)**
**Independent Audit Action Response Plan Status**



| Condition | Description | Donaldson Response | Timeline | Status Update |
|---|---|---|---|---|
| **PA 05_0136 Compliance Recommendations (Cont'd)** | | | | |
| Schedule 4, Condition 29 | Ensure consultation is undertaken with all prescribed parties during the next revision of the RMP. | Consultation for the RMP will occur and be in accordance with the NSW Resources Regulator's RMP Guidelines. | Noted | **Completed.** Consultation was undertaken in accordance with the relevant guideline during preparation of the RMP. |
| Schedule 6, Condition 1 | The previous audit recommended adding links to EMS attached documents or including as appendix to EMS. This has not been addressed during this audit period, and this recommendation still remains open. | The Abel and Donaldson Environmental Management Strategy (EMS) has recently been updated to include links to Management Plans as required by relevant approvals. | 29 July 2022 | The EMS links will be further updated following the update of the various management plans. |
| Schedule 6, Condition 2 | It is recommended that other plans prepared under this consent implement the tabular condition list as per the 2019 IEA Recommendation. | All management plans required by both the Abel and Donaldson Development Consents are currently being updated and will be resubmitted to the relevant authorities. The updated management plans all have a commitments table that outline the commitments made within the management plan | 29 July 2022 | Submission of the updated management plans to be undertaken during the 2023 reporting period. As noted above, final update of management plans is reliant upon completion of the respective Bloomfield CHPP management plan. |

# 11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the reporting period there were no:

- no non-compliances;
- reportable incidents or exceedances relating to Abel Underground Coal Mine operations; or
- official cautions, warning letters, penalty notices or prosecution proceedings relating to the Abel Underground Coal Mine operations.

# 12. ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

As outlined in Section 4.3, a range of monitoring, including surface water, groundwater, noise and subsidence monitoring, are planned during the next reporting period. This monitoring represents the monitoring approved through the updated management plans for care and maintenance. Notwithstanding, the need for and frequency of monitoring is to be continually reviewed together with corresponding management plans to ensure that an appropriate level of monitoring and management during care and maintenance is undertaken.

Other key activities to be undertaken during the next reporting period include:

- review and update of the Environmental Management Strategy and all environmental management plans; and
- commencement of the rehabilitation materials balance report.

# Appendix 1

## Noise Monitoring Reports

(No. of pages including blank pages = 206)

# DONALDSON AND ABEL COAL MINES

## Bi-Annual Noise Monitoring
## Half-year Ending June 2022

**Prepared for:**

Donaldson Coal Pty Ltd
PO Box 675
Green Hills 2320

**SLR Ref: 630.01053-R01**
**Version No: -v1.0**
**February 2023**

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# BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Donaldson Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

# DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
|---|---|---|---|---|
| Q84 630.01053-R01-v1.0 | 24 February 2023 | Martin Davenport | Jonathan Caine | Martin Davenport |
| | | | | |
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| | | | | |

# CONTENTS

# CONTENTS



# DOCUMENT REFERENCES

## TABLES



## FIGURES



## APPENDICES

# 1 Introduction

## 1.1 Background

Donaldson Coal Pty Ltd has commissioned SLR Consulting Australia Pty Ltd (SLR) to conduct half-yearly noise monitoring surveys for the Donaldson Coal Mine and Abel Coal Mine during the June 2022 half in accordance with the *Donaldson Coal Mine and Abel Underground Coal Mine - Noise Management Plan Care and Maintenance* (the NMP) dated 3 June 2019.

## 1.2 Objectives of this Report

The objectives of the noise monitoring survey for this operating half-year were as follows:

- Measure the ambient noise levels at six focus receptor locations (potentially worst affected) surrounding Donaldson Coal Mine and Abel Coal Mine.
- Qualify all sources of noise within each of the attended surveys, including estimated contribution or maximum level of individual noise sources.
- Assess the noise emissions of Donaldson Coal Mine and Abel Coal Mine with respect to the limits contained in the Development Consent.

## 1.3 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

# 2 Development Consent Project Approval

Development consent was obtained by Donaldson Coal Pty Ltd for the Donaldson Mine in October 1999 following a Commission of Inquiry. Development Consent number N97/00147 was issued by the Minister for Urban Affairs pursuant to Section 101 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

Project Approval (Application No. 05_0136) granted by the Minister of Planning was obtained by Donaldson Coal Pty Ltd for Abel Coal Mine in 2007.

## 2.1 Donaldson Coal Mine Development Consent Conditions

The Development Consent nominates hours of operation and mine noise emission goals in the Sections entitled "*Operation of Development, Condition No. 3(1) and 3(2)*", and *"Noise and Vibrational Noise Limits: Condition No. 15*" as follows:

*3.(1) Subject to (2) the approved hours of operation are as follows:*

| *Works* | *Period* | *Hours* |
|---|---|---|
| *Construction, including construction of any bunds* | *Monday to Friday*<br>*Saturday* | *7 am to 6 pm*<br>*8 am to 1 pm* |
| *Mining operations, including mining, haulage of waste to dumps and coal processing* | *Monday to Friday*<br>*Saturday, Sunday* | *24 hours per day*<br>*7 am to 6 pm* |
| *Road Transportation and stockpiling of coal* | *7 days per week* | *24 hours per day* |
| *Rail loading of coal* | *7 days per week* | *7 am to 10 pm* |
| *Maintenance of mobile and fixed plant* | *7 days per week* | *24 hours per day* |
| *Blasting, not involving closure of John Renshaw Drive* | *Monday to Saturday* | *7 am to 5 pm* |
| *Blasting, involving closure of John Renshaw Drive* | *Monday to Saturday* | *10 am to 2 pm* |

*Notes: Restrictions on Public Holidays are the same as Sundays*

*(2) The Applicant shall submit a report to the Director-General's satisfaction demonstrating the noise limits in Condition 15 can be met while rail loading of coal is occurring during the period from 6 pm to 10 pm. If that report does not demonstrate that the noise limits can be met to the Director-General's satisfaction, then the hours of operation for rail loading of coal shall be restricted to 7 am to 6 pm."*

15. *Unless subject to a negotiated agreement in accordance with Condition 23, the Applicant shall ensure that the noise emission from construction or mining operations, when measured or computed at the boundary of any dwelling not owned by the applicant (or within 30 metres of the dwelling, if the boundary is more than 30 metres from the dwelling), shall not exceed the following noise limits:*

| Location | $L_{A10(15minute)}$ Noise Limits (dBA) | |
|---|---|---|
| | Daytime | Night-time |
| *Beresfield area (residential)* | *45* | *35* |
| *Steggles Poultry Farm* | *50* | *40* |
| *Ebenezer Park Area* | *46* | *41* |
| *Black Hill Area* | *40* | *38* |
| *Buchanan and Louth Park Area* | *38* | *36* |
| *Ashtonfield Area* | *41* | *35* |
| *Thornton Area* | *48* | *40* |

*Note: Daytime is 7 am to 10 pm Monday-Saturday, and 8 am to 10 pm Sundays and Public Holidays. Night-time is 10 pm to 7 am Monday-Saturday, and 10 pm to 8 am Sundays and Public Holidays.*

*The noise limits apply for prevailing meteorological conditions (winds up to 3 m/s), except under conditions of temperature inversions."*

Other Conditions of Consent relevant to noise are as follows:

18. *The applicant shall survey and investigate noise reduction measures from plant and equipment and set targets for noise reduction in each Annual Environmental Management Report (AEMR), taking into consideration valid noise complaints received in the previous year. The Report shall also include remedial measures.*

19. *The Applicant shall revise the Noise Management Plan as necessary and provide an updated Plan five years after commencement of mining to the Director-General, the independent noise expert (Condition 48), EPA, Councils and the Community Consultative Committee.*

## 2.2 Abel Coal Mine – Project Approval

### Approved Operations

The following operations are approved under the Abel Coal Mine Project Approval:

- Extraction of up to 6.1 Mtpa of Run of Mine (ROM) coal from the Abel Underground Coal Mine.
- Transport coal to the existing Bloomfield Coal Handling and Preparation Plant by private haul roads, or by coal conveyor, or by a combination of both methods.
- Operate the Bloomfield Coal Handling Processing Plant (CHPP) to process coal extracted from the Abel Coal Mine and the Bloomfield and Donaldson Coal Mines.
- Transportation of product coal from the Bloomfield site by rail via the Bloomfield rail loading facility.

The Project Approval was modified in June 2010 (05_0136 MOD 1) allowing construction and operation of a downcast ventilation fan. In May 2011 the Project Approval was modified again (05_0136 MOD 2) to allow the construction and operation of an upcast ventilation fan (and associated facilities). In December 2013 the Project Approval was further modified (05_0136 MOD3) to account for the increase in coal extracted including the upgrade of the Bloomfield CHPP.

## Consent Conditions

The relevant conditions relating to noise from the Abel Coal Mine approval are reproduced below.

*Schedule 4*

***NOISE***

***Operational Noise Criteria***

1. *The Proponent shall ensure that the noise generated by the Project does not exceed the criteria in Table 4 at any residence on privately-owned land.*

*Table 4: Operational Noise Criteria dB(A)*

| Location | Receiver Area | Day | Evening | Night | |
|---|---|---|---|---|---|
| | | LAeq(15minute) | LAeq(15minute) | LAeq(15minute) | LA1(1minute) |
| Location I | Lord Howe Drive, Ashtonfield | *36* | *36* | *36* | *45* |
| Location K | Catholic Diocese Land | *37* | *37* | *37* | *45* |
| Location L | Kilshanny Avenue, Ashtonfield | *40* | *40* | *40* | *47* |
| All other Locations | All other privately owned Residences | *35* | *35* | *35* | *45* |

*Notes:*

- *To interpret the locations referred to in Table 4, see plan in Appendix 3.*
- *Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.*

*These noise criteria do not apply if the Proponent has an Agreement with the relevant landowner to generate higher noise levels, and the proponent has advised the Department in writing of the terms of this agreement.*

***Construction Noise Criteria***

1. *The proponent shall ensure that the noise generated during the construction of the downcast ventilation shaft as described in EA (MOD3) does not exceed the criteria in Table 5.*

*Table 5: Construction Noise Criteria dB(A)*

| Location | Receiver | Day |
|---|---|---|
| | | $L_{Aeq(15minute)}$ |
| *Location R* | *281 Lings Road, Buttai* | *50* |
| *Location S* | *189 Lings Road, Buttai* | *43* |

*Notes:*

- *The criteria in Table 5 apply only whilst the downcast ventilation shaft is being constructed, and for a maximum of 12 weeks from the commencement of construction.*
- *To interpret the locations referred to in Table 5, see plan in Appendix 3* (attached to this report as **Appendix A**).
- *Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.*

*However, these noise criteria do not apply if the Proponent has an Agreement with the relevant landowner to generate higher noise levels, and the proponent has advised the Department in writing of the terms of this agreement.*

***Rail Noise Criteria***

1. *The proponent shall ensure that the noise from rail movements on the Bloomfield Rail Spur does not exceed the limits in Table 6 at any residence on privately owned land.*

*Table 6: Rail Spur noise criteria dB (A)*

| *Location* | *Day* | *Evening* | *Night* |
|---|---|---|---|
| | *$L_{Aeq(period)}$* | | |
| *All privately-owned land* | *55* | *45* | *40* |

***Cumulative Noise Criteria***

1. *The proponent shall implement all reasonable and feasible measures to ensure that the noise generated by the project combined with noise generated by other mines does not exceed the criteria in Table 7 at any residence on privately-owned land.*

*Table 7: Cumulative noise criteria dB (A)*

| *Location* | *Day* | *Evening* | *Night* |
|---|---|---|---|
| | *$L_{Aeq(period)}$* | | |
| *All privately-owned land* | *55* | *45* | *40* |

*Notes: Cumulative noise is to be measured in accordance with the relevant requirements, and exemptions (including meteorological conditions), of the NSW Industrial Noise Policy. Appendix 4 sets out the metrological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.*

***Operating Conditions***

1. *The proponent shall:*
   a. *Implement best management practise to minimise the construction, operational, road and rail noise of the project;*
   b. *Operate an on-site noise management system to ensure compliance with the relevant conditions of this approval;*
   c. *Minimise the noise impacts of the project during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 4);*
   d. *Only receive and/or dispatch locomotives and rolling stock either on or from the site that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL (No. 3142);*
   e. *Carry out regular monitoring to determine whether the project is complying with the noise criteria and other relevant conditions of approval, to the satisfaction of the Director-General.*

***Noise Management Plan***

2. *The proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Director-General. This plan must:*
   a. *Be prepared in consultation with the EPA, and be submitted to the Director-General for approval within 6 months of the date of approval of MOD 3;*
   b. *Describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this approval; Describe the proposed noise management system in detail; and*
   c. *Include a monitoring program that:*
      - *Uses attended monitoring to evaluate the compliance of the project against the noise criteria in this approval;*
      - *Evaluates and reports on:*
        - *The effectiveness of the on-site noise management system; and*
        - *Compliance against the noise operating conditions; and*

*Defines what constitutes a noise incident, and includes protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents. Appendix 4*

***Noise Compliance Assessment***

***Applicable Meteorological Conditions***

1. *The noise criteria in Tables 4 and 7 are to apply under all metrological conditions except the following:*
   a. *During periods of rain or hail.*
   b. *Average wind speed at microphone height exceeds 5 m/s;*
   c. *Wind speeds greater than 3 m/s measured at 10m above ground level; or*
   d. *Temperature inversion conditions greater than $3^oC/100m$.*

***Determination of metrological conditions***

2. *Except for wind speed at microphone height, the data to be used for determining metrological conditions shall be that recorded by the meteorological station located on the site.*

***Compliance monitoring***

3. *Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.*
4. *Unless otherwise agreed with the director-general, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:*
   a. *Monitoring locations for the collection of representative noise data;*
   b. *Metrological conditions during which collection of noise data is not appropriate;*
   c. *Equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and*
   d. *Modification to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.*

*Appendix 5*

***Statement of Commitments***

***3. Noise***

***3.1 Construction Activities***

*The following noise control measures will be implemented prior to commencement of construction of the Abel Underground Mine or the upgrade of the Bloomfield CHPP.*

1. *Maintain all machinery and equipment in working order;*
   a. *No construction activities at the Abel pit top will take place on Sundays or Public Holidays;*
   b. *Where possible locate noisy site equipment behind structures that act as barriers or at the greatest distance from noise sensitive areas; and*
   c. *Orientate equipment so that noise emissions are directed away from noise sensitive areas.*

***3.2 Noise Control Measures***

a. *The following noise control measures will be implemented prior to the mining of coal from the Abel underground Mine:*
   i. *Orientation of the ventilation fans away from residential receivers and angle the output parallel to the ground.*
   ii. *The sound power level of the front end loader to be used near the portal should not exceed 113 dBA and will be fitted with a noise sensitive reversing alarm.*
b. *The following noise control measures will be implemented prior to the Bloomfield CHPP receiving any ROM coal from Able Underground Mine;*

*i. Noise mitigation works including partial enclosure and noise screening of drives and conveyors of the Bloomfield CHPP to screen residences to the north of the site.*

***3.2 Monitoring***

*The Company will implement a Noise Monitoring Program for the Abel Underground Mine and the Bloomfield CHPP, to the satisfaction of the Director-General. The Noise Monitoring Program shall include a combination of real-time and supplementary attended monitoring measures, and a noise monitoring protocol for evaluating compliance with the noise environmental assessment. This plan will be integrated with the monitoring plans for the Tasman, Donaldson and Bloomfield Mines to provide a single integrated Noise Monitoring Program for all 4 mines.*

***3.4 Continuous Improvement***

*The Company shall:*

*a. Report on these investigations and implementation of any new noise mitigation measures on site in the AEMR, to the satisfaction of the Director General.*

*The operator of the Bloomfield CHPP shall:*

*b. Investigate ways to reduce the noise generated by the Bloomfield CHPP, including maximum noise levels which may result in sleep disturbance;*

*c. Implement all reasonable and feasible best practice noise mitigation measures on the site; and*

*d. Report on these investigations and the implementation of any new noise mitigation measures on site in the AEMR, to the satisfaction of the Director-General.*

# 3 Noise Monitoring Methodology

## 3.1 General Requirements

The operational noise monitoring program was conducted with reference to Development Consent N97/00147 (Donaldson Coal Mine), Project Approval 05_0136 (Abel Coal Mine), the NMP and AS 1055-2018 *Acoustics - Description and Measurement of Environmental Noise*.

All acoustic instrumentation employed throughout the monitoring program has been designed to comply with the requirements of AS IEC 61672.1 – 2019 *Electroacoustics—Sound level meters*, AS IEC 60942 2017 *Electroacoustics – Sound calibrators* and carried current NATA or manufacturer calibration certificates. Certificates for acoustic instrumentation used during the June 2022 half is provided in **Appendix B**.

Instrument calibration was conducted before and after each measurement, with the variation in calibrated levels not exceeding ±0.5 dBA.

## 3.2 Monitoring Locations

Baseline and preceding operational half-yearly surveys have been conducted at 11 locations surrounding the Donaldson Mine and Abel Coal Mine sites. With the experience of these previous surveys, it was decided to concentrate noise monitoring at six focus locations that represent the potentially most noise affected areas from Donaldson Mine and Abel Coal Mine. The details of the monitoring locations are contained within **Table 1**.

It is relevant to note that Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Furthermore, Abel mine was placed in Care & Maintenance on 28th April 2016 and there were no operations onsite during the June 2022 noise monitoring period.

**Table 1 Monitoring Locations**

| Noise Monitoring Location | Description |
|---|---|
| D | Black Hill School, Black Hill |
| F | Lot 684 Black Hill Road, Black Hill |
| G | 156 Buchannan Road, Buchannan |
| I | Magnetic Drive, Ashtonfield |
| J | Parish Drive, Thornton |
| L | 65 Tipperary Dr, Ashtonfield |

A map giving the approximate location of the noise monitoring sites is contained within **Appendix C**.

## 3.3 Unattended Continuous Noise Monitoring

An environmental noise logger was deployed for a minimum of a seven day period between Thursday 30 June 2022 to Tuesday 12 July 2022 at each of the six (6) nominated locations given in **Table 1**.

All unattended monitoring equipment was programmed to continuously record statistical noise level indices in 15 minute intervals including the $L_{Amax}$, $L_{A1}$, $L_{A10}$, $L_{A90}$, $L_{A99}$, $L_{Amin}$ and $L_{Aeq}$. The statistical noise exceedance levels ($L_{AN}$) are the levels exceeded for N% of the 15 minute interval. The $L_{A90}$ represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level. The $L_{A10}$ is the level exceeded for 10% of the time and is usually referred to as the average maximum noise level. The $L_{Aeq}$ is the equivalent continuous sound pressure level and represents the steady sound level which is equal in energy to the fluctuating level over the interval period. The $L_{Amax}$ is the maximum noise level recorded over the interval.

## 3.4 Operator Attended Noise Monitoring

Operator attended surveys were conducted at each of the six monitoring locations during the daytime, evening and night-time periods, to verify the unattended logging results and to determine the character and contribution of ambient noise sources.

# 4 Operator Attended Noise Monitoring

## 4.1 Results of Operator Attended Noise Monitoring

Operator attended noise measurements were conducted commencing during the daytime period on 28 June 2022 and finished during the night-time period on 29 June 2022. Operator attended noise surveys were conducted using a Brüel & Kjær Type 2270 (serial number 2679354).

Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and mine operations as well as any other industrial operations.

The tables provide the following information:

- Monitoring location.
- Date and start time.
- Wind velocity (m/s) and Temperature (ºC) at the measurement location.
- Typical maximum ($L_{Amax}$) and contributed noise levels.

Mine contributions listed in the tables are from the Abel Coal Mine and are stated only when a contribution could be quantified.

## Table 2 Location D, Black Hill Public School, Black Hill

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 28/6/2022<br>17:53<br>11°C<br>0.3 m/s SSW | 72 | 54 | 46 | 39 | 47 | Insects 35-38<br>Wind in trees 35<br>Road traffic 39-72<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Evening | 28/6/2022<br>18:09<br>11°C<br>0.6 m/s S | 78 | 69 | 51 | 40 | 56 | Insects 37-41<br>Wind in trees 35<br>Road traffic 35-78<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Night | 28/6/2022<br>22:53<br>9°C<br>0.4 m/s W | 48 | 45 | 42 | 37 | 40 | Insects 30-41<br>Road traffic 35-48<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

## Table 3 Location F, Lot 684 Black Hill Road, Black Hill

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 28/6/2022<br>14:56<br>13°C<br>0.6 m/s SSW | 80 | 74 | 63 | 50 | 61 | Road traffic 50-80<br>Birdsong 45-55<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Evening | 28/6/2022<br>18:32<br>11°C<br>0.4 m/s SSW | 71 | 63 | 54 | 46 | 52 | Insects 44-48<br>Road traffic 45-71<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Night | 28/12/2021<br>23:17<br>9°C<br>0.4 m/s WNW | 63 | 59 | 54 | 46 | 51 | Road traffic 45-63<br>Insects 45-48<br>Other industry 35<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

### Table 4 Location G, Buchanan Road, Buchanan

| Period | Date/ Start time/ Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 28/6/2022<br>16:12<br>12°C<br>0.5 m/s SW | 70 | 54 | 52 | 46 | 50 | Road traffic 45-55<br>Birdsong 37-70<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Evening | 28/6/2022<br>19:47<br>10°C<br>0.2 m/s SW | 57 | 50 | 48 | 40 | 45 | Road traffic 38-57<br>Insects 35-40<br>Other industry 33-35<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Night | 29/6/2022<br>00:22<br>9°C<br>0.7 m/s NW | 49 | 46 | 40 | 28 | 36 | Road traffic 30-49<br>Bird 45<br>Insects 25-38<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

### Table 5 Location I, Magnetic Drive, Ashtonfield

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 28/6/2022<br>17:01<br>11°C<br>0.3 m/s SSW | 69 | 61 | 47 | 39 | 48 | Road traffic 40-69<br>Birdsong 40-52<br>Dog barking 54-59<br>Insects/Frogs 33-36<br>**Abel Mine Audible**<br>Bloomfield CHPP 32-34 |
| | | Estimated Abel Mine Noise Contribution 33 dBA LAeq(15minute) | | | | | |
| Evening | 28/6/2022<br>21:06<br>10°C<br>0.2 m/s W | 46 | 42 | 41 | 39 | 40 | Traffic 40-46<br>Insects 32-38<br>**Abel Mine Audible**<br>Bloomfield CHPP 32-35 |
| | | Estimated Abel Mine Noise Contribution 33 dBA LAeq(15minute) | | | | | |
| Night | 28/6/2022<br>22:00<br>9°C<br>0.5 m/s WNW | 48 | 43 | 40 | 35 | 38 | Traffic 30-36<br>Insects/Frogs 35-45<br>Dog barking 48<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

### Table 6 Location J, Parish Drive, Thornton

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 28/6/2022<br>17:25<br>11°C<br>0.4m/s SSW | 56 | 48 | 43 | 39 | 42 | Road traffic 39-56<br>Insects 38<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Evening | 28/6/2022<br>20:41<br>10°C<br>0.3 m/s SW | 53 | 44 | 40 | 37 | 39 | Insects 35<br>Train 38-43<br>Operator 53<br>Road traffic 37-42<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Night | 28/6/2022<br>22:02<br>9°C<br>0.5 m/s WNW | 43 | 39 | 37 | 35 | 36 | Insects 38<br>Road traffic 35-43<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |

### Table 7 Location L, 65 Tipperary Drive, Ashtonfield

| Period | Date/ Start time/ Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 28/6/2022<br>16:54<br>11°C<br>0.3 m/s SSW | 71 | 61 | 49 | 42 | 49 | Road traffic 40-71<br>Residential noise / urban hum 45-56<br>Birdsong 42-52<br>**Abel Mine Audible**<br>Bloomfield CHPP 38-41 |
| | | Estimated Abel Mine Noise Contribution<br>39 dBA LAeq(15minute) | | | | | |
| Evening | 28/6/2022<br>21:35<br>9°C<br>0.2 m/s NW | 71 | 57 | 41 | 33 | 45 | Urban Hum 33-38<br>Traffic 40-71<br>Other industry 30-38<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Night | 29/6/2022<br>00:51<br>9°C<br>0.3 m/s WSW | 48 | 36 | 34 | 29 | 31 | Operator 48<br>Road traffic 28-39<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |

## 4.2 Operator Attended Noise Monitoring Summary

### 4.2.1 Donaldson Mine

Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Therefore, compliance noise monitoring for the Donaldson Open Cut Mine is no longer required.

### 4.2.2 Abel Coal Mine

Abel mine was placed in Care & Maintenance on 28th April 2016 and there were no operations onsite, excluding that from the Bloomfield CHPP which operates under the Abel Coal Mine project consent conditions.

The Bloomfield CHPP was audible at Location L and Location I during the daytime period and at Location I during the evening. Abel noise emission were inaudible during all other operator attended noise surveys. Noise generated by local and distant traffic was a significant contributor to ambient noise levels at all monitored locations as well as neighbourhood noise and 'natural' noises such as birds, insects and wind related noise.

## 4.3 Compliance Assessment and Discussion of Results

### 4.3.1 Operations

Results of the operational compliance assessment are given in **Table 8**.

**Table 8 Compliance Noise Assessment - Operations**

| Location | Estimated Abel $L_{Aeq(15minute)}$ Contribution dBA | | | Consent Conditions | | | Compliance | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Day** | **Eve** | **Night** | **Day** | **Eve** | **Night** | **Day** | **Eve** | **Night** |
| D – Black Hill School, Black Hill | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| F – Black Hill Road, Black Hill | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| G – Buchanan Road, Buchanan | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| I – Magnetic Drive, Ashtonfield | 35 | 36 | Inaudible | 36 | 36 | 36 | Yes | Yes | Yes |
| J – Parish Drive, Thornton | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| L – 65 Tipperary Dr, Ashtonfield | 39 | Inaudible | Inaudible | 40 | 40 | 40 | Yes | Yes | Yes |

Results presented in **Table 8** indicate that compliance with the relevant consent conditions was achieved at all noise monitoring locations during all periods.

### 4.3.2 Sleep Disturbance

Results of the sleep disturbance compliance assessment are given in **Table 9**.

### Table 9 Compliance Noise Assessment – Sleep Disturbance

| Location | Estimated Abel $L_{A1(1minute)}$ Contribution dBA | Consent Conditions $L_{A1(1minute)}$ dBA | Compliance |
|---|---|---|---|
| D – Black Hill School, Black Hill | Inaudible | 45 | Yes |
| F – Black Hill Road, Black Hill | Inaudible | 45 | Yes |
| G – Buchanan Road, Buchanan | Inaudible | 45 | Yes |
| I – Magnetic Drive, Ashtonfield | Inaudible | 45 | Yes |
| J – Parish Drive, Thornton | Inaudible | 45 | Yes |
| L – 65 Tipperary Dr, Ashtonfield | Inaudible | 47 | Yes |

Results presented in **Table 9** indicate that compliance with the sleep disturbance consent conditions was achieved at all noise monitoring locations during the night-time noise surveys.

# 5 Unattended Continuous Noise Monitoring

## 5.1 Results of Unattended Continuous Noise Monitoring

Unattended continuous noise monitoring was conducted between Thursday 30 June 2022 to Tuesday 12 July 2022 at each of the six monitoring locations given in **Table 10**.

### Table 10 Noise Logger and Noise Monitoring Locations

| Location | Noise Logger Serial Number | Date of Logging |
|---|---|---|
| D – Black Hill School, Black Hill | SVAN 977 69757 | 30/06/2022 to 12/7/2022 |
| F – Black Hill Road, Black Hill | ARL 316 16-203-529 | Deployed 30/06/2022 |
| G – Buchanan Road, Buchanan | SVAN 977 98070 | 30/06/2022 to 12/7/2022 |
| I – Magnetic Drive, Ashtonfield | ARL EL316 16-306-042 | 30/06/2022 to 12/7/2022 |
| L – 65 Tipperary Dr, Ashtonfield | SVAN 957 20665 | 30/06/2022 to 12/7/2022 |
| J – Parish Drive, Thornton | ARL 316 16-203-526 | 30/06/2022 to 12/7/2022 |

The unattended ambient noise logger data from each monitoring location are presented graphically on a daily basis and are attached as **Appendix C**. A summary of the results of the unattended continuous noise monitoring is given in **Table 11**. Due to technical logger errors and vandalism no data is available for Location D, Location F and Location I.

The ambient noise level data quantifies the overall noise level at a given location independent of its source or character.

The measured ambient noise levels were divided into three periods representing day, evening and night as designated in the NSW Noise Policy for Industry (NPfI).

Precautions were taken to minimise influences from extraneous noise sources (eg optimum placement of the loggers away from creeks, trees, houses, etc), however, not all these sources or their effects can be eliminated. This is particularly the case during the warmer times of year when noise from insects, frogs, birds and other animals can become quite prevalent.

Weather data for the subject area during the noise monitoring period was provided by Bloomfield Colliery. Noise data during periods of any rainfall and/or wind speeds in excess of 5 m/s were discarded in accordance with NPfI weather affected data exclusion methodology.

### Table 11 Unattended Continuous Noise Monitoring Ambient Noise Levels (dBA)

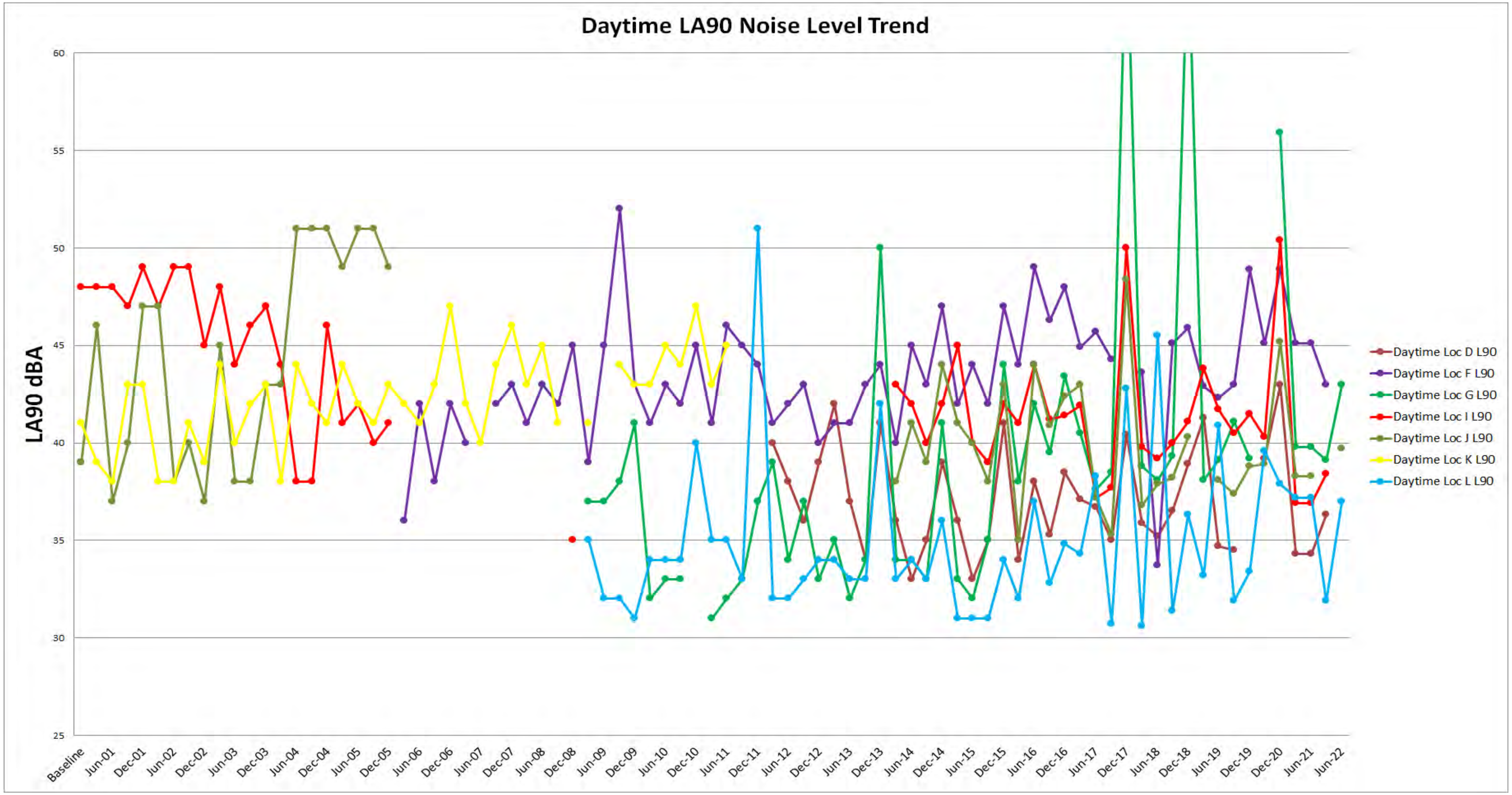
| Location | Period | Primary Noise Descriptor (dBA re 20 µPA) | | | |
|---|---|---|---|---|---|
| | | $L_{A1}$ | $L_{A10}$ | $L_{A90}$ | $L_{Aeq}$ |
| G<br>156 Buchanan Road, Buchanan | Day | 54 | 51 | 43 | 51 |
| | Evening | 51 | 48 | 40 | 48 |
| | Night | 48 | 45 | 34 | 48 |
| L<br>65 Tipperary Dr, Ashtonfield | Day | 62 | 52 | 37 | 53 |
| | Evening | 57 | 41 | 34 | 48 |
| | Night | 45 | 37 | 31 | 45 |
| J<br>Parish Drive, Thornton | Day | 54 | 48 | 40 | 50 |
| | Evening | 48 | 44 | 40 | 50 |
| | Night | 47 | 44 | 35 | 47 |

## 5.2 Long term Unattended Continuous Monitoring Summary for Donaldson Mine and Abel Coal Mine

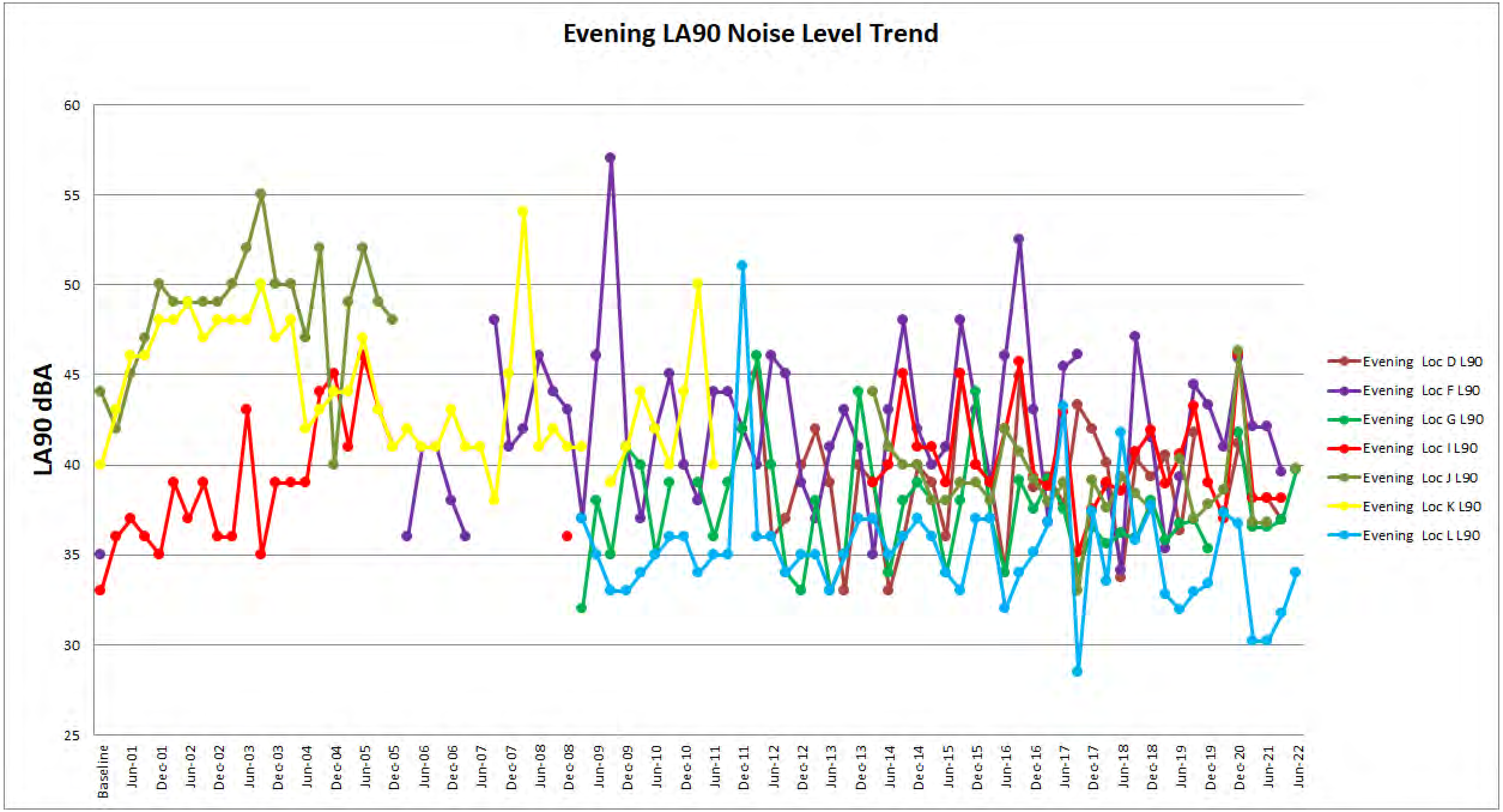
### 5.2.1 Ambient LA90 Noise Levels

The long term ambient $L_{A90}$ noise levels collected from each monitoring location are presented graphically in **Figure 1**, **Figure 2** and **Figure 3** for the daytime, evening and night-time periods respectively.

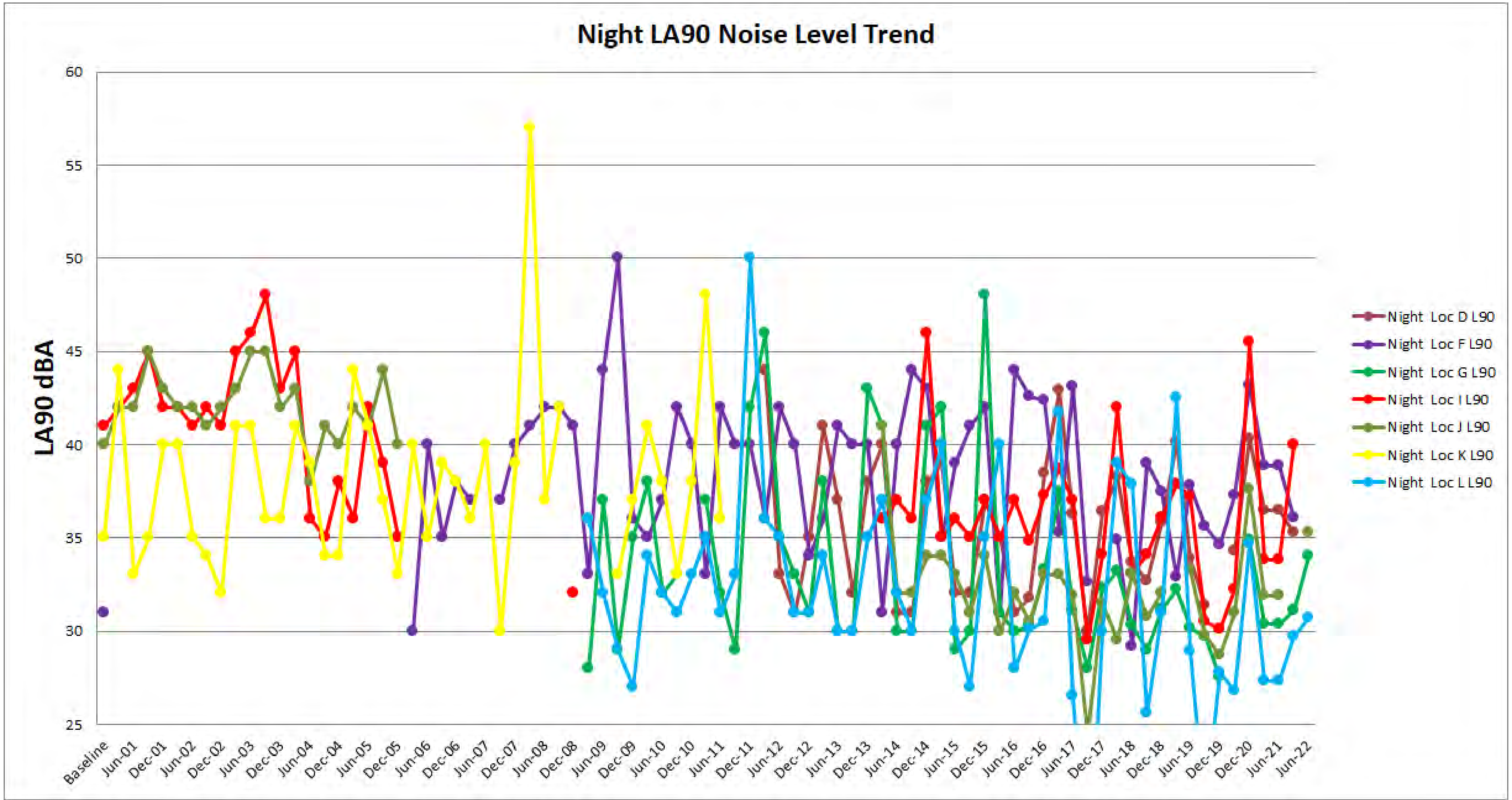
## Figure 1 Long Term Daytime LA90 Noise Levels



## Figure 2 Long Term Evening LA90 Noise Levels



## Figure 3 Long Term Night-time LA90 Noise Levels






SLR

#### 5.2.1.1 Baseline

The summary of results in **Table 12** shows the ambient LA90 noise levels recorded for the current monitoring period compared to the levels recorded during the baseline monitoring process (ie. prior to commencement of mining operation at Donaldson).

**Table 12 LA90 Results Comparison - Baseline**

| Monitoring Location | Period[1] | Long term Night-time LA90 Noise Levels | | Difference dB[3] |
|---|---|---|---|---|
| | | **Baseline** | **June 2022** | |
| D<br>Black Hill School, Black Hill | Day | N/A[2] | -[4] | N/A[2] |
| | Evening | N/A[2] | -[4] | N/A[2] |
| | Night | N/A[2] | -[4] | N/A[2] |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 39 | -[4] | -[4] |
| | Evening | 35 | -[4] | -[4] |
| | Night | 31 | -[4] | -[4] |
| G<br>156 Buchanan Road, Buchanan | Day | N/A[2] | 43 | N/A[2] |
| | Evening | N/A[2] | 40 | N/A[2] |
| | Night | N/A[2] | 34 | N/A[2] |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 48 | -[4] | -[4] |
| | Evening | 33 | -[4] | -[4] |
| | Night | 41 | -[4] | -[4] |
| L<br>65 Tipperary Drive, Ashtonfield | Day | N/A[2] | 37 | N/A[2] |
| | Evening | N/A[2] | 34 | N/A[2] |
| | Night | N/A[2] | 31 | N/A[2] |
| J<br>220 Parish Drive, Thornton | Day | 39 | 40 | 1 |
| | Evening | 44 | 40 | -4 |
| | Night | 40 | 35 | -5 |

Note 1: Periods are as detailed the NPfI and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: No data was available during baseline measurements, no comparisons can be made.

Note 3: Rounded to the nearest whole dB.

Note 4: No data available or comparison can't be made.

#### 5.2.1.2 Previous Half-year

**Table 13** presents the ambient $L_{A90}$ noise levels recorded for the current monitoring period compared to those measured during the previous monitoring period.

**Table 13 $L_{A90}$ Results Comparison – Previous Half-year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | **December 2021** | **June 2022** | |
| D Black Hill School, Black Hill | Day | 36 | -[3] | -[3] |
| | Evening | 37 | -[3] | -[3] |
| | Night | 35 | -[3] | -[3] |
| F Lot 684 Black Hill Road, Black Hill | Day | 43 | -[3] | -[3] |
| | Evening | 40 | -[3] | -[3] |
| | Night | 36 | -[3] | -[3] |
| G 156 Buchanan Road, Buchanan | Day | 39 | 43 | 4 |
| | Evening | 37 | 40 | 3 |
| | Night | 31 | 34 | 3 |
| I 49 Magnetic Drive, Ashtonfield | Day | 38 | -[3] | -[3] |
| | Evening | 38 | -[3] | -[3] |
| | Night | 40 | -[3] | -[3] |
| L 65 Tipperary Drive, Ashtonfield | Day | 32 | 37 | 5 |
| | Evening | 32 | 34 | 2 |
| | Night | 30 | 31 | 1 |
| J 220 Parish Drive, Thornton | Day | -[3] | 40 | -[3] |
| | Evening | -[3] | 40 | -[3] |
| | Night | -[3] | 35 | -[3] |

Note 1: 1. Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: Rounded to the nearest whole dB.

Note 3: No data available or comparison cannot be made.

#### 5.2.1.3 Coinciding Period last Year

**Table 14** presents the ambient $L_{A90}$ noise levels recorded for the current monitoring period compared to those measured during the coinciding monitoring period last year.

**Table 14 $L_{A90}$ Results Comparison – Coinciding Period Last Year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A90}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | June 2021 | June 2022 | |
| D<br>Black Hill School, Black Hill | Day | 34 | -[3] | -[3] |
| | Evening | 38 | -[3] | -[3] |
| | Night | 37 | -[3] | -[3] |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 45 | -[3] | -[3] |
| | Evening | 42 | -[3] | -[3] |
| | Night | 39 | -[3] | -[3] |
| G<br>156 Buchanan Road, Buchanan | Day | 40 | 43 | 3 |
| | Evening | 37 | 40 | 3 |
| | Night | 30 | 34 | 4 |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 37 | -[3] | -[3] |
| | Evening | 38 | -[3] | -[3] |
| | Night | 34 | -[3] | -[3] |
| L<br>65 Tipperary Drive, Ashtonfield | Day | 37 | 37 | 0 |
| | Evening | 30 | 34 | 4 |
| | Night | 27 | 31 | 3 |
| J<br>220 Parish Drive, Thornton | Day | 38 | 40 | 1 |
| | Evening | 37 | 40 | 3 |
| | Night | 32 | 35 | 3 |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

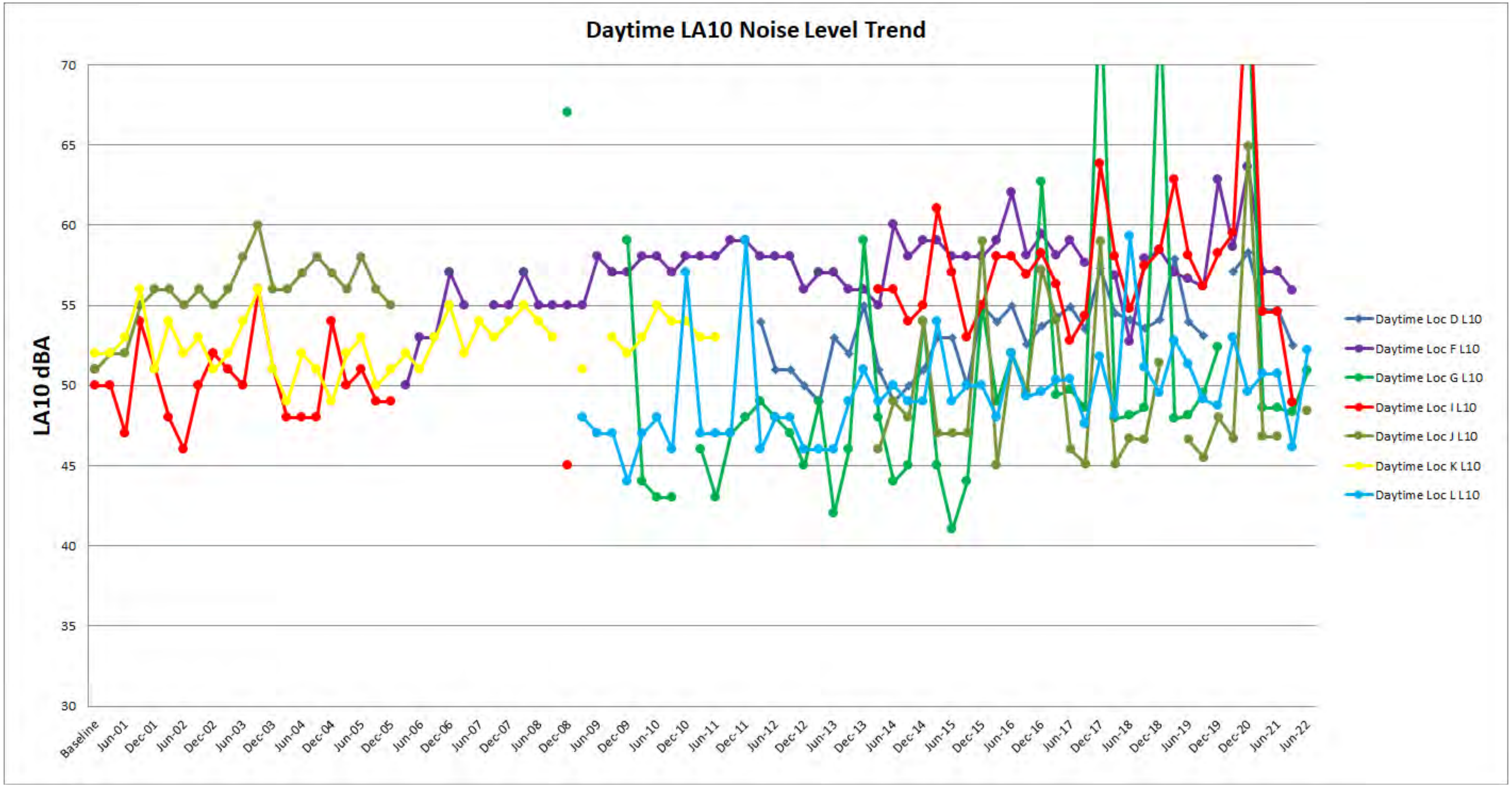
Note 2: Rounded to the nearest whole dB.

Note 3: No data available or comparison cannot be made.

### 5.2.2 Ambient $L_{A10}$ Noise Comparison

The long term ambient $L_{A10}$ noise levels collected from each monitoring location are presented graphically in **Figure 4**, **Figure 5** and **Figure 6** for the daytime, evening and night-time respectively.

## Figure 4 Long Term Daytime LA10 Noise Levels



## Figure 5 Long term Evening LA10 Noise Levels

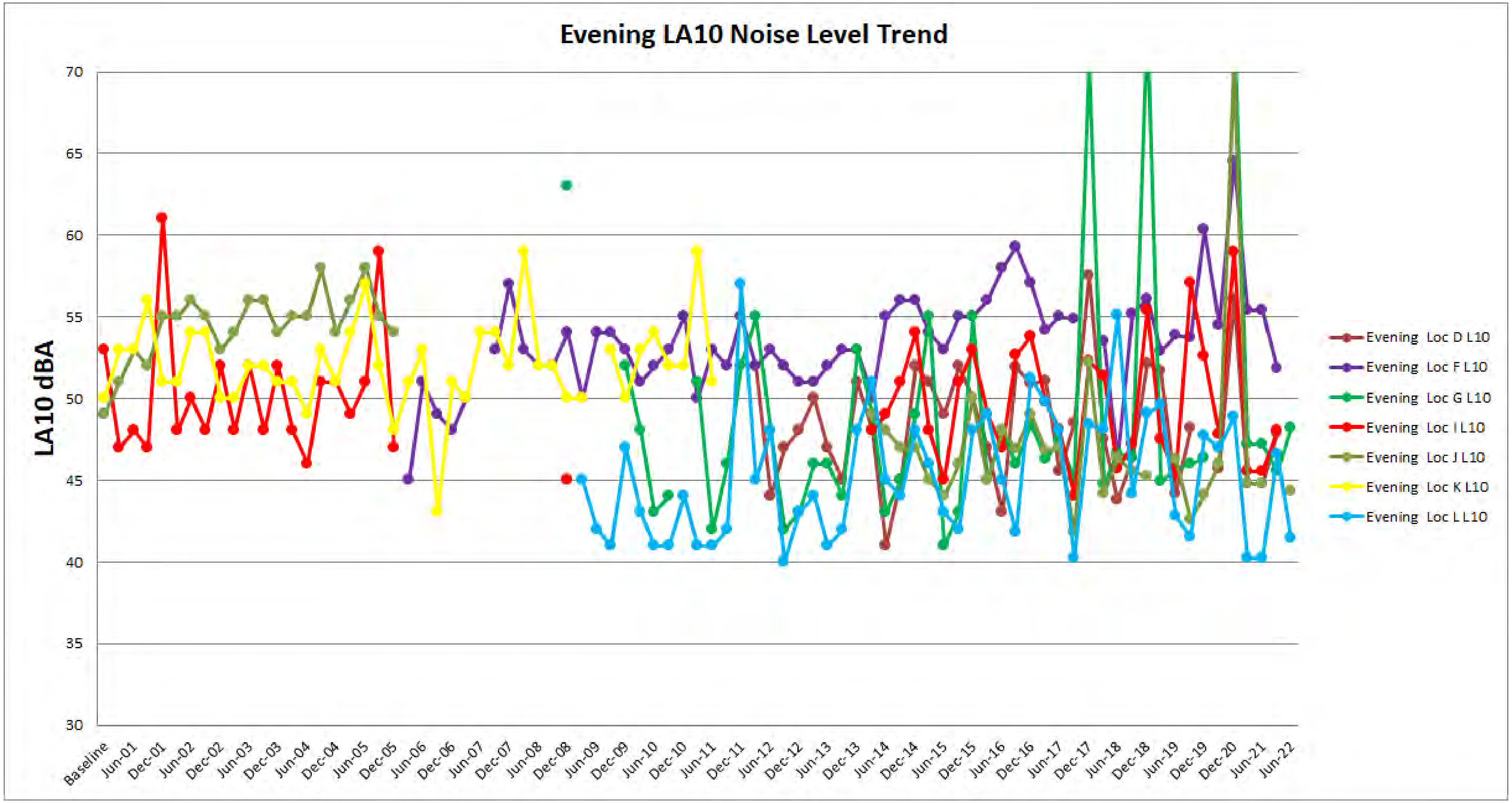
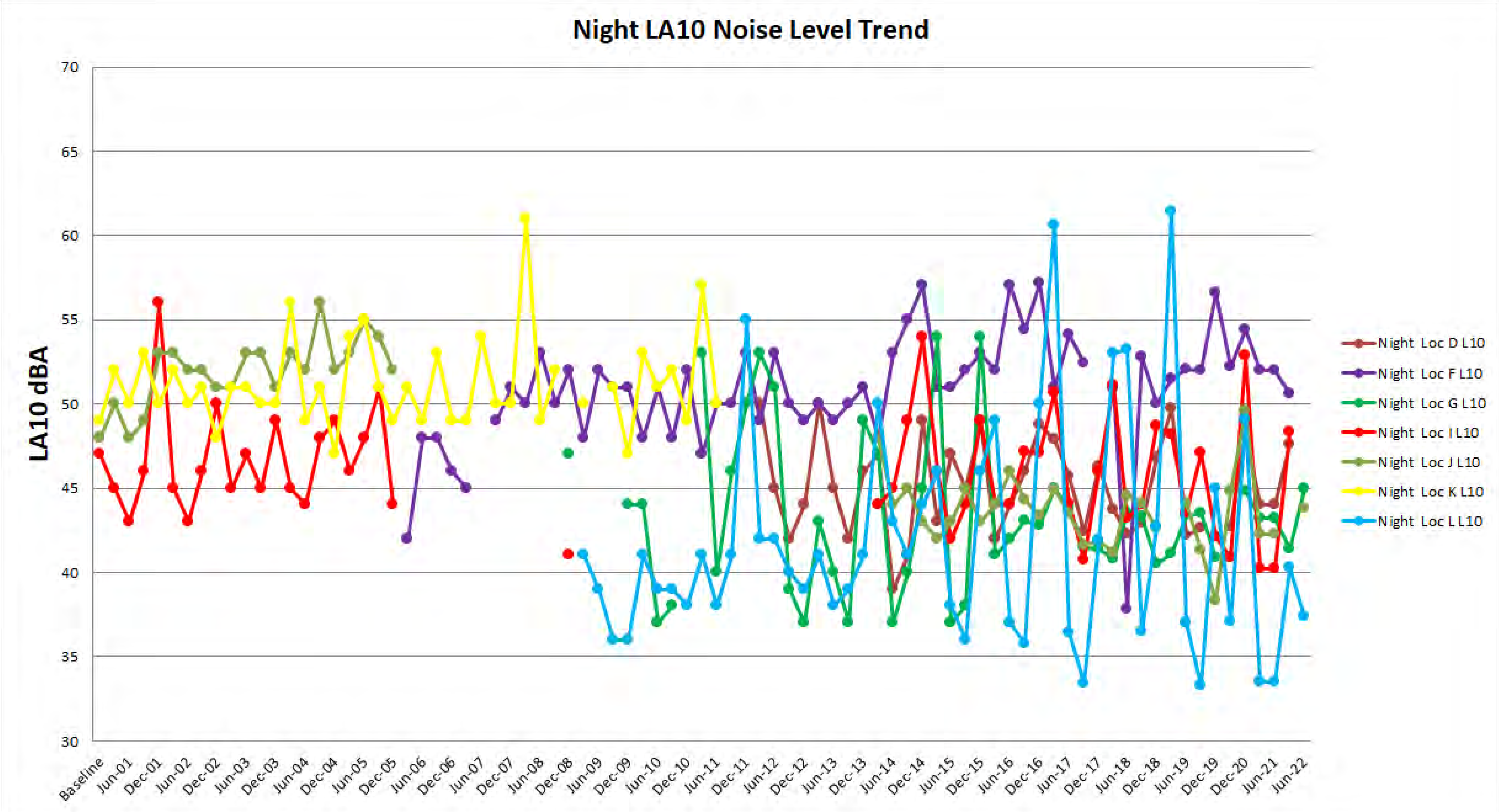


**Figure 6 Long term Night LA10 Noise Levels**



#### 5.2.2.1 Baseline

**Table 15** presents the ambient $L_{A10}$ noise levels recorded for the current monitoring period compared to the levels recorded during the baseline monitoring period.

**Table 15 $L_{A10}$ Results Comparison – Baseline**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[3] |
|---|---|---|---|---|
| | | **Baseline** | **June 2022** | |
| D<br>Black Hill School, Black Hill | Day | N/A[2] | -[4] | N/A |
| | Evening | N/A[2] | -[4] | N/A |
| | Night | N/A[2] | -[4] | N/A |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 51 | -[4] | -[4] |
| | Evening | 49 | -[4] | -[4] |
| | Night | 48 | -[4] | -[4] |
| G<br>156 Buchanan Road, Buchanan | Day | N/A[2] | 51 | N/A |
| | Evening | N/A[2] | 48 | N/A |
| | Night | N/A[2] | 45 | N/A |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 50 | -[4] | -[4] |
| | Evening | 53 | -[4] | -[4] |
| | Night | 47 | -[4] | -[4] |
| L<br>65 Tipperary Drive, Ashtonfield | Day | N/A[2] | 52 | N/A |
| | Evening | N/A[2] | 41 | N/A |
| | Night | N/A[2] | 37 | N/A |
| J<br>220 Parish Drive, Thornton | Day | 51 | 48 | -3 |
| | Evening | 49 | 44 | -5 |
| | Night | 48 | 44 | -4 |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: No data was available during baseline measurements, no comparisons can be made.

Note 3: Difference rounded to the nearest whole dB.

Note 4: No data available or a comparison cannot be made.

#### 5.2.2.2 Previous Half-year

**Table 16** presents the ambient $L_{A10}$ noise levels recorded for the current monitoring period compared to those measured during the previous monitoring period.

### Table 16 $L_{A10}$ Results Comparison – Previous Half-year

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | **December 2021** | **June 2022** | |
| D Black Hill School, Black Hill | Day | 53 | -[4] | -[3] |
| | Evening | 48 | -[4] | -[3] |
| | Night | 48 | -[4] | -[3] |
| F Lot 684 Black Hill Road, Black Hill | Day | 56 | -[4] | -[3] |
| | Evening | 52 | -[4] | -[3] |
| | Night | 51 | -[4] | -[3] |
| G 156 Buchanan Road, Buchanan | Day | 48 | 51 | 3 |
| | Evening | 46 | 48 | 3 |
| | Night | 41 | 45 | 4 |
| I 49 Magnetic Drive, Ashtonfield | Day | 49 | -[4] | -[3] |
| | Evening | 48 | -[4] | -[3] |
| | Night | 48 | -[4] | -[3] |
| L 65 Tipperary Drive, Ashtonfield | Day | 46 | 52 | 6 |
| | Evening | 47 | 41 | -5 |
| | Night | 40 | 37 | -3 |
| J 220 Parish Drive, Thornton | Day | -[3] | 48 | -[3] |
| | Evening | -[3] | 44 | -[3] |
| | Night | -[3] | 44 | -[3] |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: Difference Rounded to the nearest whole dB.

Note 3: No data available or a comparison cannot be made.

#### 5.2.2.3 Coinciding Period Last Year

**Table 17** presents the ambient $L_{A10}$ noise levels recorded for the current monitoring period compared to those measured during the coinciding monitoring period last year.

**Table 17 $L_{A10}$ Result Comparison – Coinciding Period Last Year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | **June 2021** | **June 2022** | |
| D<br>Black Hill School, Black Hill | Day | 55 | -[4] | -[3] |
| | Evening | 45 | -[4] | -[3] |
| | Night | 44 | -[4] | -[3] |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 57 | -[4] | -[3] |
| | Evening | 55 | -[4] | -[3] |
| | Night | 52 | -[4] | -[3] |
| G<br>156 Buchanan Road, Buchanan | Day | 49 | 51 | 2 |
| | Evening | 47 | 48 | 1 |
| | Night | 43 | 45 | 2 |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 55 | -[4] | -[3] |
| | Evening | 46 | -[4] | -[3] |
| | Night | 40 | -[4] | -[3] |
| L<br>65 Tipperary Dr, Ashtonfield | Day | 51 | 52 | 1 |
| | Evening | 40 | 41 | 1 |
| | Night | 34 | 37 | 4 |
| J<br>220 Parish Drive, Thornton | Day | 47 | 48 | 2 |
| | Evening | 45 | 44 | -1 |
| | Night | 42 | 44 | 2 |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: Rounded to the nearest whole dB.

Note 3: No data available or a comparison cannot be made.

## 5.3 Rail Noise Monitoring

In order to determine compliance with the rail noise criteria, a noise logger was positioned at Location J. The train loading times during the noise monitoring period are presented in **Table 18**.

**Table 18 Coal Train Loading Operations Log**

| Date | Coal Train Loading Time | Period |
|---|---|---|
| 11/07/2022 | 07:35-14:15 | Day |
| 12/07/2022 | 07:40-11:20 | Day |

The measured $L_{Aeq(period)}$ noise level for each period from rail traffic at Location J are presented in **Table 19.**

**Table 19 Rail Noise Impact Monitoring Results**

| Location | Date | Period | Measured $L_{Aeq(period)}$ | Criteria $L_{Aeq(period)}$ | Compliance |
|---|---|---|---|---|---|
| | 11/7/2022 | Day | 37 | 55 | Yes |
| | 12/7/2022 | Day | 38 | 55 | Yes |

Results presented in **Table 19** indicate that rail noise levels from the Bloomfield Rail Spur were in compliance with the Abel Mine Project Approval during the noise monitoring period.

# 6 Conclusion

SLR was engaged by Donaldson Coal Pty Ltd to conduct half-yearly noise monitoring surveys for Donaldson Coal Mine and Abel Coal Mine in accordance with the NMP, dated 3 June 2019.

Abel mine was placed in Care & Maintenance on 28th April 2016 and there were no operations onsite, excluding that from the Bloomfield CHPP which operates under the Abel Coal Mine project consent conditions.

Operator-attended and unattended noise measurements were conducted for the June 2022 half at six focus locations surrounding the mine.

Results of the attended noise monitoring have indicated that compliance with the Abel Mine *Project Approval* was achieved at all locations.

A comparison of ambient $L_{A10}$ and $L_{A90}$ noise levels recorded during the current monitoring period (June 2022), the baseline monitoring period, the last monitoring period (December 2021), and the coinciding monitoring period from last year (June 2021) has been conducted.

Rail noise levels from the Bloomfield Rail Spur were considered to be in compliance with the Abel Mine Project Approval during the noise monitoring period.

# APPENDIX A

Acoustic Terminology

## 1. Sound Level or Noise Level

The terms ‘sound’ and ‘noise’ are almost interchangeable, except that ‘noise’ often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x $10^{-5}$ Pa.

## 2. ‘A’ Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an ‘A-weighting’ filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People’s hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

| Sound Pressure Level (dBA) | Typical Source | Subjective Evaluation |
|---|---|---|
| 130 | Threshold of pain | Intolerable |
| 120 | Heavy rock concert | Extremely noisy |
| 110 | Grinding on steel | |
| 100 | Loud car horn at 3 m | Very noisy |
| 90 | Construction site with pneumatic hammering | |
| 80 | Kerbside of busy street | Loud |
| 70 | Loud radio or television | |
| 60 | Department store | Moderate to quiet |
| 50 | General Office | |
| 40 | Inside private office | Quiet to very quiet |
| 30 | Inside bedroom | |
| 20 | Recording studio | Almost silent |

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as ‘linear’, and the units are expressed as dB(lin) or dB.

## 3. Sound Power Level

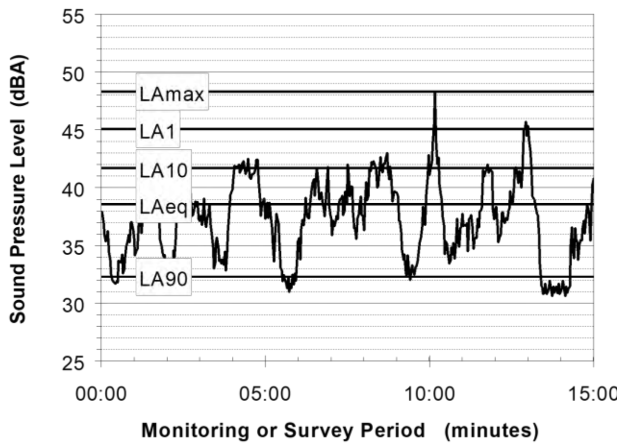
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit $10^{-12}$ W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

## 4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.




Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

## 5. Frequency Analysis

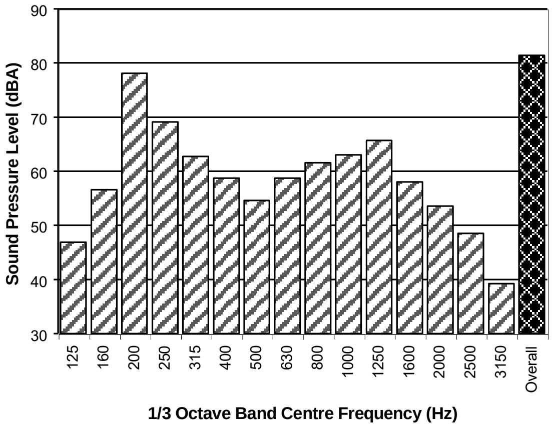
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.




## 6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

## 7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level ($10^{-9}$ m/s). Care is required in this regard, as other reference levels may be used.

## 8. Human Perception of Vibration

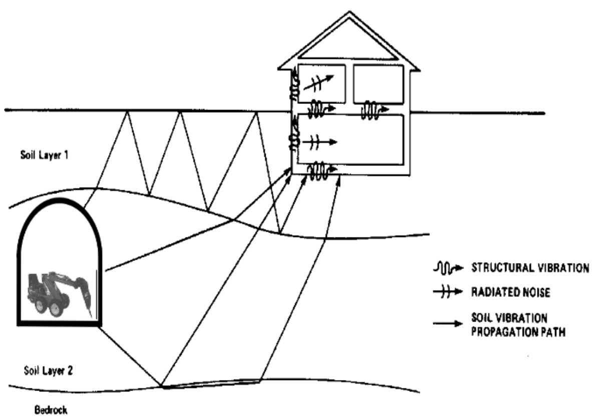
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

## 9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

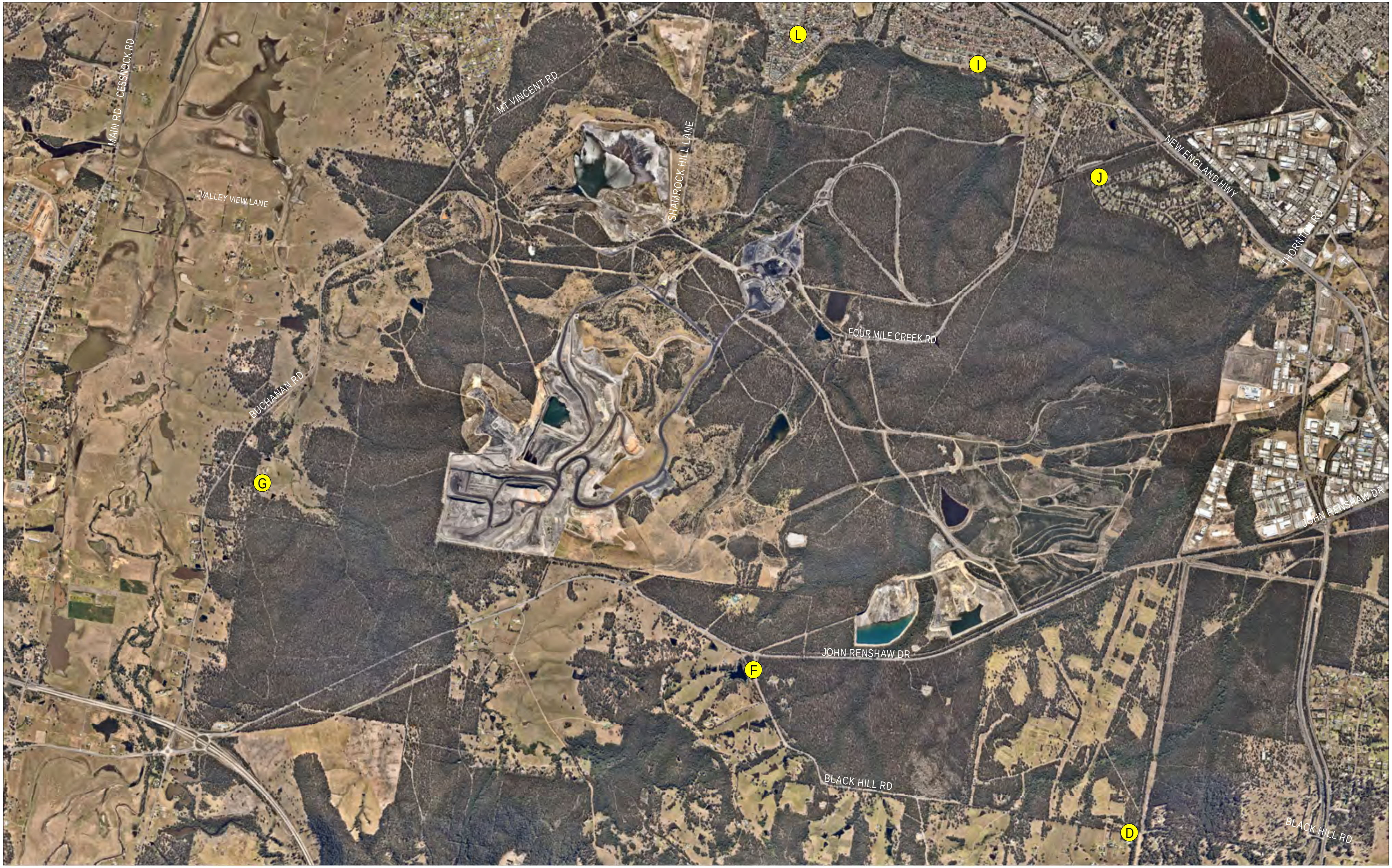
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.




The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

# APPENDIX B

Noise Monitoring Locations




D:\Quick Jobs\Martin Davenport\Donaldson\SLR630010530\1200_AB_MonitoringLocations_01.mxd

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| | |
|---|---|
| Project No.: | 630.01053.01200 |
| Date: | 11/01/2018 |
| Drawn by: | NT |
| Scale: | 1:45,000 |
| Sheet Size: | A4 |
| Projection: | GDA 1994 MGA Zone 56 |

LEGEND

Noise Monitoring Locations

N W E S

0 500 1,000 1,500 2,000 m

Donaldson Coal

Noise Monitoring

**Noise Monitoring Locations**

APPENDIX B

# APPENDIX C

Calibration Certificates

# Certificate Of Calibration

**Certificate No: SLM32604**

**Equipment Tested:** Sound Level Meter

| | | | |
|---|---|---|---|
| **Manufacturer:** | Svantek | | |
| **Type No:** | SVAN-977C | **Serial No:** | 98070 |
| **Mic. Type:** | MK255 | **Serial No:** | 21096 |
| **Pre-Amp. Type:** | SV12L | **Serial No:** | 118240 |
| **Filter Type:** | 1/3 Octave | **Test No:** | F032610 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013 & IEC 61260-3:2016

**Comments:** All Test passed for Class 1. (See overleaf for details)

**Conditions Of Test:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 1003 | hPa ±1 hPa | **Date of Receipt :** | 17/05/2022 |
| **Temperature** | 24 | °C ±1° C | **Date of Calibration :** | 17/05/2022 |
| **Relative Humidity** | 51 | % ±5% | **Date of Issue :** | 18/05/2022 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**Checked By:** KB **Authorised Signature:** Bruce Meldrum

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**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing successfully completed the 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 specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications 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.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:**

| **Tests performed** | *Clause* | *Result* |
|---|---|---|
| *Test of relative attenuation at filter midband frequency* | 10 | Pass |
| *Linear operating range including range control if fitted* | 11 | Pass |
| *Test of lower limit of linear operating range* | 12 | Pass |
| *Measurement of relative attenuation (filter shape)* | 13 | Pass |

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

**A full technical report is available on request.**

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO: SLM32386**

**EQUIPMENT TESTED:** Sound & Vibration Analyser

**Manufacturer:** Svantek
**Type No:** SVAN-977A **Serial No:** 69757
**Mic. Type:** 7052E **Serial No:** 71198
**Pre-Amp. Type:** SV12L **Serial No:** 73688

**Filter Type:** 1/3 Octave **Test No:** F032387

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013 & IEC 61260-3:2016

**Comments:** All Test passed for Class 1. (See overleaf for details)

**CONDITIONS OF TEST:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 1004 | hPa ±1 hPa | **Date of Receipt :** | 11/04/2022 |
| **Temperature** | 23 | °C ±1° C | **Date of Calibration :** | 27/04/2022 |
| **Relative Humidity** | 63 | % ±5% | **Date of Issue :** | 27/04/2022 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** ..................... **AUTHORISED SIGNATURE:** .....................

Bruce Meldrum

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**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing successfully completed the 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 specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications 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.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:**

| **Tests performed** | *Clause* | *Result* |
|---|---|---|
| *Test of relative attenuation at filter midband frequency* | 10 | Pass |
| *Linear operating range including range control if fitted* | 11 | Pass |
| *Test of lower limit of linear operating range* | 12 | Pass |
| *Measurement of relative attenuation (filter shape)* | 13 | Pass |

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

**A full technical report is available on request.**

# Certificate Of Calibration

**Certificate No: SLM32724**

**Equipment Tested:** Sound & Vibration Analyser

| | | | |
|---|---|---|---|
| **Manufacturer:** | Svantek | | |
| **Type No:** | Svan-957 | **Serial No:** | 20665 |
| **Mic. Type:** | 7052E | **Serial No:** | 80497 |
| **Pre-Amp. Type:** | SV12L | **Serial No:** | 106966 |
| **Filter Type:** | 1/1 Octave | **Test No:** | FILT6780 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013,
IEC 1260:1995, & AS/NZS 4476:1997

**Comments:** All Test passed for Class 1. (See overleaf for details)

**Conditions Of Test:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 986 | hPa ±1 hPa | **Date of Receipt :** | 22/02/2022 |
| **Temperature** | 21 | °C ±1° C | **Date of Calibration :** | 30/05/2022 |
| **Relative Humidity** | 48 | % ±5% | **Date of Issue :** | 30/05/2022 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**Checked by:** ........ **Authorised Signature:** ..........

Hein Soe

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**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| Tests Performed: | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing successfully completed the 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 specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications 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.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**A full technical report is available on request.**

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO: SLM30625**

**EQUIPMENT TESTED:** Sound Level Meter

| | | | |
|---|---|---|---|
| **Manufacturer:** | B & K | | |
| **Type No:** | 2270 | **Serial No:** | 2679354 |
| **Mic. Type:** | 4189 | **Serial No:** | 2695417 |
| **Pre-Amp. Type:** | ZC0032 | **Serial No:** | 12254 |
| **Filter Type:** | 1/3 Octave | **Test No:** | FILT 6666 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013,
IEC 1260:1995, & AS/NZS 4476:1997

**Comments:** All Test passed for Class 1. (See overleaf for details)

**CONDITIONS OF TEST:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 994 | hPa ±1 hPa | **Date of Receipt :** | 17/09/2021 |
| **Temperature** | 24 | °C ±1° C | **Date of Calibration :** | 21/09/2021 |
| **Relative Humidity** | 27 | % ±5% | **Date of Issue :** | 21/09/2021 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** .......... **AUTHORISED SIGNATURE:** ..........................

Jack Kielt

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**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Not Applicable |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing successfully completed the 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 specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications 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.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**A full technical report is available on request.**

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# Sound Level Meter

## AS 1259-1:1990 - AS 1259-2:1990

# Calibration Certificate

**Calibration Number** C22207

**Client Details** SLR Consulting Pty Ltd
Level 11, 176 Wellington Parade
East Melbourne VIC 3002

**Equipment Tested/ Model Number :** ARL EL-316
**Instrument Serial Number :** 16-306-042
**Microphone Serial Number :** 313469
**Pre-amplifier Serial Number :** 28223

**Atmospheric Conditions**
**Ambient Temperature :** 24°C
**Relative Humidity :** 63.6%
**Barometric Pressure :** 100.9kPa

**Calibration Technician :** Lucky Jaiswal **Secondary Check:** Shaheen Boaz
**Calibration Date :** 7 Apr 2022 **Report Issue Date :** 7 Apr 2022

**Approved Signatory :** Ken Williams

| Clause and Characteristic Tested | Result | Clause and Characteristic Tested | Result |
|---|---|---|---|
| 10.2.2: Absolute sensitivity | *Pass* | 10.3.4: Inherent system noise level | *Pass* |
| 10.2.3: Frequency weighting | *Pass* | 10.4.2: Time weighting characteristic F and S | *Pass* |
| 10.3.2: Overload indications | *Pass* | 10.4.3: Time weighting characteristic I | *Pass* |
| 10.3.3: Accuracy of level range control | *Pass* | 10.4.5: R.M.S performance | *Pass* |
| 8.9: Detector-indicator linearity | *Pass* | 9.3.2: Time averaging | *Pass* |
| 8.10: Differential level linearity | *Pass* | 9.3.5: Overload indication | *Pass* |

Uncertainties of Measurement -

| Acoustic Tests | | Environmental Conditions | |
|---|---|---|---|
| *31.5 Hz to 8kHz* | *±0.14dB* | *Temperature* | *±0.1°C* |
| *12.5kHz* | *±0.19dB* | *Relative Humidity* | *±1.9%* |
| *16kHz* | *±0.29dB* | *Barometric Pressure* | *±0.014kPa* |
| Electrical Tests | | | |
| *31.5 Hz to 20 kHz* | *±0.11dB* | | |

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

*The sound level meter under test has been shown to conform to the type 1 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.*

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 units.

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# Sound Level Meter
## AS 1259-1:1990 - AS 1259-2:1990
# Calibration Test Report

**Calibration Number** C22207

**Client Details** SLR Consulting Pty Ltd
Level 11, 176 Wellington Parade
East Melbourne VIC 3002

**Equipment Tested/ Model Number :** ARL EL-316
**Instrument Serial Number :** 16-306-042
**Microphone Serial Number :** 313469
**Pre-amplifier Serial Number :** 28223

**Atmospheric Conditions**
**Ambient Temperature :** 24°C
**Relative Humidity :** 63.6%
**Barometric Pressure :** 100.9kPa

**Calibration Technician :** Lucky Jaiswal **Secondary Check:** Shaheen Boaz
**Calibration Date :** 7 Apr 2022 **Report Issue Date :** 7 Apr 2022

**Approved Signatory :** Ken Williams

| Clause and Characteristic Tested | Result | Clause and Characteristic Tested | Result |
|---|---|---|---|
| 10.2.2: Absolute sensitivity | *Pass* | 10.3.4: Inherent system noise level | *Pass* |
| 10.2.3: Frequency weighting | *Pass* | 10.4.2: Time weighting characteristic F and S | *Pass* |
| 10.3.2: Overload indications | *Pass* | 10.4.3: Time weighting characteristic I | *Pass* |
| 10.3.3: Accuracy of level range control | *Pass* | 10.4.5: R.M.S performance | *Pass* |
| 8.9: Detector-indicator linearity | *Pass* | 9.3.2: Time averaging | *Pass* |
| 8.10: Differential level linearity | *Pass* | 9.3.5: Overload indication | *Pass* |

Uncertainties of Measurement -

| | | | |
|---|---|---|---|
| Acoustic Tests | | Environmental Conditions | |
| *31.5 Hz to 8kHz* | *±0.14dB* | *Temperature* | *±0.1°C* |
| *12.5kHz* | *±0.19dB* | *Relative Humidity* | *±1.9%* |
| *16kHz* | *±0.29dB* | *Barometric Pressure* | *±0.014kPa* |
| Electrical Tests | | | |
| *31.5 Hz to 20 kHz* | *±0.11dB* | | |

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

*The sound level meter under test has been shown to conform to the type 1 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.*

# 1. OVERVIEW

This report presents the calibration test results of a ARL EL-316 Sound Level Meter, and associated equipment. Calibration is carried out in accordance with *AS1259.1:1990, Sound Level Meters, Non Integrating*, and if applicable, *AS1259.2:1990, Sound Level Meters, Integrating-averaging*.

Relevant clauses from this standard have been used for periodic testing in conjunction with Acoustic Research Labs internal test methods described in Section 2 of the calibration work instruction manual.

## 1.1 UNCERTAINTIES

For each test performed, the associated measurement uncertainties are derived at the 95% confidence level and are given with a coverage factor of 2.

The uncertainty applies at the time of measurement only, and takes no account of any drift or other effects that may apply afterwards. When estimating uncertainty at any later time, other relevant information should also be considered, including, where possible, the history of the performance of the instrument and the manufacturer's specifications.

## 1.2 DOCUMENT CONVENTIONS

Test results which highlight non-conformances relative to the standard, and the sound level meter type specified by the manufacturer have been marked with an **F** in the respective tests.

Any tests that are not required, due to sound level meter configuration, are marked N/A.

# 2. GENERAL

## 2.1 ENVIRONMENTAL CONDITIONS DURING TEST

No corrections have been applied to any results obtained to compensate for the above environmental conditions.

## 2.2 CALIBRATION TESTS

Where applicable the following tests were performed in accordance with AS1259.1:1990. These clauses are used for periodic calibration testing of Sound Level Meters, Non-integrating.

| | |
|---|---|
| Clause 8.9 | Detector-Indicator linearity |
| Clause 8.10 | Differential level linearity |
| Clause 10.2.2 | Absolute sensitivity |
| Clause 10.2.3 | Frequency weighting |
| Clause 10.3.2 | Overload indication |
| Clause 10.3.3 | Accuracy of level range control |
| Clause 10.3.4 | Inherent weighted system noise level |
| Clause 10.4.2 | Time-weighting characteristics F and S |
| Clause 10.4.3 | Time weighting characteristics I |
| Clause 10.4.4 | Time weighting characteristics P |
| Clause 10.4.5 | RMS performance |

Where the sound level meter includes an integrating or averaging function, the following additional tests were performed in accordance with AS1259.2:1990. These clauses are used for periodic calibration testing of Sound Level Meters, Integrating-averaging.

| | |
|---|---|
| Clause 9.3.2 | Time Averaging |
| Clause 9.3.5 | Overload Indication |

## 2.3 TEST EQUIPMENT USED

All test equipment used during periodic testing are calibrated every 12months by an accredited laboratory, traceable to SI units.

The performance of all equipment during these calibrations and the effects of instrument stability are used to determine the measurement uncertainty of each reported result.

### 2.3.1 Multi-function Acoustic Calibrator

A Bruel & Kjaer 4226 Multi-function calibrator (S/N - 3215300) was used for frequency response testing of the entire instrument (including microphone). This instrument was used as a reference calibrator and for frequency response verification.

### 2.3.2 Microphone Electrical Equivalent Circuit

Calibration of most instrument parameters is carried out using electrical signals fed to the unit via a two-port electrical equivalent circuit of the microphone.

A N/ApF capacitance dummy microphone was used during testing.

### 2.3.3 Adjustable Attenuator

A means for varying the attenuation of electrical signals via the dummy microphone was provided by a JFW Industries dual rotary attenuator (S/N - 792819 2132). The attenuator is switchable in 1dB steps between 0dB and 60dB.

### 2.3.4 Arbitrary Function Generator

A Hewlett Packard 33120A (S/N - US36047448) was used to generate the required electrical signals.

### 2.3.5 Environmental Monitoring

A MHB-382SD (S/N –AH.88227) was used for measuring environmental conditions during device calibration. It is capable of providing temperature, relative humidity and pressure measurements.

# 3. CALIBRATION TEST RESULTS

## 3.1 ACOUSTIC CALIBRATION TEST RESULTS

The following tests were performed on the complete sound level meter with the associated pre-amplifier and microphone attached. A multi-function acoustic calibrator was used for providing test signals for testing the acoustic measurement capabilities.

### 3.1.1 Absolute Sensitivity

The absolute sensitivity test was performed by providing an acoustic signal at the reference frequency and reference level at the reference direction of the sound level meter as specified by the manufacturer and recording the results. The instrument's absolute sensitivity was then adjusted according to manufacturer's specifications and a post adjustment measurement was taken.

**Table 1 – Pre-Adjustment Absolute sensitivity test results**

| Frequency Weighting | Sound Pressure Level (dB) |
|---|---|
| A | 94.2 |
| C | 94.2 |
| Linear | N/A |

**Table 2 – Post-Adjustment Absolute sensitivity test results**

| Frequency Weighting | Sound Pressure Level (dB) |
|---|---|
| A | 94.2 |
| C | 94.2 |
| Linear | N/A |

The measurement uncertainty for the above tests, derived at the 95% confidence level is  0.13dB.

### 3.1.2 Frequency Weighting

The frequency weighting test was performed by providing an acoustic signal at the reference level of the sound level meter as specified by the manufacturer.

Frequencies were then altered in nominal full octave steps to test the frequency weighting performance.

**Table 3 - Acoustic frequency response test**

| Frequency (Hz) | A Weighted Response (dB) | C Weighted Response (dB) | Lin Weighted Response (dB) | Uncertainty (dB) |
|---|---|---|---|---|
| 31.6 | 55.4 | 91.3 | N/A | 0.1 |
| 63.1 | 68.5 | 93.5 | N/A | 0.1 |
| 125.9 | 78.3 | 94.1 | N/A | 0.1 |
| 251.3 | 85.4 | 94.0 | N/A | 0.1 |
| 502.5 | 90.6 | 94.0 | N/A | 0.1 |
| 1005.1 | 94.2 | 94.2 | N/A | 0.1 |
| 1978.8 | 95.7 | 94.2 | N/A | 0.1 |
| 3957.5 | 95.9 (E) | 93.9 | N/A | 0.1 |
| 7915.1 | 93.7 | 91.5 | N/A | 0.1 |
| 12664.1 | 89.7 | 87.6 | N/A | 0.2 |
| 15830.2 | 86.9 | 84.9 | N/A | 0.3 |

The measurement uncertainties for this test, derived at the 95% confidence level are as shown in Table 3.

### 3.1.3 Overload Indication Test - Acoustic Inverse A Weighting Test

The overload indication test was performed by providing an acoustic signal at the reference level and reference frequency. The frequency level was altered in octave steps, and the level was adjusted, according to the A weighting filter response in order to maintain the same sound pressure level display.

Where the sound pressure level is not within the A weighting tolerance, a clear overload indication is to be displayed.

**Table 4 - Acoustic inverse A weighting test**

| Frequency (Hz) | Inverse A Weighting Level (dB) | Deviation From Expected Response (dB) | Overload Indicated (Y/N?) | Uncertainty (dB) |
|---|---|---|---|---|
| 20.0 | N/A | N/A | N/A | 0.1 |
| 31.6 | N/A | N/A | N/A | 0.1 |
| 63.1 | N/A | N/A | N/A | 0.1 |
| 125.9 | 115.3 | -0.3 | Y | 0.1 |
| 251.2 | 114.9 | 0.1 | N | 0.1 |
| 501.2 | 114.9 | 0.1 | N | 0.1 |
| 1000.0 | 115.0 | 0.0 | N | 0.1 |

The measurement uncertainties for this test, derived at the 95% confidence level are as shown in Table 4.

## 3.2 ELECTRICAL CALIBRATION TEST RESULTS

Electrical testing was performed by removing the microphone and substituting an equivalent electrical impedance by use of a dummy microphone. Electrical signals were then provided by an arbitrary waveform generator, via an adjustable attenuator to provide appropriate input levels.

### 3.2.1 Detector-Indicator Linearity

Detector-indicator linearity tests were performed by providing an electrical signal at the reference level of the sound level meter as specified by the manufacturer. Sound pressure levels were then altered to test the linearity of the sound level meter.

Tests were also performed at 31.5Hz and 8000Hz.

**Table 5 - Detector-indicator linearity test**

| Amplitude (dB) | 1000 Hz Response (dB) | 8000 Hz Response (dB) | 31.5 Hz Response (dB) |
|---|---|---|---|
| 110.0 | 110.2 | 110.4 | 110.3 |
| 100.0 | 99.9 | 99.7 | 99.8 |
| 90.0 | 89.9 | 90.0 | 89.9 |
| 80.0 | 80.1 | 80.1 | 80.1 |
| 70.0 | 69.9 | 69.8 | 69.9 |
| 60.0 | 59.9 | 60.1 | 59.9 |
| 50.0 | 50.0 | 50.0 | 50.0 |

The measurement uncertainties for this test, derived at the 95% confidence level is 0.1dB for 1000Hz, 0.1db for 8000Hz tests and 0.1dB for 31.5Hz tests.

### 3.2.2 Differential Level Linearity

Differential level linearity tests were performed by providing an electrical signal at the Reference Level of the sound level meter as specified by the manufacturer. Sound pressure levels were then altered to test the linearity of the sound level meter.

Tests were also performed at 31.5Hz and 8000Hz.

**Table 6 - Differential level linearity test**

| Amplitude (dB) | 1000 Hz Response (dB) | 8000 Hz Response (dB) | 31.5 Hz Response (dB) |
|---|---|---|---|
| 99.0 | 99.1 | 99.2 (E) | 99.1 |
| 98.0 | 98.0 | 98.0 | 98.0 |
| 97.0 | 97.0 | 96.9 | 97.0 |
| 96.0 | 95.9 | 95.9 | 96.0 |
| 95.0 | 95.0 | 95.0 | 94.9 |
| 94.0 | 94.0 | 94.0 | 94.0 |
| 93.0 | 93.0 | 93.0 | 93.0 |
| 92.0 | 92.0 | 92.0 | 92.0 |
| 91.0 | 91.1 | 91.1 | 91.1 |
| 90.0 | 89.9 | 89.9 | 90.0 |
| 89.0 | 89.0 | 89.0 | 89.0 |

The measurement uncertainties for this test, derived at the 95% confidence level is  0.1dB for 1000Hz, 0.1db for 8000Hz tests and  0.1dB for 31.5Hz tests.

### 3.2.3 Frequency Weighting

The frequency weighting test was performed by providing an electrical signal at the reference level of the sound level meter as specified by the manufacturer.

Frequency levels were then altered in exact one third octave steps to test the frequency weighting performance.

**Table 7 - Electrical frequency response test**

| Frequency (Hz) | A Weighted Response (dB) | C Weighted Response (dB) | Lin Weighted Response (dB) | Uncertainty (dB) |
|---|---|---|---|---|
| 10.0 | 24.3 | 77.9 | N/A | 0.1 |
| 12.6 | 29.8 | 81.7 | N/A | 0.1 |
| 15.9 | 36.8 | 85.0 | N/A | 0.1 |
| 20.0 | 43.6 | 87.5 | N/A | 0.1 |
| 25.1 | 49.6 | 89.6 | N/A | 0.1 |
| 31.6 | 55.1 | 91.0 | N/A | 0.1 |
| 39.8 | 59.8 | 92.0 | N/A | 0.1 |
| 50.1 | 64.1 | 92.8 | N/A | 0.1 |
| 63.1 | 68.3 | 93.3 | N/A | 0.1 |
| 79.4 | 72.0 | 93.6 | N/A | 0.1 |
| 100.0 | 75.3 | 93.8 | N/A | 0.1 |
| 125.9 | 78.1 | 94.0 | N/A | 0.1 |
| 158.5 | 80.8 | 94.0 | N/A | 0.1 |
| 199.5 | 83.2 | 94.0 | N/A | 0.1 |
| 251.2 | 85.3 | 94.0 | N/A | 0.1 |
| 316.2 | 87.3 | 94.0 | N/A | 0.1 |
| 398.1 | 88.9 | 94.1 | N/A | 0.1 |
| 501.2 | 90.5 | 94.0 | N/A | 0.1 |
| 631.0 | 92.0 | 94.0 | N/A | 0.1 |
| 794.3 | 93.1 | 94.0 | N/A | 0.1 |
| 1000.0 | 94.0 | 94.0 | N/A | 0.1 |
| 1259.0 | 94.5 | 94.0 | N/A | 0.1 |
| 1585.0 | 95.0 | 94.0 | N/A | 0.1 |
| 1995.0 | 95.3 | 93.9 | N/A | 0.1 |
| 2512.0 | 95.3 | 93.6 | N/A | 0.1 |
| 3162.0 | 95.3 | 93.4 | N/A | 0.1 |
| 3981.0 | 95.0 | 92.9 | N/A | 0.1 |
| 5012.0 | 94.4 | 92.3 | N/A | 0.1 |
| 6310.0 | 93.5 | 91.4 | N/A | 0.1 |
| 7943.0 | 92.3 | 90.1 | N/A | 0.1 |
| 10000.0 | 90.6 | 88.4 | N/A | 0.1 |
| 12590.0 | 88.5 | 86.4 | N/A | 0.1 |
| 15850.0 | 86.1 | 83.9 | N/A | 0.1 |
| 19950.0 | 83.0 | 80.9 | N/A | 0.1 |

The measurement uncertainties for this test, derived at the 95% confidence level are as shown in Table 7.

### 3.2.4 Overload Indication - Electrical Rectangular Pulse Test

The overload indication was tested electrically by applying rectangular test pulses of various crest factors at a level 2dB below the upper limit of the primary indicator range.

Where the response is not within the crest factor tolerance, a clear overload indication is to be displayed.

**Table 8 - Electrical rectangular pulse test**

| Pulse Direction and Crest Factor | Response (dB) | Overload Indicated (Y/N?) |
|---|---|---|
| CF3 Positive | 108.0 | N |
| CF3 Negative | 107.9 | N |
| CF5 Positive | N/A | N/A |
| CF5 Negative | N/A | N/A |
| CF10 Positive | N/A | N/A |
| CF10 Negative | N/A | N/A |

The measurement uncertainty for this test, derived at the 95% confidence level is 0.2dB.

### 3.2.5 Accuracy of Level Range Control

The accuracy of the level range control was tested by applying a sound pressure level half way between the maximum and minimum of the highest scale. The sound pressure level was then reduced by half of the scale range, each time reducing the level range by one step.

**Table 9 - Accuracy of level range control - C Weighting**

| Range (dB) | 20 Hz Level (dB) | 31.5 Hz Level (dB) | 1000 Hz Level (dB) | 8000 Hz Level (dB) | 12500 Hz Level (dB) |
|---|---|---|---|---|---|
| 30 - 120 | N/A | N/A | N/A | N/A | N/A |

The measurement uncertainties for this test, derived at the 95% confidence level are 0.1dB for 20Hz-31.5Hz tests and 0.1dB for 1000Hz-12500Hz tests.

### 3.2.6 Inherent Weighted System Noise Level

The weighted inherent system noise level (electrical noise floor) was tested by removing any input signal to the dummy microphone, and electrically shorting the input to this device.

**Table 10 - Inherent weighted system noise level**

| Frequency Weighting | Level (dB) | Under Range |
|---|---|---|
| A | 21.0 | N/A |
| C | 19.7 | N/A |
| Lin | N/A | N/A |

### 3.2.7 Time Weighting Characteristics - Fast and Slow

#### 3.2.7.1 Onset Transient Characteristics

Onset Transient Characteristics were tested by applying single sinusoidal tonebursts of specified duration and amplitude, and recording the maximum response sound pressure level.

**Table 11 - Onset transient characteristics**

| Continuous Level (dB) | Fast Weighting Response (dB) (200ms Toneburst) | Slow - 500ms Toneburst (dB) (500ms Toneburst) |
|---|---|---|
| 106.0 | 105.1 | N/A |
| 96.0 | 94.7 | N/A |
| 86.0 | 84.9 | N/A |
| 76.0 | 75.0 | N/A |
| 66.0 | 64.8 | N/A |
| 56.0 | 55.1 | N/A |

The measurement uncertainty for this test, derived at the 95% confidence level is 0.1dB.

#### 3.2.7.2 Overshoot

Overshoot was tested by suddenly increasing the sound pressure level by 20dB, and recording the maximum response sound pressure level.

**Table 12 - Overshoot**

| Continuous Level (dB) | Fast Weighting Response (dB) (200ms Toneburst) | Slow - 500ms Toneburst (dB) (500ms Toneburst) |
|---|---|---|
| 106.0 | 106.0 | N/A |
| 96.0 | 96.0 | N/A |
| 86.0 | 85.9 | N/A |
| 76.0 | 76.0 | N/A |
| 66.0 | 66.0 | N/A |
| 56.0 | 56.0 | N/A |

The measurement uncertainty for this test, derived at the 95% confidence level is 0.1dB.

#### 3.2.7.3 Decay Time

Decay times were tested by measuring the amount of time taken for the sound pressure level to fall by 10dB, after an input signal is suddenly withdrawn.

**Table 13 - Decay Time**

| Continuous Level (dB) | Fast Weighting Response 10dB Decay Time (s) | Slow Weighting Response 10dB Decay Time (s) |
|---|---|---|
| 106.0 | 0.3 | N/A |

The measurement uncertainty for this test, derived at the 95% confidence level is 0.1dB.

### 3.2.8 Time Weighting Characteristic - Impulse

#### 3.2.8.1 Response to a Single Burst

The time weighting characteristic I was tested by applying single sinusoidal tonebursts of specified duration and amplitude, and recording the maximum response sound pressure level.

**Table 14 - Response to a single burst**

| Amplitude (dB) | 20ms Burst Response (dB) | 5ms Burst Response (dB) | Increase in reading for +5dB input for 5ms Burst (dB) | 2ms Burst Response (dB) | Increase in reading for +10dB input for 2ms Burst (dB) |
|---|---|---|---|---|---|
| 100.0 | N/A | N/A | N/A | N/A | N/A |
| 90.0 | N/A | N/A | N/A | N/A | N/A |
| 80.0 | N/A | N/A | N/A | N/A | N/A |
| 70.0 | N/A | N/A | N/A | N/A | N/A |
| 60.0 | N/A | N/A | N/A | N/A | N/A |

### 3.2.8.2 Response to a Continuous Sequence of Bursts

The time weighting characteristic I was tested by applying a continuous sequence of bursts of a fixed reference amplitude, frequency and duration at various burst frequencies. The sound pressure level was recorded for each burst frequency at various levels.

**Table 15 - Response to a continuous sequence of bursts**

| Amplitude (dB) | 100Hz Response (dB) | 20Hz Response (dB) | 2Hz Response (dB) | Increase in reading for +5dB input for 2Hz (dB) |
|---|---|---|---|---|
| 100.0 | N/A | N/A | N/A | N/A |
| 90.0 | N/A | N/A | N/A | N/A |
| 80.0 | N/A | N/A | N/A | N/A |
| 70.0 | N/A | N/A | N/A | N/A |
| 60.0 | N/A | N/A | N/A | N/A |

### 3.2.8.3 Decay Time

Decay rate for impulse response was tested by measuring the amount of time taken for the sound pressure level to fall by 10dB, after an input signal is suddenly withdrawn.

**Table 16 - Decay Time**

| Continuous Level (dB) | Impulse Response Decay Rate (dB/s) |
|---|---|
| 100.0 | N/A |

### 3.2.9 Time Weighting Characteristic - Peak

The time weighting characteristic P was tested by applying a rectangular test pulse equal to the onset time as specified by the manufacturer. The onset time was then calculated by reducing the width of the test pulse until the instrument indicated a level 2dB less than that of the Reference Test Pulse.

**Table 17 - Onset time pulse test**

| | Positive Pulse | Negative Pulse |
|---|---|---|
| Reference Test Pulse (dB) | N/A | N/A |
| Onset Time (μs) | N/A | N/A |

### 3.2.10 RMS Performance

#### 3.2.10.1 Rectangular Pulse Test

The RMS Performance was tested by producing repetitive short term rectangular pulses of different crest factors with an equal RMS level to that of a reference continuous sinusoidal signal. The output level of the rectangular pulse was measured in order to verify the RMS performance.

**Table 18 - RMS performance for rectangular pulse**

| Amplitude (dB) | CF = 3 Positive Pulse Response (dB) | CF = 3 Negative Pulse Response (dB) | CF = 5 Positive Pulse Response (dB) | CF = 5 Negative Pulse Response (dB) | CF = 10 Positive Pulse Response (dB) | CF = 10 Negative Pulse Response (dB) |
|---|---|---|---|---|---|---|
| 108.0 | 108.0 | 107.9 | N/A | N/A | N/A | N/A |
| 98.0 | 98.0 | 97.8 | N/A | N/A | N/A | N/A |
| 88.0 | 87.7 | 87.6 | N/A | N/A | N/A | N/A |
| 78.0 | 77.9 | 77.8 | N/A | N/A | N/A | N/A |
| 68.0 | 67.9 | 67.7 | N/A | N/A | N/A | N/A |
| 58.0 | 57.6 | 57.4 (E) | N/A | N/A | N/A | N/A |

The measurement uncertainty for this test, derived at the 95% confidence level is 0.2dB.

### 3.2.10.2 Continuous Toneburst Test

The RMS performance was tested by applying a continuous sequence of bursts of a fixed reference amplitude and burst frequency. The burst count was altered in order to provide various signals of different crest factor.

The sound pressure level was recorded for each test signal of different crest factor at different levels.

**Table 19 - RMS performance for continuous toneburst**

| Amplitude (dB) | CF = 3 Response (dB) | CF = 5 Response (dB) | CF = 10 Response (dB) |
|---|---|---|---|
| 108.0 | 108.1 | N/A | N/A |
| 98.0 | 98.1 | N/A | N/A |
| 88.0 | 88.0 | N/A | N/A |
| 78.0 | 78.0 | N/A | N/A |
| 68.0 | 68.0 | N/A | N/A |
| 58.0 | 57.8 | N/A | N/A |

The measurement uncertainty for this test, derived at the 95% confidence level is 0.2dB.

### 3.2.11 Time Averaging

#### 3.2.11.1 Leq Test

The time averaging (Leq) function of the sound level meter is tested by applying continuous toneburst signals of a fixed amplitude, frequency and burst frequency. The duty cycle of the signal is adjusted, and the Leq display is recorded at the end of the integration period, specified by the manufacturer, up to a maximum of 1 hour.

**Table 20 - Leq performance for continuous tonebursts**

| Burst Duty Cycle | Increase in Gain (dB) | Response (dB) | Uncertainty (dB) |
|---|---|---|---|
| "1/10" | 10.0 | 69.9 | 0.1 |
| "1/100" | 20.0 | 69.8 | 0.1 |
| "1/1000" | 30.0 | 69.8 | 0.1 |
| "1/10000" | 40.0 | 69.7 | 0.1 |

The measurement uncertainties for this test, derived at the 95% confidence level are as shown in Table 20.

#### 3.2.11.2 SEL Test

The sound exposure level (SEL) function of the sound level meter is tested by applying the same signals as for the Leq test above.

**Table 21 - SEL performance for continuous tonebursts**

| Burst Duty Cycle | Increase in Gain (dB) | Response (dB) | Uncertainty (dB) |
|---|---|---|---|
| "1/10" | 10.0 | N/A | 0.1 |
| "1/100" | 20.0 | N/A | 0.1 |
| "1/1000" | 30.0 | N/A | 0.1 |
| "1/10000" | 40.0 | N/A | 0.1 |

The measurement uncertainties for this test, derived at the 95% confidence level are as shown in Table 21.

### 3.2.12 Overload Indication - Time Averaging

The overload indication for time averaging is tested by applying individual toneburst signals of a specified duration and frequency, and increasing the level until such time an overload indication occurs. Once an overload is indicated, the level was reduced below the point of threshold, and the overload indication was checked to make sure the indication remains until reset.

| | |
|---|---|
| **Overload Indication remains ON until reset ?** | Y |

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# Service Report

| | |
|---|---|
| **Report Number:** | 21025 |
| **Date:** | 11/03/2021 |
| **Equipment:** | ARL EL-316 SN: 16-203-529 |
| **Client Name:** | SLR Consulting Pty Ltd (East Melbourne) |
| **Contact Name:** | Simon De Lisle |

**Accesories:**

UC-53A SN:318848, (OLD)NH-17 SN:26872 post, cables, post case and case.

**1. Information from customer:**

Upgrade to 4 piece mic post set.

**2. Condition of the instrument:**

Fair.

**3. Corrective action required:**

Installed mic base lid, attached mic Post (4 piece post set).
Replaced old post preamp with new NH-17 cable preamp.
Old preamp SN 26872, new NH-17 preamp SN 28624.
Logger hardware adjusted to correct linearity and dB levels.

**4. Tests conducted to ensure fault rectification**

Microphone connected with Calibrator at 94dB and read 94dB.
Logger links and displays status correctly.
Full NATA calibration carried out.

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# Sound Level Meter
## AS 1259.1:1990 - AS 1259.2:1990
# Calibration Certificate

**Calibration Number** C21096

**Client Details** SLR Consulting Pty Ltd
Level 11, 176 Wellington Parade
East Melbourne VIC 3002

**Equipment Tested/ Model Number :** ARL EL-316
**Instrument Serial Number :** 16-203-529
**Microphone Serial Number :** 318848
**Pre-amplifier Serial Number :** 28624

**Atmospheric Conditions**
**Ambient Temperature :** 23.5°C
**Relative Humidity :** 56.3%
**Barometric Pressure :** 100.19kPa

**Calibration Technician :** Jeff Yu
**Calibration Date :** 9 Mar 2021
**Secondary Check:** Max Moore
**Report Issue Date :** 11 Mar 2021

**Approved Signatory :** Ken Williams

| Clause and Characteristic Tested | Result | Clause and Characteristic Tested | Result |
|---|---|---|---|
| 10.2.2: Absolute sensitivity | *Pass* | 10.3.4: Inherent system noise level | *Pass* |
| 10.2.3: Frequency weighting | *Pass* | 10.4.2: Time weighting characteristic F and S | *Pass* |
| 10.3.2: Overload indications | *Pass* | 10.4.3: Time weighting characteristic I | *Pass* |
| 10.3.3: Accuracy of level range control | *Pass* | 10.4.5: R.M.S performance | *Pass* |
| 8.9: Detector-indicator linearity | *Pass* | 9.3.2: Time averaging | *Pass* |
| 8.10: Differential level linearity | *Pass* | 9.3.5: Overload indication | *Pass* |

Least Uncertainties of Measurement -

| Acoustic Tests | | Environmental Conditions | |
|---|---|---|---|
| *31.5 Hz to 8kHz* | *±0.13dB* | *Temperature* | *±0.2°C* |
| *12.5kHz* | *±0.19dB* | *Relative Humidity* | *±2.4%* |
| *16kHz* | *±0.31dB* | *Barometric Pressure* | *±0.015kPa* |
| Electrical Tests | | | |
| *31.5 Hz to 20 kHz* | *±0.1dB* | | |

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

*The sound level meter under test has been shown to conform to the type 1 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.*

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 units.

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.

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# Sound Level Meter

## AS 1259-1:1990 - AS 1259-2:1990

# Calibration Certificate

**Calibration Number** C22130

**Client Details** SLR Consulting Australia Pty Ltd
Level 16, 175 Eagle Street
Brisbane QLD 4000

**Equipment Tested/ Model Number :** ARL EL-316
**Instrument Serial Number :** 16-203-526
**Microphone Serial Number :** 322264
**Pre-amplifier Serial Number :** 28144

**Atmospheric Conditions**
**Ambient Temperature :** 25.4°C
**Relative Humidity :** 61.4%
**Barometric Pressure :** 100.09kPa

**Calibration Technician :** Lucky Jaiswal
**Calibration Date :** 1 Mar 2022
**Secondary Check:** Rhys Gravelle
**Report Issue Date :** 1 Mar 2022

**Approved Signatory :** Ken Williams

| Clause and Characteristic Tested | Result | Clause and Characteristic Tested | Result |
|---|---|---|---|
| 10.2.2: Absolute sensitivity | *Pass* | 10.3.4: Inherent system noise level | *Pass* |
| 10.2.3: Frequency weighting | *Pass* | 10.4.2: Time weighting characteristic F and S | *Pass* |
| 10.3.2: Overload indications | *Pass* | 10.4.3: Time weighting characteristic I | *Pass* |
| 10.3.3: Accuracy of level range control | *Pass* | 10.4.5: R.M.S performance | *Pass* |
| 8.9: Detector-indicator linearity | *Pass* | 9.3.2: Time averaging | *Pass* |
| 8.10: Differential level linearity | *Pass* | 9.3.5: Overload indication | *Pass* |

Uncertainties of Measurement -

| | | | |
|---|---|---|---|
| Acoustic Tests | | Environmental Conditions | |
| *31.5 Hz to 8kHz* | *±0.14dB* | *Temperature* | *±0.1°C* |
| *12.5kHz* | *±0.19dB* | *Relative Humidity* | *±1.9%* |
| *16kHz* | *±0.29dB* | *Barometric Pressure* | *±0.014kPa* |
| Electrical Tests | | | |
| *31.5 Hz to 20 kHz* | *±0.11dB* | | |

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

*The sound level meter under test has been shown to conform to the type 1 requirements for periodic testing as described in AS 1259.1:1990 and AS 1259.2:1990 for the tests stated above.*

NATA
WORLD RECOGNISED ACCREDITATION

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

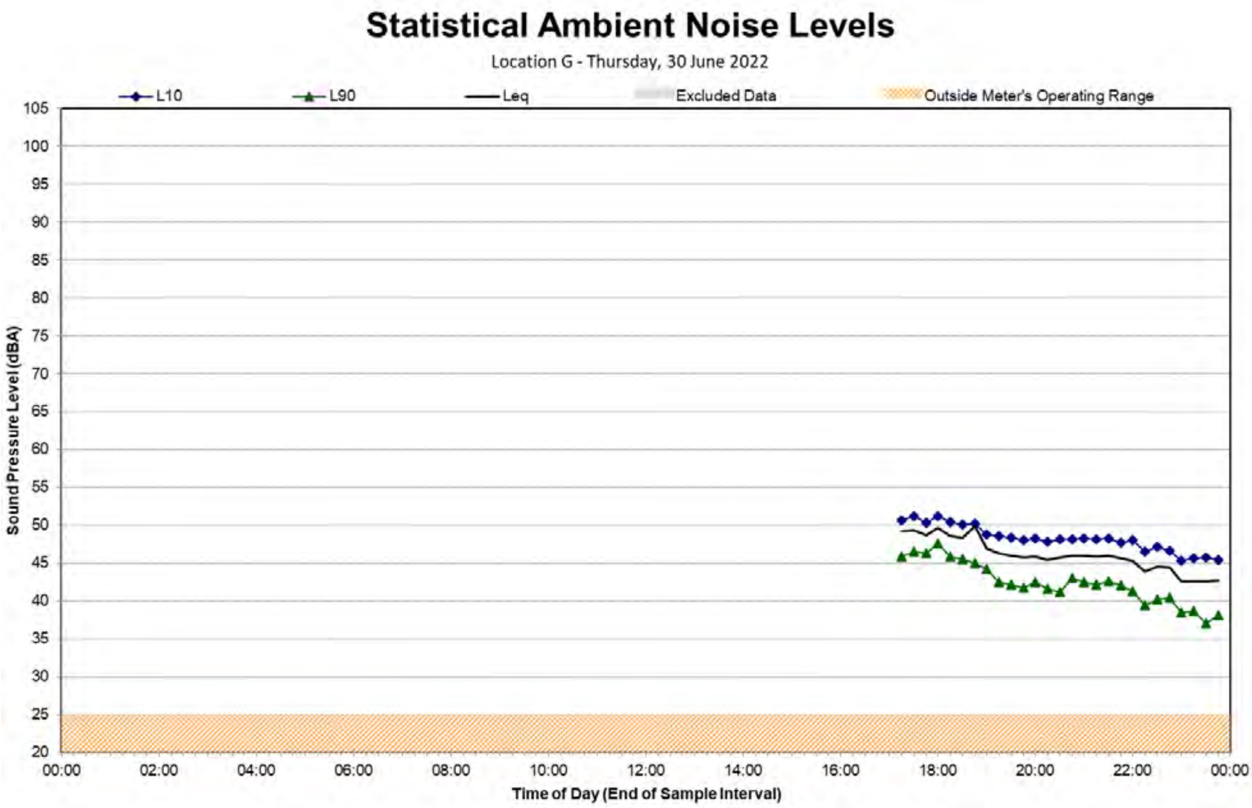
The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

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

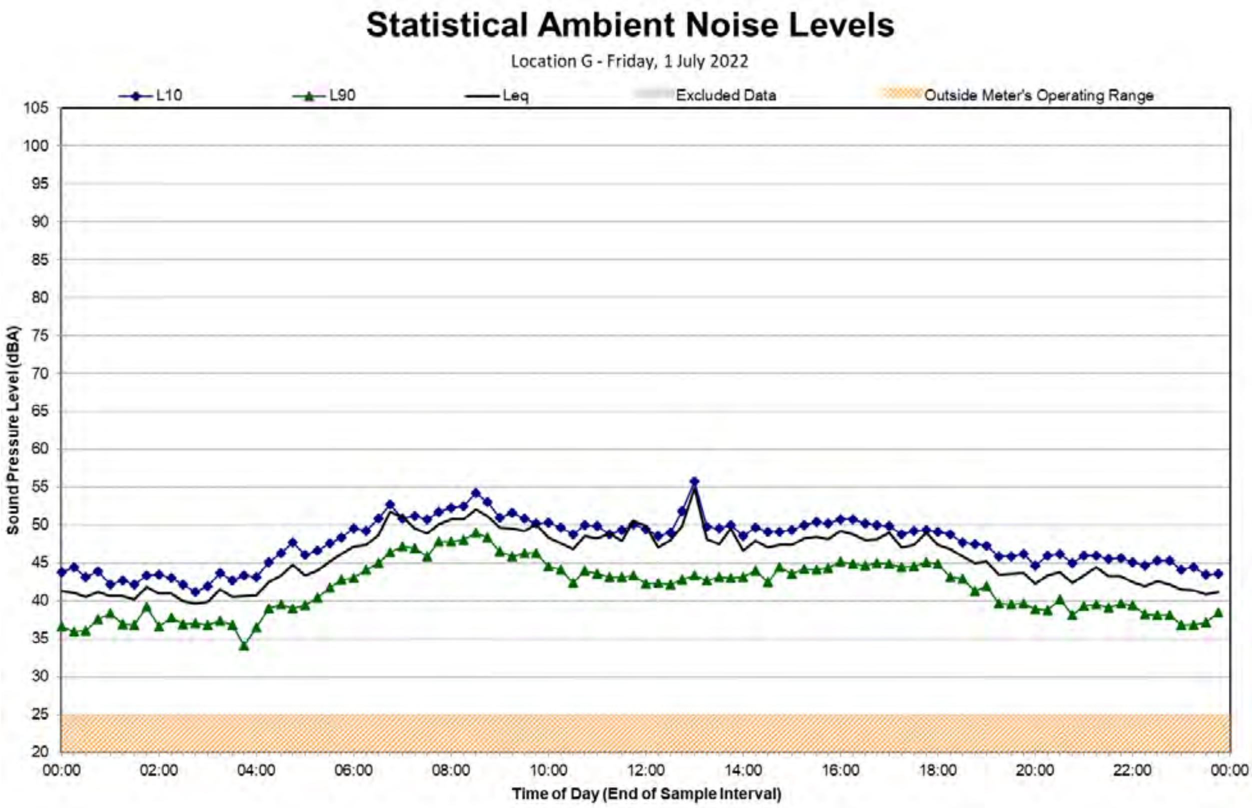
Appendix C contents here

# APPENDIX D

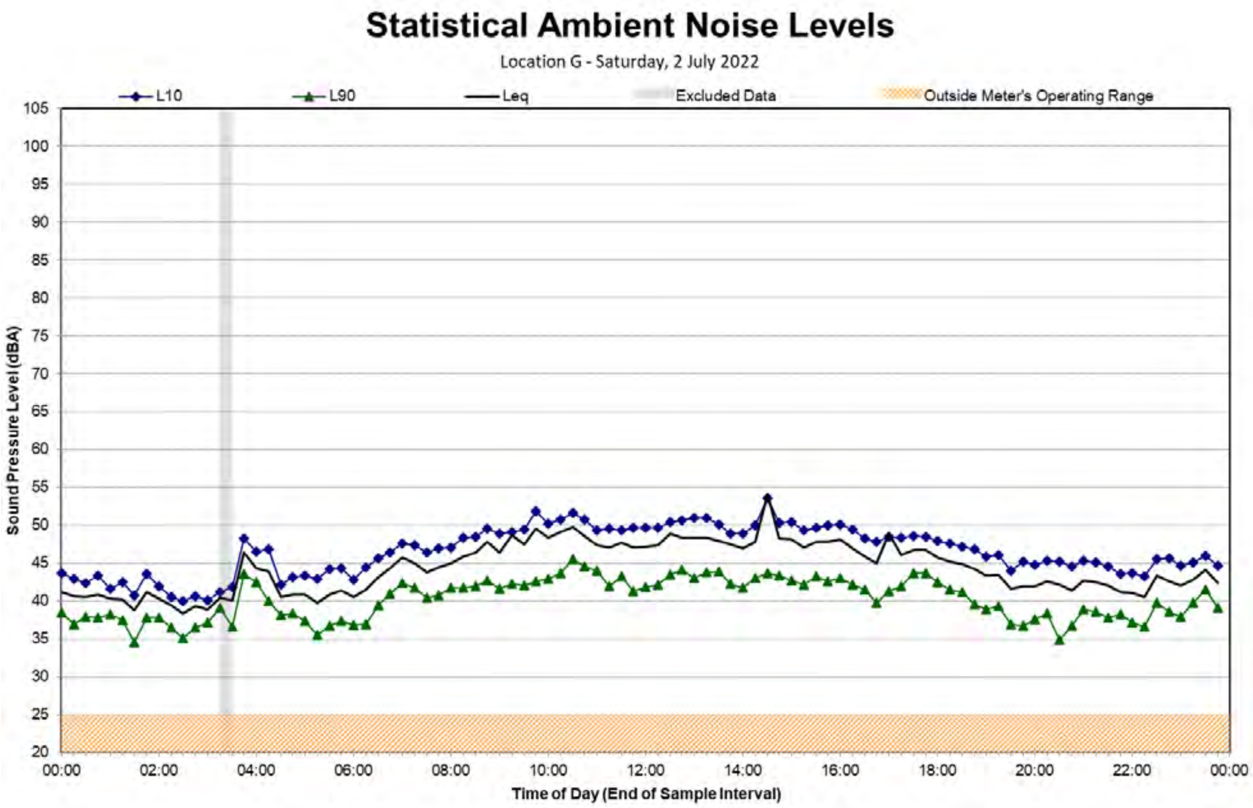
Statistical Ambient Noise Levels

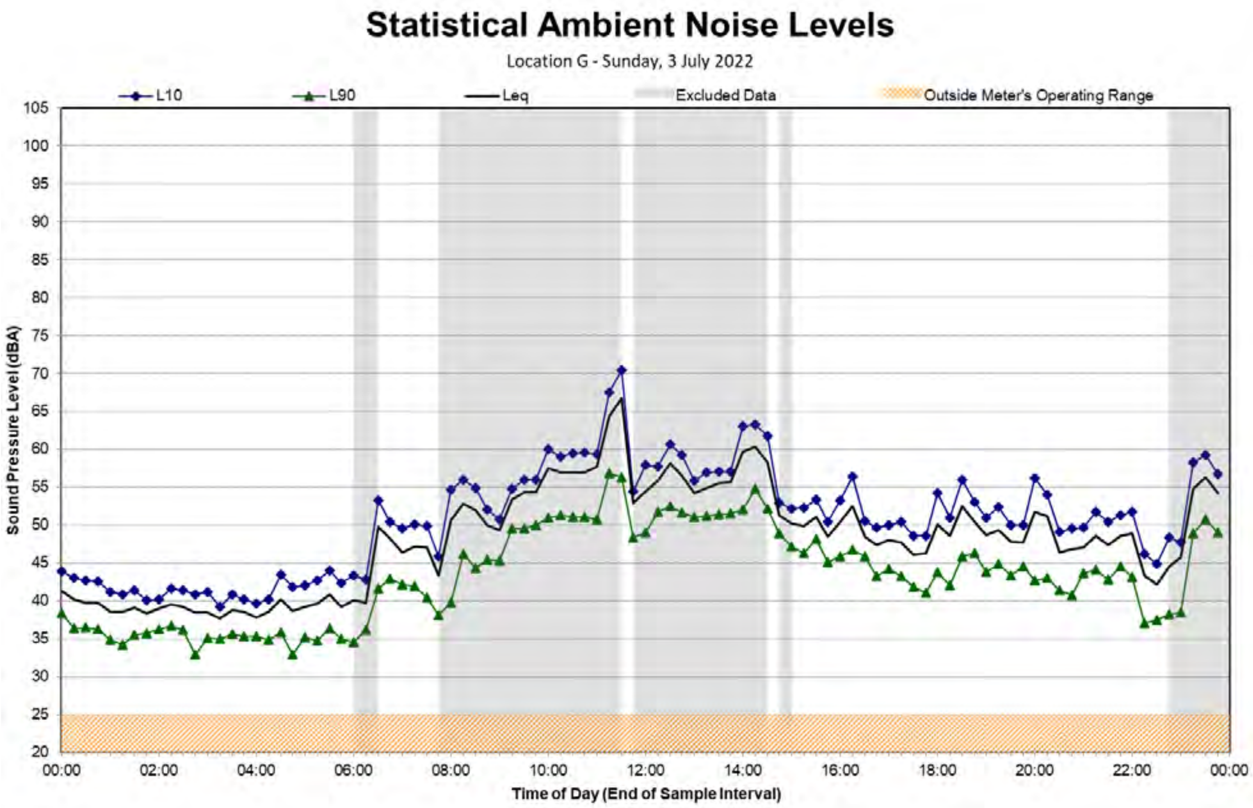


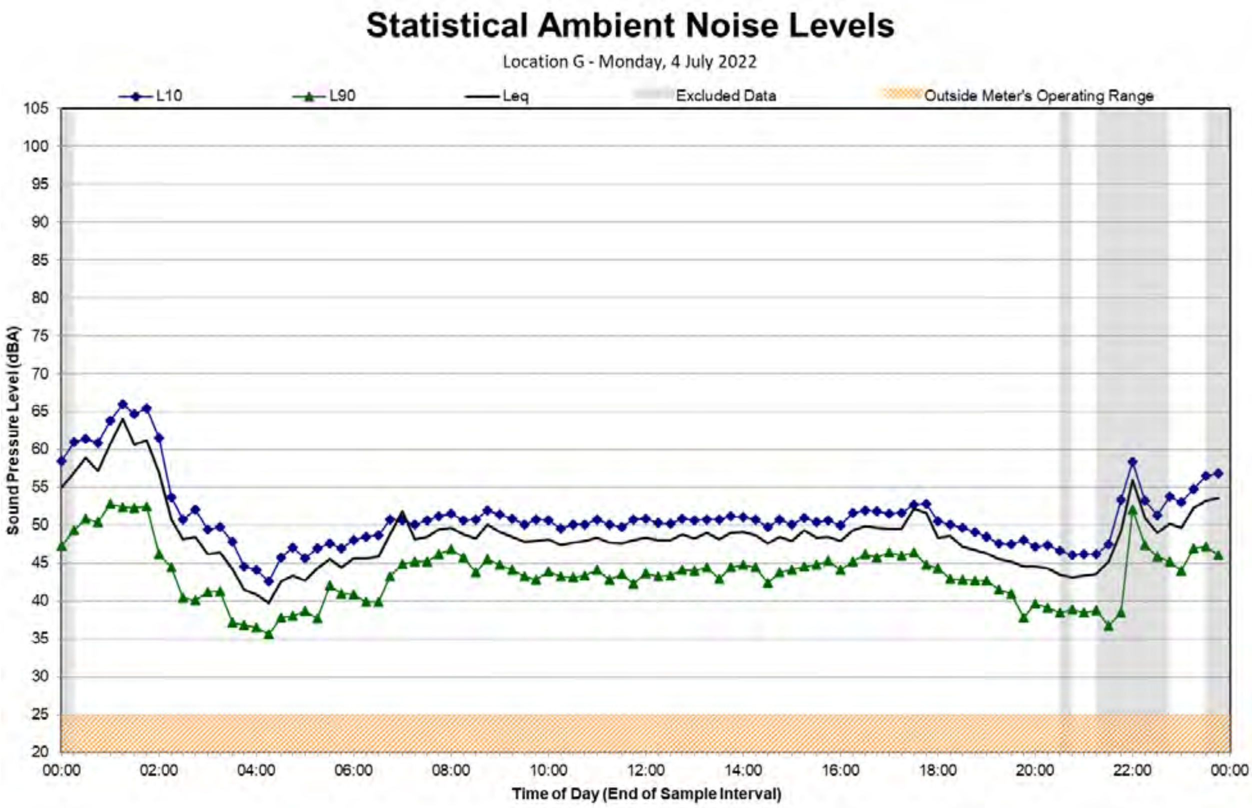
Statistical Ambient Noise Levels
Location G - Thursday, 30 June 2022
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels
Location G - Friday, 1 July 2022
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Saturday, 2 July 2022
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Sunday, 3 July 2022
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)



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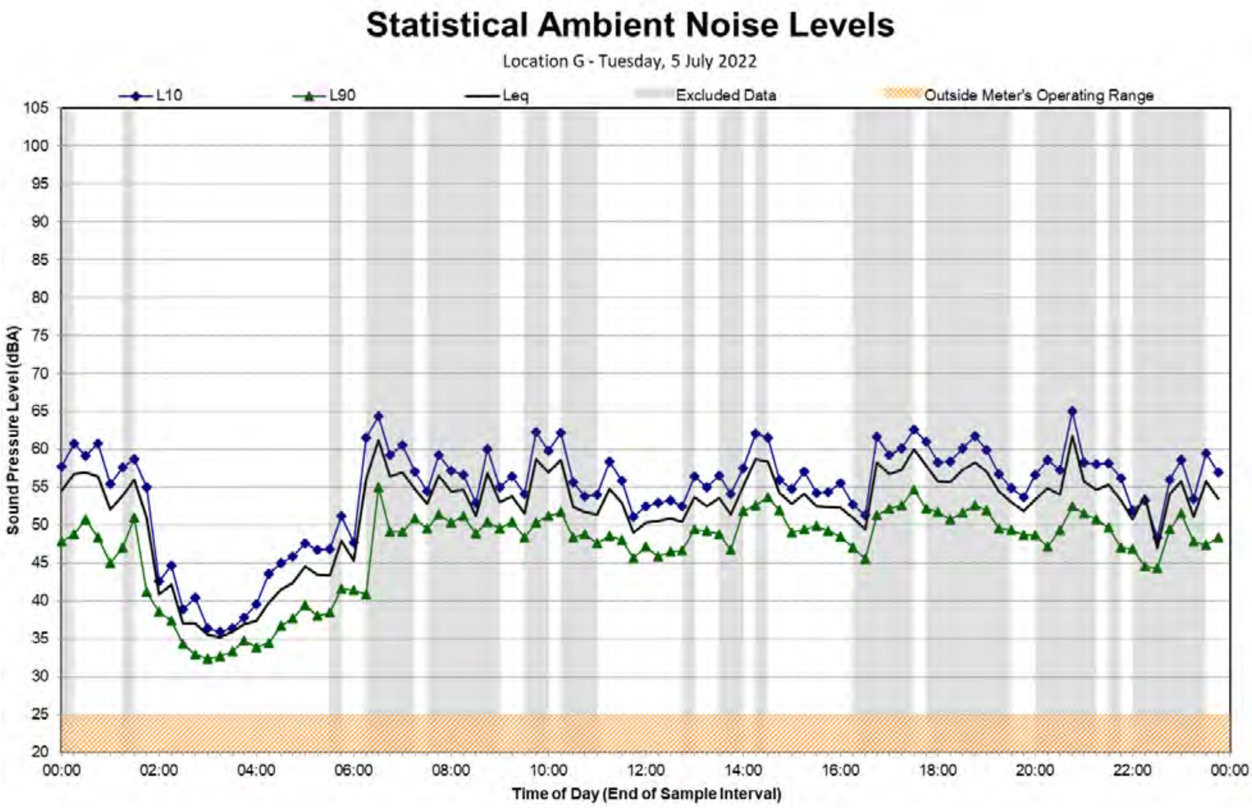
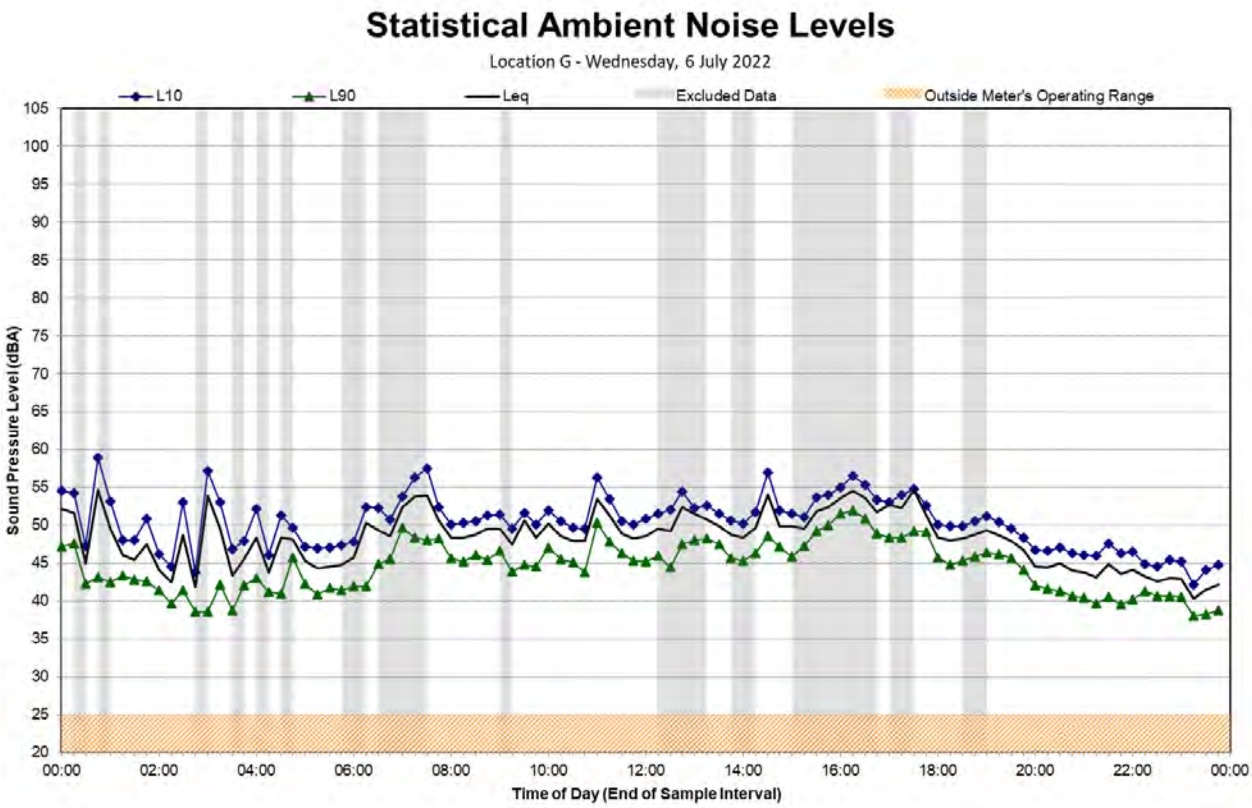
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels
Location G - Tuesday, 5 July 2022
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)



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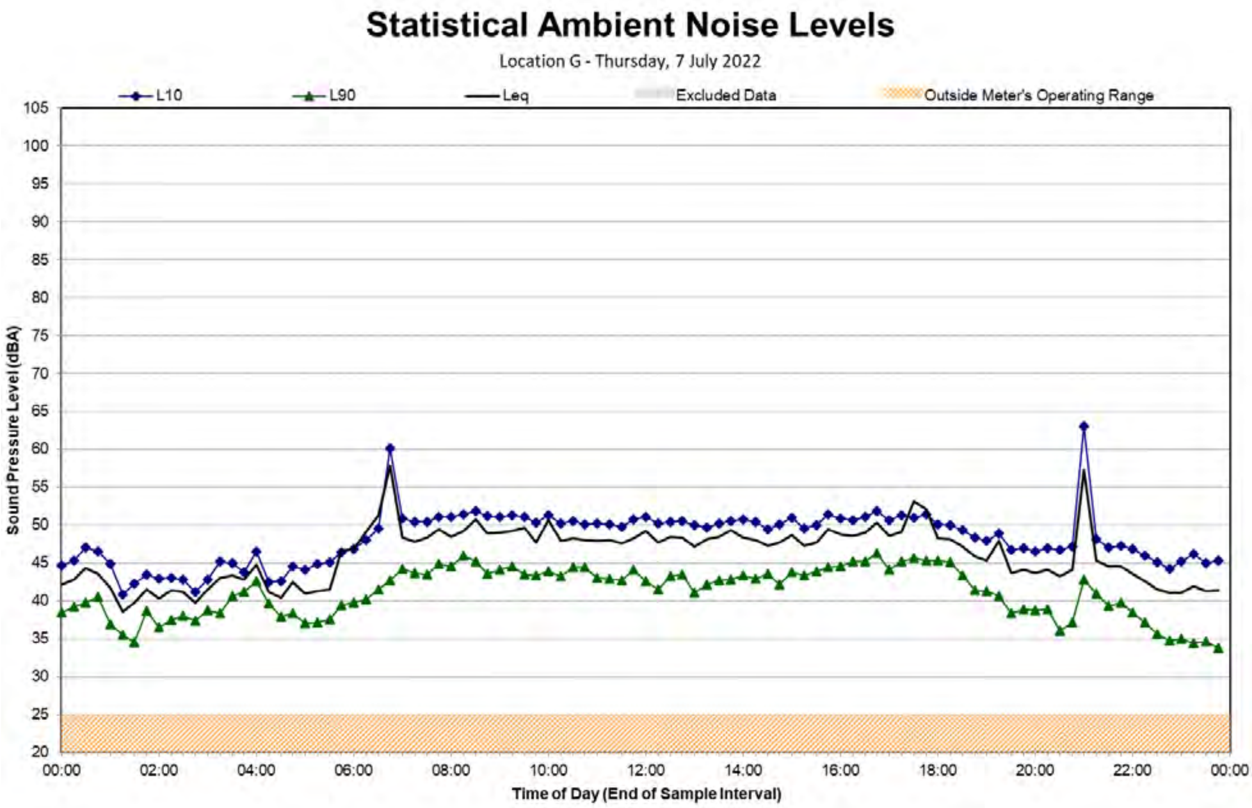
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels
Location G - Thursday, 7 July 2022
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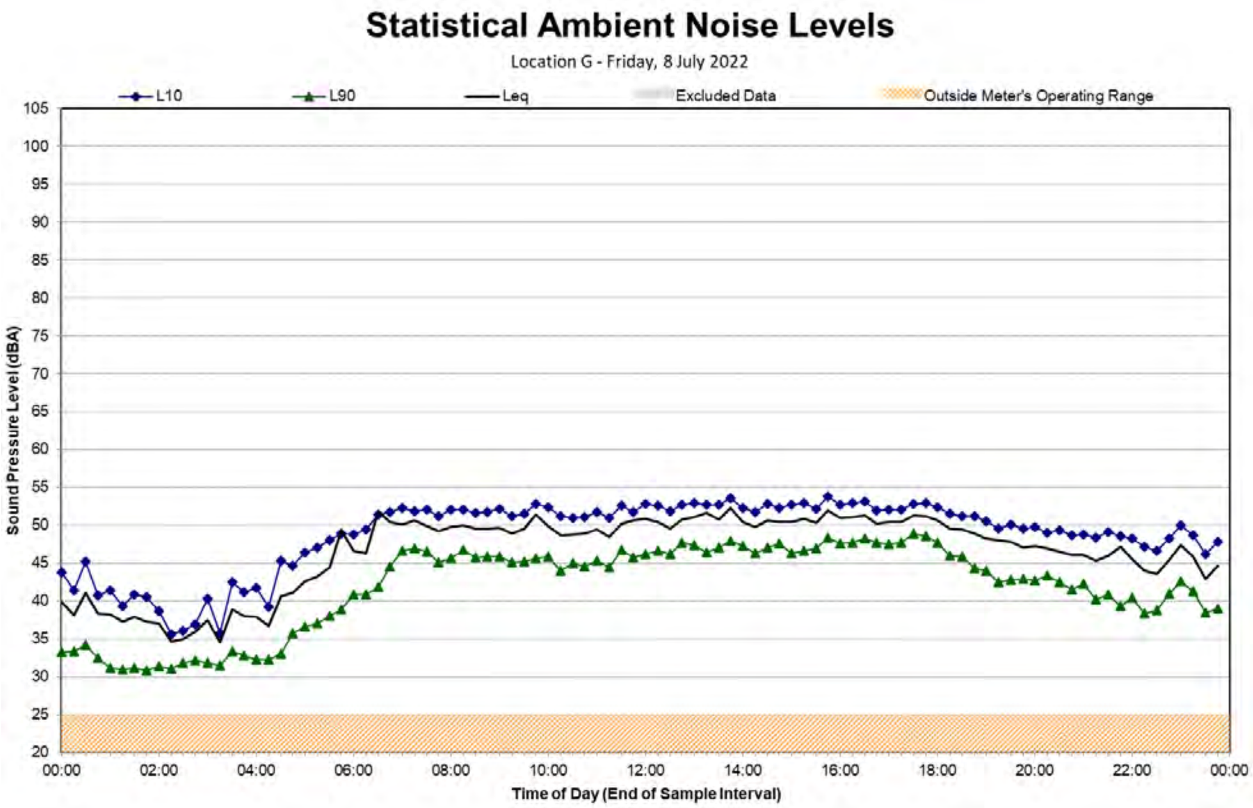
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Friday, 8 July 2022
L10
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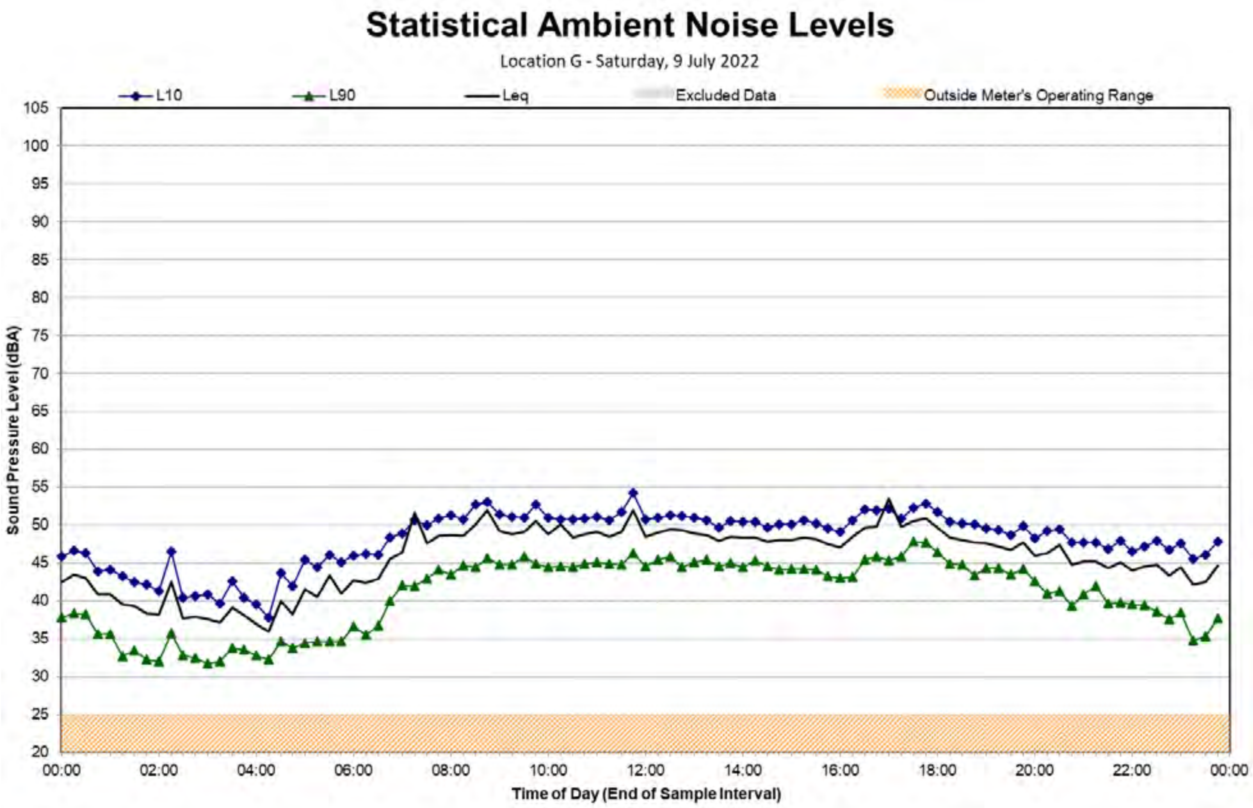
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Saturday, 9 July 2022
L10
L90
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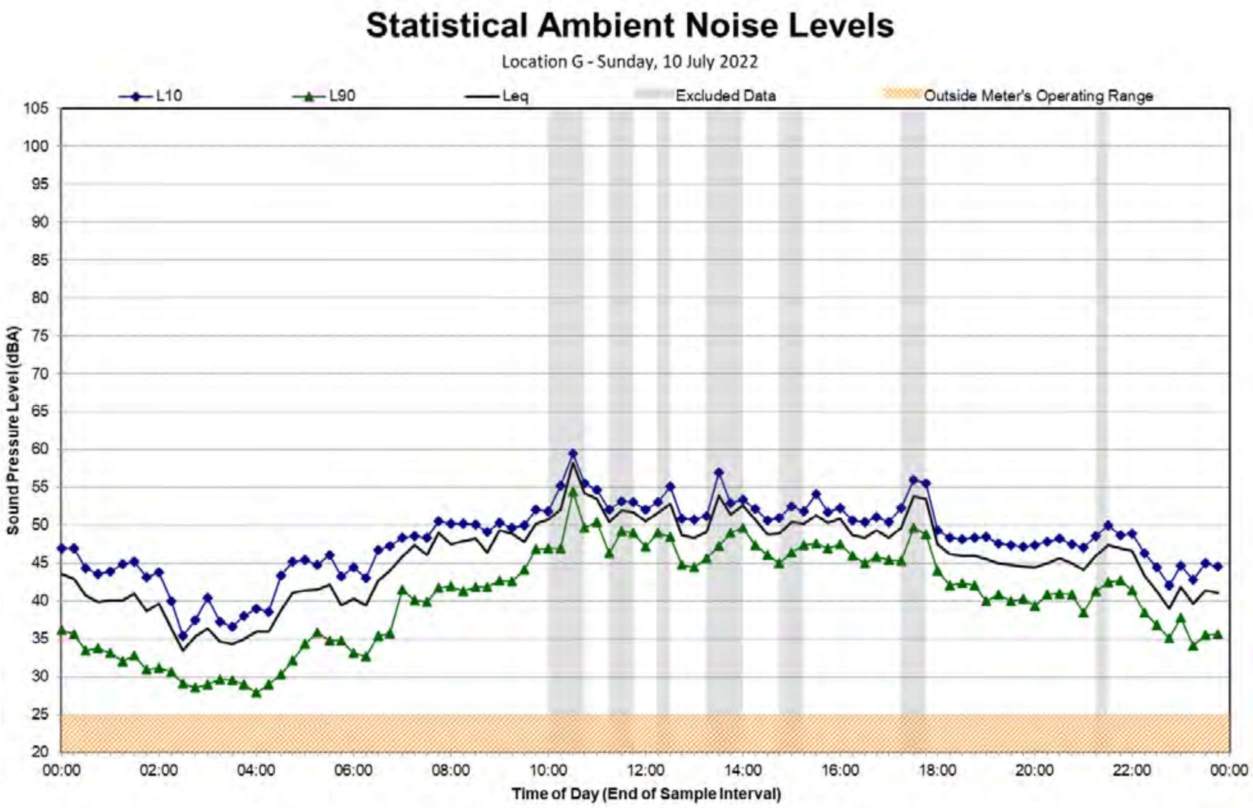
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Sunday, 10 July 2022
L10
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Leq
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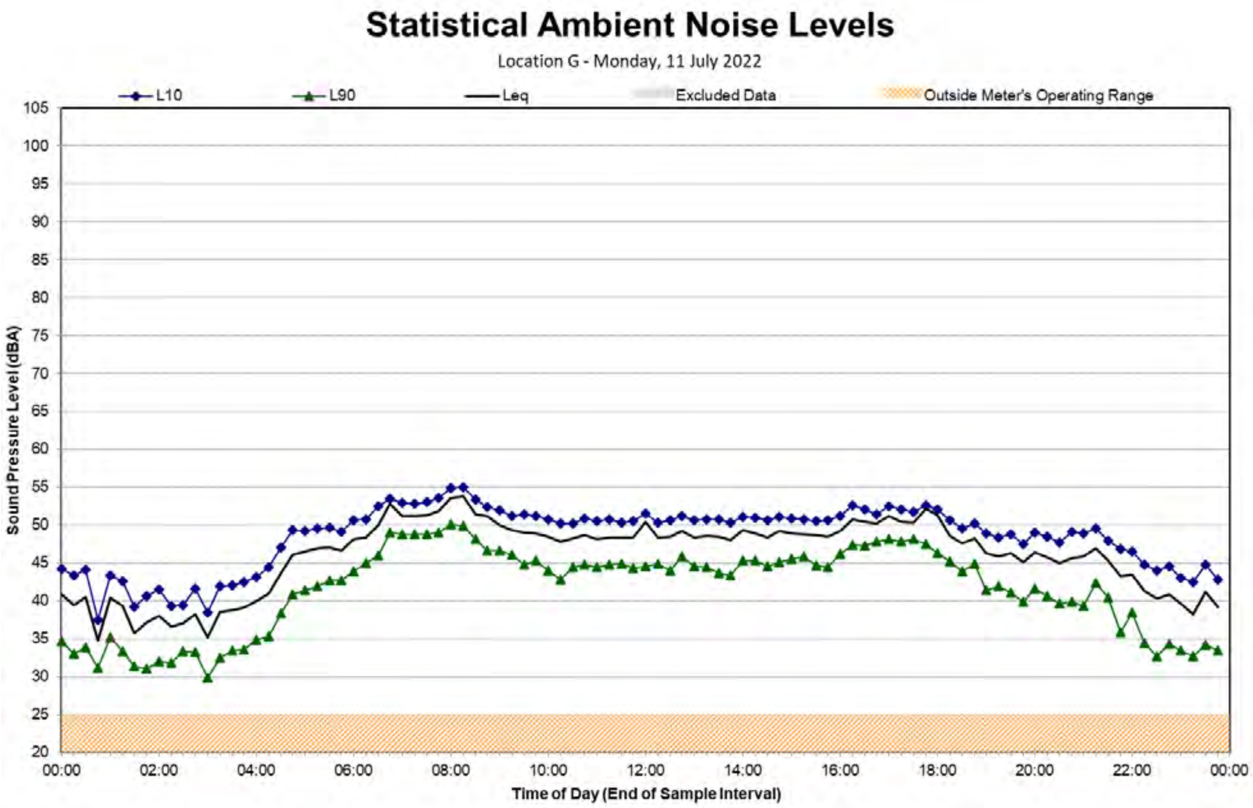
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)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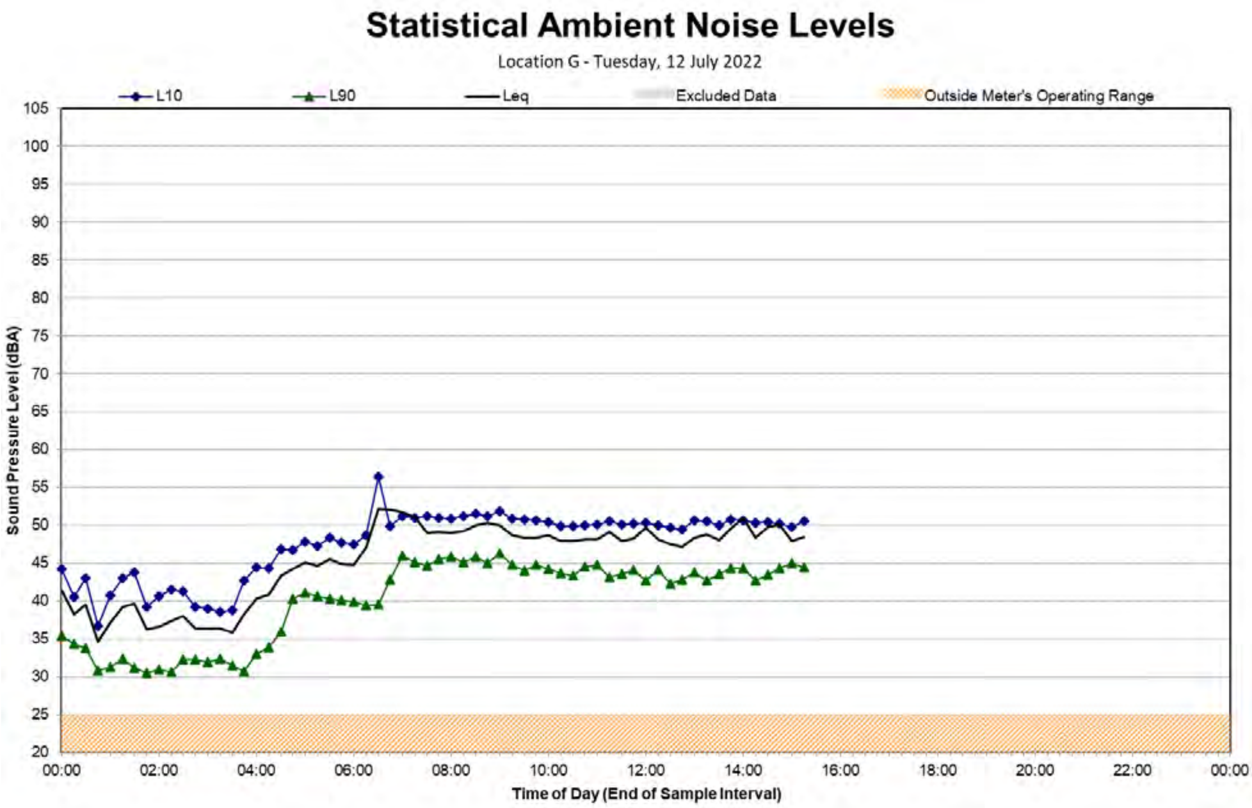
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
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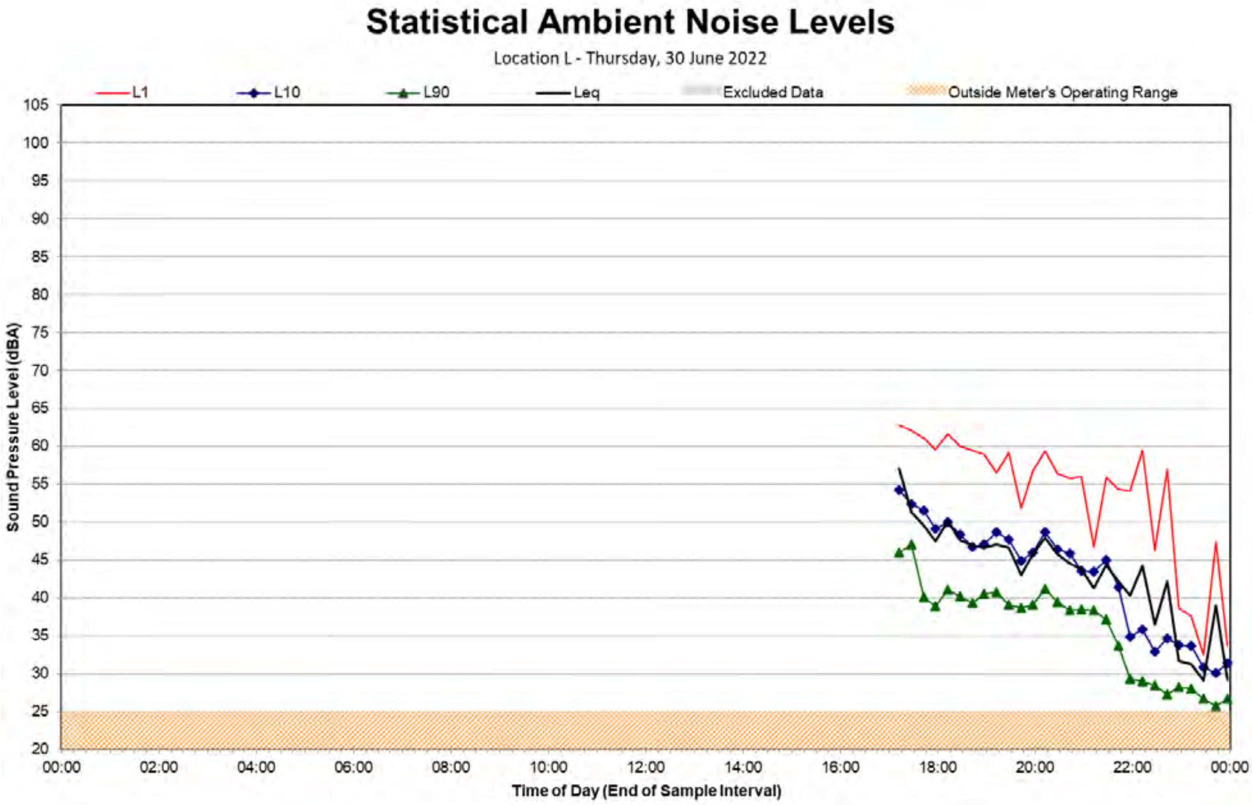
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels
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L90
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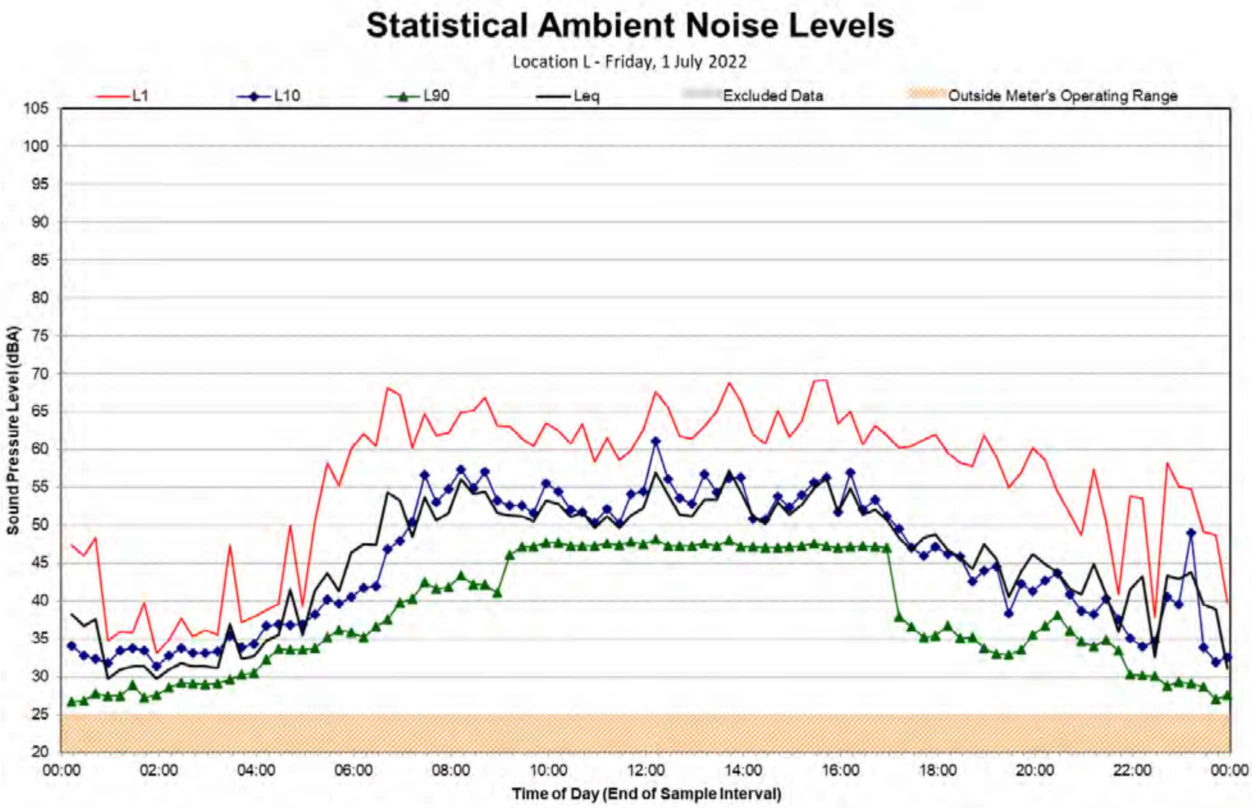
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
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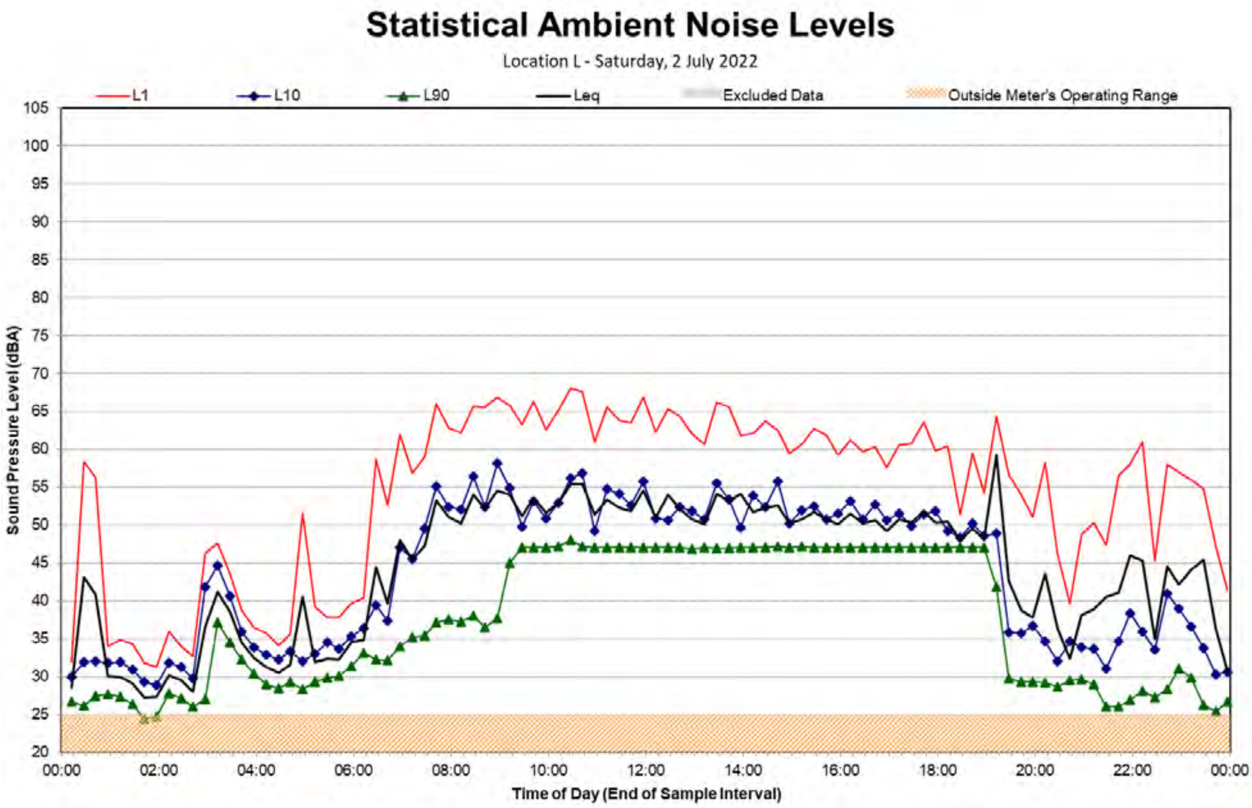
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Saturday, 2 July 2022
L1
L10
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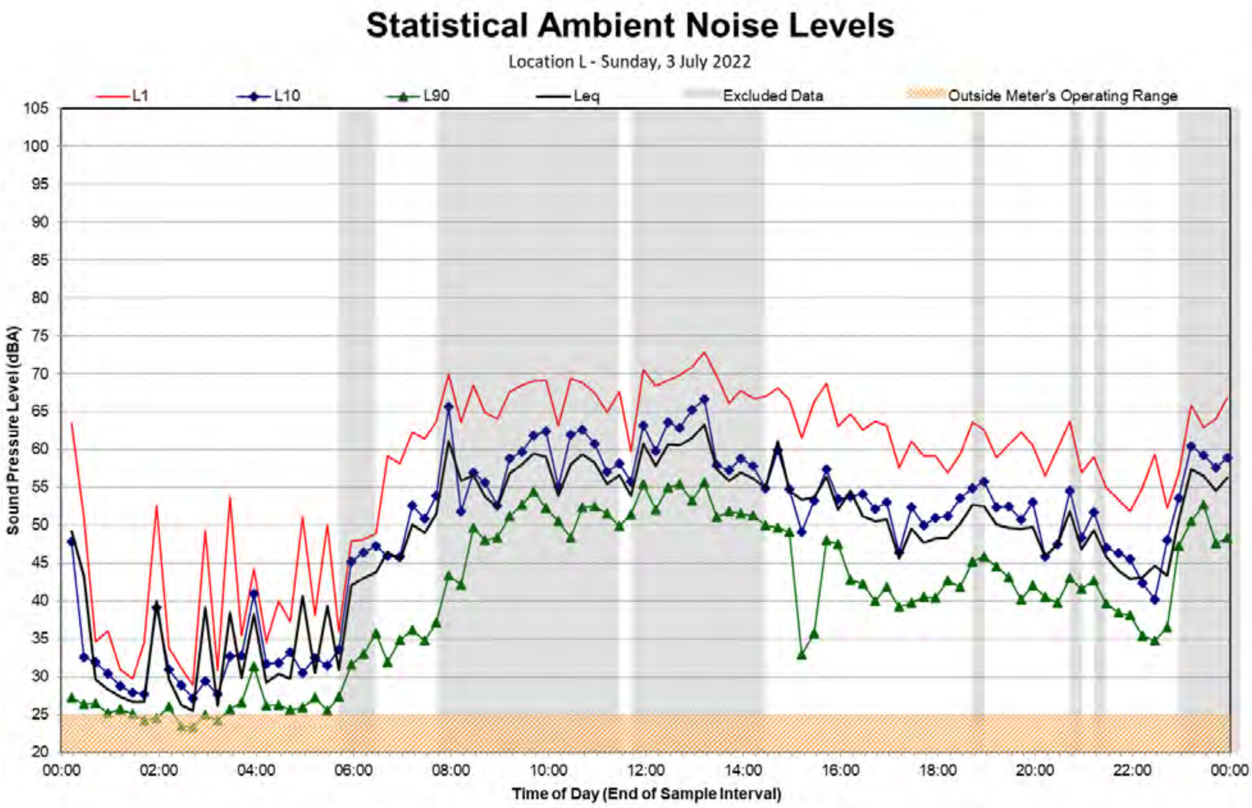
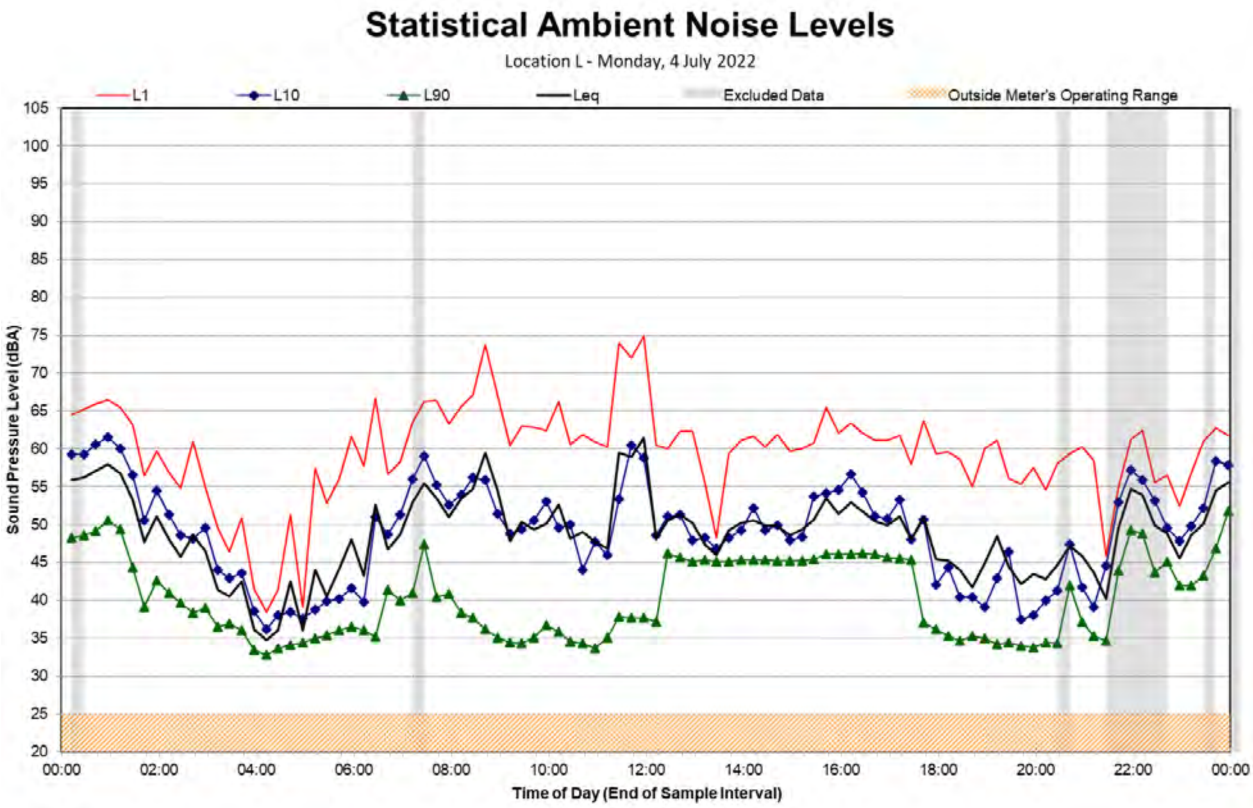
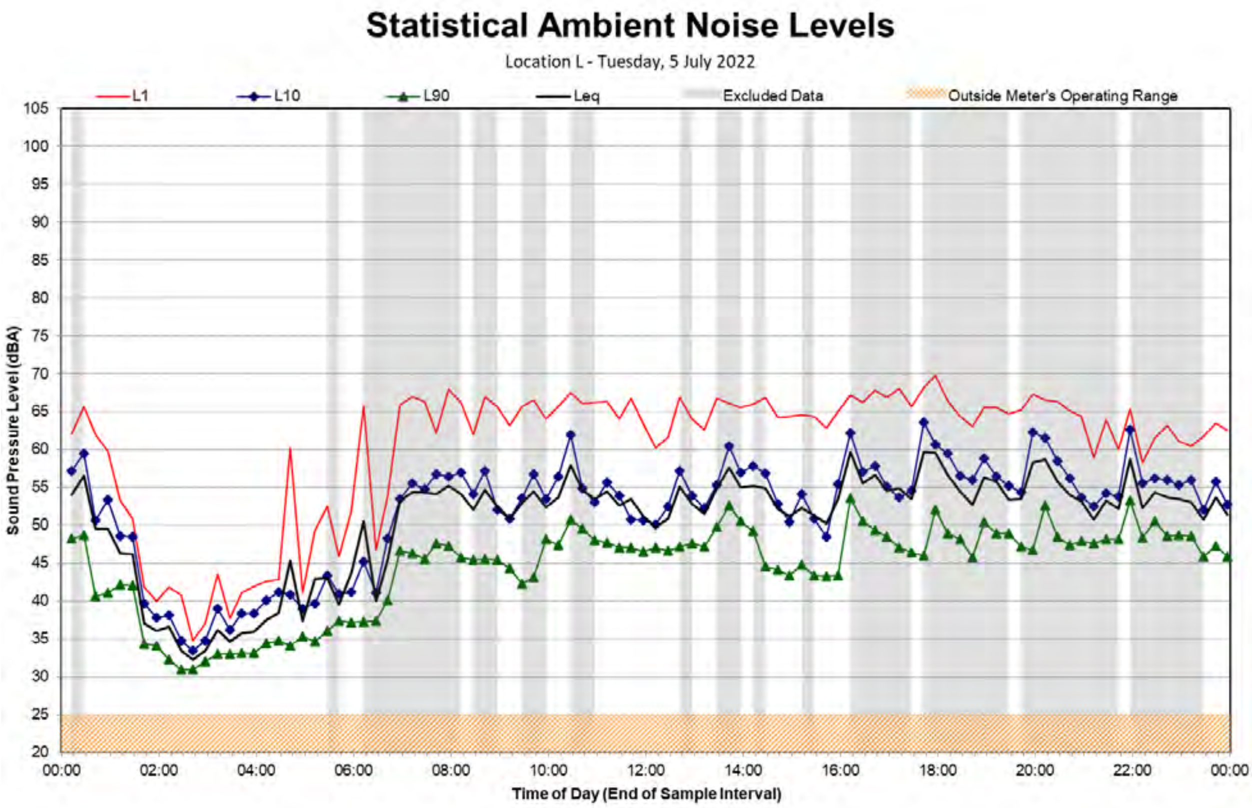
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Sunday, 3 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Monday, 4 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
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Leq
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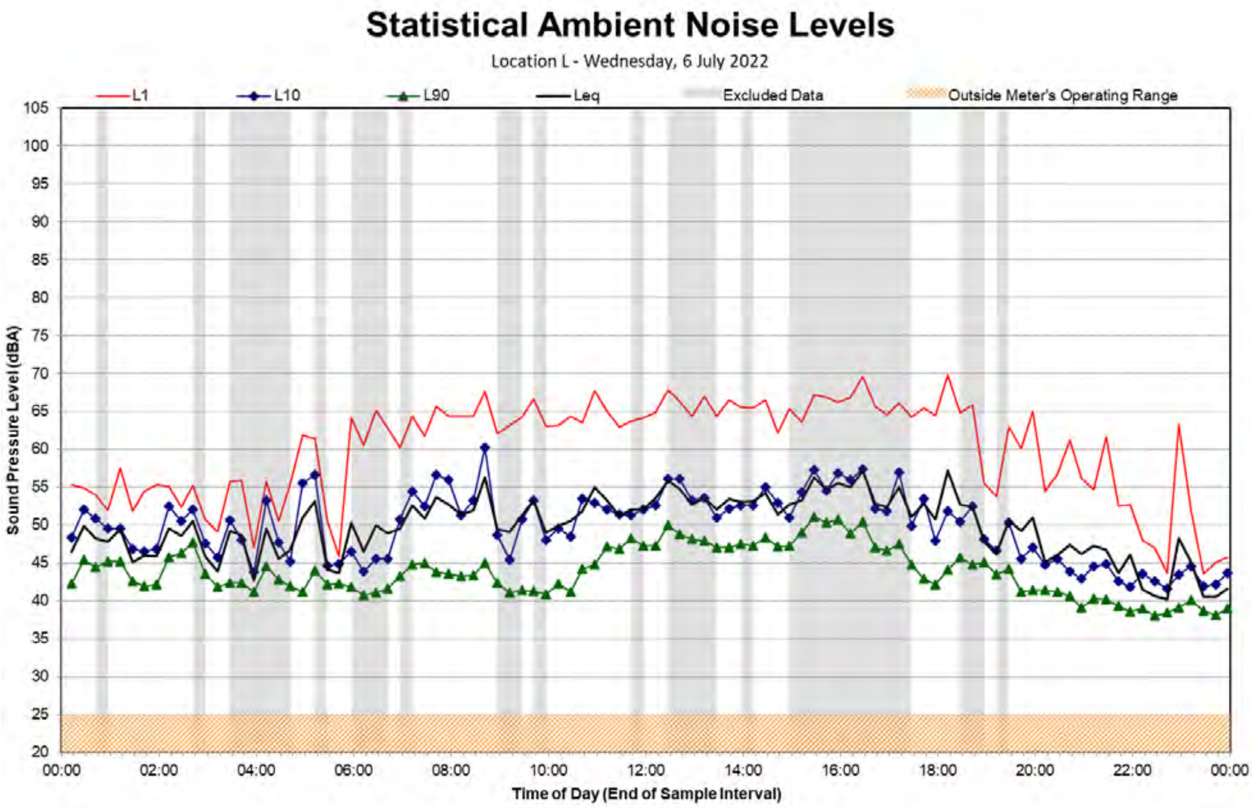
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
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L1
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L90
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Excluded Data
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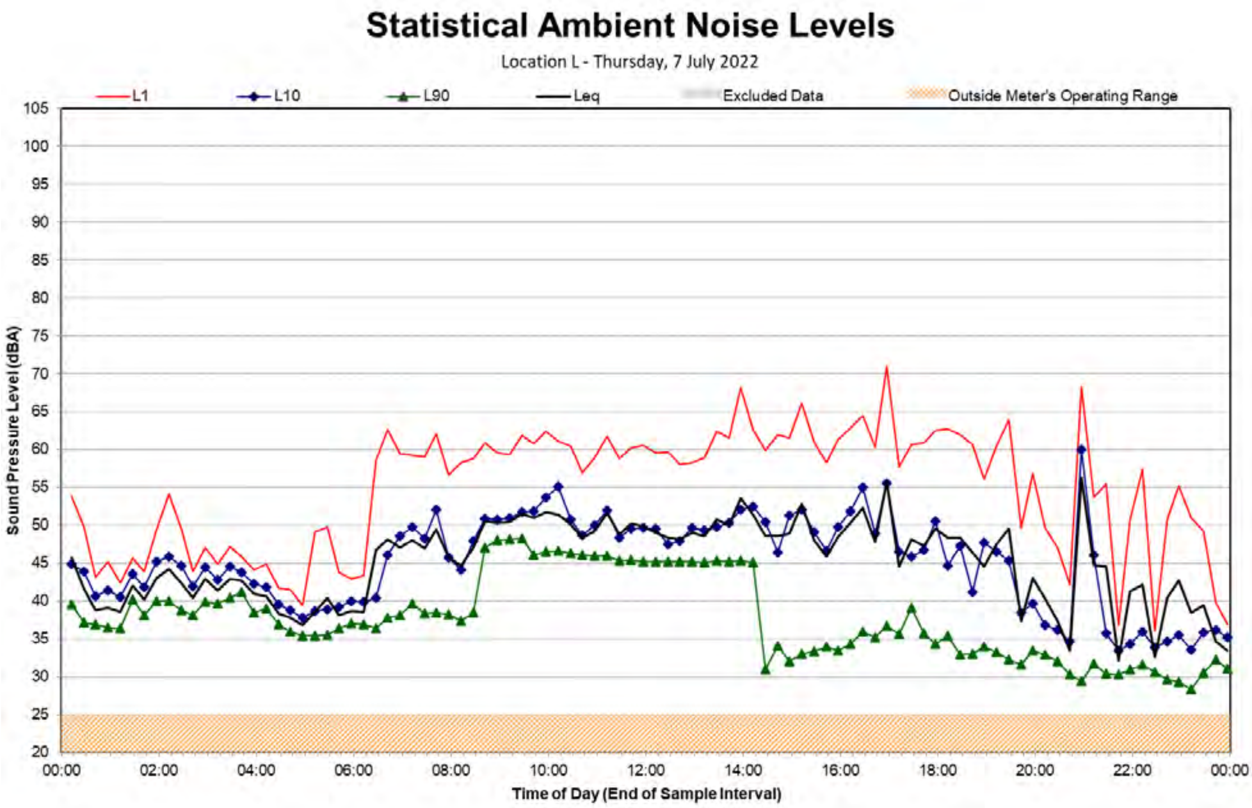
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
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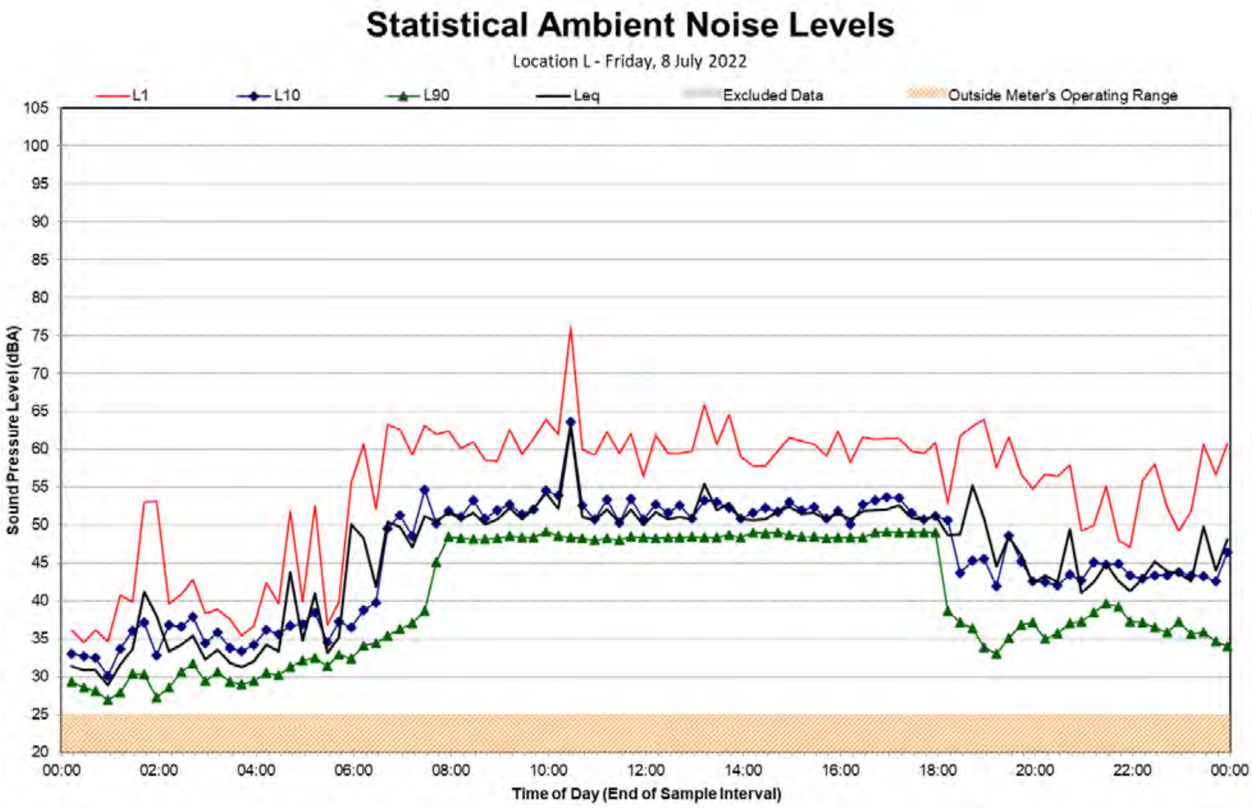
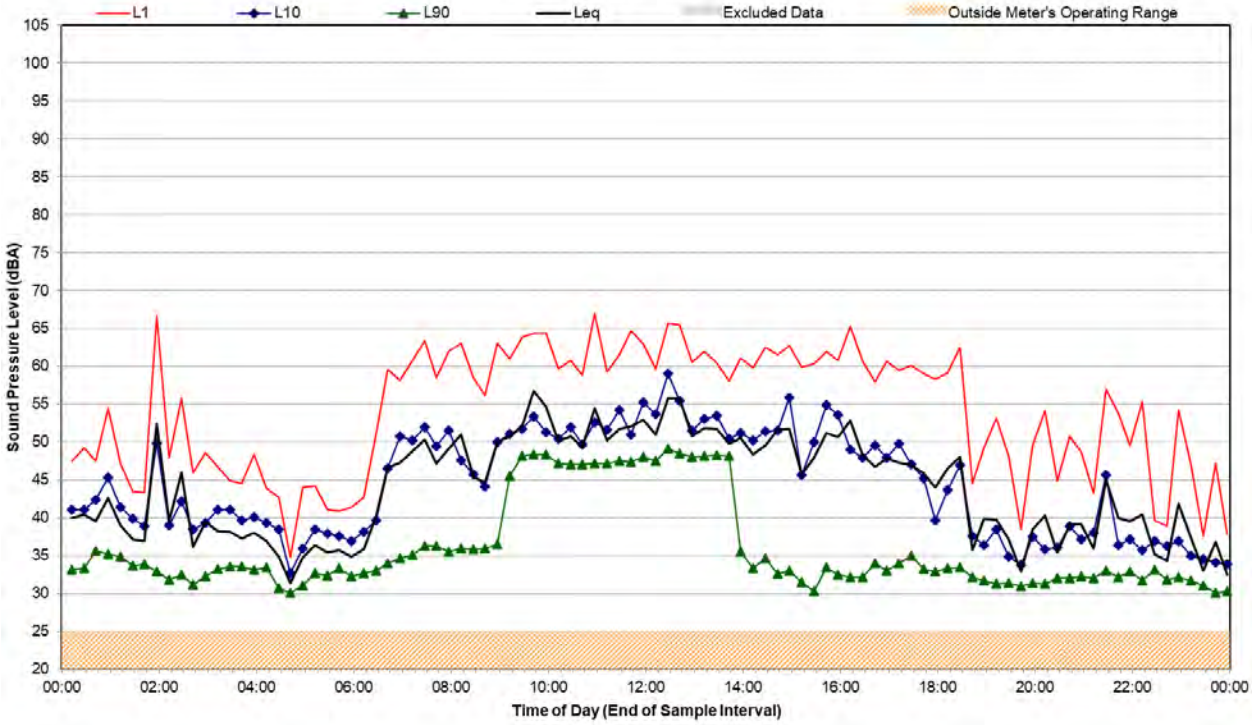
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Friday, 8 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

## Statistical Ambient Noise Levels

Location L - Saturday, 9 July 2022




## Statistical Ambient Noise Levels

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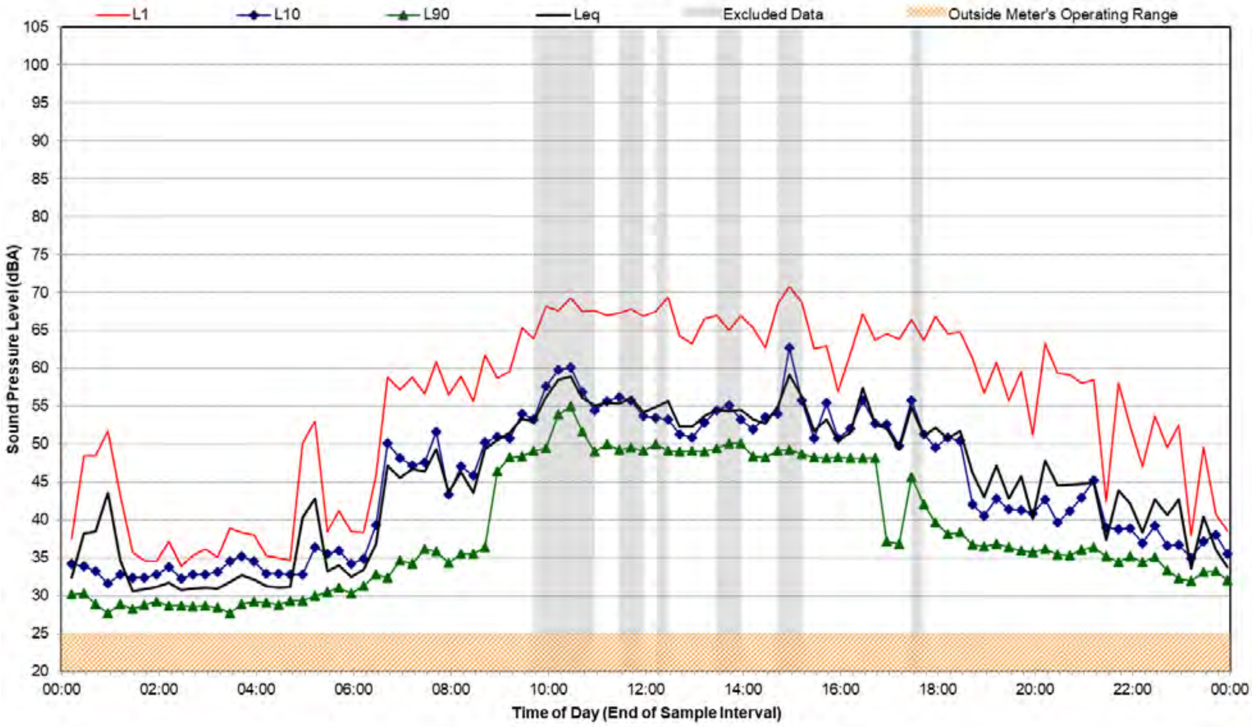
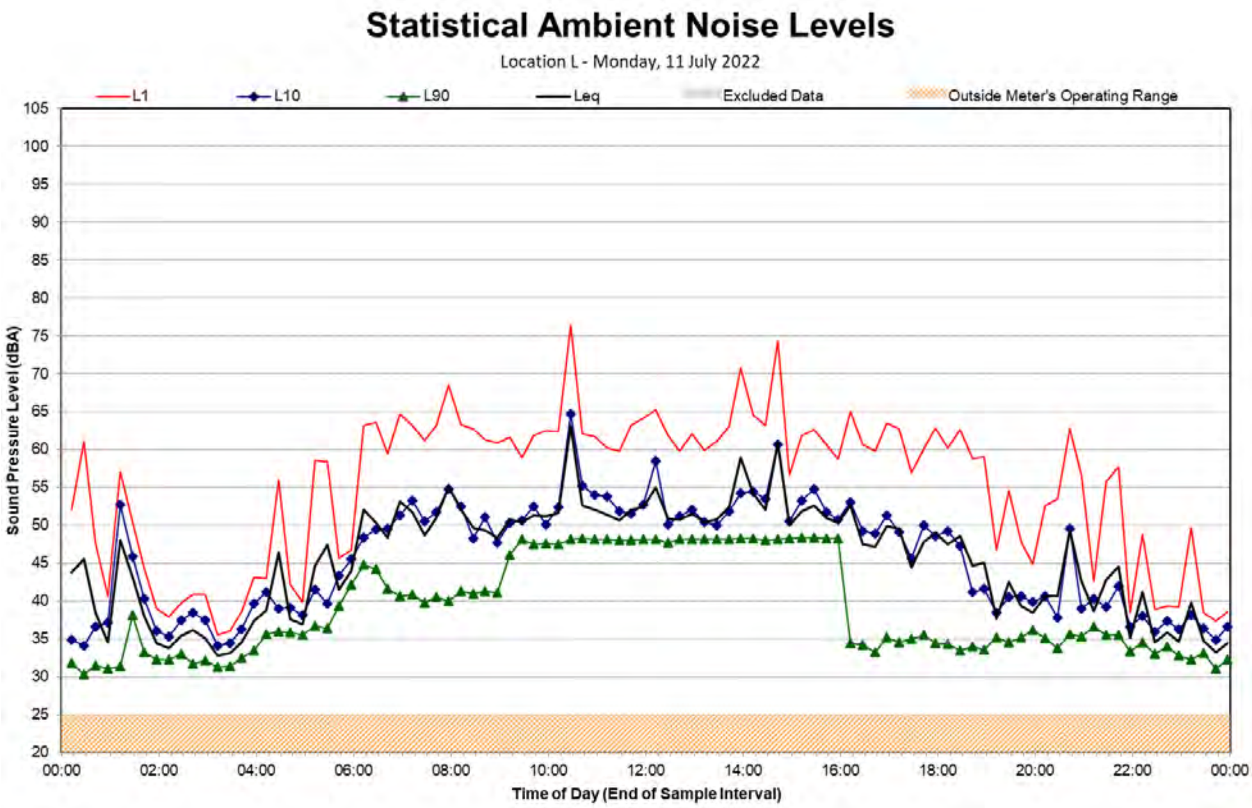
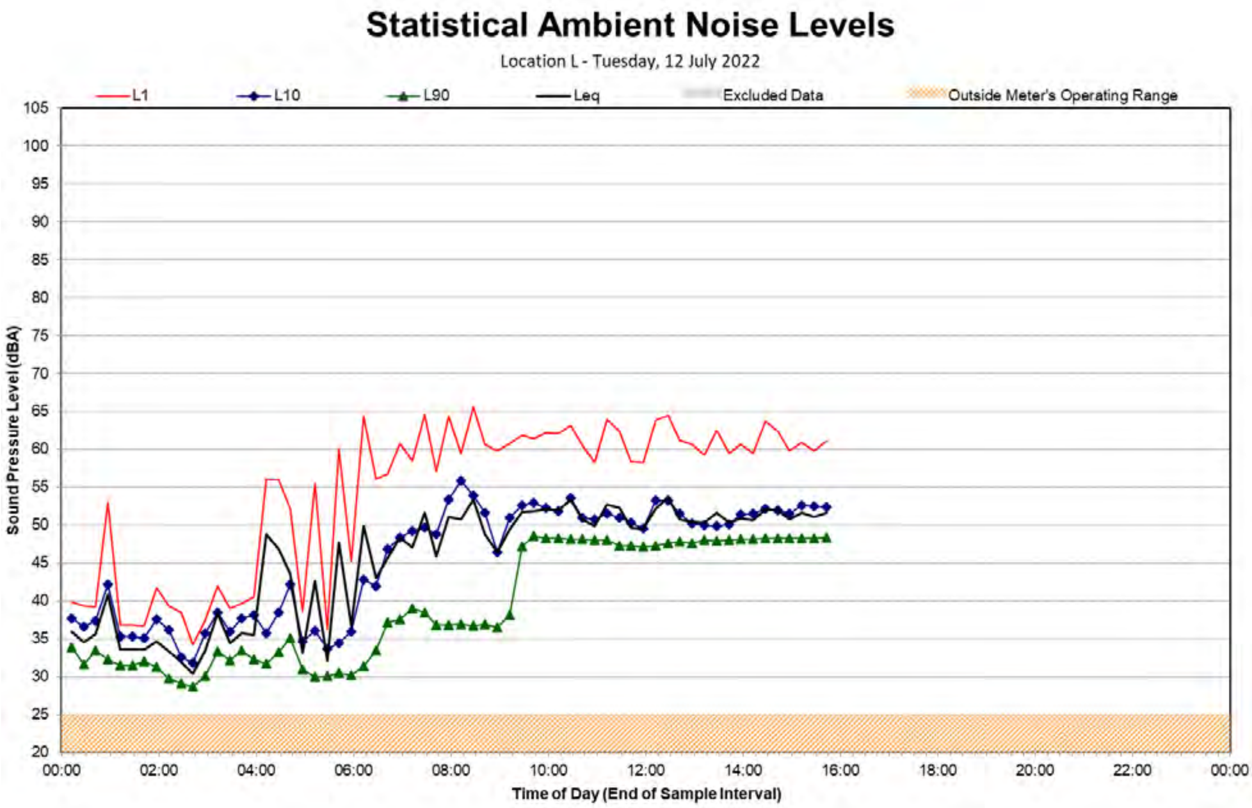



Statistical Ambient Noise Levels
Location L - Monday, 11 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)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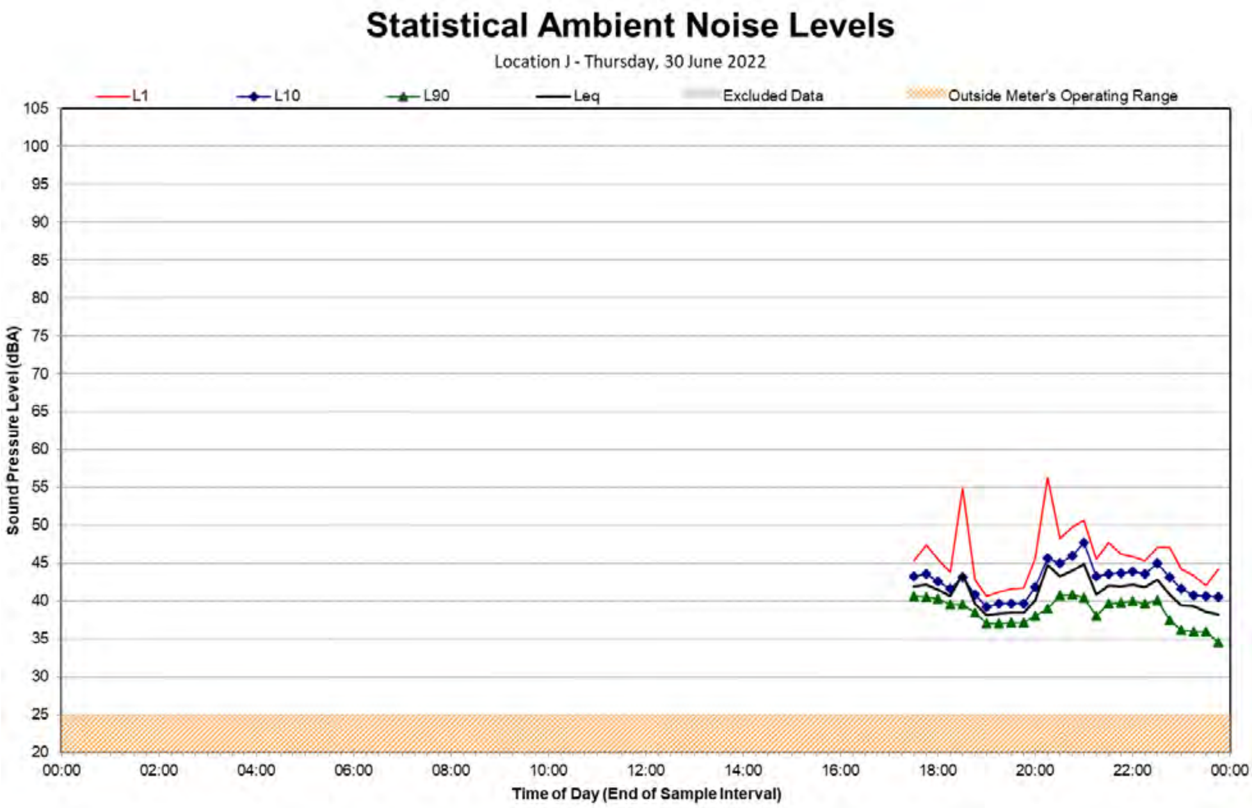
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)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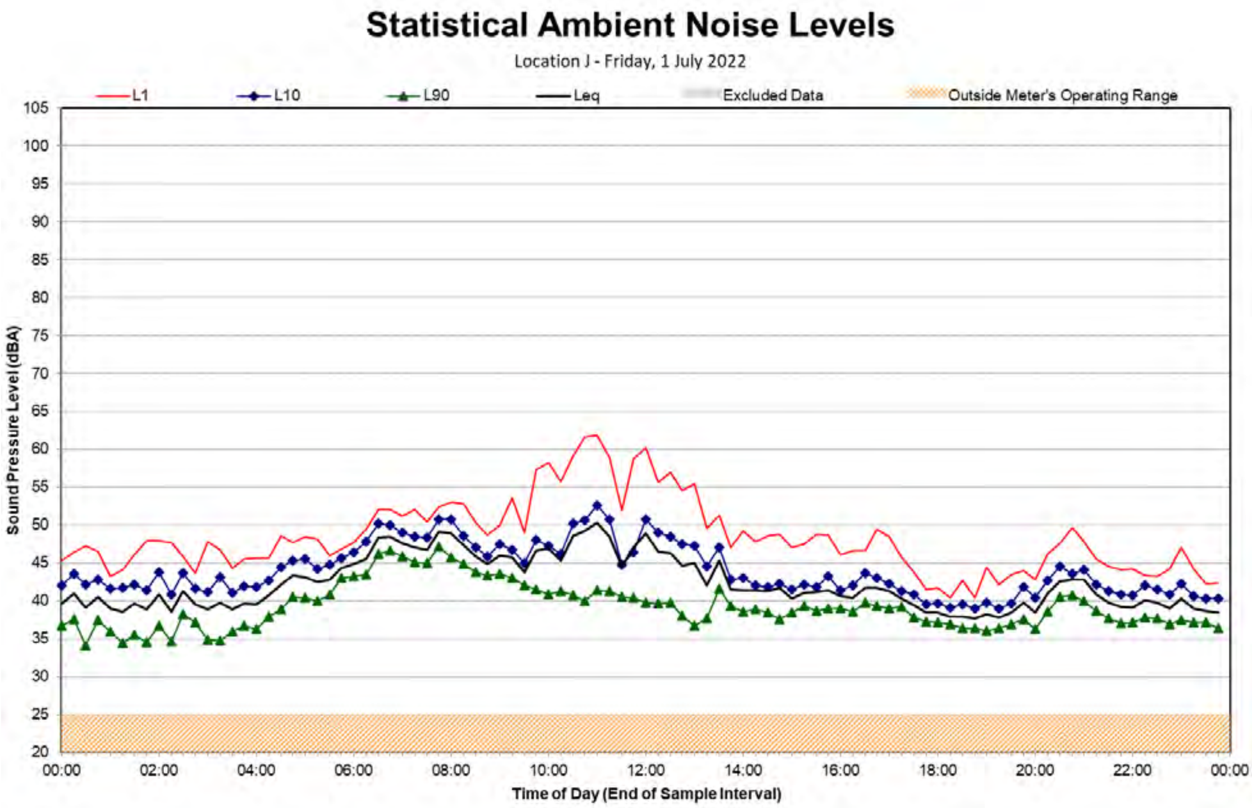
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)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Location J - Friday, 1 July 2022
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Excluded Data
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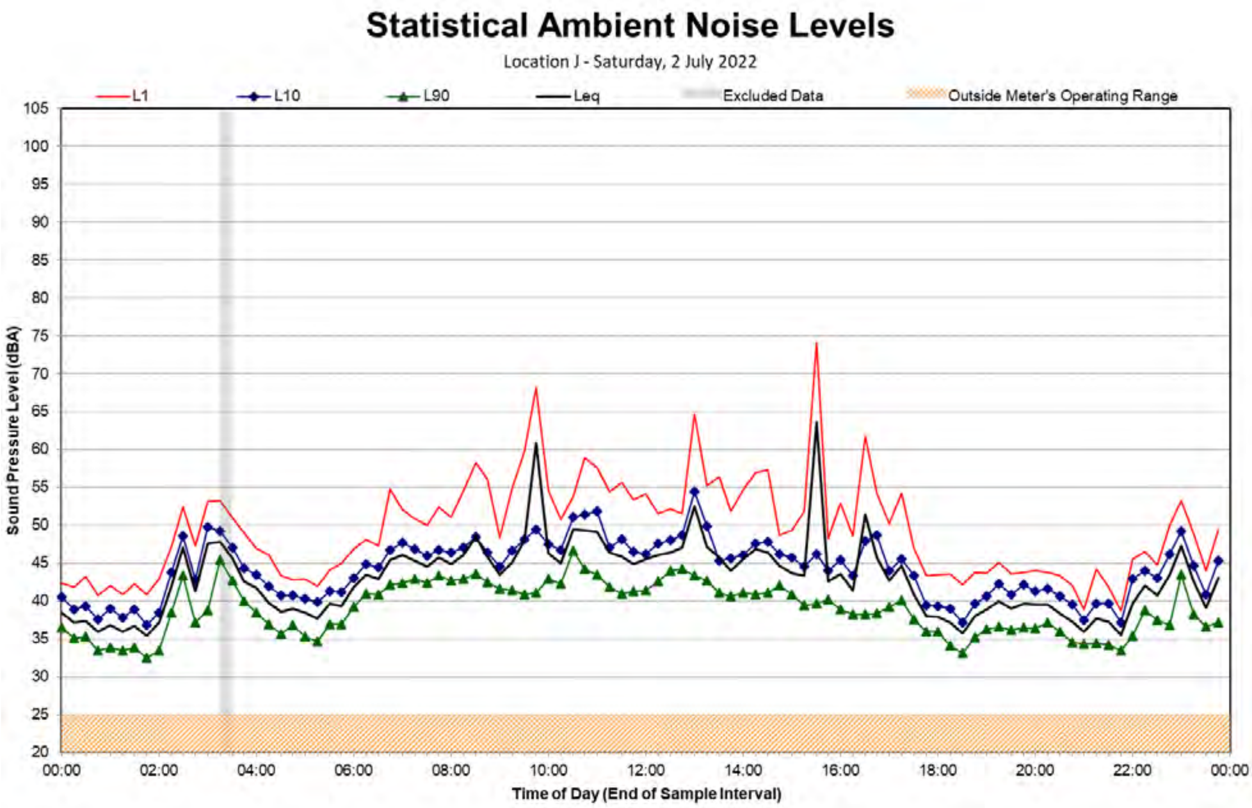
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)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Location J - Saturday, 2 July 2022
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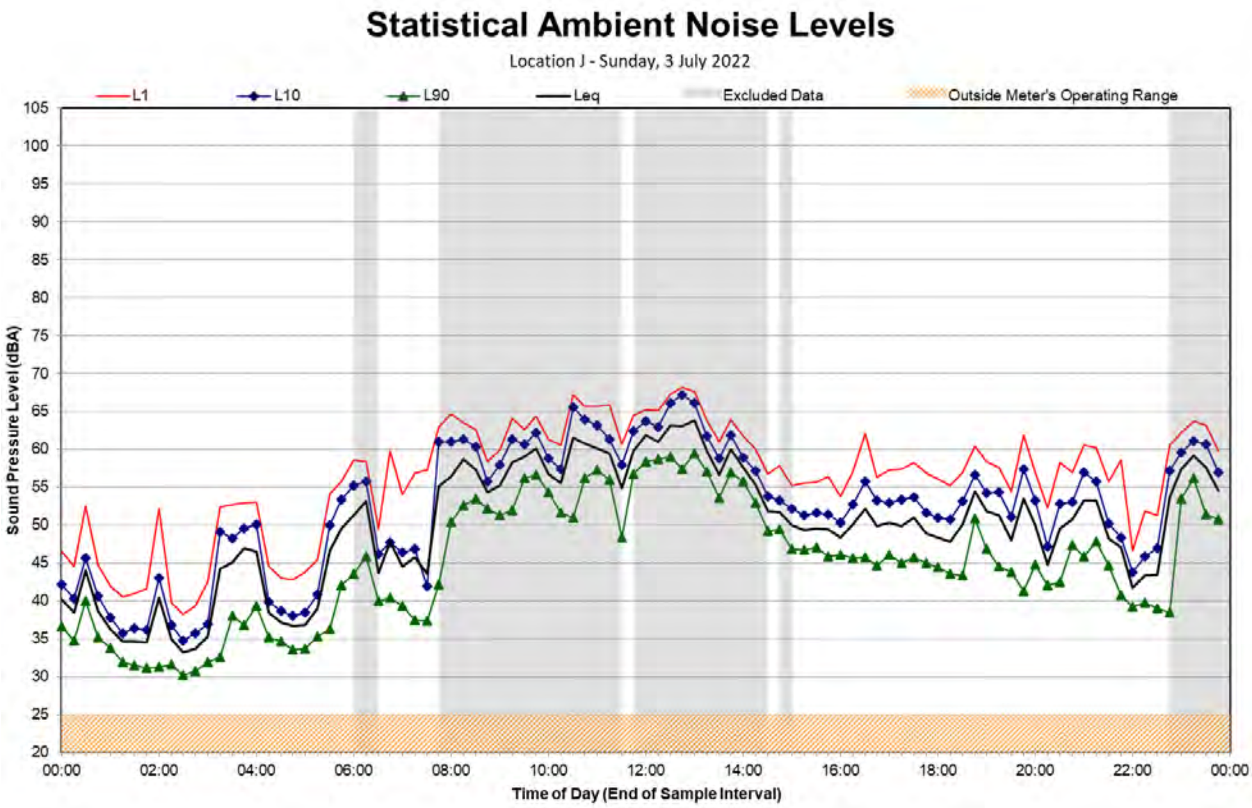
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)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Location J - Sunday, 3 July 2022
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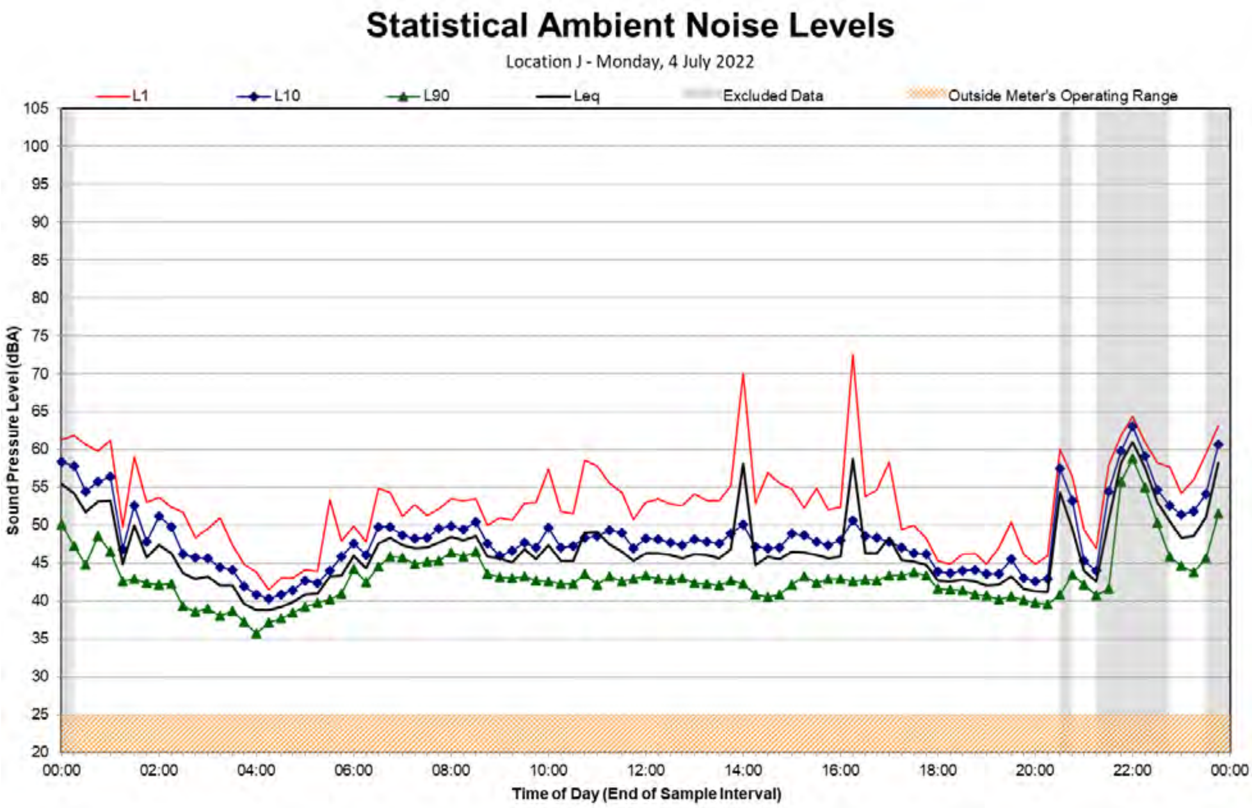
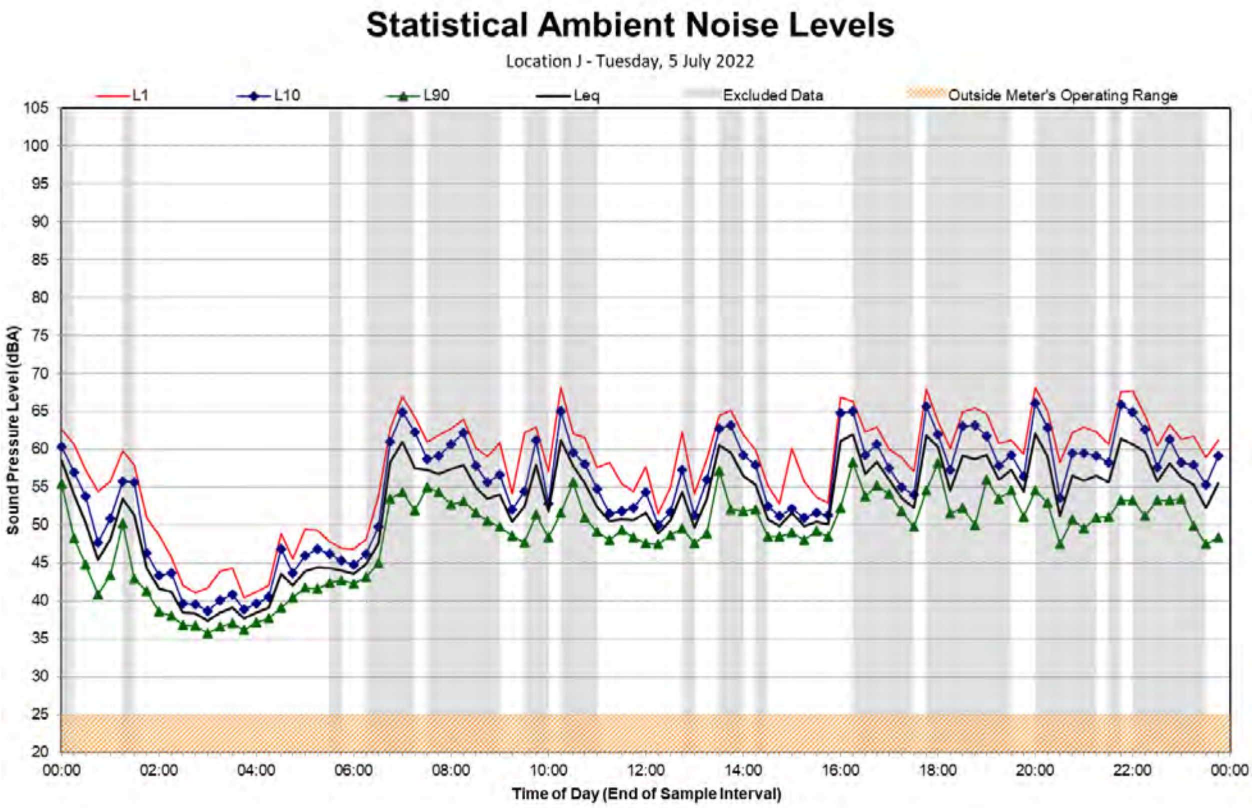
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Monday, 4 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Tuesday, 5 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
00:00
02:00
04:00
06:00
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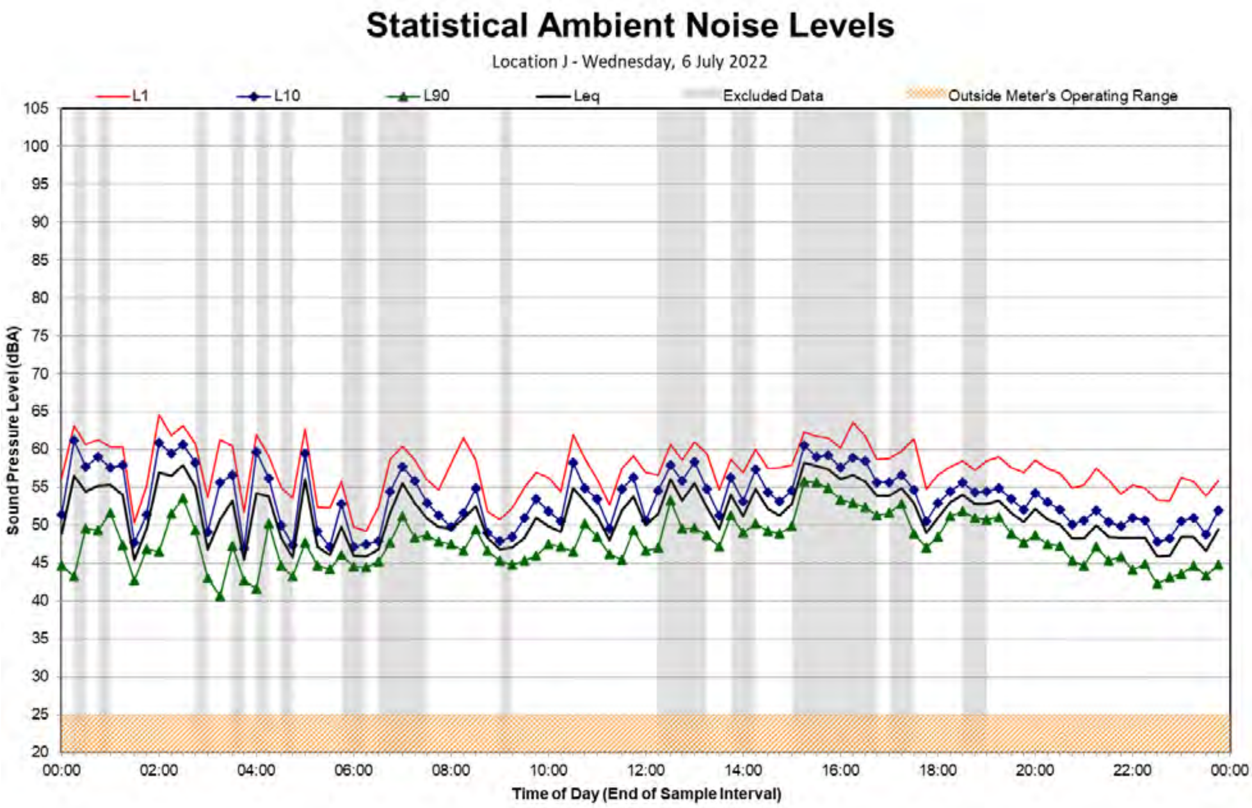
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Wednesday, 6 July 2022
L1
L10
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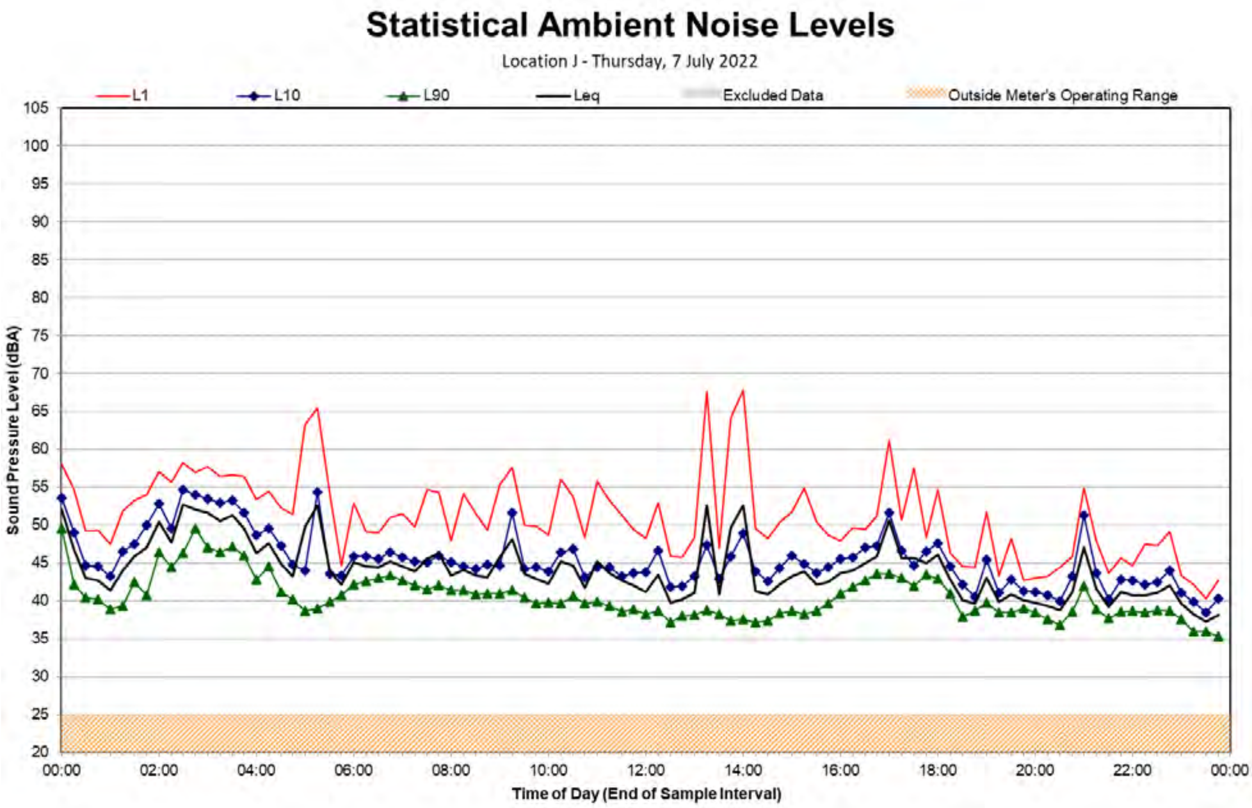
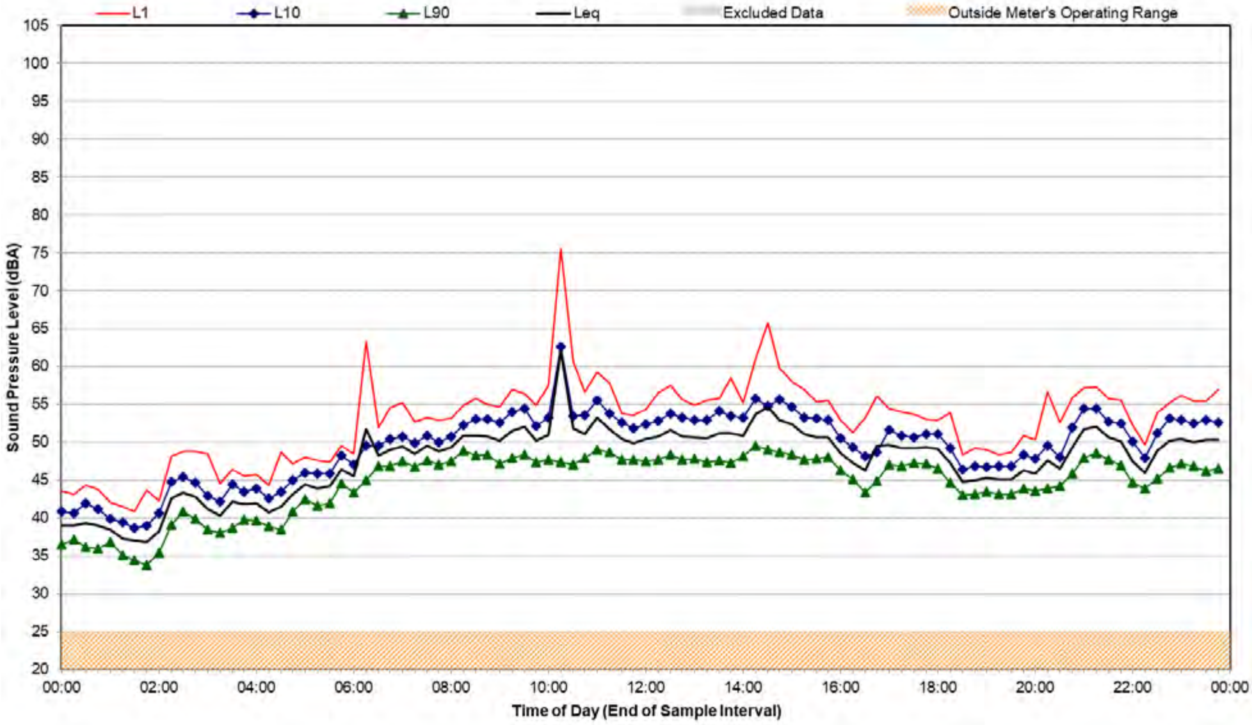
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Thursday, 7 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

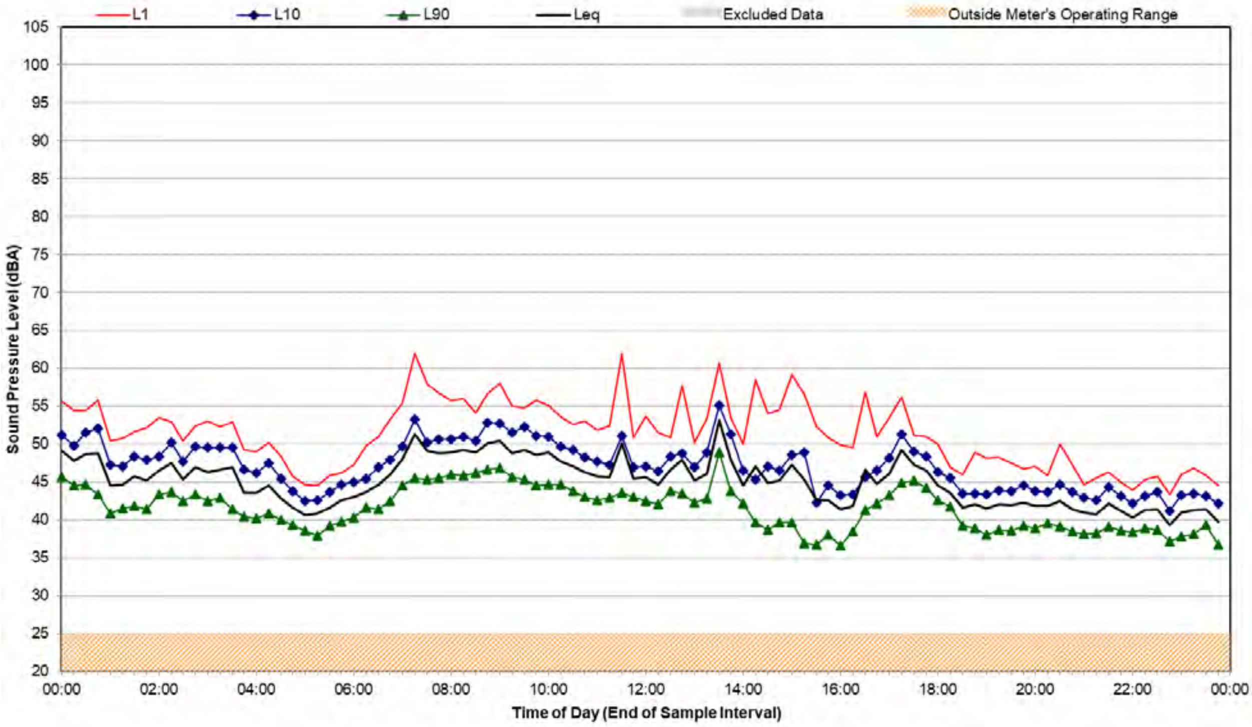
## Statistical Ambient Noise Levels

Location J - Friday, 8 July 2022



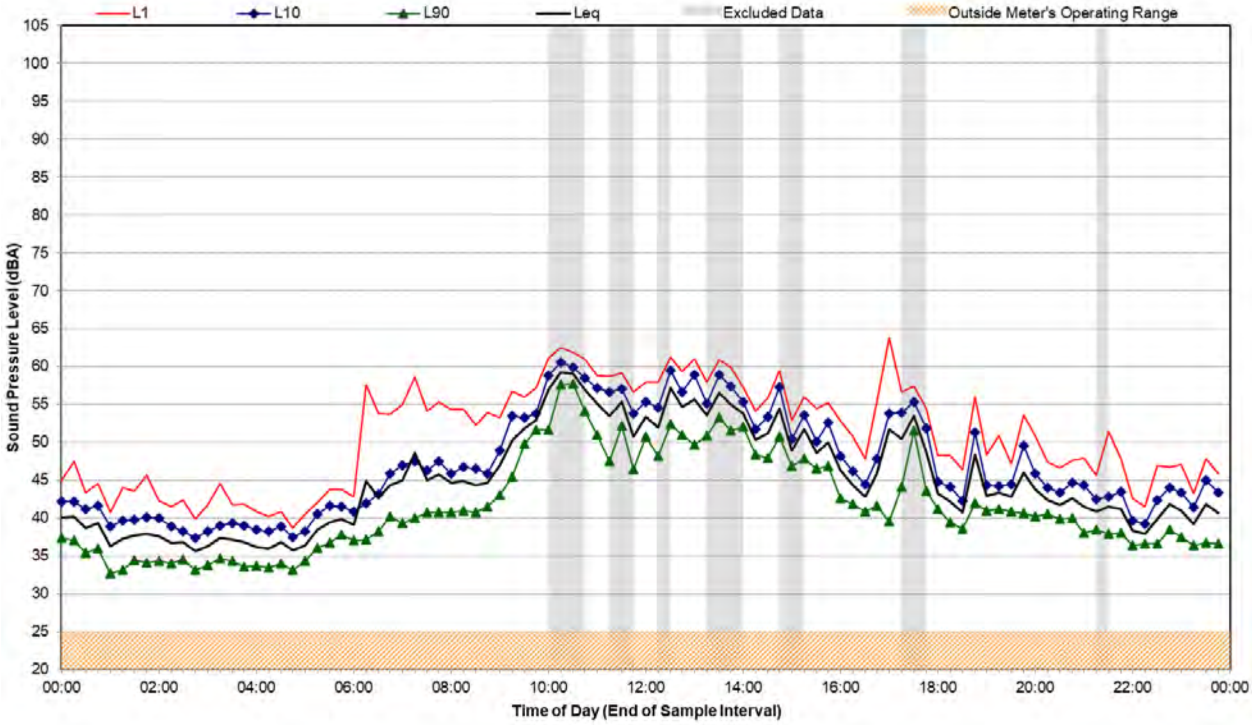

## Statistical Ambient Noise Levels

Location J - Saturday, 9 July 2022



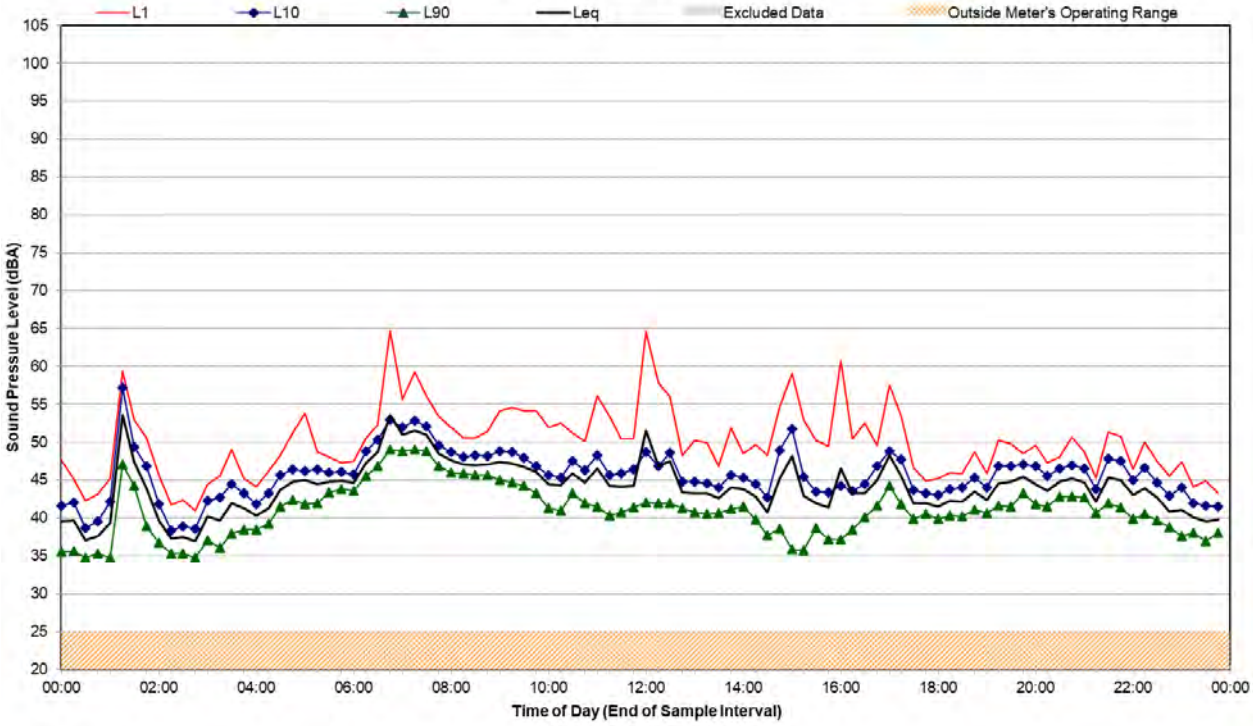
## Statistical Ambient Noise Levels

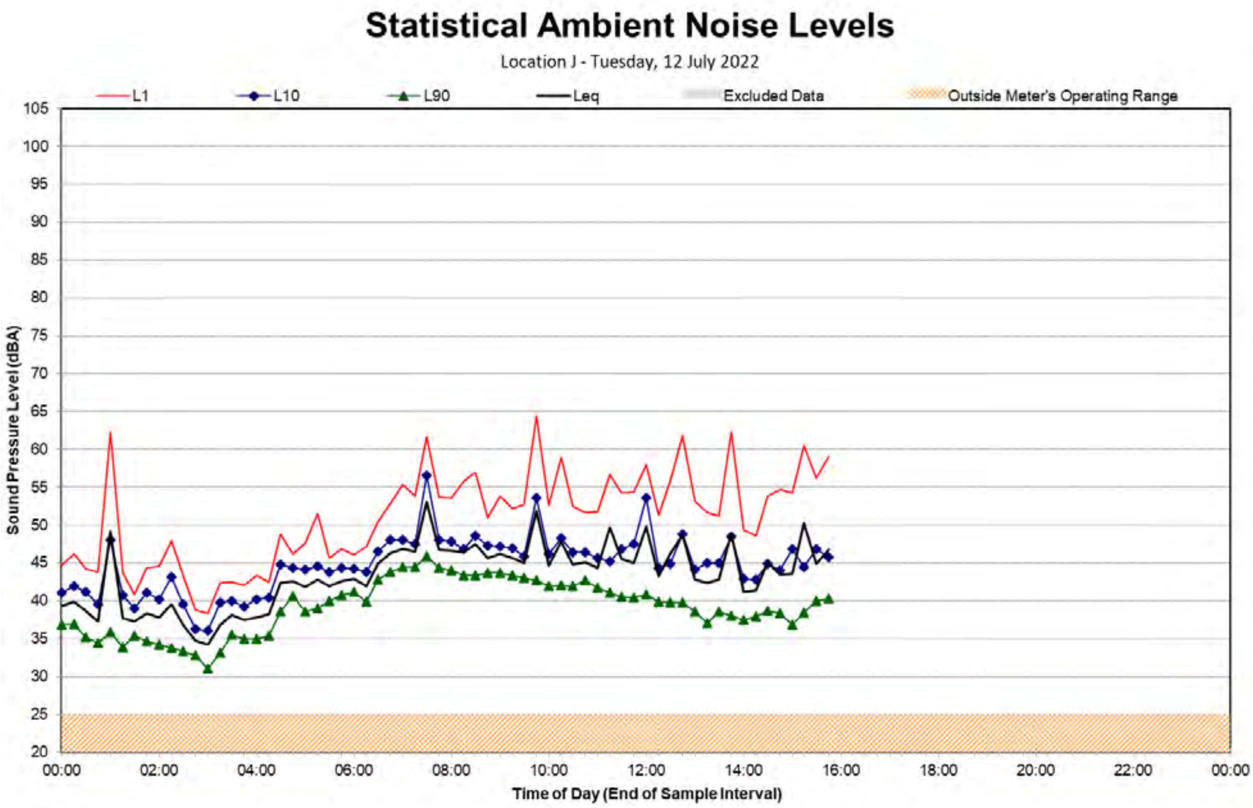
Location J - Sunday, 10 July 2022




## Statistical Ambient Noise Levels

Location J - Monday, 11 July 2022





Statistical Ambient Noise Levels
Location J - Tuesday, 12 July 2022
L1
L10
L90
Leq
Excluded Data
Outside Meter's Operating Range
Sound Pressure Level (dBA)
Time of Day (End of Sample Interval)

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# DONALDSON AND ABEL COAL MINES

**Bi-Annual Noise Monitoring**
**Half-year Ending December 2022**

**Prepared for:**

Donaldson Coal Pty Ltd
PO Box 675
Green Hills 2320

**SLR Ref: 630.01053-R01**
**Version No: -v0.1**
**March 2023**

# PREPARED BY

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E: newcastleau@slrconsulting.com www.slrconsulting.com

# BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Donaldson Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

# DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
|---|---|---|---|---|
| Q88 630.01053-R01-v0.1 | 7 March 2023 | Martin Davenport | Jonathan Caine | |
| | | | | |
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| | | | | |

# CONTENTS

# CONTENTS



# DOCUMENT REFERENCES

## TABLES



## FIGURES



## APPENDICES

# 1 Introduction

## 1.1 Background

Donaldson Coal Pty Ltd has commissioned SLR Consulting Australia Pty Ltd (SLR) to conduct half-yearly noise monitoring surveys for the Donaldson Coal Mine and Abel Coal Mine during the December 2022 half in accordance with the *Donaldson Coal Mine and Abel Underground Coal Mine - Noise Management Plan Care and Maintenance* (the NMP) dated 3 June 2019.

## 1.2 Objectives of this Report

The objectives of the noise monitoring survey for this operating half-year were as follows:

- Measure the ambient noise levels at six focus receptor locations (potentially worst affected) surrounding Donaldson Coal Mine and Abel Coal Mine.
- Qualify all sources of noise within each of the attended surveys, including estimated contribution or maximum level of individual noise sources.
- Assess the noise emissions of Donaldson Coal Mine and Abel Coal Mine with respect to the limits contained in the Development Consent.

## 1.3 Acoustic Terminology

The following report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

# 2 Development Consent Project Approval

Development consent was obtained by Donaldson Coal Pty Ltd for the Donaldson Mine in October 1999 following a Commission of Inquiry. Development Consent number N97/00147 was issued by the Minister for Urban Affairs pursuant to Section 101 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

Project Approval (Application No. 05_0136) granted by the Minister of Planning was obtained by Donaldson Coal Pty Ltd for Abel Coal Mine in 2007.

## 2.1 Donaldson Coal Mine Development Consent Conditions

The Development Consent nominates hours of operation and mine noise emission goals in the Sections entitled "*Operation of Development, Condition No. 3(1) and 3(2)*", and *"Noise and Vibrational Noise Limits: Condition No. 15*" as follows:

*3.(1) Subject to (2) the approved hours of operation are as follows:*

| *Works* | *Period* | *Hours* |
|---|---|---|
| *Construction, including construction of any bunds* | *Monday to Friday*<br>*Saturday* | *7 am to 6 pm*<br>*8 am to 1 pm* |
| *Mining operations, including mining, haulage of waste to dumps and coal processing* | *Monday to Friday*<br>*Saturday, Sunday* | *24 hours per day*<br>*7 am to 6 pm* |
| *Road Transportation and stockpiling of coal* | *7 days per week* | *24 hours per day* |
| *Rail loading of coal* | *7 days per week* | *7 am to 10 pm* |
| *Maintenance of mobile and fixed plant* | *7 days per week* | *24 hours per day* |
| *Blasting, not involving closure of John Renshaw Drive* | *Monday to Saturday* | *7 am to 5 pm* |
| *Blasting, involving closure of John Renshaw Drive* | *Monday to Saturday* | *10 am to 2 pm* |

*Notes: Restrictions on Public Holidays are the same as Sundays*

*(2) The Applicant shall submit a report to the Director-General's satisfaction demonstrating the noise limits in Condition 15 can be met while rail loading of coal is occurring during the period from 6 pm to 10 pm. If that report does not demonstrate that the noise limits can be met to the Director-General's satisfaction, then the hours of operation for rail loading of coal shall be restricted to 7 am to 6 pm."*

15. *Unless subject to a negotiated agreement in accordance with Condition 23, the Applicant shall ensure that the noise emission from construction or mining operations, when measured or computed at the boundary of any dwelling not owned by the applicant (or within 30 metres of the dwelling, if the boundary is more than 30 metres from the dwelling), shall not exceed the following noise limits:*

| Location | $L_{A10(15minute)}$ Noise Limits (dBA) | |
|---|---|---|
| | Daytime | Night-time |
| *Beresfield area (residential)* | *45* | *35* |
| *Steggles Poultry Farm* | *50* | *40* |
| *Ebenezer Park Area* | *46* | *41* |
| *Black Hill Area* | *40* | *38* |
| *Buchanan and Louth Park Area* | *38* | *36* |
| *Ashtonfield Area* | *41* | *35* |
| *Thornton Area* | *48* | *40* |

*Note: Daytime is 7 am to 10 pm Monday-Saturday, and 8 am to 10 pm Sundays and Public Holidays. Night-time is 10 pm to 7 am Monday-Saturday, and 10 pm to 8 am Sundays and Public Holidays.*

*The noise limits apply for prevailing meteorological conditions (winds up to 3 m/s), except under conditions of temperature inversions."*

Other Conditions of Consent relevant to noise are as follows:

18. *The applicant shall survey and investigate noise reduction measures from plant and equipment and set targets for noise reduction in each Annual Environmental Management Report (AEMR), taking into consideration valid noise complaints received in the previous year. The Report shall also include remedial measures.*

19. *The Applicant shall revise the Noise Management Plan as necessary and provide an updated Plan five years after commencement of mining to the Director-General, the independent noise expert (Condition 48), EPA, Councils and the Community Consultative Committee.*

## 2.2 Abel Coal Mine – Project Approval

### Approved Operations

The following operations are approved under the Abel Coal Mine Project Approval:

- Extraction of up to 6.1 Mtpa of Run of Mine (ROM) coal from the Abel Underground Coal Mine.
- Transport coal to the existing Bloomfield Coal Handling and Preparation Plant (CHPP) by private haul roads, or by coal conveyor, or by a combination of both methods.
- Operate the CHPP to process coal extracted from the Abel Coal Mine and the Bloomfield and Donaldson Coal Mines.
- Transportation of product coal from the Bloomfield site by rail via the Bloomfield rail loading facility.

The Project Approval was modified in June 2010 (05_0136 MOD 1) allowing construction and operation of a downcast ventilation fan. In May 2011 the Project Approval was modified again (05_0136 MOD 2) to allow the construction and operation of an upcast ventilation fan (and associated facilities). In December 2013 the Project Approval was further modified (05_0136 MOD3) to account for the increase in coal extracted including the upgrade of the Bloomfield CHPP.

## Consent Conditions

The relevant conditions relating to noise from the Abel Coal Mine approval are reproduced below.

*Schedule 4*

***NOISE***

***Operational Noise Criteria***

1. *The Proponent shall ensure that the noise generated by the Project does not exceed the criteria in Table 4 at any residence on privately-owned land.*

*Table 4: Operational Noise Criteria dB(A)*

| Location | Receiver Area | Day | Evening | Night | |
|---|---|---|---|---|---|
| | | $L_{Aeq(15minute)}$ | $L_{Aeq(15minute)}$ | $L_{Aeq(15minute)}$ | $L_{A1(1minute)}$ |
| Location I | Lord Howe Drive, Ashtonfield | *36* | *36* | *36* | *45* |
| Location K | Catholic Diocese Land | *37* | *37* | *37* | *45* |
| Location L | Kilshanny Avenue, Ashtonfield | *40* | *40* | *40* | *47* |
| All other Locations | All other privately owned Residences | *35* | *35* | *35* | *45* |

*Notes:*

- *To interpret the locations referred to in Table 4, see plan in Appendix 3.*
- *Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 4 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.*

*These noise criteria do not apply if the Proponent has an Agreement with the relevant landowner to generate higher noise levels, and the proponent has advised the Department in writing of the terms of this agreement.*

***Construction Noise Criteria***

1. *The proponent shall ensure that the noise generated during the construction of the downcast ventilation shaft as described in EA (MOD3) does not exceed the criteria in Table 5.*

*Table 5: Construction Noise Criteria dB(A)*

| Location | Receiver | Day |
|---|---|---|
| | | $L_{Aeq(15minute)}$ |
| *Location R* | *281 Lings Road, Buttai* | *50* |
| *Location S* | *189 Lings Road, Buttai* | *43* |

*Notes:*

- *The criteria in Table 5 apply only whilst the downcast ventilation shaft is being constructed, and for a maximum of 12 weeks from the commencement of construction.*
- *To interpret the locations referred to in Table 5, see plan in Appendix 3* (attached to this report as **Appendix A**).
- *Noise generated by the project is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.*

*However, these noise criteria do not apply if the Proponent has an Agreement with the relevant landowner to generate higher noise levels, and the proponent has advised the Department in writing of the terms of this agreement.*

***Rail Noise Criteria***

1. *The proponent shall ensure that the noise from rail movements on the Bloomfield Rail Spur does not exceed the limits in Table 6 at any residence on privately owned land.*

*Table 6: Rail Spur noise criteria dB (A)*

| *Location* | *Day* | *Evening* | *Night* |
|---|---|---|---|
| | *$L_{Aeq(period)}$* | | |
| *All privately-owned land* | *55* | *45* | *40* |

***Cumulative Noise Criteria***

1. *The proponent shall implement all reasonable and feasible measures to ensure that the noise generated by the project combined with noise generated by other mines does not exceed the criteria in Table 7 at any residence on privately-owned land.*

*Table 7: Cumulative noise criteria dB (A)*

| *Location* | *Day* | *Evening* | *Night* |
|---|---|---|---|
| | *$L_{Aeq(period)}$* | | |
| *All privately-owned land* | *55* | *45* | *40* |

*Notes: Cumulative noise is to be measured in accordance with the relevant requirements, and exemptions (including meteorological conditions), of the NSW Industrial Noise Policy. Appendix 4 sets out the metrological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.*

***Operating Conditions***

1. *The proponent shall:*
   a. *Implement best management practise to minimise the construction, operational, road and rail noise of the project;*
   b. *Operate an on-site noise management system to ensure compliance with the relevant conditions of this approval;*
   c. *Minimise the noise impacts of the project during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 4);*
   d. *Only receive and/or dispatch locomotives and rolling stock either on or from the site that are approved to operate on the NSW rail network in accordance with the noise limits in ARTC's EPL (No. 3142);*
   e. *Carry out regular monitoring to determine whether the project is complying with the noise criteria and other relevant conditions of approval, to the satisfaction of the Director-General.*

***Noise Management Plan***

2. *The proponent shall prepare and implement a Noise Management Plan for the project to the satisfaction of the Director-General. This plan must:*
   a. *Be prepared in consultation with the EPA, and be submitted to the Director-General for approval within 6 months of the date of approval of MOD 3;*
   b. *Describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this approval; Describe the proposed noise management system in detail; and*
   c. *Include a monitoring program that:*
      - *Uses attended monitoring to evaluate the compliance of the project against the noise criteria in this approval;*
      - *Evaluates and reports on:*
        - *The effectiveness of the on-site noise management system; and*
        - *Compliance against the noise operating conditions; and*

*Defines what constitutes a noise incident, and includes protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents. Appendix 4*

***Noise Compliance Assessment***

***Applicable Meteorological Conditions***

1. *The noise criteria in Tables 4 and 7 are to apply under all metrological conditions except the following:*
   a. *During periods of rain or hail.*
   b. *Average wind speed at microphone height exceeds 5 m/s;*
   c. *Wind speeds greater than 3 m/s measured at 10m above ground level; or*
   d. *Temperature inversion conditions greater than 3°C/100m.*

***Determination of metrological conditions***

2. *Except for wind speed at microphone height, the data to be used for determining metrological conditions shall be that recorded by the meteorological station located on the site.*

***Compliance monitoring***

3. *Attended monitoring is to be used to evaluate compliance with the relevant conditions of this approval.*
4. *Unless otherwise agreed with the director-general, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the NSW Industrial Noise Policy (as amended from time to time), in particular the requirements relating to:*
    a. *Monitoring locations for the collection of representative noise data;*
    b. *Metrological conditions during which collection of noise data is not appropriate;*
    c. *Equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and*
    d. *Modification to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.*

*Appendix 5*

***Statement of Commitments***

***3. Noise***

***3.1 Construction Activities***

*The following noise control measures will be implemented prior to commencement of construction of the Abel Underground Mine or the upgrade of the Bloomfield CHPP.*

1. *Maintain all machinery and equipment in working order;*
    a. *No construction activities at the Abel pit top will take place on Sundays or Public Holidays;*
    b. *Where possible locate noisy site equipment behind structures that act as barriers or at the greatest distance from noise sensitive areas; and*
    c. *Orientate equipment so that noise emissions are directed away from noise sensitive areas.*

***3.2 Noise Control Measures***

a. *The following noise control measures will be implemented prior to the mining of coal from the Abel underground Mine:*
    i. *Orientation of the ventilation fans away from residential receivers and angle the output parallel to the ground.*
    ii. *The sound power level of the front end loader to be used near the portal should not exceed 113 dBA and will be fitted with a noise sensitive reversing alarm.*
b. *The following noise control measures will be implemented prior to the Bloomfield CHPP receiving any ROM coal from Able Underground Mine;*

i. *Noise mitigation works including partial enclosure and noise screening of drives and conveyors of the Bloomfield CHPP to screen residences to the north of the site.*

***3.2 Monitoring***

*The Company will implement a Noise Monitoring Program for the Abel Underground Mine and the Bloomfield CHPP, to the satisfaction of the Director-General. The Noise Monitoring Program shall include a combination of real-time and supplementary attended monitoring measures, and a noise monitoring protocol for evaluating compliance with the noise environmental assessment. This plan will be integrated with the monitoring plans for the Tasman, Donaldson and Bloomfield Mines to provide a single integrated Noise Monitoring Program for all 4 mines.*

***3.4 Continuous Improvement***

*The Company shall:*

a. *Report on these investigations and implementation of any new noise mitigation measures on site in the AEMR, to the satisfaction of the Director General.*

*The operator of the Bloomfield CHPP shall:*

b. *Investigate ways to reduce the noise generated by the Bloomfield CHPP, including maximum noise levels which may result in sleep disturbance;*

c. *Implement all reasonable and feasible best practice noise mitigation measures on the site; and*

d. *Report on these investigations and the implementation of any new noise mitigation measures on site in the AEMR, to the satisfaction of the Director-General.*

# 3 Noise Monitoring Methodology

## 3.1 General Requirements

The operational noise monitoring program was conducted with reference to Development Consent N97/00147 (Donaldson Coal Mine), Project Approval 05_0136 (Abel Coal Mine), the NMP and AS 1055-2018 *Acoustics - Description and Measurement of Environmental Noise*.

All acoustic instrumentation employed throughout the monitoring program has been designed to comply with the requirements of AS IEC 61672.1 – 2019 *Electroacoustics—Sound level meters*, AS IEC 60942 2017 *Electroacoustics – Sound calibrators* and carried current NATA or manufacturer calibration certificates. Certificates for acoustic instrumentation used during the June 2022 half is provided in **Appendix B**.

Instrument calibration was conducted before and after each measurement, with the variation in calibrated levels not exceeding ±0.5 dBA.

## 3.2 Monitoring Locations

Baseline and preceding operational half-yearly surveys have been conducted at 11 locations surrounding the Donaldson Mine and Abel Coal Mine sites. With the experience of these previous surveys, it was decided to concentrate noise monitoring at six focus locations that represent the potentially most noise affected areas from Donaldson Mine and Abel Coal Mine. The details of the monitoring locations are contained within **Table 1**.

It is relevant to note that Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Furthermore, Abel mine was placed in Care & Maintenance on 28th April 2016 and there were no operations onsite during the December 2022 noise monitoring period.

### Table 1 Monitoring Locations

| Noise Monitoring Location | Description |
|---|---|
| D | Black Hill School, Black Hill |
| F | Lot 684 Black Hill Road, Black Hill |
| G | 156 Buchannan Road, Buchannan |
| I | Magnetic Drive, Ashtonfield |
| J | Parish Drive, Thornton |
| L | 65 Tipperary Dr, Ashtonfield |

A map giving the approximate location of the noise monitoring sites is contained within **Appendix C**.

## 3.3 Unattended Continuous Noise Monitoring

An environmental noise logger was deployed for a minimum of a seven day period between Sunday 18 December 2022 to Tuesday 3 January 2023 at each of the six (6) nominated locations given in **Table 1**.

All unattended monitoring equipment was programmed to continuously record statistical noise level indices in 15 minute intervals including the $L_{Amax}$, $L_{A1}$, $L_{A10}$, $L_{A90}$, $L_{A99}$, $L_{Amin}$ and $L_{Aeq}$. The statistical noise exceedance levels ($L_{AN}$) are the levels exceeded for N% of the 15 minute interval. The $L_{A90}$ represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level. The $L_{A10}$ is the level exceeded for 10% of the time and is usually referred to as the average maximum noise level. The $L_{Aeq}$ is the equivalent continuous sound pressure level and represents the steady sound level which is equal in energy to the fluctuating level over the interval period. The $L_{Amax}$ is the maximum noise level recorded over the interval.

## 3.4 Operator Attended Noise Monitoring

Operator attended surveys were conducted at each of the six monitoring locations during the daytime, evening and night-time periods, to verify the unattended logging results and to determine the character and contribution of ambient noise sources.

# 4 Operator Attended Noise Monitoring

## 4.1 Results of Operator Attended Noise Monitoring

Operator attended noise measurements were conducted commencing during the evening period on 22 December 2022 and finished during the daytime period on 23 December 2022. Operator attended noise surveys were conducted using a Brüel & Kjær Type 2250L (serial number 3003389).

Ambient noise levels given in the tables include all noise sources such as traffic, insects, birds, and mine operations as well as any other industrial operations.

The tables provide the following information:

- Monitoring location.
- Date and start time.
- Wind velocity (m/s) and Temperature (ºC) at the measurement location.
- Typical maximum ($L_{Amax}$) and contributed noise levels.

Mine contributions listed in the tables are from the Abel Coal Mine and are stated only when a contribution could be quantified.

## Table 2 Location D, Black Hill Public School, Black Hill

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 23/12/2022 07:07 17°C 0.7 m/s S | 79 | 67 | 56 | 35 | 55 | Birdsong 55-68 Wind in trees 35 Road traffic 42-79 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Evening | 22/12/2022 18:42 18°C 1.6 m/s SE | 80 | 68 | 54 | 41 | 57 | Insects 35 Birdsong 41-57 Road traffic 44-80 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Night | 22/12/2022 22:31 9°C 0.4 m/s W | 75 | 62 | 49 | 47 | 52 | Insects 45-50 Road traffic 39-75 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

## Table 3 Location F, Lot 684 Black Hill Road, Black Hill

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 23/12/2022 07:27 18°C 0.7 m/s SW | 75 | 68 | 60 | 48 | 57 | Road traffic 50-75 Birdsong 45-50 Insects 38 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Evening | 22/12/2022 19:03 17°C 0.5 m/s SE | 71 | 61 | 54 | 42 | 51 | Insects 38-49 Road traffic 40-71 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Night | 22/12/2022 22:51 17°C 0.5 m/s E | 65 | 56 | 51 | 45 | 49 | Road traffic 42-65 Insects 47-50 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

### Table 4 Location G, Buchanan Road, Buchanan

| Period | Date/ Start time/ Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 23/12/2022<br>08:36<br>19°C<br>1.2 m/s NW | 77 | 76 | 73 | 50 | 67 | Road traffic 51-55<br>Insects 57-77<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Evening | 22/12/2022<br>20:04<br>17°C<br>0.2 m/s SE | 82 | 81 | 80 | 56 | 76 | Road traffic 59<br>Insects (cicadas) 75-82<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Night | 22/12/2022<br>23:40<br>17°C<br>0.9 m/s NW | 65 | 50 | 46 | 40 | 43 | Road traffic 45-53<br>Operator 65<br>Insects 39-42<br>Other Industry 25-37<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |

### Table 5 Location I, Magnetic Drive, Ashtonfield

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 23/12/2022<br>09:49<br>22°C<br>1.8 m/s NW | 69 | 63 | 51 | 45 | 51 | Road traffic 38-69<br>Dog barking 50-56<br>Insects 45-54<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Evening | 22/12/2022<br>20:53<br>17°C<br>0.6 m/s SSE | 71 | 59 | 47 | 43 | 48 | Road traffic 38-71<br>Insects 45-48<br>**Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution<br>Inaudible | | | | | |
| Night | 23/12/2022<br>00:28<br>17°C<br>0.8 m/s S | 61 | 50 | 46 | 42 | 45 | Traffic 35-61<br>Insects 41-52<br>**Abel Mine Audible**<br>Bloomfield CHPP 30-33 |
| | | Estimated Abel Mine Noise Contribution<br>30 dBA LAeq(15minute)<br>33 dBA LA1(1minute) | | | | | |

### Table 6 Location J, Parish Drive, Thornton

| Period | Date/ Start time/Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 23/12/2022 10:12 23°C 1.3m/s WNW | 61 | 56 | 55 | 52 | 53 | Road traffic 40-61 Birdsong 50-61 Insects 51-54 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Evening | 22/12/2022 21:17 17°C 0.5 m/s SE | 57 | 52 | 51 | 47 | 49 | Insects 47-53 Train 49 Road traffic 35-42 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |
| Night | 22/12/2022 22:00 17°C 0.5 m/s ESE | 56 | 53 | 51 | 46 | 49 | Insects 50-56 Road traffic 38-47 **Abel Mine Inaudible** |
| | | Estimated Abel Mine Noise Contribution Inaudible | | | | | |

### Table 7 Location L, 65 Tipperary Drive, Ashtonfield

| Period | Date/ Start time/ Weather | Primary Noise Descriptor (dBA re 20 µPa) | | | | | Description of Noise Emission, Typical Maximum Noise Levels (LAmax – dBA) |
|---|---|---|---|---|---|---|---|
| | | LAmax | LA1 | LA10 | LA90 | LAeq | |
| Day | 23/12/2022 09:15 22°C 1.4 m/s W | 74 | 67 | 48 | 35 | 53 | Road traffic 52-74 Residents 44-51 Birdsong 45-62 **Abel Mine Audible** Bloomfield CHPP 35-38 |
| | | Estimated Abel Mine Noise Contribution 36 dBA $L_{Aeq(15minute)}$ | | | | | |
| Evening | 22/12/2022 20:31 17°C 0.8 m/s SSE | 70 | 62 | 47 | 39 | 49 | Insects 40-48 Birdsong 53 Traffic 42-70 **Abel Mine Audible** Bloomfield CHPP 36-43 |
| | | Estimated Abel Mine Noise Contribution 38 dBA $L_{Aeq(15minute)}$ | | | | | |
| Night | 23/12/2022 00:07 17°C 0.3 m/s SSW | 76 | 59 | 35 | 30 | 50 | Train 38 Road traffic 30-76 Insects 33-40 **Abel Mine Audible** Bloomfield CHPP <25-26 |
| | | Estimated Abel Mine Noise Contribution 25 dBA $L_{Aeq(15minute)}$ 26 dBA $L_{A1(1minute)}$ | | | | | |

## 4.2 Operator Attended Noise Monitoring Summary

### 4.2.1 Donaldson Mine

Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Therefore, compliance noise monitoring for the Donaldson Open Cut Mine is no longer required.

### 4.2.2 Abel Coal Mine

Abel mine was placed in Care & Maintenance on 28th April 2016 and there were no operations onsite, excluding that from the Bloomfield CHPP which operates under the Abel Coal Mine project consent conditions.

The Bloomfield CHPP was audible at Location L and Location I. Abel noise emission were inaudible during all other operator attended noise surveys. Noise generated by local and distant traffic was a significant contributor to ambient noise levels at all monitored locations as well as neighbourhood noise and 'natural' noises such as birds, insects and wind related noise.

## 4.3 Compliance Assessment and Discussion of Results

### 4.3.1 Operations

Results of the operational compliance assessment are given in **Table 8**.

**Table 8 Compliance Noise Assessment - Operations**

| Location | Estimated Abel $L_{Aeq(15minute)}$ Contribution dBA | | | Consent Conditions | | | Compliance | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Day** | **Eve** | **Night** | **Day** | **Eve** | **Night** | **Day** | **Eve** | **Night** |
| D – Black Hill School, Black Hill | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| F – Black Hill Road, Black Hill | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| G – Buchanan Road, Buchanan | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| I – Magnetic Drive, Ashtonfield | Inaudible | Inaudible | 30 | 36 | 36 | 36 | Yes | Yes | Yes |
| J – Parish Drive, Thornton | Inaudible | Inaudible | Inaudible | 35 | 35 | 35 | Yes | Yes | Yes |
| L – 65 Tipperary Dr, Ashtonfield | 36 | 38 | 25 | 40 | 40 | 40 | Yes | Yes | Yes |

Results presented in **Table 8** indicate that compliance with the relevant consent conditions was achieved at all noise monitoring locations during all periods.

### 4.3.2 Sleep Disturbance

Results of the sleep disturbance compliance assessment are given in **Table 9**.

### Table 9 Compliance Noise Assessment – Sleep Disturbance

| Location | Estimated Abel $L_{A1(1minute)}$ Contribution dBA | Consent Conditions $L_{A1(1minute)}$ dBA | Compliance |
|---|---|---|---|
| D – Black Hill School, Black Hill | Inaudible | 45 | Yes |
| F – Black Hill Road, Black Hill | Inaudible | 45 | Yes |
| G – Buchanan Road, Buchanan | Inaudible | 45 | Yes |
| I – Magnetic Drive, Ashtonfield | 33 | 45 | Yes |
| J – Parish Drive, Thornton | Inaudible | 45 | Yes |
| L – 65 Tipperary Dr, Ashtonfield | 26 | 47 | Yes |

Results presented in **Table 9** indicate that compliance with the sleep disturbance consent conditions was achieved at all noise monitoring locations during the night-time noise surveys.

# 5 Unattended Continuous Noise Monitoring

## 5.1 Results of Unattended Continuous Noise Monitoring

Unattended continuous noise monitoring was conducted between Sunday 18 December 2022 to Tuesday 3 January 2023 at each of the six monitoring locations given in **Table 10**.

**Table 10 Noise Logger and Noise Monitoring Locations**

| Location | Noise Logger Serial Number | Date of Logging |
|---|---|---|
| D – Black Hill School, Black Hill | SVAN 957 20644 | 18/12/2022 to 3/1/2023 |
| F – Black Hill Road, Black Hill | SVAN 957 23247 | 18/12/2022 to 3/1/2023 |
| G – Buchanan Road, Buchanan | SVAN 957 20668 | 18/12/2022 to 3/1/2023 |
| I – Magnetic Drive, Ashtonfield | ARL Ngara 878053 | 23/12/2022 to 3/1/2023 |
| L – 65 Tipperary Dr, Ashtonfield | ARL Ngara 8781B1 | 23/12/2022 to 3/1/2023 |
| J – Parish Drive, Thornton | ARL Ngara 878202 | 23/12/2022 to 3/1/2023 |

The unattended ambient noise logger data from each monitoring location are presented graphically on a daily basis and are attached as **Appendix C**. A summary of the results of the unattended continuous noise monitoring is given in **Table 11**.

The ambient noise level data quantifies the overall noise level at a given location independent of its source or character.

The measured ambient noise levels were divided into three periods representing day, evening and night as designated in the NSW Noise Policy for Industry (NPfI).

Precautions were taken to minimise influences from extraneous noise sources (eg optimum placement of the loggers away from creeks, trees, houses, etc), however, not all these sources or their effects can be eliminated. This is particularly the case during the warmer times of year when noise from insects, frogs, birds and other animals can become quite prevalent.

Weather data for the subject area during the noise monitoring period was provided by Bloomfield Colliery. Noise data during periods of any rainfall and/or wind speeds in excess of 5 m/s were discarded in accordance with NPfI weather affected data exclusion methodology.

### Table 11 Unattended Continuous Noise Monitoring Ambient Noise Levels (dBA)

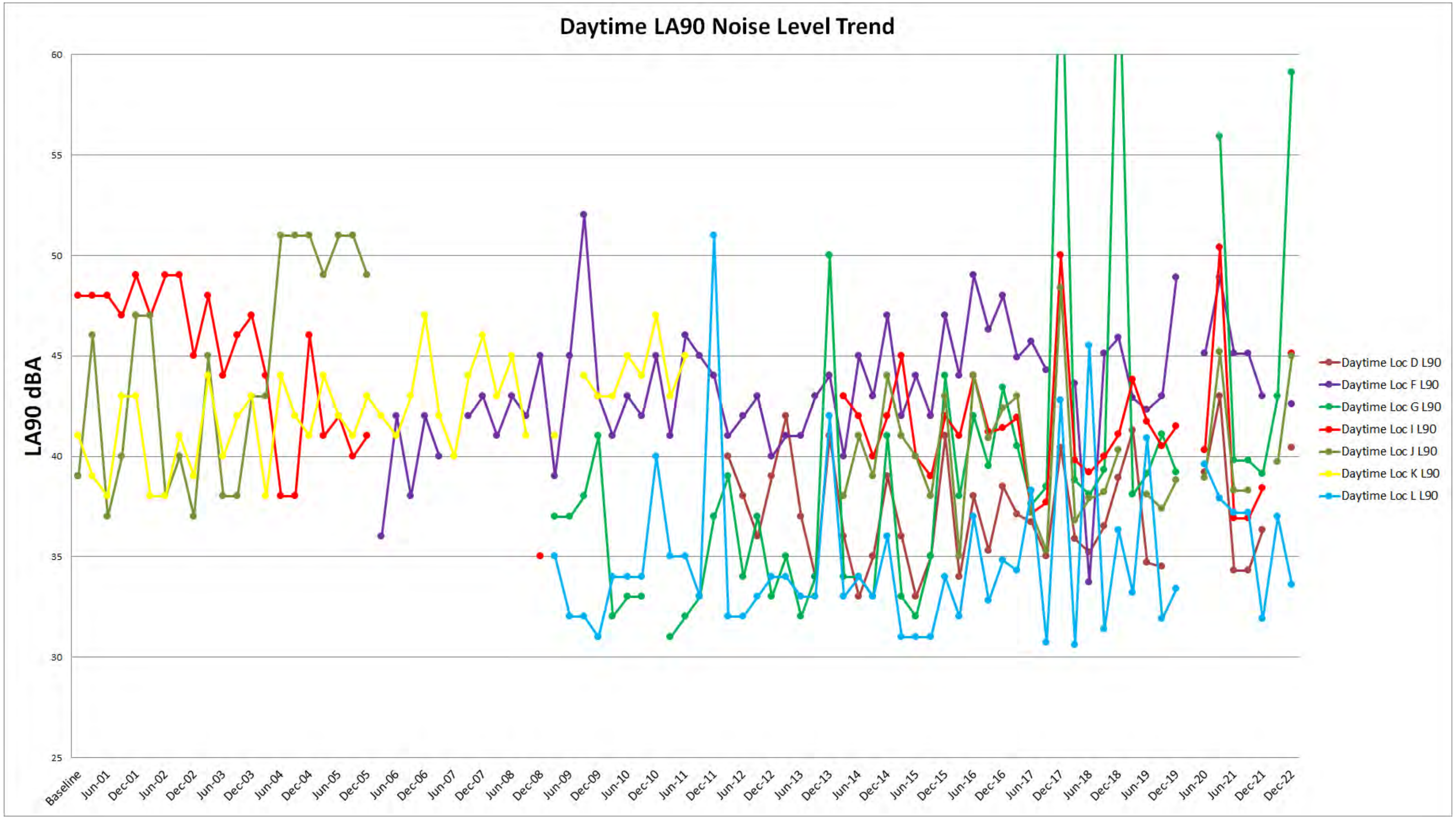
| Location | Period | Primary Noise Descriptor (dBA re 20 µPA) | | | |
|---|---|---|---|---|---|
| | | $L_{A1}$ | $L_{A10}$ | $L_{A90}$ | $L_{Aeq}$ |
| D<br>Black Hill School, Black Hill | Day | 64 | 54 | 40 | 54 |
| | Evening | 63 | 53 | 40 | 55 |
| | Night | 55 | 49 | 39 | 50 |
| F<br>Black Hill Road, Black Hill | Day | 59 | 53 | 43 | 53 |
| | Evening | 57 | 54 | 45 | 64 |
| | Night | 49 | 46 | 32 | 51 |
| G<br>156 Buchanan Road, Buchanan | Day | 75 | 73 | 59 | 74 |
| | Evening | 65 | 61 | 43 | 69 |
| | Night | 48 | 45 | 34 | 64 |
| I<br>Magnetic Drive, Ashtonfield | Day | 60 | 52 | 45 | 57 |
| | Evening | 60 | 52 | 41 | 57 |
| | Night | 51 | 48 | 41 | 49 |
| L<br>65 Tipperary Dr, Ashtonfield | Day | 58 | 48 | 34 | 50 |
| | Evening | 58 | 49 | 34 | 48 |
| | Night | 42 | 37 | 27 | 43 |
| J<br>Parish Drive, Thornton | Day | 58 | 55 | 45 | 56 |
| | Evening | 54 | 50 | 43 | 61 |
| | Night | 49 | 46 | 35 | 52 |

## 5.2 Long term Unattended Continuous Monitoring Summary for Donaldson Mine and Abel Coal Mine

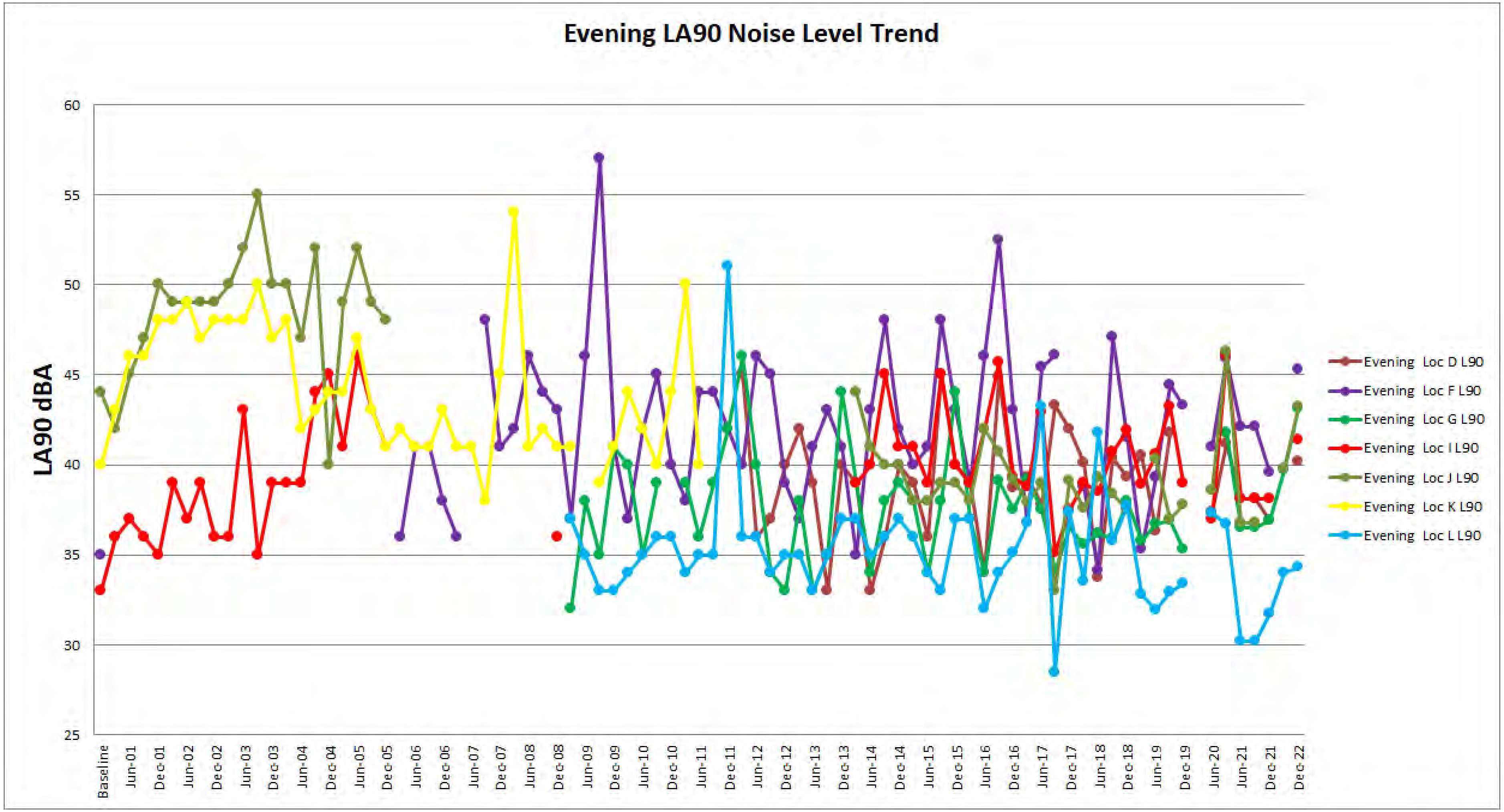
### 5.2.1 Ambient LA90 Noise Levels

The long term ambient $L_{A90}$ noise levels collected from each monitoring location are presented graphically in **Figure 1**, **Figure 2** and **Figure 3** for the daytime, evening and night-time periods respectively.

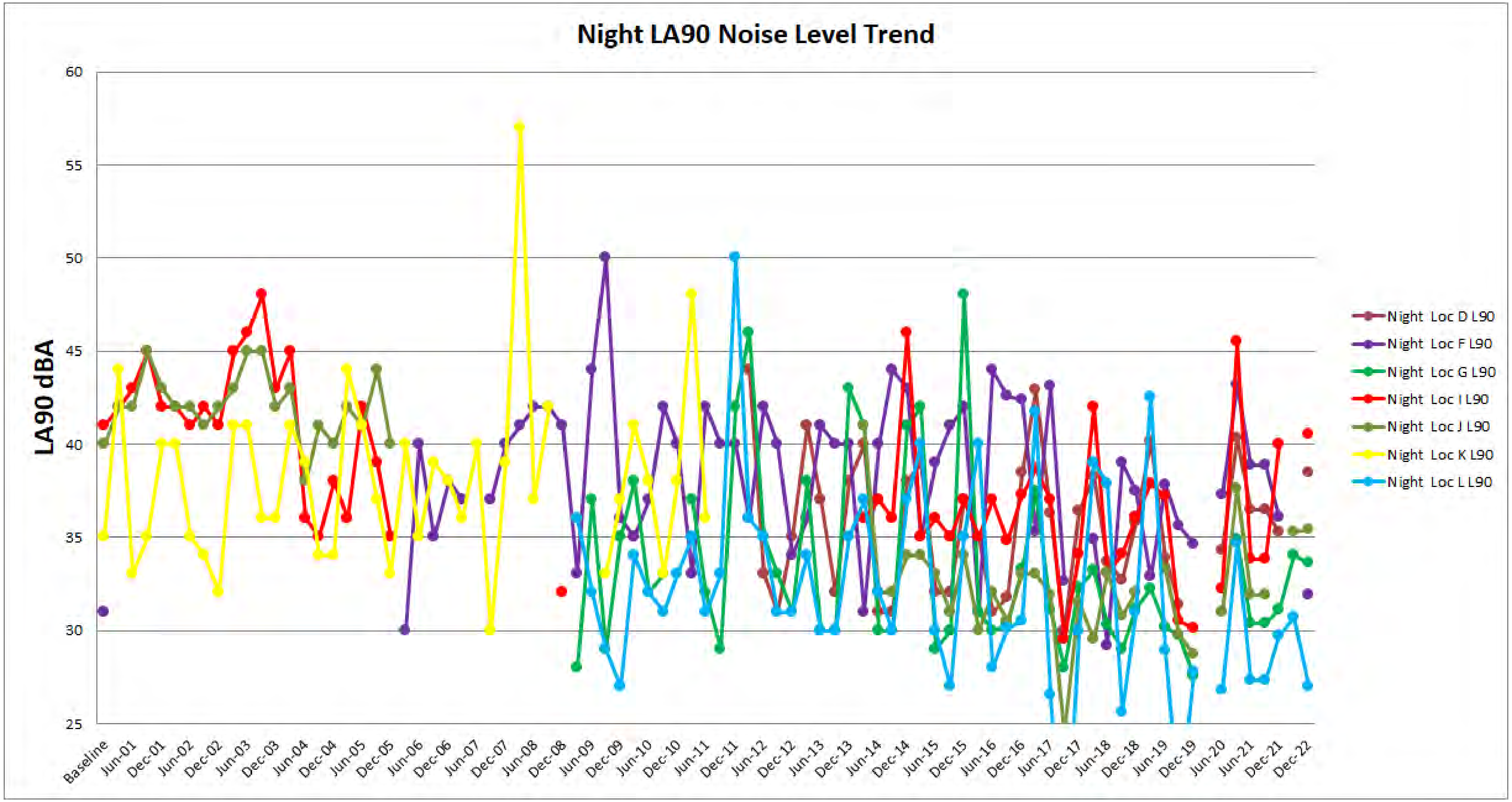
## Figure 1 Long Term Daytime LA90 Noise Levels



## Figure 2 Long Term Evening LA90 Noise Levels



## Figure 3 Long Term Night-time LA90 Noise Levels



#### 5.2.1.1 Baseline

The summary of results in **Table 12** shows the ambient $L_{A90}$ noise levels recorded for the current monitoring period compared to the levels recorded during the baseline monitoring process (ie. prior to commencement of mining operation at Donaldson).

**Table 12 $L_{A90}$ Results Comparison - Baseline**

| Monitoring Location | Period[1] | Long term Night-time $L_{A90}$ Noise Levels | | Difference dB[3] |
|---|---|---|---|---|
| | | **Baseline** | **December 2022** | |
| D<br>Black Hill School, Black Hill | Day | N/A[2] | 40 | N/A[2] |
| | Evening | N/A[2] | 40 | N/A[2] |
| | Night | N/A[2] | 39 | N/A[2] |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 39 | 43 | 4 |
| | Evening | 35 | 45 | 10 |
| | Night | 31 | 32 | 1 |
| G<br>156 Buchanan Road, Buchanan | Day | N/A[2] | 59 | N/A[2] |
| | Evening | N/A[2] | 43 | N/A[2] |
| | Night | N/A[2] | 34 | N/A[2] |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 48 | 45 | -3 |
| | Evening | 33 | 41 | 8 |
| | Night | 41 | 41 | -1 |
| L<br>65 Tipperary Drive, Ashtonfield | Day | N/A[2] | 34 | N/A[2] |
| | Evening | N/A[2] | 34 | N/A[2] |
| | Night | N/A[2] | 27 | N/A[2] |
| J<br>220 Parish Drive, Thornton | Day | 39 | 45 | 6 |
| | Evening | 44 | 43 | -1 |
| | Night | 40 | 35 | -5 |

Note 1: Periods are as detailed the NPfI and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: No data was available during baseline measurements, no comparisons can be made.

Note 3: Rounded to the nearest whole dB.

#### 5.2.1.2 Previous Half-year

**Table 13** presents the ambient $L_{A90}$ noise levels recorded for the current monitoring period compared to those measured during the previous monitoring period.

**Table 13 $L_{A90}$ Results Comparison – Previous Half-year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | **June 2022** | **December 2022** | |
| D<br>Black Hill School, Black Hill | Day | -[3] | 40 | -[3] |
| | Evening | -[3] | 40 | -[3] |
| | Night | -[3] | 39 | -[3] |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | -[3] | 43 | -[3] |
| | Evening | -[3] | 45 | -[3] |
| | Night | -[3] | 32 | -[3] |
| G<br>156 Buchanan Road, Buchanan | Day | 43 | 59 | 16 |
| | Evening | 40 | 43 | 3 |
| | Night | 34 | 34 | 0 |
| I<br>49 Magnetic Drive, Ashtonfield | Day | -[3] | 45 | -[3] |
| | Evening | -[3] | 41 | -[3] |
| | Night | -[3] | 41 | -[3] |
| L<br>65 Tipperary Drive, Ashtonfield | Day | 37 | 34 | -3 |
| | Evening | 34 | 34 | 0 |
| | Night | 31 | 27 | -4 |
| J<br>220 Parish Drive, Thornton | Day | 40 | 45 | 5 |
| | Evening | 40 | 43 | 3 |
| | Night | 35 | 35 | 0 |

Note 1: 1. Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: Rounded to the nearest whole dB.

Note 3: No data available or comparison cannot be made.

#### 5.2.1.3 Coinciding Period last Year

**Table 14** presents the ambient $L_{A90}$ noise levels recorded for the current monitoring period compared to those measured during the coinciding monitoring period last year.

**Table 14 $L_{A90}$ Results Comparison – Coinciding Period Last Year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A90}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | **December 2021** | **December 2022** | |
| D<br>Black Hill School, Black Hill | Day | 36 | 40 | 4 |
| | Evening | 37 | 40 | 3 |
| | Night | 35 | 39 | 3 |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 43 | 43 | 0 |
| | Evening | 40 | 45 | 6 |
| | Night | 36 | 32 | -4 |
| G<br>156 Buchanan Road, Buchanan | Day | 39 | 59 | 20 |
| | Evening | 37 | 43 | 6 |
| | Night | 31 | 34 | 3 |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 38 | 45 | 7 |
| | Evening | 38 | 41 | 3 |
| | Night | 40 | 41 | 1 |
| L<br>65 Tipperary Drive, Ashtonfield | Day | 32 | 34 | 2 |
| | Evening | 32 | 34 | 3 |
| | Night | 30 | 27 | -3 |
| J<br>220 Parish Drive, Thornton | Day | -[3] | 40 | -[3] |
| | Evening | -[3] | 40 | -[3] |
| | Night | -[3] | 35 | -[3] |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

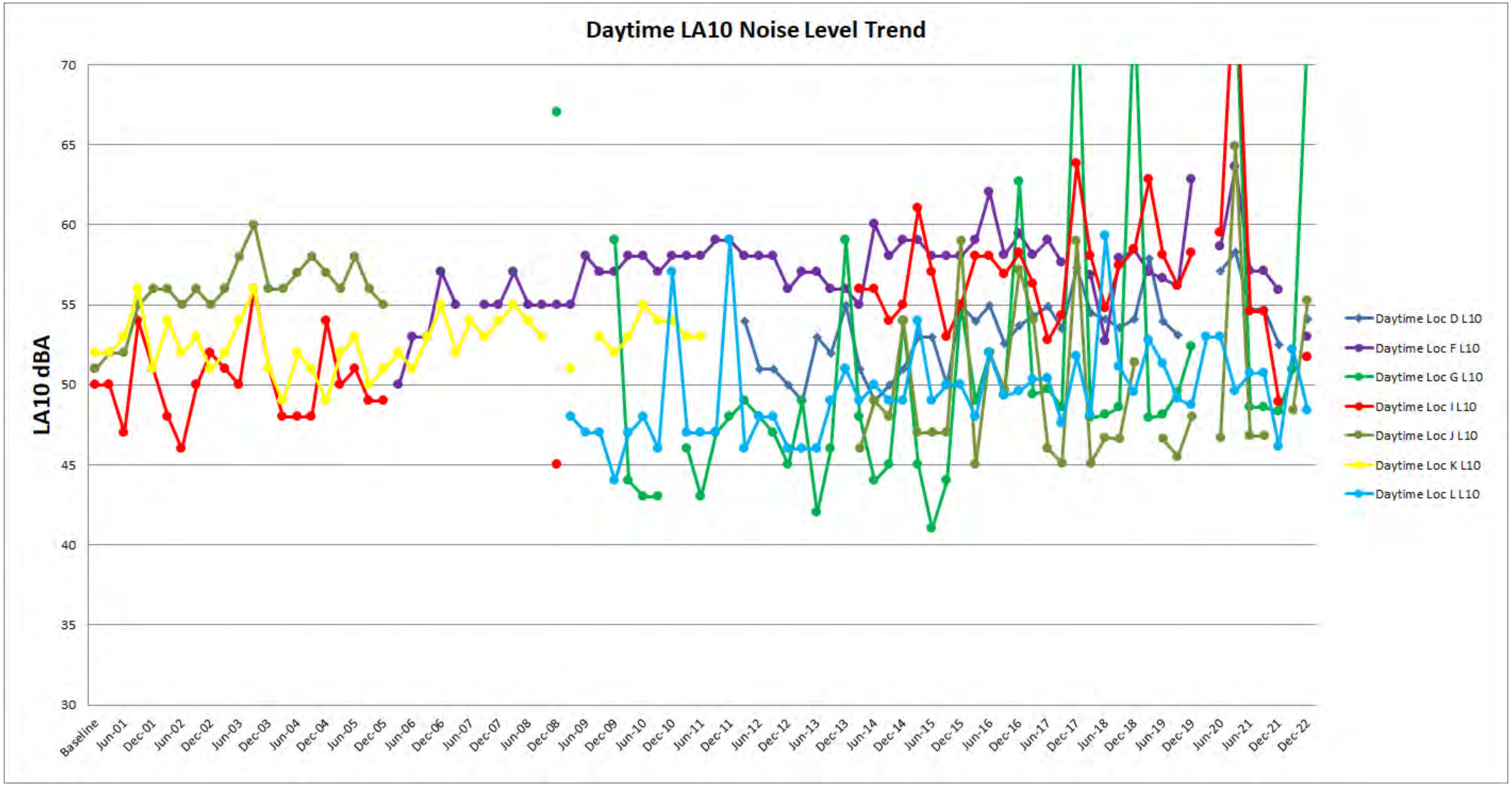
Note 2: Rounded to the nearest whole dB.

Note 3: No data available or comparison cannot be made.

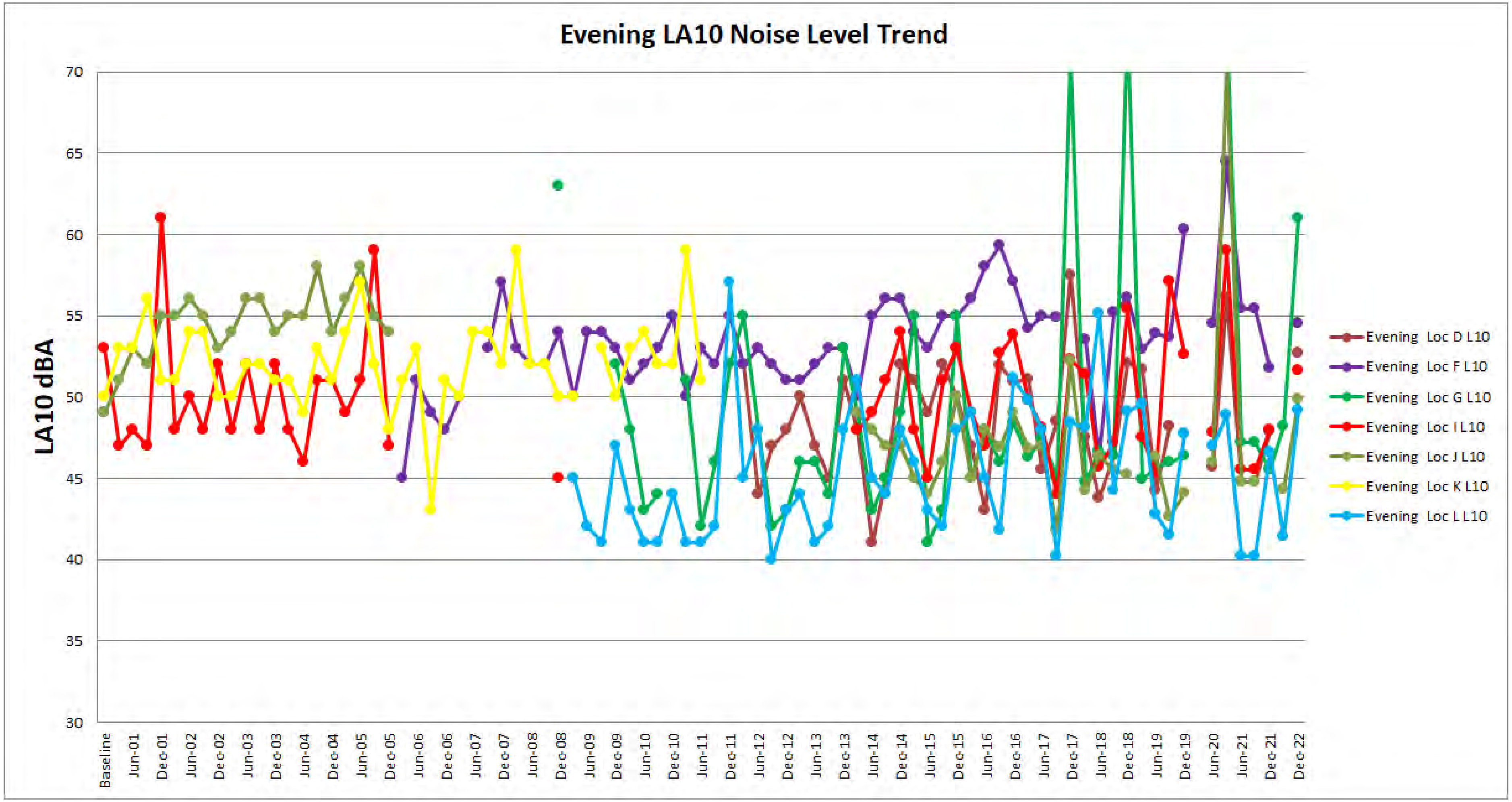
### 5.2.2 Ambient $L_{A10}$ Noise Comparison

The long term ambient $L_{A10}$ noise levels collected from each monitoring location are presented graphically in **Figure 4**, **Figure 5** and **Figure 6** for the daytime, evening and night-time respectively.

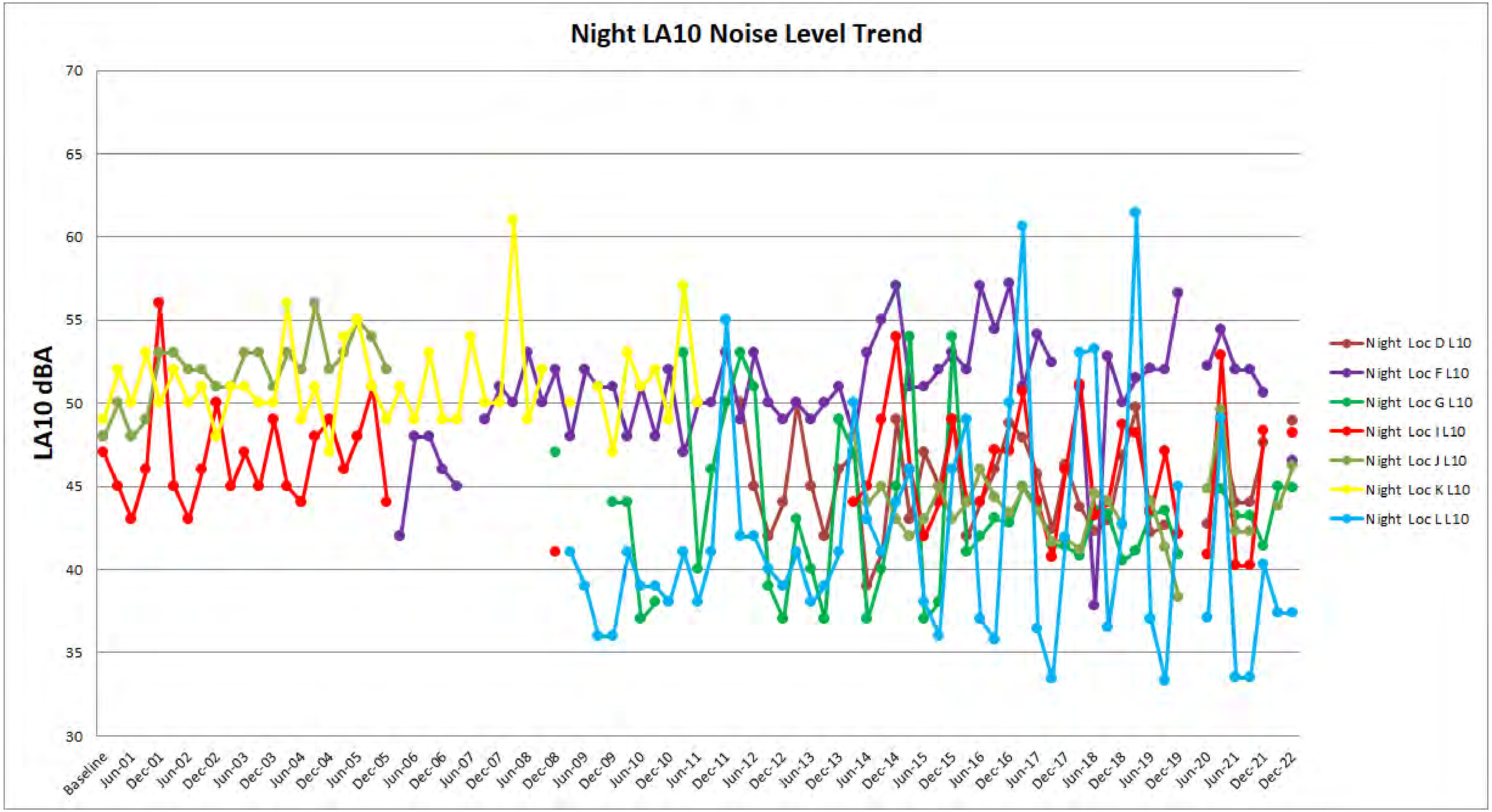
## Figure 4 Long Term Daytime LA10 Noise Levels



## Figure 5 Long term Evening LA10 Noise Levels



## Figure 6 Long term Night $L_{A10}$ Noise Levels



#### 5.2.2.1 Baseline

**Table 15** presents the ambient $L_{A10}$ noise levels recorded for the current monitoring period compared to the levels recorded during the baseline monitoring period.

**Table 15 $L_{A10}$ Results Comparison – Baseline**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[3] |
|---|---|---|---|---|
| | | **Baseline** | **December 2022** | |
| D<br>Black Hill School, Black Hill | Day | N/A[2] | 54 | N/A |
| | Evening | N/A[2] | 53 | N/A |
| | Night | N/A[2] | 49 | N/A |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 51 | 53 | 2 |
| | Evening | 49 | 55 | 6 |
| | Night | 48 | 47 | -2 |
| G<br>156 Buchanan Road, Buchanan | Day | N/A[2] | 73 | N/A |
| | Evening | N/A[2] | 61 | N/A |
| | Night | N/A[2] | 45 | N/A |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 50 | 52 | 2 |
| | Evening | 53 | 52 | -1 |
| | Night | 47 | 48 | 1 |
| L<br>65 Tipperary Drive, Ashtonfield | Day | N/A[2] | 48 | N/A |
| | Evening | N/A[2] | 49 | N/A |
| | Night | N/A[2] | 37 | N/A |
| J<br>220 Parish Drive, Thornton | Day | 51 | 55 | 4 |
| | Evening | 49 | 50 | 1 |
| | Night | 48 | 46 | -2 |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: No data was available during baseline measurements, no comparisons can be made.

Note 3: Difference rounded to the nearest whole dB.

#### 5.2.2.2 Previous Half-year

**Table 16** presents the ambient $L_{A10}$ noise levels recorded for the current monitoring period compared to those measured during the previous monitoring period.

**Table 16 $L_{A10}$ Results Comparison – Previous Half-year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | June 2022 | December 2022 | |
| D<br>Black Hill School, Black Hill | Day | -[3] | 54 | -[3] |
| | Evening | -[3] | 53 | -[3] |
| | Night | -[3] | 49 | -[3] |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | -[3] | 53 | -[3] |
| | Evening | -[3] | 55 | -[3] |
| | Night | -[3] | 47 | -[3] |
| G<br>156 Buchanan Road, Buchanan | Day | 51 | 73 | 22 |
| | Evening | 48 | 61 | 13 |
| | Night | 45 | 45 | 0 |
| I<br>49 Magnetic Drive, Ashtonfield | Day | -[3] | 52 | -[3] |
| | Evening | -[3] | 52 | -[3] |
| | Night | -[3] | 48 | -[3] |
| L<br>65 Tipperary Drive, Ashtonfield | Day | 52 | 48 | -4 |
| | Evening | 41 | 49 | 8 |
| | Night | 37 | 37 | 0 |
| J<br>220 Parish Drive, Thornton | Day | 48 | 55 | 7 |
| | Evening | 44 | 50 | 6 |
| | Night | 44 | 46 | 2 |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: Difference Rounded to the nearest whole dB.

Note 3: No data available or a comparison cannot be made.

#### 5.2.2.3 Coinciding Period Last Year

**Table 17** presents the ambient $L_{A10}$ noise levels recorded for the current monitoring period compared to those measured during the coinciding monitoring period last year.

**Table 17 $L_{A10}$ Result Comparison – Coinciding Period Last Year**

| Monitoring Location | Period[1] | Long term Night-time $L_{A10}$ Noise Levels | | Difference dB[2] |
|---|---|---|---|---|
| | | June 2021 | June 2022 | |
| D<br>Black Hill School, Black Hill | Day | 53 | 54 | 2 |
| | Evening | 48 | 53 | 5 |
| | Night | 48 | 49 | 1 |
| F<br>Lot 684 Black Hill Road, Black Hill | Day | 56 | 53 | -3 |
| | Evening | 52 | 55 | 3 |
| | Night | 51 | 47 | -4 |
| G<br>156 Buchanan Road, Buchanan | Day | 48 | 73 | 24 |
| | Evening | 46 | 61 | 16 |
| | Night | 41 | 45 | 4 |
| I<br>49 Magnetic Drive, Ashtonfield | Day | 49 | 52 | 3 |
| | Evening | 48 | 52 | 4 |
| | Night | 48 | 48 | 0 |
| L<br>65 Tipperary Dr, Ashtonfield | Day | 46 | 48 | 2 |
| | Evening | 47 | 49 | 3 |
| | Night | 40 | 37 | -3 |
| J<br>220 Parish Drive, Thornton | Day | -[3] | 55 | -[3] |
| | Evening | -[3] | 50 | -[3] |
| | Night | -[3] | 46 | -[3] |

Note 1: Periods are as detailed in the Industrial Noise Policy (INP) and are Daytime - 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening - 6.00 pm 10.00 pm; Night - 10.00 pm to 7.00 am pm Monday to Saturday, 10.00 pm to 8.00 am Sunday.

Note 2: Rounded to the nearest whole dB.

Note 3: No data available or a comparison cannot be made.

## 5.3 Rail Noise Monitoring

In order to determine compliance with the rail noise criteria, a noise logger was positioned at Location J. No rail movements were recorded over the noise monitoring period and as such noise levels from the Bloomfield Rail Spur were in compliance with the Abel Mine Project Approval during the noise monitoring period.

# 6 Conclusion

SLR was engaged by Donaldson Coal Pty Ltd to conduct half-yearly noise monitoring surveys for Donaldson Coal Mine and Abel Coal Mine in accordance with the NMP, dated 3 June 2019.

Abel mine was placed in Care & Maintenance on 28th April 2016 and there were no operations onsite, excluding that from the Bloomfield CHPP which operates under the Abel Coal Mine project consent conditions.

Operator-attended and unattended noise measurements were conducted for the December 2022 half at six focus locations surrounding the mine.

Results of the attended noise monitoring have indicated that compliance with the Abel Mine *Project Approval* was achieved at all locations.

A comparison of ambient $L_{A10}$ and $L_{A90}$ noise levels recorded during the current monitoring period (December 2022), the baseline monitoring period, the last monitoring period (June 2022), and the coinciding monitoring period from last year (December 2021) has been conducted.

Rail noise levels from the Bloomfield Rail Spur were considered to be in compliance with the Abel Mine Project Approval during the noise monitoring period.

# APPENDIX A

Acoustic Terminology

## 1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x $10^{-5}$ Pa.

## 2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

| Sound Pressure Level (dBA) | Typical Source | Subjective Evaluation |
|---|---|---|
| 130 | Threshold of pain | Intolerable |
| 120 | Heavy rock concert | Extremely noisy |
| 110 | Grinding on steel | |
| 100 | Loud car horn at 3 m | Very noisy |
| 90 | Construction site with pneumatic hammering | |
| 80 | Kerbside of busy street | Loud |
| 70 | Loud radio or television | |
| 60 | Department store | Moderate to quiet |
| 50 | General Office | |
| 40 | Inside private office | Quiet to very quiet |
| 30 | Inside bedroom | |
| 20 | Recording studio | Almost silent |

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

## 3. Sound Power Level

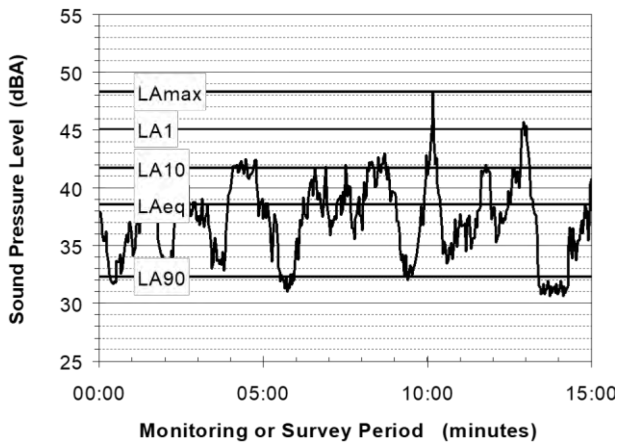
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit $10^{-12}$ W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

## 4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.




Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

## 5. Frequency Analysis

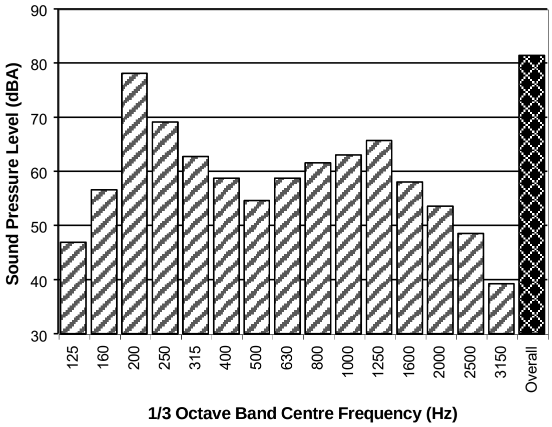
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.




## 6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

## 7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level ($10^{-9}$ m/s). Care is required in this regard, as other reference levels may be used.

## 8. Human Perception of Vibration

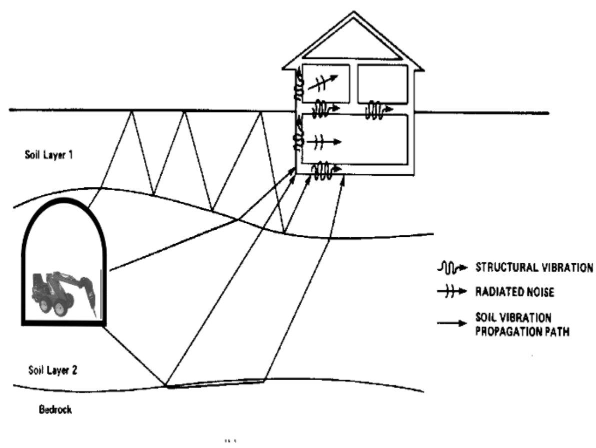
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

## 9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

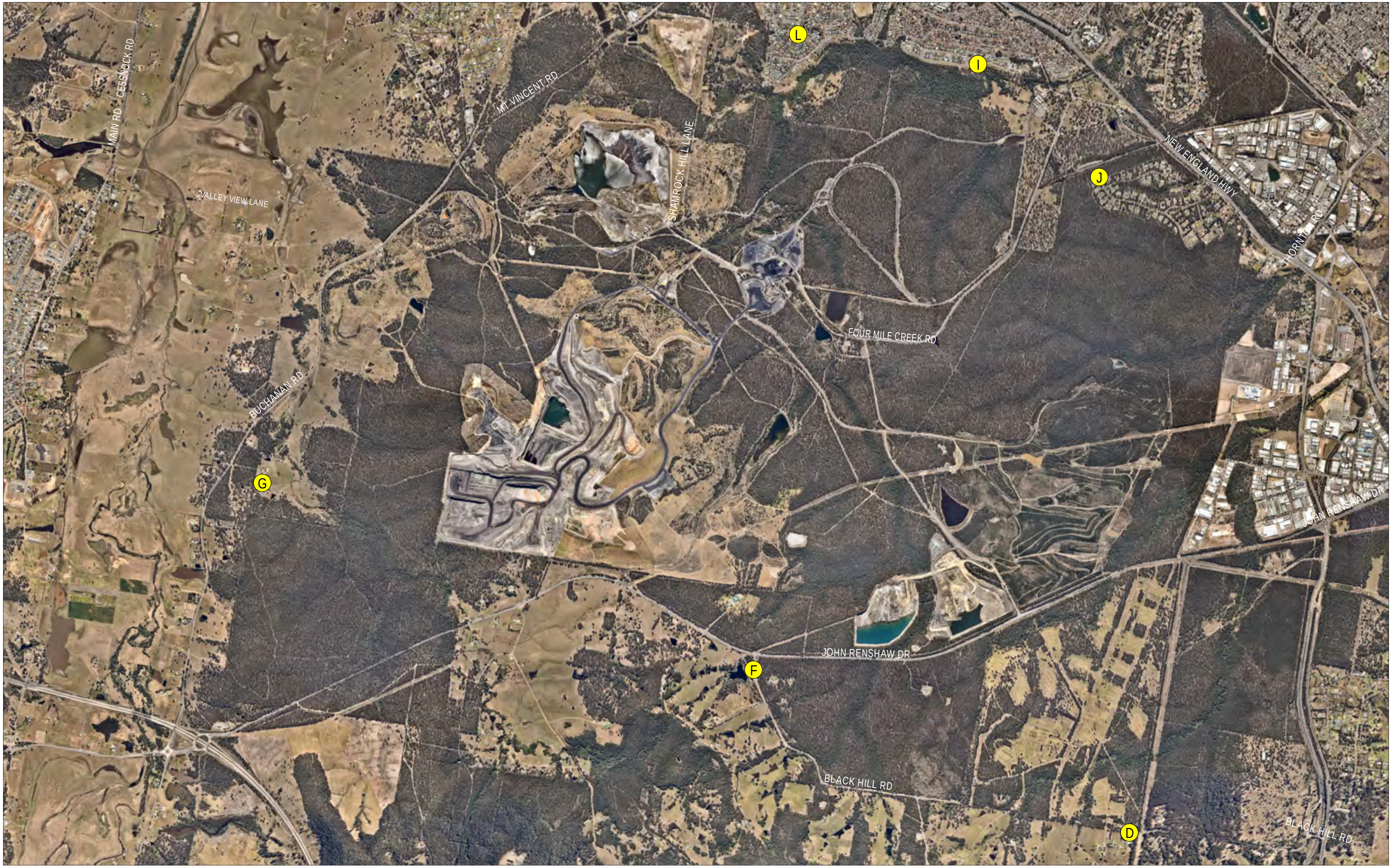
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.




The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

# APPENDIX B

Noise Monitoring Locations




D:\Quick Jobs\Martin Davenport\Donaldson\SLR630010530 1200_AB_MonitoringLocations_01.mxd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| | |
|---|---|
| Project No.: | 630.01053.01200 |
| Date: | 11/01/2018 |
| Drawn by: | NT |
| Scale: | 1:45,000 |
| Sheet Size: | A4 |
| Projection: | GDA 1994 MGA Zone 56 |

LEGEND

Noise Monitoring Locations

N
W E
S

0 500 1,000 1,500 2,000 m

Donaldson Coal

Noise Monitoring

## Noise Monitoring Locations

APPENDIX B

# APPENDIX C

Calibration Certificates

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO: SLM33967**

**EQUIPMENT TESTED:** Sound Level Meter

| | | | |
|---|---|---|---|
| **Manufacturer:** | Svantek | | |
| **Type No:** | SVAN-957 | **Serial No:** | 27578 |
| **Mic. Type:** | 7052H | **Serial No:** | 43256 |
| **Pre-Amp. Type:** | SV12L | **Serial No:** | 22202 |
| **Filter Type:** | 1/1 Octave | **Test No:** | F033971 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013 & IEC 61260-3:2016

**Comments:** All Test passed for Class 1. (See overleaf for details)

**CONDITIONS OF TEST:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 1012 | hPa ±1 hPa | **Date of Receipt :** | 10/10/2022 |
| **Temperature** | 21 | °C ±1° C | **Date of Calibration :** | 11/10/2022 |
| **Relative Humidity** | 57 | % ±5% | **Date of Issue :** | 11/10/2022 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** ............ **AUTHORISED SIGNATURE:** ....................

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** 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. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:**

| **Tests performed** | *Clause* | *Result* |
|---|---|---|
| *Test of relative attenuation at filter midband frequency* | 10 | Pass |
| *Linear operating range including range control if fitted* | 11 | Pass |
| *Test of lower limit of linear operating range* | 12 | Pass |
| *Measurement of relative attenuation (filter shape)* | 13 | Pass |

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

**A full technical report is available on request.**

**Acu-Vib Electronics**
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**Acu-Vib Electronics**
CALIBRATIONS SALES RENTALS REPAIRS

# Tax Invoice

**INVOICE TO**
SLR CONSULTING AUSTRALIA PTY LTD
PO BOX 2003
NORTH SYDNEY NSW 2059
ABN 29 001 584 612

**SHIP TO**
SLR CONSULTING AUSTRALIA PTY LTD
40 ATTIWELL CIRCUIT
KAMBAH, ACT 2902
ATTN: MATT BRYCE
0417 628 730

**INVOICE NO.** AV28314
**DATE** 12/10/2022
**DUE DATE** 11/11/2022
**TERMS** Net 30

**JOB NO.**
17007

**PO#**
31959

| DATE | | DESCRIPTION | GST | QTY | RATE | AMOUNT |
|---|---|---|---|---|---|---|
| | **SVAN-957 1/1** | NATA CALIBRATION OF SVANTEK SVAN-957 SOUND LEVEL METER WITH 1/1 OCTAVE FILTER SN: 27578 | GST | 1 | 500.00 | 500.00 |

We thank you for your business and we look forward to helping you again soon.

| | |
|---|---|
| SUBTOTAL | 500.00 |
| GST TOTAL | 53.00 |
| SHIPPING | 30.00 |
| TOTAL | 583.00 |
| BALANCE DUE | **A$583.00** |

COPY

EFT PAYMENT MADE TO ACU-VIB ELECTRONICS BSB: 062 169 ACCOUNT No.: 2800 0414
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# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO: SLM32069**

**EQUIPMENT TESTED:** Sound & Vibration Analyser

| | | | |
|---|---|---|---|
| **Manufacturer:** | Svantek | | |
| **Type No:** | Svan-957 | **Serial No:** | 23247 |
| **Mic. Type:** | 7052E | **Serial No:** | 71084 |
| **Pre-Amp. Type:** | SV12L | **Serial No:** | 73599 |
| **Filter Type:** | 1/3 Octave | **Test No:** | F032070 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013 & IEC 61260-3:2016

**Comments:** All Test passed for Class 1. (See overleaf for details)

**CONDITIONS OF TEST:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 1004 | hPa ±1 hPa | **Date of Receipt :** | 16/03/2022 |
| **Temperature** | 25 | °C ±1° C | **Date of Calibration :** | 17/03/2022 |
| **Relative Humidity** | 58 | % ±5% | **Date of Issue :** | 23/03/2022 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** ............ **AUTHORISED SIGNATURE:** ...................
Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Acoustic and Vibration Measurements

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing successfully completed the 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 specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications 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.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:**

| **Tests performed** | *Clause* | *Result* |
|---|---|---|
| *Test of relative attenuation at filter midband frequency* | 10 | Pass |
| *Linear operating range including range control if fitted* | 11 | Pass |
| *Test of lower limit of linear operating range* | 12 | Pass |
| *Measurement of relative attenuation (filter shape)* | 13 | Pass |

The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

**A full technical report is available on request.**

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO: SLM 29699**

**EQUIPMENT TESTED:** Sound & Vibration Analyser

| | | | |
|---|---|---|---|
| **Manufacturer:** | Svantek | | |
| **Type No:** | Svan-957 | **Serial No:** | 20668 |
| **Mic. Type:** | 7052H | **Serial No:** | 43017 |
| **Pre-Amp. Type:** | SV12L | **Serial No:** | 22153 |
| **Filter Type:** | 1/3 Octave | **Test No:** | FILT 6485 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013, IEC 1260:1995, & AS/NZS 4476:1997
**Comments:** All Test passed for Class 1. (See overleaf for details)

**CONDITIONS OF TEST:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 997 | hPa ±1 hPa | **Date of Receipt :** | 02/06/2021 |
| **Temperature** | 21 | °C ±1° C | **Date of Calibration :** | 04/06/2021 |
| **Relative Humidity** | 48 | % ±5% | **Date of Issue :** | 07/06/2021 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** .............. **AUTHORISED SIGNATURE:** ....................

Jack Kielt

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Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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(02) 9680 8133
www.acu-vib.com.au

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** 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. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

**A full technical report is available on request.**

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO.:** **SLM 28944**

**Equipment Description:** Sound & Vibration Analyser

**Manufacturer:** Svantek

**Model No:** Svan-957 **Serial No:** 20644

**Microphone Type:** 7052E **Serial No:** 61421

**Preamplifier Type:** SV12L **Serial No:** 19758

**Filter Type:** 1/3 Octave **Test No:** FILT 6284

**Comments:** All tests passed for class 1.
(See over for details)

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Ambient Pressure:** 1000 hPa ±1.5 hPa

**Temperature:** 25 °C ±2° C **Relative Humidity:** 46% ±5%

**Date of Calibration:** 04/03/2021 **Issue Date:** 04/03/2021

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** ...... **AUTHORISED SIGNATURE:** ..................
Hein Soe

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The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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ACU-VIB ELECTRONICS

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Acoustic and Vibration Measurements


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Mobile: 0413 809806
web site: www.acu-vib.com.au

## CERTIFICATE NO.: **SLM 28944**

**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| **Tests Performed:** | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Pass |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** 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. As public evidence was available, from an independent organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2013.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 1260: 1995 and AS/NZS 4476 - 1997 and were conducted to test the following performance characteristics:**

1. Relative attenuation clause 5.3

A full technical report is available if required.

**Date of Calibration:** 04/03/2021 **Issue Date:** 04/03/2021

Accredited for compliance with ISO/IEC 17025 - Calibration
The results of the tests, calibration and/or measurements included in this document are traceable to Australian/national standards.

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# Sound Level Meter
## IEC 61672-3.2013
# Calibration Certificate

**Calibration Number** C21184

**Client Details** SLR Consulting Pty Ltd
Level 11, 176 Wellington Parade
East Melbourne VIC 3002

**Equipment Tested/ Model Number :** ARL Ngara
**Instrument Serial Number :** 878202
**Microphone Serial Number :** 322453
**Pre-amplifier Serial Number :** 28495

| **Pre-Test Atmospheric Conditions** | | **Post-Test Atmospheric Conditions** | |
|---|---|---|---|
| **Ambient Temperature :** | 23.2°C | **Ambient Temperature :** | 23.1°C |
| **Relative Humidity :** | 50.3% | **Relative Humidity :** | 50% |
| **Barometric Pressure :** | 101.45kPa | **Barometric Pressure :** | 101.43kPa |

**Calibration Technician :** Lucky Jaiswal
**Calibration Date :** 1 Apr 2021
**Secondary Check:** Max Moore
**Report Issue Date :** 1 Apr 2021

**Approved Signatory :** 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* |
| 13: 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 | *N/A* |
| 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.

Least Uncertainties of Measurement -

| | | | |
|---|---|---|---|
| Acoustic Tests | | Environmental Conditions | |
| *125Hz* | *±0.12dB* | *Temperature* | *±0.2°C* |
| *1kHz* | *±0.11dB* | *Relative Humidity* | *±2.4%* |
| *8kHz* | *±0.13dB* | *Barometric Pressure* | *±0.015kPa* |
| Electrical Tests | *±0.10dB* | | |

*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 units.

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.

NATA WORLD RECOGNISED ACCREDITATION

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www.acousticresearch.com.au

# Sound Level Meter
## IEC 61672-3.2013
# Calibration Test Report

**Calibration Number** C21184

**Client Details** SLR Consulting Pty Ltd
Level 11, 176 Wellington Parade
East Melbourne VIC 3002

**Equipment Tested/ Model Number :** ARL Ngara
**Instrument Serial Number :** 878202
**Microphone Serial Number :** 322453
**Pre-amplifier Serial Number :** 28495

| **Pre-Test Atmospheric Conditions** | | **Post-Test Atmospheric Conditions** | |
|---|---|---|---|
| **Ambient Temperature :** | 23.2°C | **Ambient Temperature :** | 23.1°C |
| **Relative Humidity :** | 50.3% | **Relative Humidity :** | 50% |
| **Barometric Pressure :** | 101.45kPa | **Barometric Pressure :** | 101.43kPa |

**Calibration Technician :** Lucky Jaiswal
**Calibration Date :** 1 Apr 2021
**Secondary Check:** Max Moore
**Report Issue Date :** 1 Apr 2021

**Approved Signatory :** 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* |
| 13: 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 | *N/A* |
| 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.

Least Uncertainties of Measurement -

| Acoustic Tests | | Environmental Conditions | |
|---|---|---|---|
| *125Hz* | *±0.12dB* | *Temperature* | *±0.2°C* |
| *1kHz* | *±0.11dB* | *Relative Humidity* | *±2.4%* |
| *8kHz* | *±0.13dB* | *Barometric Pressure* | *±0.015 kPa* |
| Electrical Tests | *±0.10dB* | | |

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

# 1. OVERVIEW

This report presents the calibration test results of a ARL Ngara Sound Level Meter, and associated equipment. Calibration is carried out in accordance with *IEC 61672-3.2013, Electroacoustics - Sound Level Meters - Part 3: Periodic Tests*.

Relevant clauses from this standard have been used for periodic testing in conjunction with Acoustic Research Labs internal test methods described in Section 2 of the calibration work instruction manual.

## 1.1 UNCERTAINTIES

For each test performed, the associated measurement uncertainties are derived at the 95% confidence level and are given with a coverage factor of 2.

The uncertainty applies at the time of measurement only, and takes no account of any drift or other effects that may apply afterwards. When estimating uncertainty at any later time, other relevant information should also be considered, including, where possible, the history of the performance of the instrument and the manufacturer's specifications.

## 1.2 DOCUMENT CONVENTIONS

Test results which highlight non-conformances relative to the standard, and the sound level meter type specified by the manufacturer have been marked with an **F** in the respective tests.

Any tests that are not required, due to sound level meter configuration, are marked N/A.

# 2. GENERAL

## 2.1 ENVIRONMENTAL CONDITIONS DURING TEST

No corrections have been applied to any results obtained to compensate for the environmental conditions.

## 2.2 CALIBRATION TESTS

Where applicable the following tests were performed in accordance with the requirements of *IEC 61672-3.2013*. These clauses are used to define the periodic testing of Sound Level Meters.

| | |
|---|---|
| Clause 10 | Indication at the Calibration Check Frequency |
| Clause 11 | Self Generated Noise |
| Clause 12 | Acoustical Signal Tests of Frequency Weighting |
| Clause 13 | Electrical Signal Tests of Frequency Weightings |
| Clause 14 | Frequency and Time Weightings at 1kHz |
| Clause 15 | Long Term Stability |
| Clause 16 | Level Linearity on the Reference Level Range |
| Clause 17 | Level Linearity including the level range control |
| Clause 18 | Toneburst Response |
| Clause 19 | Peak C Sound Level |
| Clause 20 | Overload Indication |
| Clause 21 | High Level Stability |

## 2.3 TEST EQUIPMENT USED

All test equipment used during periodic testing are calibrated every 12months by an accredited laboratory, traceable to SI units.

The performance of all equipment during these calibrations and the effects of instrument stability are used to determine the measurement uncertainty of each reported result.

### 2.3.1 Multi-function Acoustic Calibrator

A Bruel & Kjaer 4226 Multi-function calibrator (S/N - 2985012) was used for frequency response testing of the entire instrument (including microphone). This instrument was used as a reference calibrator and for frequency response verification.

### 2.3.2 Microphone Electrical Equivalent Circuit

Calibration of most instrument parameters is carried out using electrical signals fed to the unit via a two-port electrical equivalent circuit of the microphone.

A 12pF capacitance dummy microphone was used during testing.

### 2.3.3 Adjustable Attenuator

A means for varying the attenuation of electrical signals via the dummy microphone was provided by a JFW Industries dual rotary attenuator (S/N - 761637). The attenuator is switchable in 1dB steps between 0dB and 60dB.

### 2.3.4 Arbitrary Function Generator

A Hewlett Packard 33120A (S/N - US36047448) was used to generate the required electrical signals.

### 2.3.5 Environmental Monitoring

A MHB-382SD (S/N – AG44204) was used for measuring environmental conditions during device calibration. It is capable of providing temperature, relative humidity and pressure measurements.

# 3. CALIBRATION TEST RESULTS

## 3.1 INDICATION AT THE CALIBRATION CHECK FREQUENCY

The indication of the sound level meter at the calibration check frequency was checked by application of an acoustic signal at the reference sound pressure level and frequency.

Stated reference conditions as found in manual are

Reference Level : 94.0 dB

Reference Frequency : 1000.0 Hz

Indications before and after adjustments were recorded and are shown in Table 1 (all measurements in dB) -

**Table 1 - Check Frequency Calibration Results**

| Frequency Weighting | Initial Response | B&K 4226 Corrected | FreeField Corrected | Final Corrected Response |
|---|---|---|---|---|
| A | 94.00 | 94.05 | 94.03 | 94.00 |
| C | 93.94 | 94.01 | 93.98 | 93.95 |
| Z | N/A | N/A | N/A | N/A |

Free field adjustment data as provided by the manufacturer. Windscreen correction factors applied.

## 3.2 SELF GENERATED NOISE

### 3.2.1 Microphone Installed

Self generated noise was measured with the microphone installed on the sound level meter, in the configuration submitted for periodic testing. The sound level meter was set to the most-sensitive level range and with frequency weighting A selected.

Ten (10) time weighted observations were made over a period of 60 seconds.

**Random Readings dB(A)**

| | | | | |
|---|---|---|---|---|
| 19.40 | 19.40 | 19.50 | 19.60 | 19.50 |
| 19.30 | 19.50 | 19.60 | 19.70 | 19.50 |

Acoustic Noise Floor : 19.5 dB(A)

### 3.2.2 Electrical Input Signal Device

With the microphone replaced by the electrical input signal device and terminated as specified, the sound level meter was set to the most-sensitive level range and with frequency weightings Z, C and A selected as provided.

Ten (10) time weighted observations were made over a period of 60 seconds.

**Random Readings dB(A)**

| | | | | |
|---|---|---|---|---|
| 17.30 | 17.50 | 17.40 | 17.50 | 17.50 |
| 17.40 | 17.20 | 17.20 | 17.40 | 17.60 |

**Random Readings dB(C)**

| | | | | |
|---|---|---|---|---|
| 19.30 | 19.40 | 19.50 | 19.50 | 19.60 |
| 19.20 | 19.40 | 19.60 | 19.40 | 19.70 |

**Random Readings dB(Z)**

| | | | | |
|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A |
| N/A | N/A | N/A | N/A | N/A |

| | dB(A) | dB(C) | dB(Z) |
|---|---|---|---|
| Electric Noise Floor : | 17.4 | 19.5 | N/A |

## 3.3 ACOUSTICAL SIGNAL TESTS OF A FREQUENCY WEIGHTING

The sound level meter was set to measure frequency weighting C with a FAST response. The test was carried out using a multi-function acoustic calibrator set to pressure mode.

Three (3) readings were made at each test frequency. The average of the readings was then corrected to the multi-function acoustic calibrator.

**Table 2 - Frequency Weighting C Response**

| Freq Hz | Reading 1 | Reading 2 | Reading 3 | U95 |
|---|---|---|---|---|
| 125 | 93.9 | 93.9 | 93.9 | 0.12 |
| 1 000 | 94.0 | 94.0 | 94.0 | 0.11 |
| 8 000 | 88.4 | 88.4 | 88.4 | 0.13 |

| Actual Freq Hz | B&K 4226 Corrections | Corrected Response dB(C) | | Uexp |
|---|---|---|---|---|
| | | Actual | re 1kHz | |
| 125.90 | -0.03 | 93.87 | -0.08 | 0.12 |
| 1005.10 | -0.05 | 93.95 | 0.00 | 0.11 |
| 7915.10 | -0.03 | 88.32 | -5.63 | 0.13 |

Adjustments were then applied to correct for free field and sound level meter body effects with data supplied by the manufacturer as per Table 3. Windscreen correction factors applied.

**Table 3 - Correction Data**

| Actual Freq Hz | FreeField Corrections | U95 | BodyEffects Corrections | U95 | Windscreen Corrections | U95 |
|---|---|---|---|---|---|---|
| 125.90 | -0.11 | 0.25 | 0.00 | 0.00 | 0.000 | 0.250 |
| 1005.10 | 0.02 | 0.25 | 0.00 | 0.00 | 0.000 | 0.250 |
| 7915.10 | 2.74 | 0.35 | 0.00 | 0.00 | 0.100 | 0.350 |

Finally, the corrected responses are normalised to the response at 1kHz and compared to the tolerances stated in Table 2 of IEC 61672.1-2013.

**Table 4 - Acoustic C Response**

| Actual Freq (Hz) | Corrected Response dB(C) | | Expected Response dB(C) | | Deviation | P/F | Uexp |
|---|---|---|---|---|---|---|---|
| | Actual | re 1kHz | re 1kHz | Tolerance | | | |
| 125.90 | 93.76 | -0.21 | -0.2 | ±1.0 | -0.01 | P | 0.38 |
| 1005.10 | 93.97 | 0.00 | 0.0 | ±0.7 | 0.00 | P | 0.37 |
| 7915.10 | 91.16 | -2.81 | -3.0 | +1.5 / -2.5 | 0.19 | P | 0.52 |

## 3.4 ELECTRICAL SIGNAL TESTS OF FREQUENCY WEIGHTINGS

Frequency weighting responses for Z, C and A were determined relative to the response at 1kHz using steady sinusoidal electrical input signals.

On the reference level range, and for each frequency weighting under test, the level of a 1kHz input signal was adjusted to yield 75dB. At test frequencies other than 1kHz, the input signal level was adjusted to compensate for the design goal attenuations as specified in Table 2 of IEC 61672.1-2013.

**Table 5 - Measured Electrical Frequency Response**

| Freq Hz | A Weighting (dB) | C Weighting (dB) | Z Weighting (dB) | U95 |
|---|---|---|---|---|
| 63 | 74.8 | 74.8 | N/A | 0.10 |
| 125 | 74.9 | 75.0 | N/A | 0.10 |
| 250 | 74.9 | 75.0 | N/A | 0.10 |
| 500 | 75.0 | 75.0 | N/A | 0.10 |
| 1 000 | 75.0 | 75.0 | N/A | 0.10 |
| 2 000 | 75.0 | 75.1 | N/A | 0.10 |
| 4 000 | 75.0 | 75.0 | N/A | 0.10 |
| 8 000 | 74.9 | 74.9 | N/A | 0.10 |
| 15 850 | 72.3 | 72.2 | N/A | 0.10 |

Adjustments were then applied to correct for a uniform free field response and sound level meter body effects with data supplied by the manufacturer as per Table 6. Windscreen correction factors applied.

**Table 6 - Correction Data**

| Freq Hz | Ufreq | U95 | Body Effects | U95 | WS Effects | U95 |
|---|---|---|---|---|---|---|
| 63 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.250 |
| 125 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.250 |
| 250 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.250 |
| 500 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.250 |
| 1 000 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.250 |
| 2 000 | 0.000 | 0.250 | 0.000 | 0.000 | 0.000 | 0.250 |
| 4 000 | 0.100 | 0.250 | 0.000 | 0.000 | 0.100 | 0.250 |
| 8 000 | 0.100 | 0.350 | 0.000 | 0.000 | 0.100 | 0.350 |
| 15 850 | 0.800 | 0.450 | 0.000 | 0.000 | 0.800 | 0.450 |

Finally, the corrected responses were referenced to the response at 1kHz and compared to the tolerances stated in Table 2 of IEC 61672.1-2013.

**Table 7 - A Weighted Electrical Response**

| Freq Hz | Response | | Tolerance (dB) | P/F | Uexp |
|---|---|---|---|---|---|
| | Corrected | re 1kHz | | | |
| 63 | 74.80 | -0.20 | ±1.0 | P | 0.37 |
| 125 | 74.90 | -0.10 | ±1.0 | P | 0.37 |
| 250 | 74.90 | -0.10 | ±1.0 | P | 0.37 |
| 500 | 75.00 | 0.00 | ±1.0 | P | 0.37 |
| 1 000 | 75.00 | 0.00 | ±0.7 | P | 0.37 |
| 2 000 | 75.00 | 0.00 | ±1.0 | P | 0.37 |
| 4 000 | 75.20 | 0.20 | ±1.0 | P | 0.37 |
| 8 000 | 75.10 | 0.10 | +1.5 / -2.5 | P | 0.51 |
| 15 850 | 73.90 | -1.10 | +2.5 / −16 | P | 0.65 |

**Table 8 - C Weighted Electrical Response**

| Freq Hz | Response | | Tolerance (dB) | P/F | Uexp |
|---|---|---|---|---|---|
| | Corrected | re 1kHz | | | |
| 63 | 74.80 | -0.20 | ±1.0 | P | 0.37 |
| 125 | 75.00 | 0.00 | ±1.0 | P | 0.37 |
| 250 | 75.00 | 0.00 | ±1.0 | P | 0.37 |
| 500 | 75.00 | 0.00 | ±1.0 | P | 0.37 |
| 1 000 | 75.00 | 0.00 | ±0.7 | P | 0.37 |
| 2 000 | 75.10 | 0.10 | ±1.0 | P | 0.37 |
| 4 000 | 75.20 | 0.20 | ±1.0 | P | 0.37 |
| 8 000 | 75.10 | 0.10 | +1.5 / -2.5 | P | 0.51 |
| 15 850 | 73.80 | -1.20 | +2.5 / −16 | P | 0.65 |

**Table 9 - Z Weighted Electrical Response**

| Freq Hz | Response | | Tolerance (dB) | P/F | Uexp |
|---|---|---|---|---|---|
| | Corrected | re 1kHz | | | |
| 63 | N/A | N/A | ±1.0 | N/A | 0.37 |
| 125 | N/A | N/A | ±1.0 | N/A | 0.37 |
| 250 | N/A | N/A | ±1.0 | N/A | 0.37 |
| 500 | N/A | N/A | ±1.0 | N/A | 0.37 |
| 1 000 | N/A | N/A | ±0.7 | N/A | 0.37 |
| 2 000 | N/A | N/A | ±1.0 | N/A | 0.37 |
| 4 000 | N/A | N/A | ±1.0 | N/A | 0.37 |
| 8 000 | N/A | N/A | +1.5 / -2.5 | N/A | 0.51 |
| 15 850 | N/A | N/A | +2.5 / −16 | N/A | 0.65 |

## 3.5 FREQUENCY AND TIME WEIGHTINGS AT 1KHZ

A steady sinusoidal electrical input signal of 1kHz at the reference sound pressure level was applied to the reference level range.

The deviations of the indicated level of C and Z frequency weightings were recorded, along with the deviations of the indication of A weighted time averaged, and SLOW weighted response.

**Table 10 - Frequency and Time Weighting Results**

| Frequency Weighting | Time Weighting | Response (dB) | Deviation (dB) | P/F | Tolerance (dB) | U95 |
|---|---|---|---|---|---|---|
| A | Fast | 94.0 | 0.0 | P | ±0.2 | 0.10 |
| | Leq | 94.0 | 0.0 | P | ±0.2 | 0.10 |
| | Slow | 94.0 | 0.0 | P | ±0.2 | 0.10 |
| C | Fast | 94.0 | 0.0 | P | ±0.2 | 0.10 |
| Z | Fast | N/A | N/A | N/A | ±0.2 | 0.10 |

## 3.6 LONG-TERM STABILITY

Long-term stability was tested by comparing a steady sinusoidal electrical signal applied at the start, and at the end of testing. The applied signal level was set to the reference level and frequency and was maintained constant. The difference between the indicated levels was recorded.

**Table 11 - Frequency and Time Weighting Results**

| Signal Level (mV) | Initial Response (dB) | Final Response (dB) | Deviation (dB) | P/F | Tolerance (dB) | U95 |
|---|---|---|---|---|---|---|
| 62.9 | 94 | 94.0 | 0.0 | P | ±0.1 | 0.10 |

## 3.7 LEVEL LINEARITY ON THE REFERENCE LEVEL RANGE

Level linearity was tested with a steady sinusoidal electrical signal at a frequency of 8kHz, with the meter set to display frequency weighted A, FAST response.

The starting point for level linearity testing was set to 94.0dB as stated in the instruction manual.

Level linearity was measured in 5dB steps of increasing input signal level from the starting point up to within 5dB of the stated upper limit, then at 1dB steps up to (but not including) the first indication of overload.

**Table 12 - Level Linearity - Increasing**

| Ideal (dB) | Response (dB) | Deviation (dB) | Tolerance (dB) | P/F | U95 |
|---|---|---|---|---|---|
| 94.0 | 94.0 | 0.0 | ±0.8 | P | 0.1 |
| 99.0 | 99.0 | 0.0 | ±0.8 | P | 0.1 |
| 104.0 | 104.0 | 0.0 | ±0.8 | P | 0.1 |
| 109.0 | 109.0 | 0.0 | ±0.8 | P | 0.1 |
| 114.0 | 114.0 | 0.0 | ±0.8 | P | 0.1 |
| 115.0 | 115.0 | 0.0 | ±0.8 | P | 0.1 |
| 116.0 | 116.0 | 0.0 | ±0.8 | P | 0.1 |
| 117.0 | 117.0 | 0.0 | ±0.8 | P | 0.1 |
| 118.0 | 118.0 | 0.0 | ±0.8 | P | 0.1 |
| 119.0 | 118.9 | -0.1 | ±0.8 | P | 0.1 |
| 120.0 | 119.9 | -0.1 | ±0.8 | P | 0.1 |
| 121.0 | 120.9 | -0.1 | ±0.8 | P | 0.1 |
| 122.0 | 121.8 | -0.2 | ±0.8 | P | 0.1 |

Overload indication at 123.0dB.

Level linearity test was the continued in 5dB steps of decreasing input signal level from the starting point up to within 5dB of the stated lower limit, then at 1dB steps up to (but not including) the first indication of under range.

**Table 13 - Level Linearity - Decreasing**

| Ideal (dB) | Response (dB) | Deviation (dB) | Tolerance (dB) | P/F | U95 |
|---|---|---|---|---|---|
| 94.0 | 94.0 | 0.0 | ±0.8 | P | 0.1 |
| 89.0 | 89.0 | 0.0 | ±0.8 | P | 0.1 |
| 84.0 | 84.0 | 0.0 | ±0.8 | P | 0.1 |
| 79.0 | 79.0 | 0.0 | ±0.8 | P | 0.1 |
| 74.0 | 74.0 | 0.0 | ±0.8 | P | 0.1 |
| 69.0 | 69.0 | 0.0 | ±0.8 | P | 0.1 |
| 64.0 | 64.0 | 0.0 | ±0.8 | P | 0.1 |
| 59.0 | 59.0 | 0.0 | ±0.8 | P | 0.1 |
| 54.0 | 54.0 | 0.0 | ±0.8 | P | 0.1 |
| 49.0 | 49.0 | 0.0 | ±0.8 | P | 0.1 |
| 44.0 | 44.0 | 0.0 | ±0.8 | P | 0.1 |
| 39.0 | 39.0 | 0.0 | ±0.8 | P | 0.1 |
| 34.0 | 34.0 | 0.0 | ±0.8 | P | 0.1 |
| 30.0 | 30.2 | 0.2 | ±0.8 | P | 0.1 |
| 29.0 | 29.3 | 0.3 | ±0.8 | P | 0.1 |
| 28.0 | 28.3 | 0.3 | ±0.8 | P | 0.1 |
| 27.0 | 27.4 | 0.4 | ±0.8 | P | 0.1 |
| 26.0 | 26.6 | 0.6 | ±0.8 | P | 0.1 |
| 25.0 | 25.7 | 0.7 | ±0.8 | P | 0.1 |

No under range indicated.

## 3.8 TONEBURST RESPONSE

The response of the sound level meter to short-duration signals was tested on the reference range with 4kHz tone bursts.

The tone bursts were generated from a steady sinusoidal signal at a level of 117.0dB.

**Table 14 - FAST Weighted Response**

| Burst Length | Response dB(A) | Deviation (dB) | Tolerance (dB) | P/F | U95 |
|---|---|---|---|---|---|
| 200ms | 116.0 | 0.0 | ±0.5 | P | 0.1 |
| 2ms | 99.0 | 0.0 | +1.0 / -1.5 | P | 0.1 |
| 0.25ms | 89.9 | -0.1 | +1.0 / -3 | P | 0.1 |

**Table 15 - SLOW Weighted Response**

| Burst Length | Response dB(A) | Deviation (dB) | Tolerance (dB) | P/F | U95 |
|---|---|---|---|---|---|
| 200ms | 109.6 | 0.0 | ±0.5 | P | 0.1 |
| 2ms | 90.0 | 0.0 | +1.0 / -3 | P | 0.1 |

**Table 16 - Sound Exposure Level Response**

| Burst Length | Response dB(A) | Deviation (dB) | Tolerance (dB) | P/F | U95 |
|---|---|---|---|---|---|
| 200ms | N/A | N/A | N/A | N/A | N/A |
| 2ms | N/A | N/A | N/A | N/A | N/A |
| 0.25ms | N/A | N/A | N/A | N/A | N/A |

## 3.9 PEAK C RESPONSE

Indication of Peak C sound level was tested on the least sensitive level range. Test signals used were -

- A single complete cycle of an 8kHz sinusoid, starting and stopping at zero crossings
- Positive and negative half cycles of a 500Hz sinusoid, starting and stopping at zero crossings.

The level of the steady 8kHz sinusoid was adjusted to display dB(C).

## 3.10 OVERLOAD INDICATION

The overload indication was tested on the least sensitive level range, with the sound level meter set to display frequency weighted A, time averaged values.

Positive and negative half cycle sinusoidal electrical signals at 4kHz were used. The test began at an indicated time averaged level of119.0dB(A).

Using the positive half cycle signal, the signal level was increased in steps of 0.5dB up to, but not including, the first indication of overload. The level of the input signal was then increased in steps of 0.1dB until the first indication of overload. These steps were repeated using the negative half cycle signal.

**Table 17 - Overload Indication**

| Signal Orientation | Overload Response | Difference | Tolerance | P/F | Uncertainty |
|---|---|---|---|---|---|
| Positive | 121.4 | 0.0 | ±1.5 | P | 0.1 |
| Negative | 121.3 | | | | |

Overload indication was verified.

Overload latch indication was verified.

## 3.11 HIGH LEVEL STABILITY

High level stability was tested by measuring the response of the meter to high signal levels. The result was evaluated as the difference between the A-Weighted indicated levels in response to a steady 1kHz signal applied over 5 minutes.

**Table 18 - FAST Weighted Response**

| Time Weighting | Initial Response (dB) | Final Response (dB) | Deviation (dB) | Tolerance (dB) | P/F | U95 |
|---|---|---|---|---|---|---|
| Fast | 119.0 | 119.0 | 0.0 | ±0.1 | P | 0.10 |
| Slow | N/A | N/A | N/A | ±0.1 | N/A | 0.10 |
| Leq | 119.0 | 119.0 | 0.0 | ±0.1 | P | 0.10 |

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# Sound Level Meter
## IEC 61672-3.2013
# Calibration Certificate

**Calibration Number** C21360

**Client Details** SLR Consulting Pty Ltd
Level 11, 176 Wellington Parade
East Melbourne VIC 3002

**Equipment Tested/ Model Number :** ARL Ngara
**Instrument Serial Number :** 878053
**Microphone Serial Number :** 322751
**Pre-amplifier Serial Number :** 28632

| **Pre-Test Atmospheric Conditions** | | **Post-Test Atmospheric Conditions** | |
|---|---|---|---|
| **Ambient Temperature :** | 23°C | **Ambient Temperature :** | 23.8°C |
| **Relative Humidity :** | 39.6% | **Relative Humidity :** | 38.9% |
| **Barometric Pressure :** | 101.31kPa | **Barometric Pressure :** | 101.3kPa |

| | | | |
|---|---|---|---|
| **Calibration Technician :** | Charlie Neil | **Secondary Check:** | Harrison Kim |
| **Calibration Date :** | 1 Jun 2021 | **Report Issue Date :** | 1 Jun 2021 |

**Approved Signatory :** 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* |
| 13: 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 | *N/A* |
| 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.

Least Uncertainties of Measurement -

| Acoustic Tests | | Environmental Conditions | |
|---|---|---|---|
| *125Hz* | *±0.12dB* | *Temperature* | *±0.2°C* |
| *1kHz* | *±0.11dB* | *Relative Humidity* | *±2.4%* |
| *8kHz* | *±0.13dB* | *Barometric Pressure* | *±0.015kPa* |
| Electrical Tests | *±0.10dB* | | |

*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.

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

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# Sound Level Meter
## IEC 61672-3.2013
# Calibration Certificate

**Calibration Number** C21258

**Client Details** SLR Consulting Pty Ltd
Level 2, 15 Astor Terrace
Spring Hill QLD 4000

**Equipment Tested/ Model Number :** ARL Ngara
**Instrument Serial Number :** 8781CE
**Microphone Serial Number :** 322451
**Pre-amplifier Serial Number :** 28499

**Pre-Test Atmospheric Conditions**
**Ambient Temperature :** 23.8°C
**Relative Humidity :** 54.3%
**Barometric Pressure :** 100.87kPa

**Post-Test Atmospheric Conditions**
**Ambient Temperature :** 23.8°C
**Relative Humidity :** 53.9%
**Barometric Pressure :** 100.83kPa

**Calibration Technician :** Jeff Yu
**Calibration Date :** 3 May 2021
**Secondary Check:** Harrison Kim
**Report Issue Date :** 4 May 2021

**Approved Signatory :** 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* |
| 13: 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 | *N/A* |
| 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.

Least Uncertainties of Measurement -

| Acoustic Tests | | Environmental Conditions | |
|---|---|---|---|
| *125Hz* | *±0.12dB* | *Temperature* | *±0.2°C* |
| *1kHz* | *±0.11dB* | *Relative Humidity* | *±2.4%* |
| *8kHz* | *±0.13dB* | *Barometric Pressure* | *±0.015kPa* |
| Electrical Tests | *±0.10dB* | | |

*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 units.

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.

# CERTIFICATE OF CALIBRATION

**CERTIFICATE NO: SLM33812**

**EQUIPMENT TESTED:** Sound Level Meter

| | | | |
|---|---|---|---|
| **Manufacturer:** | B&K | | |
| **Type No:** | 2250-L | **Serial No:** | 3003389 |
| **Mic. Type:** | 4950 | **Serial No:** | 2913816 |
| **Pre-Amp. Type:** | ZC0032 | **Serial No:** | 20519 |
| **Filter Type:** | 1/3 Octave | **Test No:** | F033825 |

**Owner:** SLR Consulting Australia Pty Ltd
120 High Street
North Sydney, NSW 2060

**Tests Performed:** IEC 61672-3:2013 & IEC 61260-3:2016

**Comments:** All Test passed for Class 1. (See overleaf for details)

**CONDITIONS OF TEST:**

| | | | | |
|---|---|---|---|---|
| **Ambient Pressure** | 1001 | hPa ±1 hPa | **Date of Receipt :** | 26/09/2022 |
| **Temperature** | 22 | °C ±1° C | **Date of Calibration :** | 26/09/2022 |
| **Relative Humidity** | 52 | % ±5% | **Date of Issue :** | 28/09/2022 |

**Acu-Vib Test Procedure:** AVP10 (SLM) & AVP06 (Filters)

**CHECKED BY:** ..................... **AUTHORISED SIGNATURE:** .....................

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

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Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
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**The performance characteristics listed below were tested. The tests are based on the relevant clauses of IEC 61672-3:2013**

| Tests Performed: | *Clause* | *Result* |
|---|---|---|
| *Absolute Calibration* | 10 | Pass |
| *Acoustical Frequency Weighting* | 12 | Pass |
| *Self-Generated Noise* | 11.1 | Observed |
| *Electrical Noise* | 11.2 | Observed |
| *Long Term Stability* | 15 | Pass |
| *Electrical Frequency Weightings* | 13 | Pass |
| *Frequency and Time Weightings* | 14 | Pass |
| *Reference Level Linearity* | 16 | Pass |
| *Range Level Linearity* | 17 | Not Applicable |
| *Toneburst* | 18 | Pass |
| *Peak C Sound Level* | 19 | Pass |
| *Overload Indicator* | 20 | Pass |
| *High Level Stability* | 21 | Pass |

**Statement of Compliance:** The sound level meter submitted for testing successfully completed the 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 specifications of IEC 61672-1:-2013 because evidence was not publically available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications 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.

**This Sound Level Meter included an Octave Filter Set. Tests were based on IEC 61260-3:2016 and were conducted to test the following performance characteristics:**

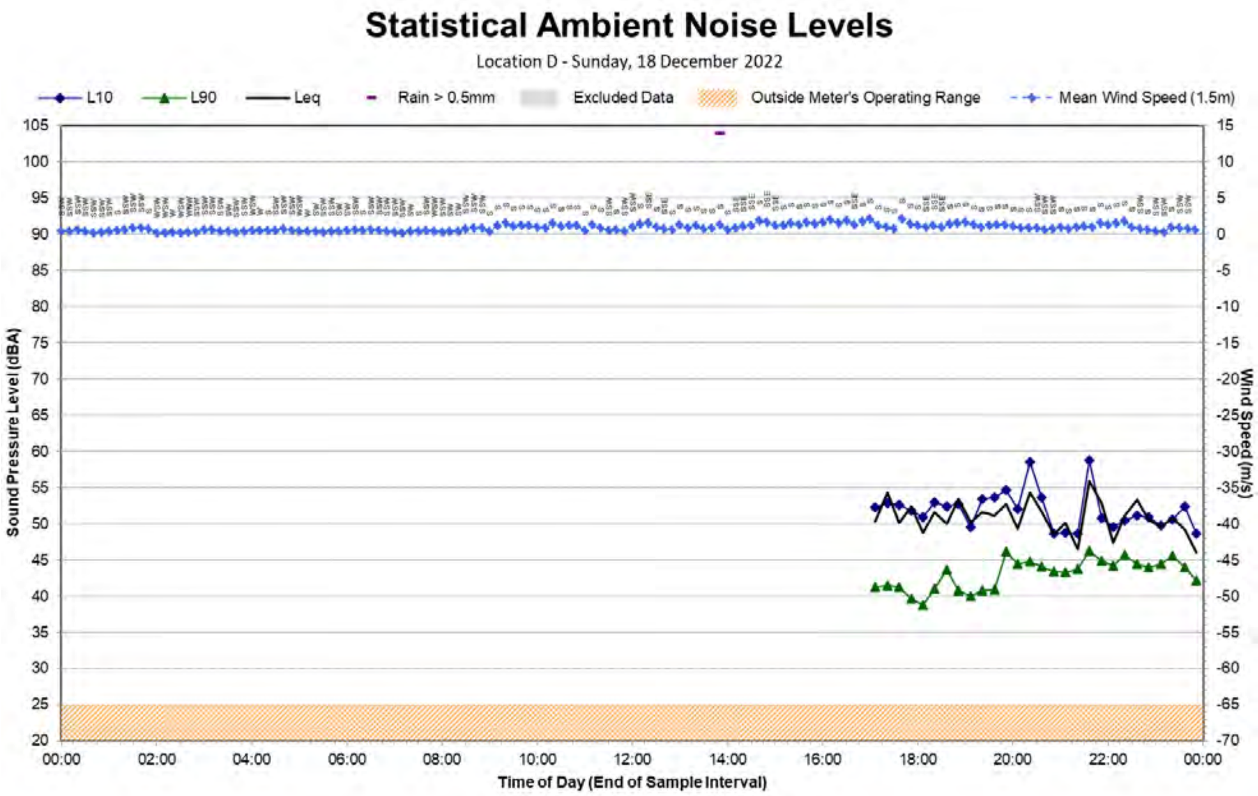
| Tests performed | *Clause* | *Result* |
|---|---|---|
| *Test of relative attenuation at filter midband frequency* | 10 | Pass |
| *Linear operating range including range control if fitted* | 11 | N/A |
| *Test of lower limit of linear operating range* | 12 | Pass |
| *Measurement of relative attenuation (filter shape)* | 13 | Pass |

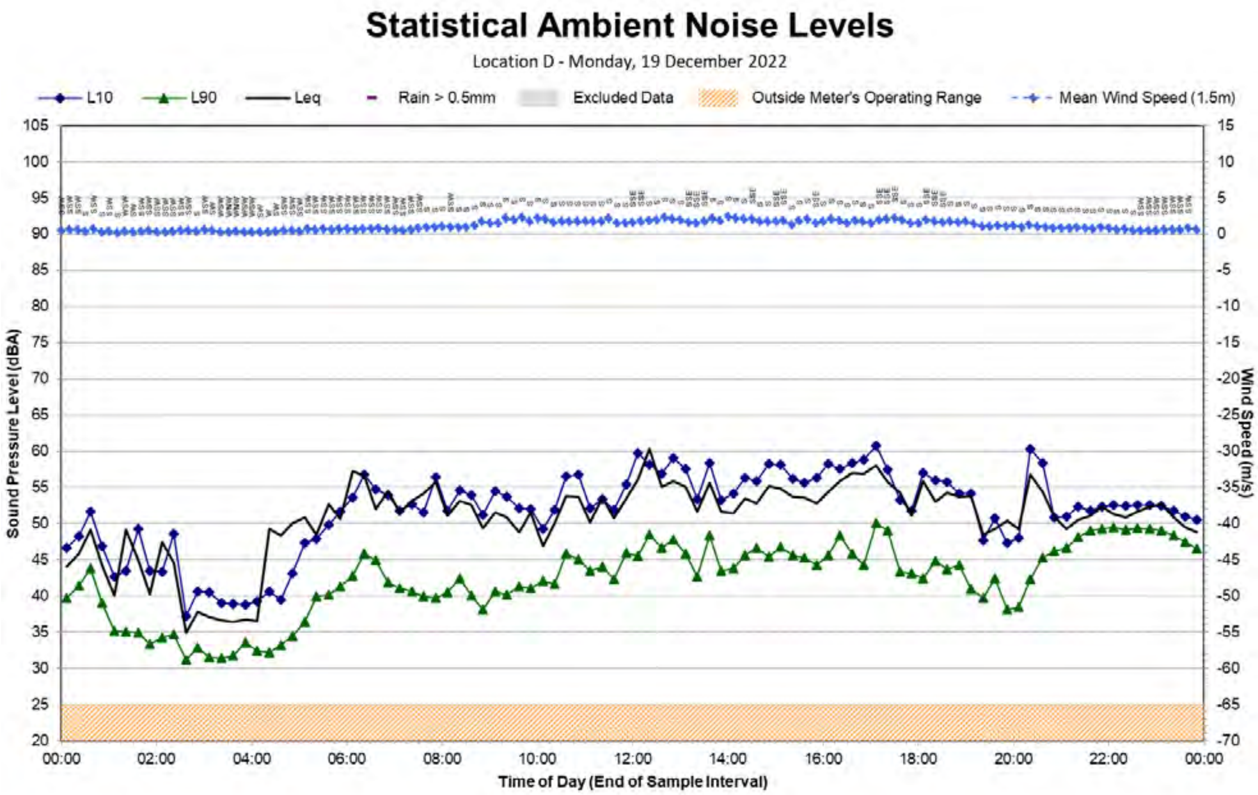
The filter submitted for testing successfully completed the tests listed above for the environmental conditions under which the tests were performed. If the filter type has successfully completed the pattern-evaluation tests of IEC 61260-2 then it can be stated that the filter set continues to conform to the specifications of IEC 61260-1.

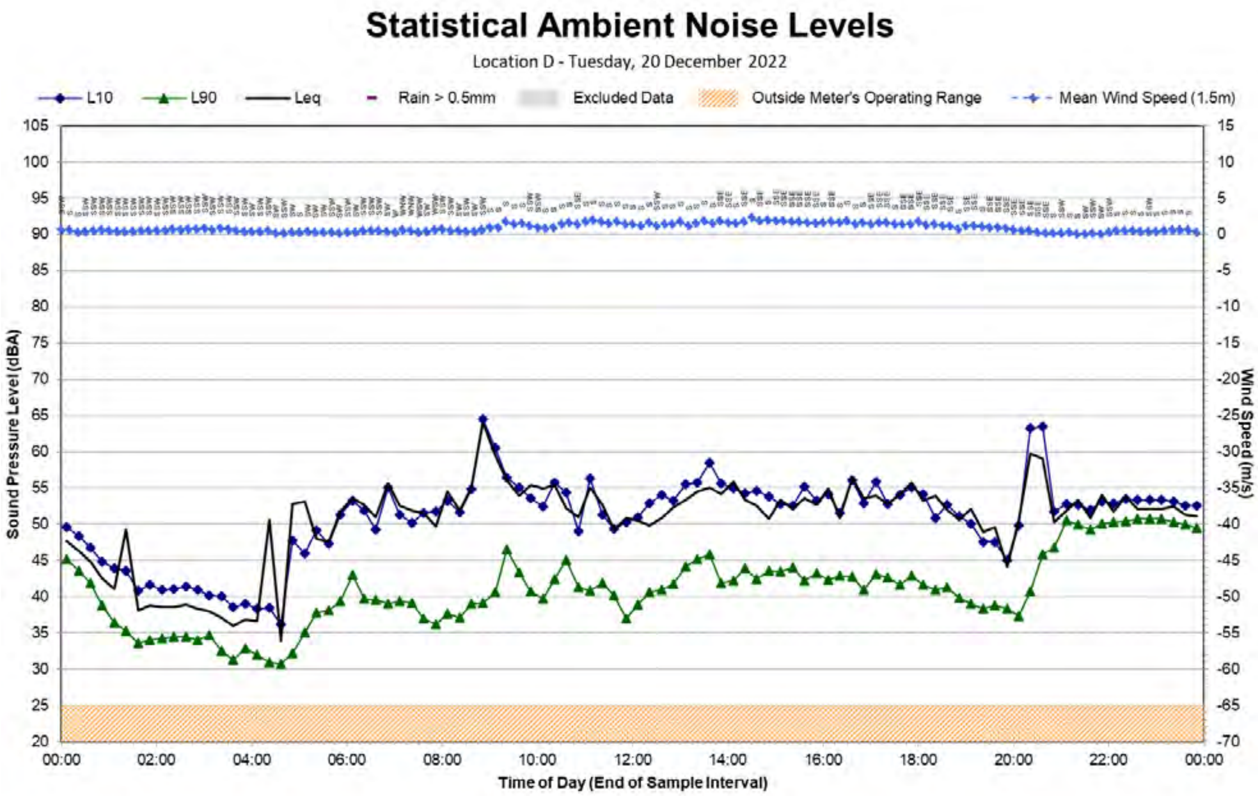
**A full technical report is available on request.**

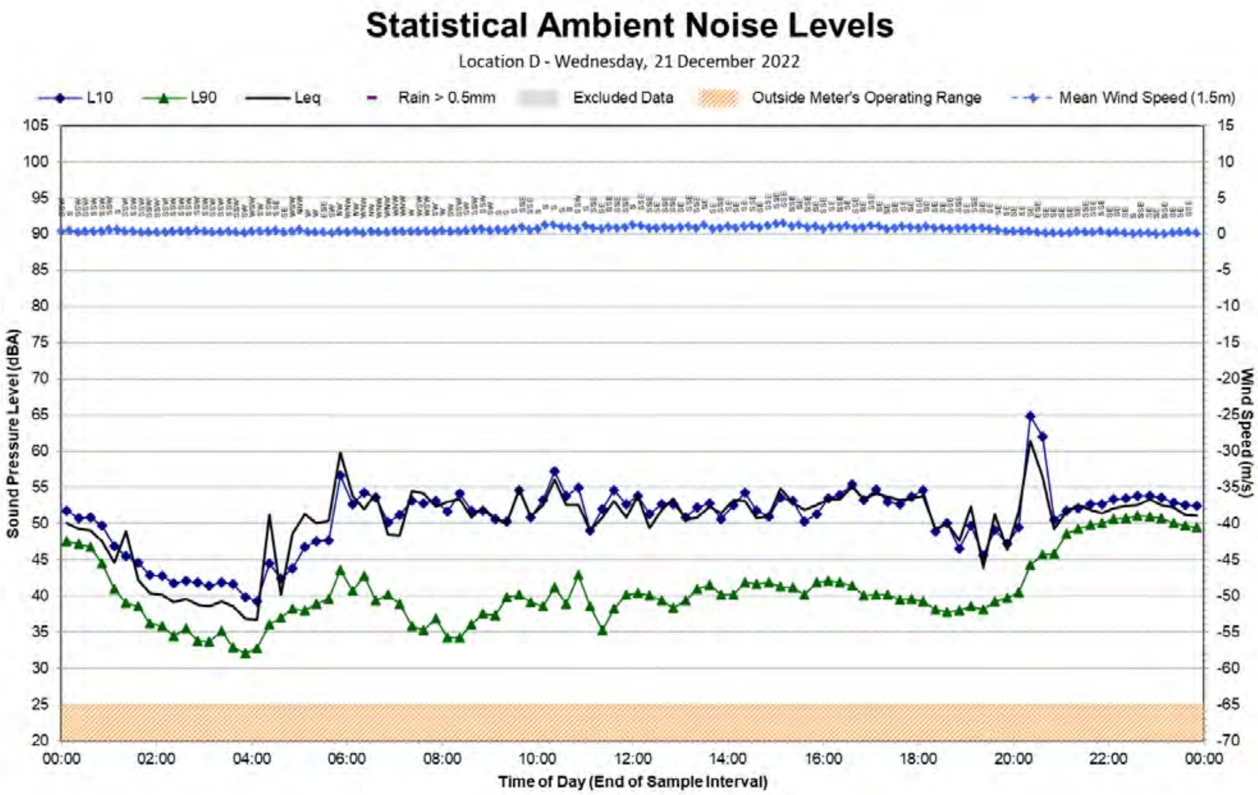
# APPENDIX D

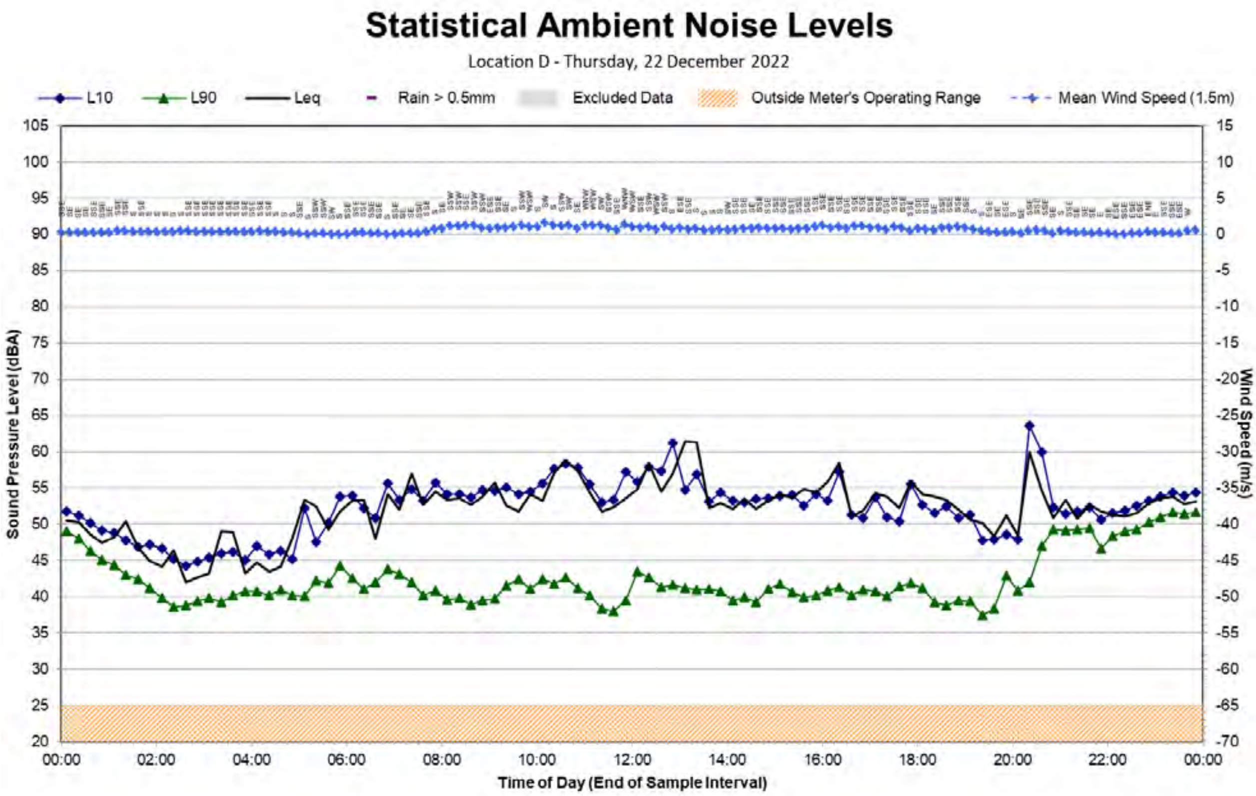
Statistical Ambient Noise Levels

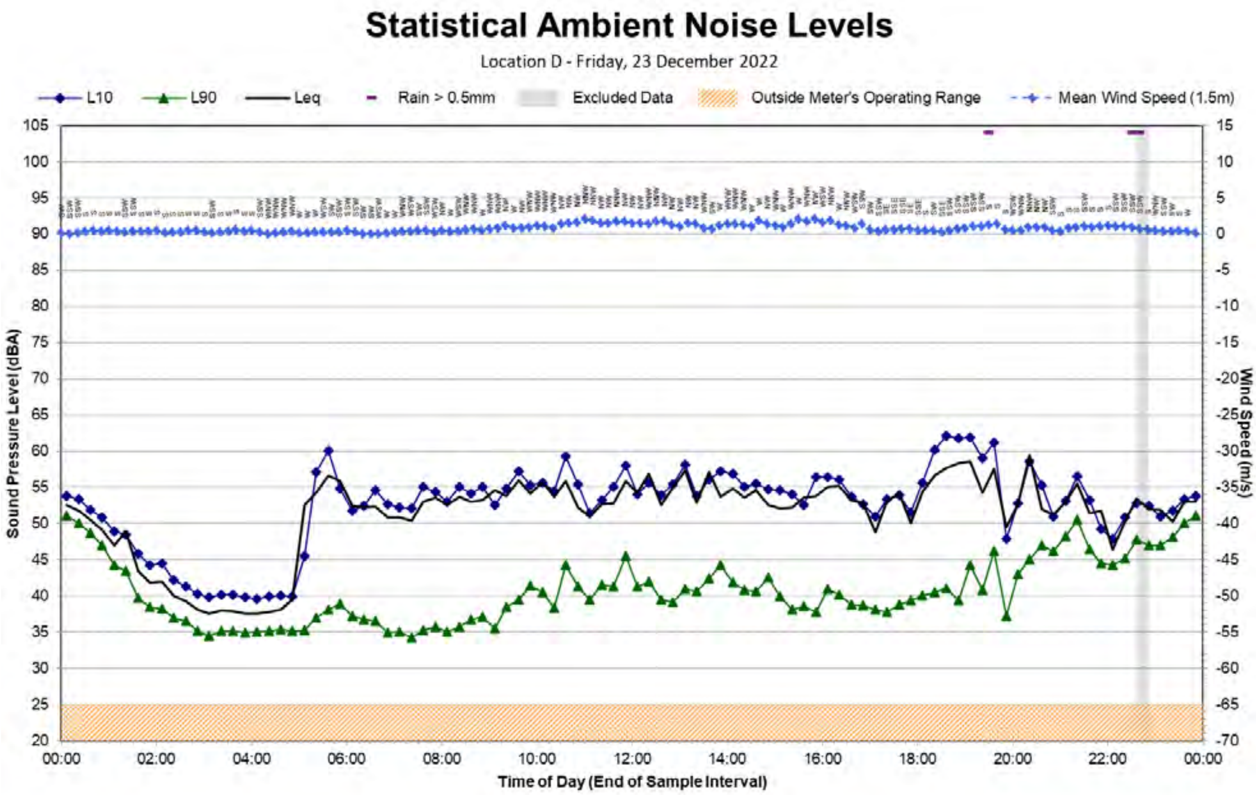

Statistical Ambient Noise Levels
Location D - Sunday, 18 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Monday, 19 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Tuesday, 20 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

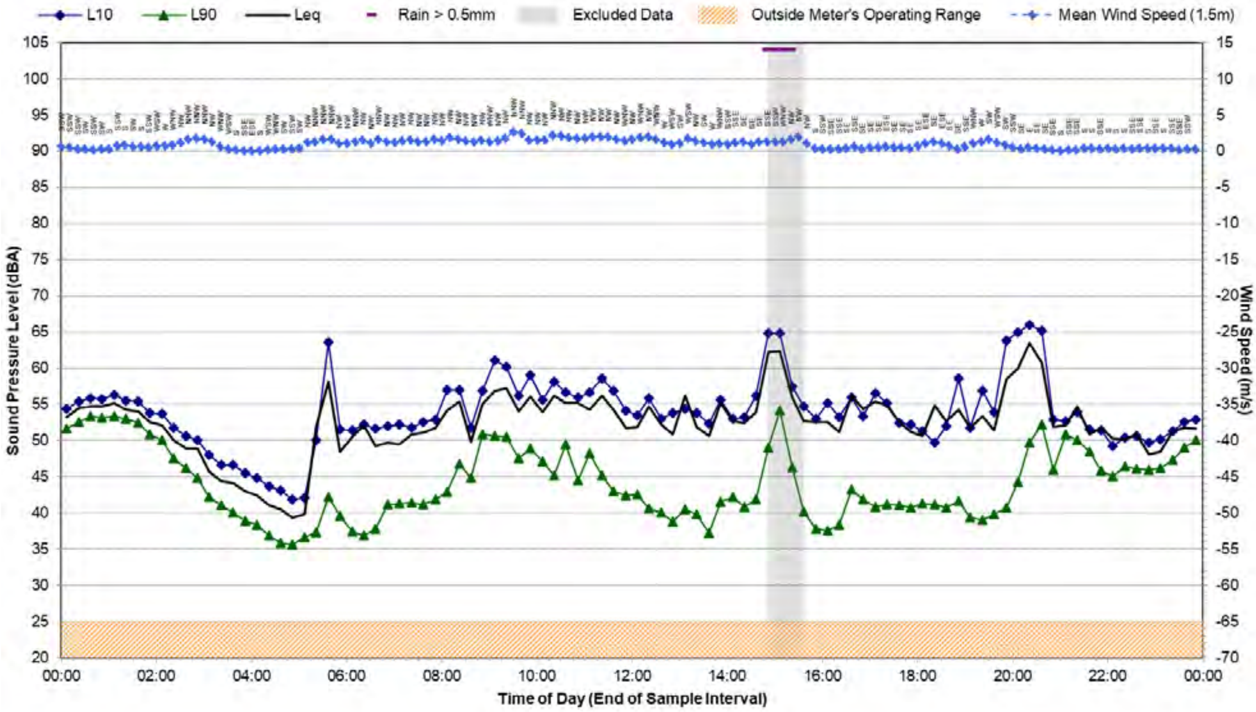

Statistical Ambient Noise Levels
Location D - Wednesday, 21 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Thursday, 22 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Friday, 23 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

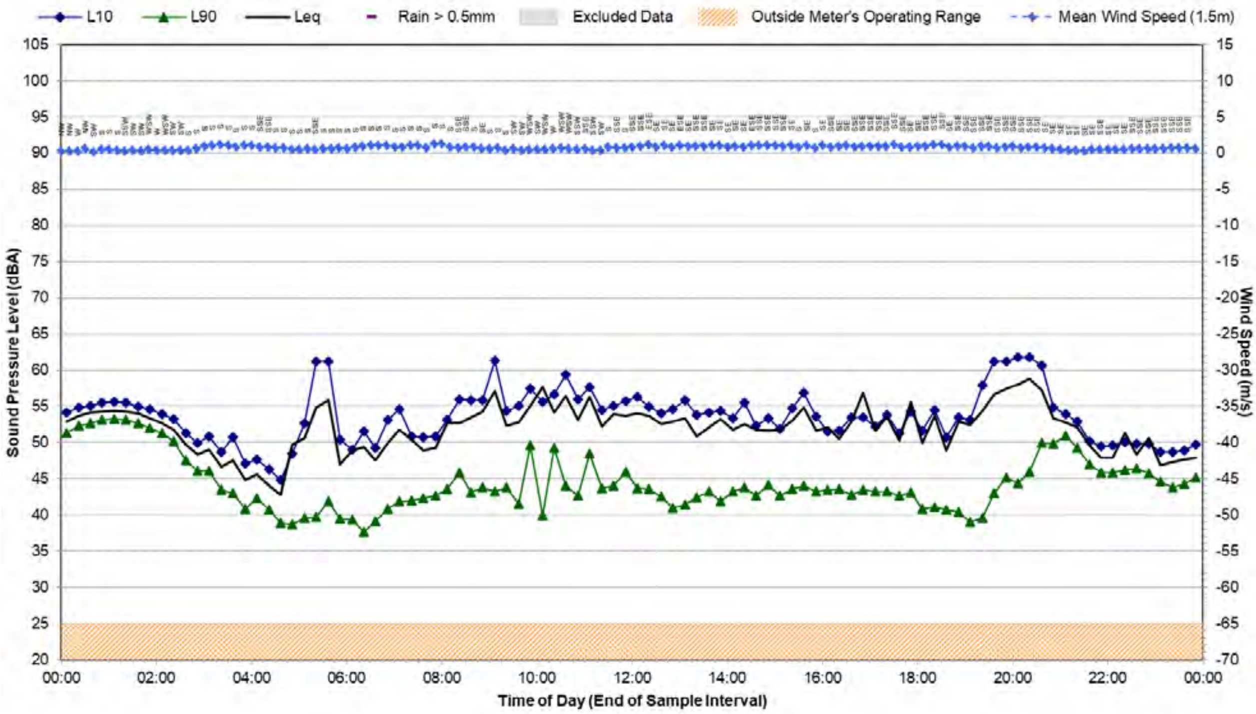
## Statistical Ambient Noise Levels

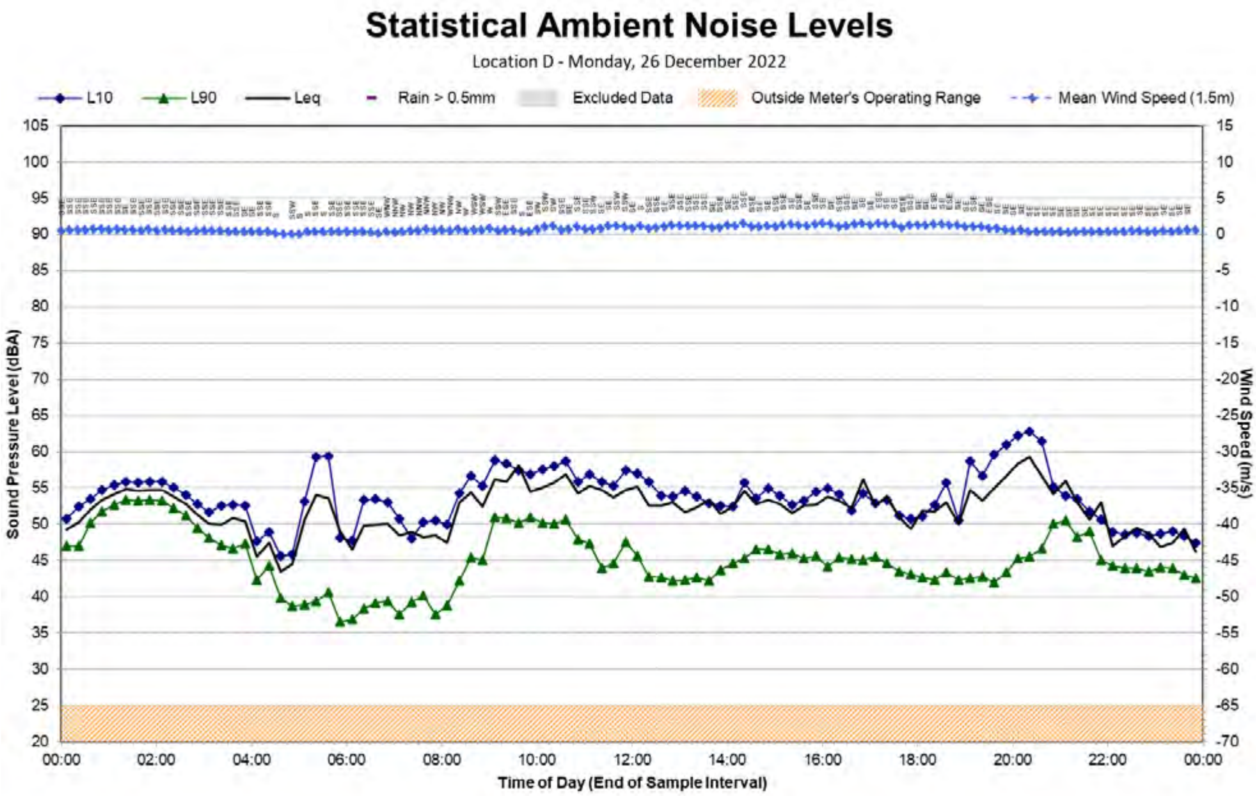
Location D - Saturday, 24 December 2022



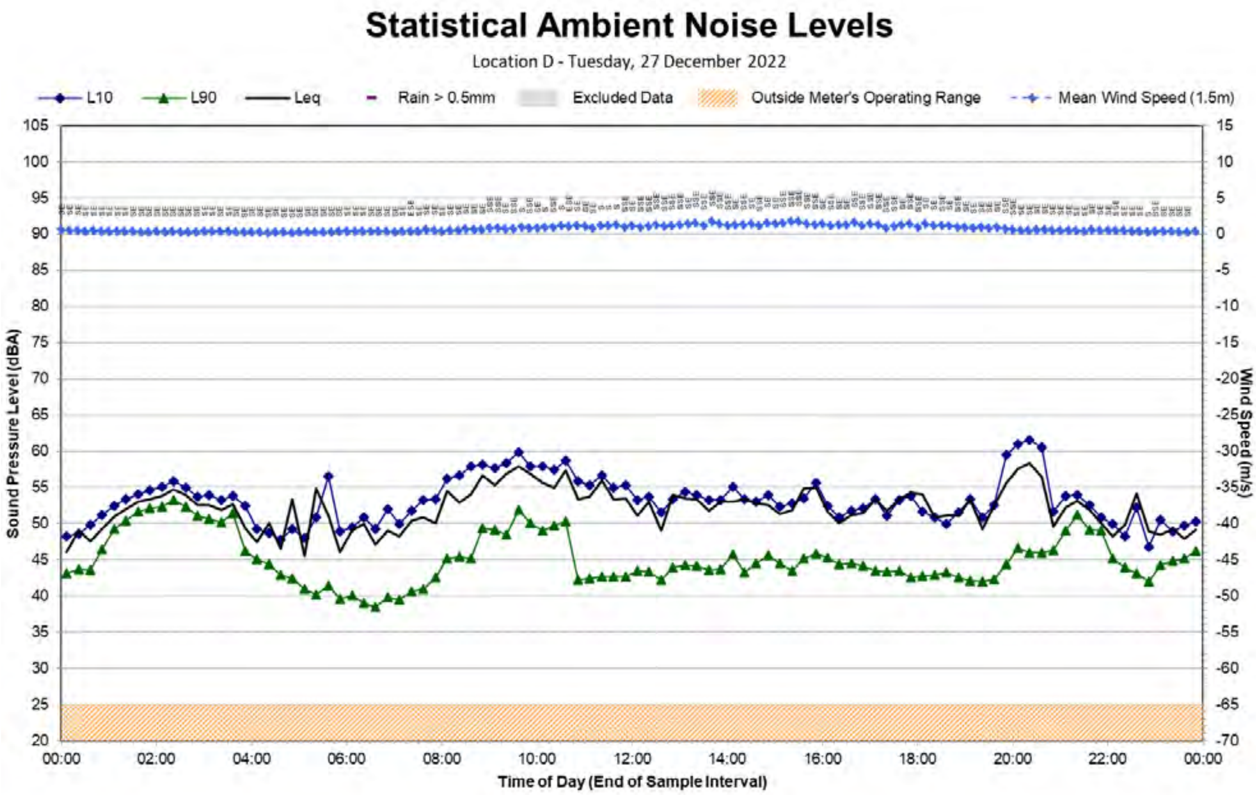

## Statistical Ambient Noise Levels

Location D - Sunday, 25 December 2022





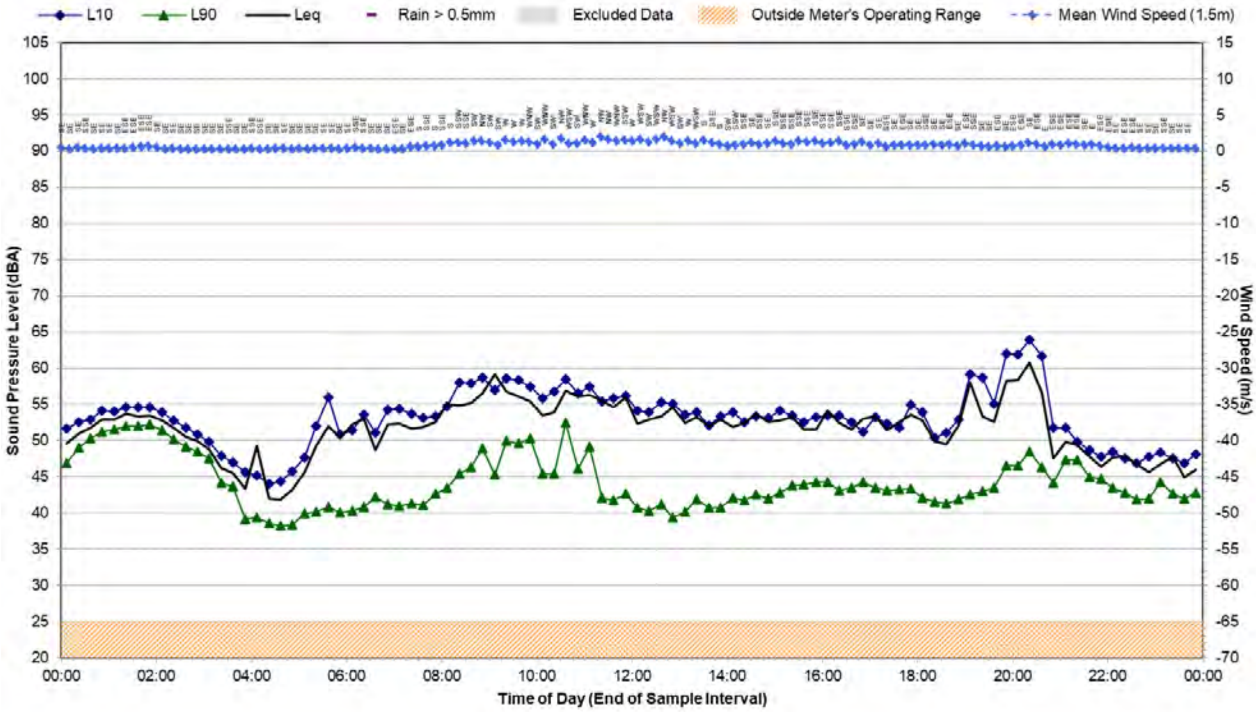
Statistical Ambient Noise Levels
Location D - Monday, 26 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels
Location D - Tuesday, 27 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

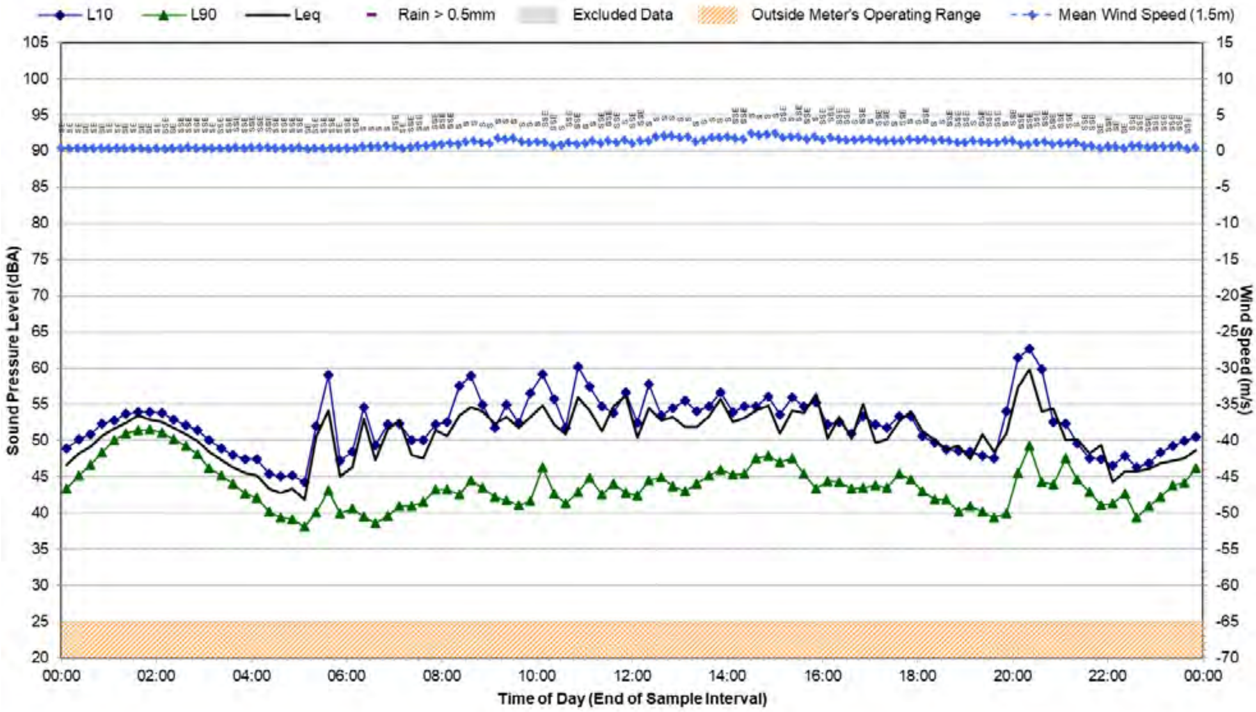
# Statistical Ambient Noise Levels

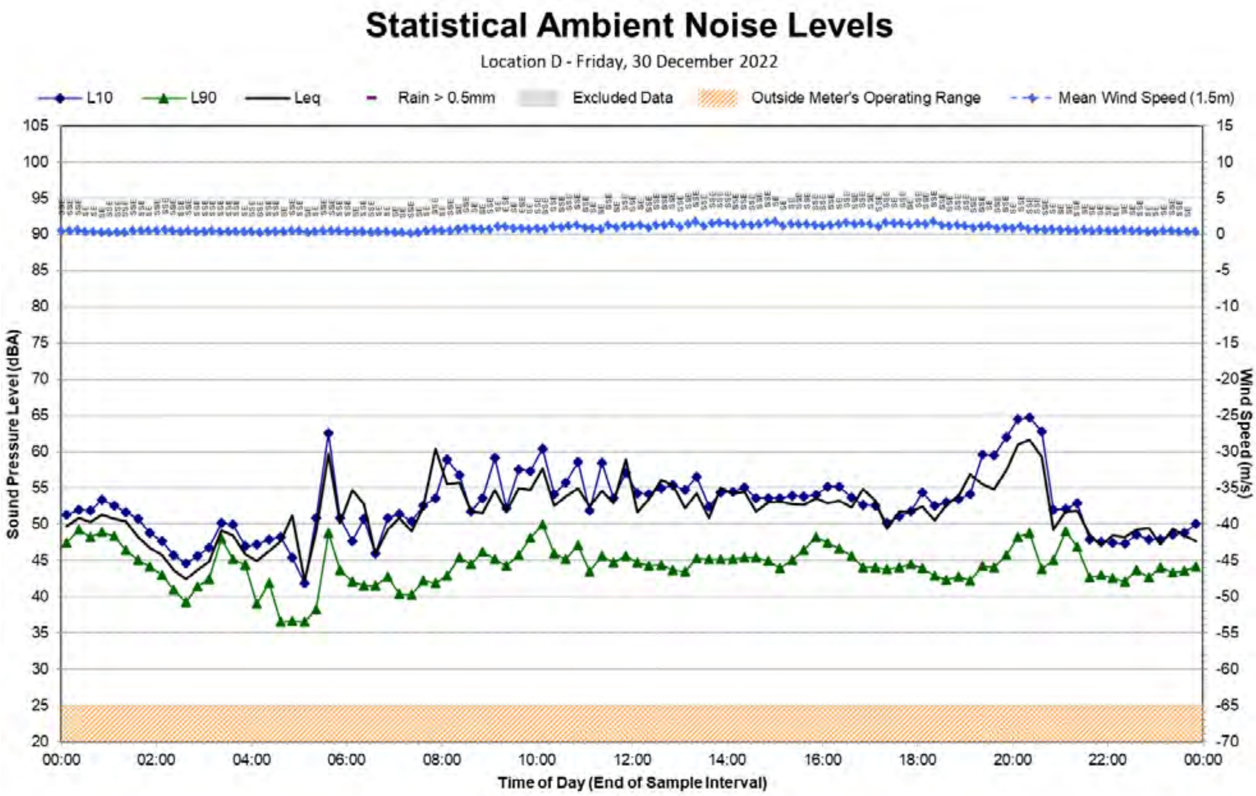
Location D - Wednesday, 28 December 2022

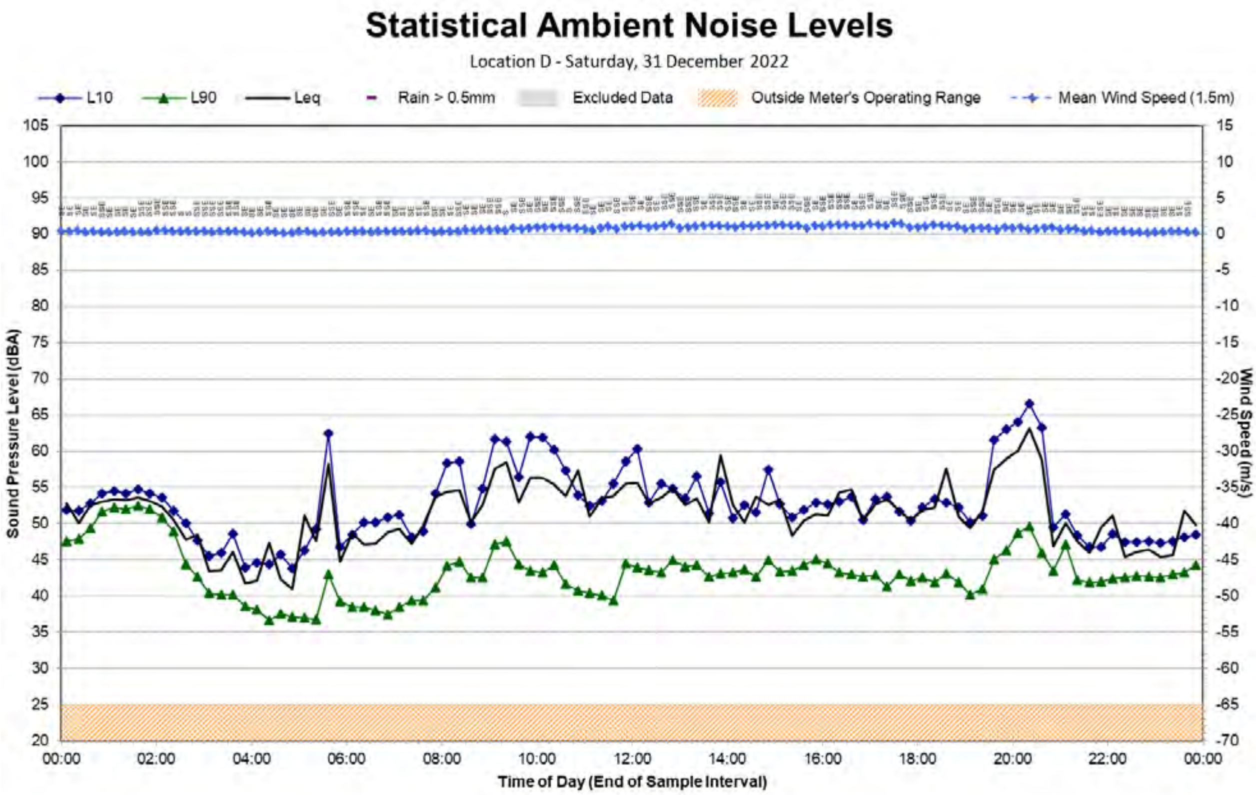


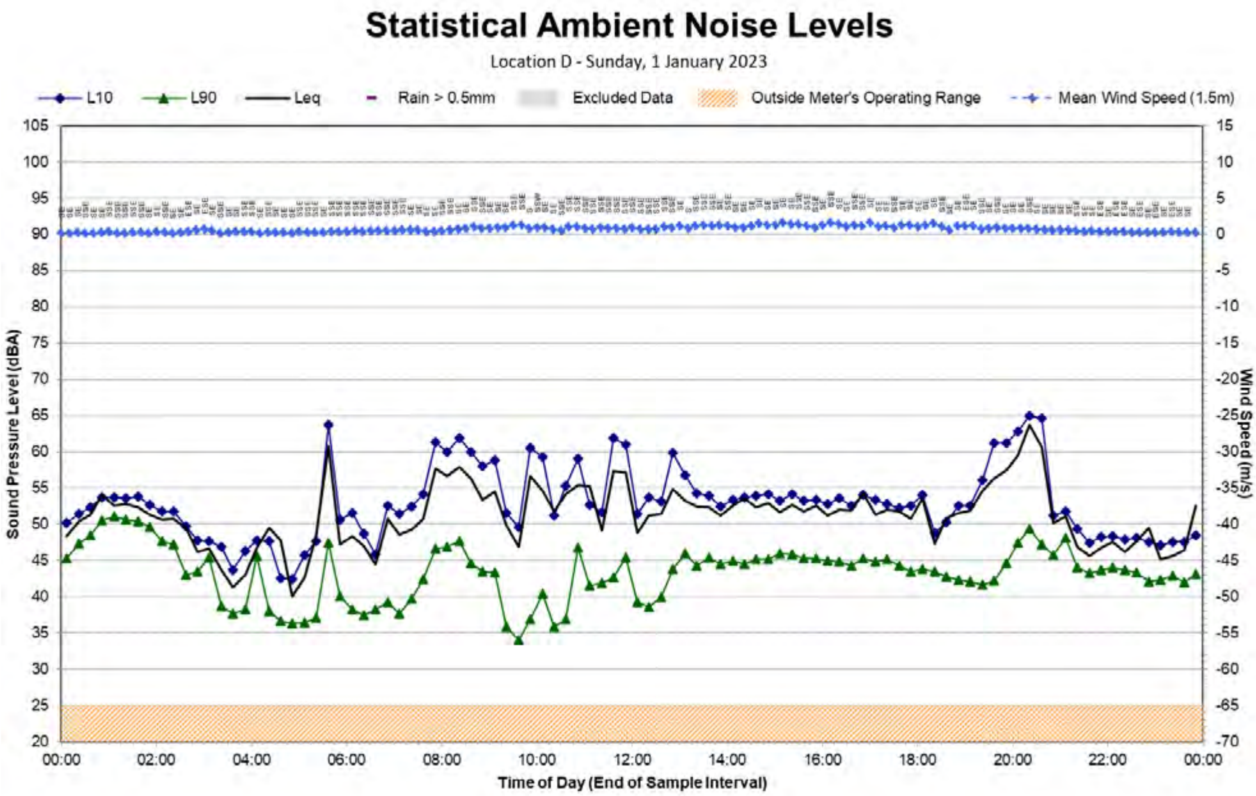

# Statistical Ambient Noise Levels

Location D - Thursday, 29 December 2022

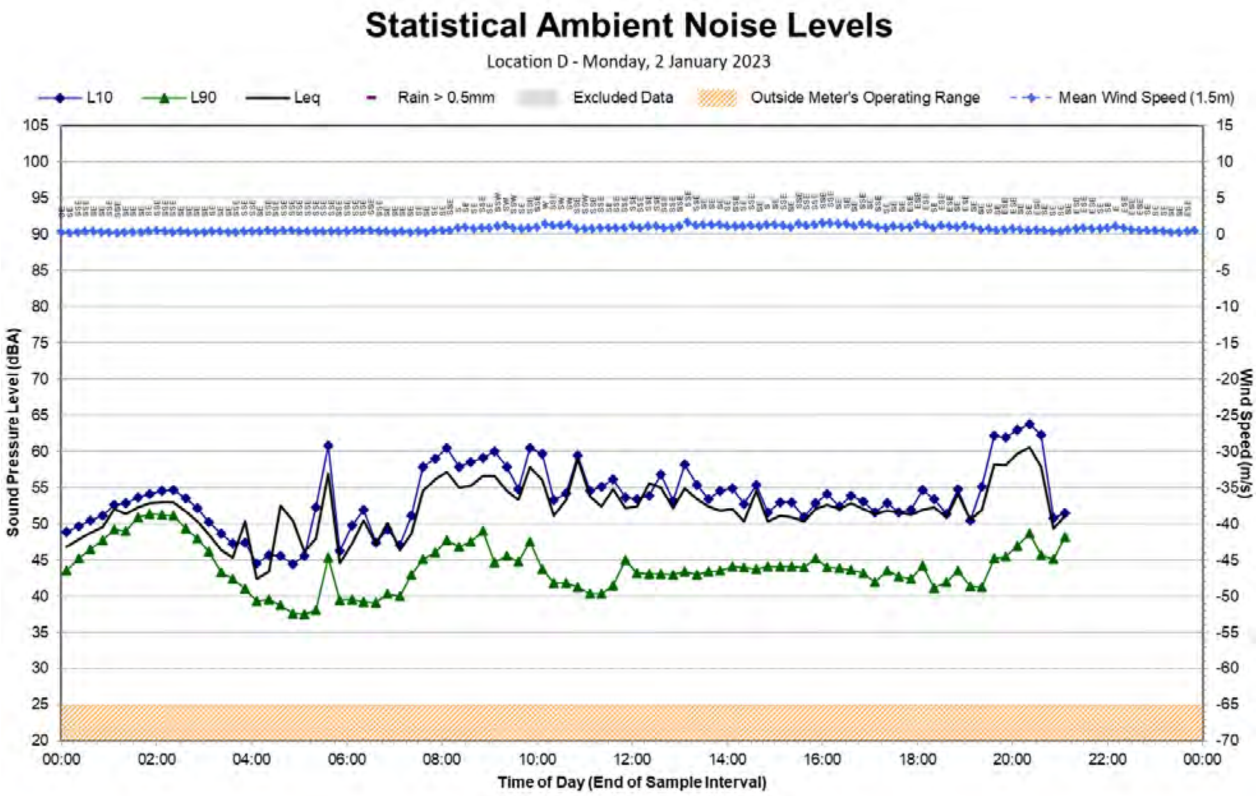



Statistical Ambient Noise Levels
Location D - Friday, 30 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

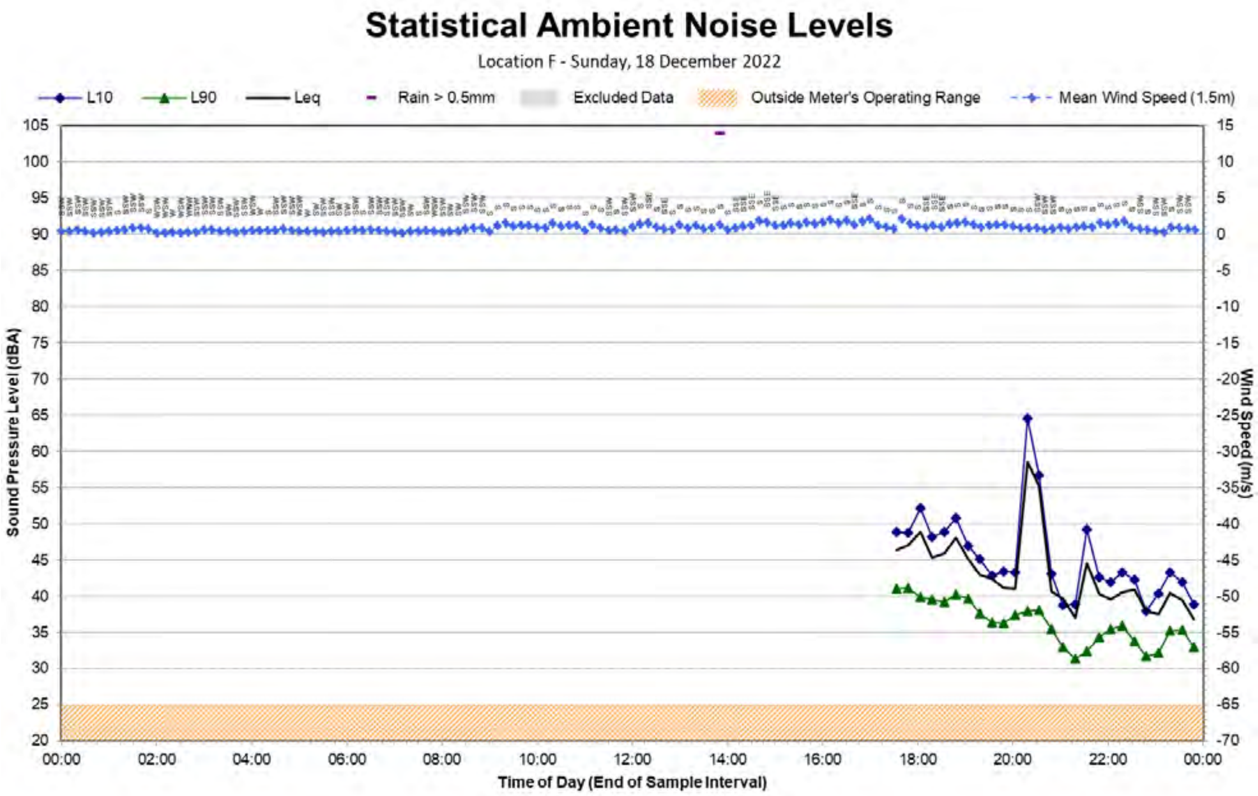

Statistical Ambient Noise Levels
Location D - Saturday, 31 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

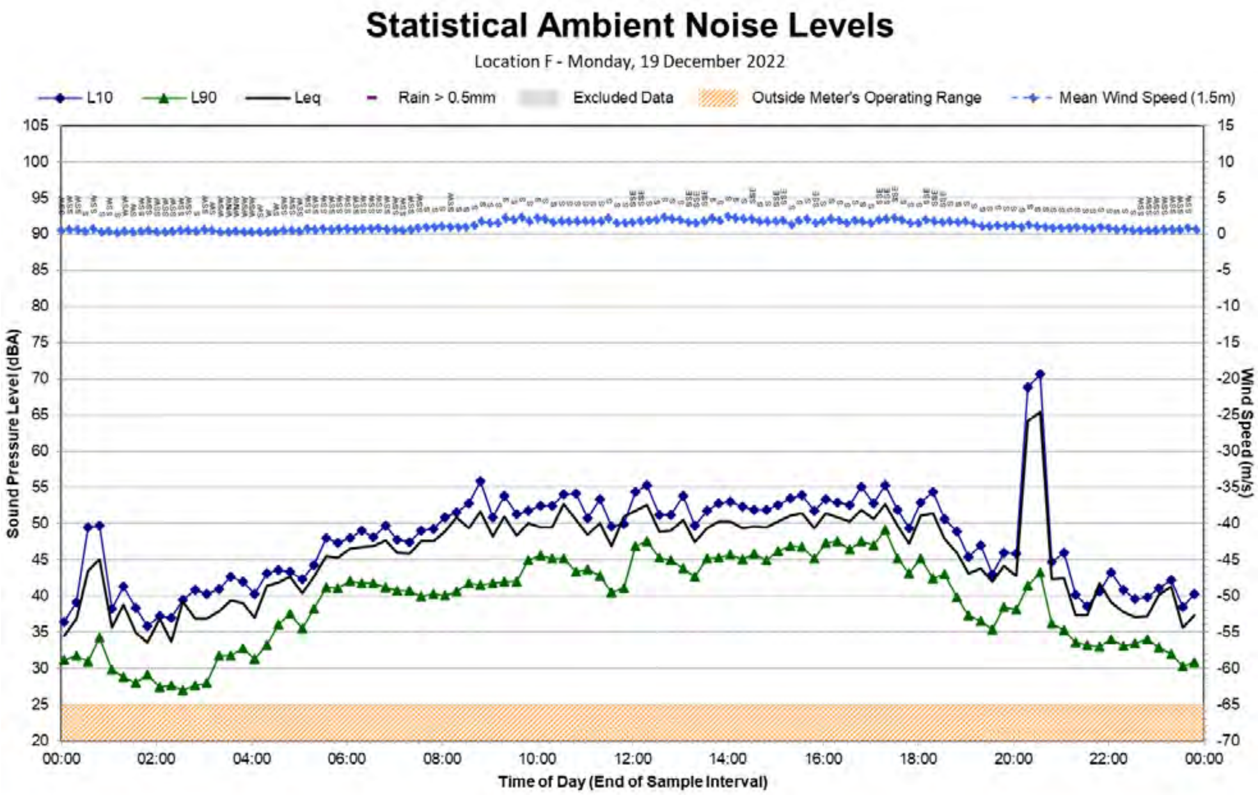


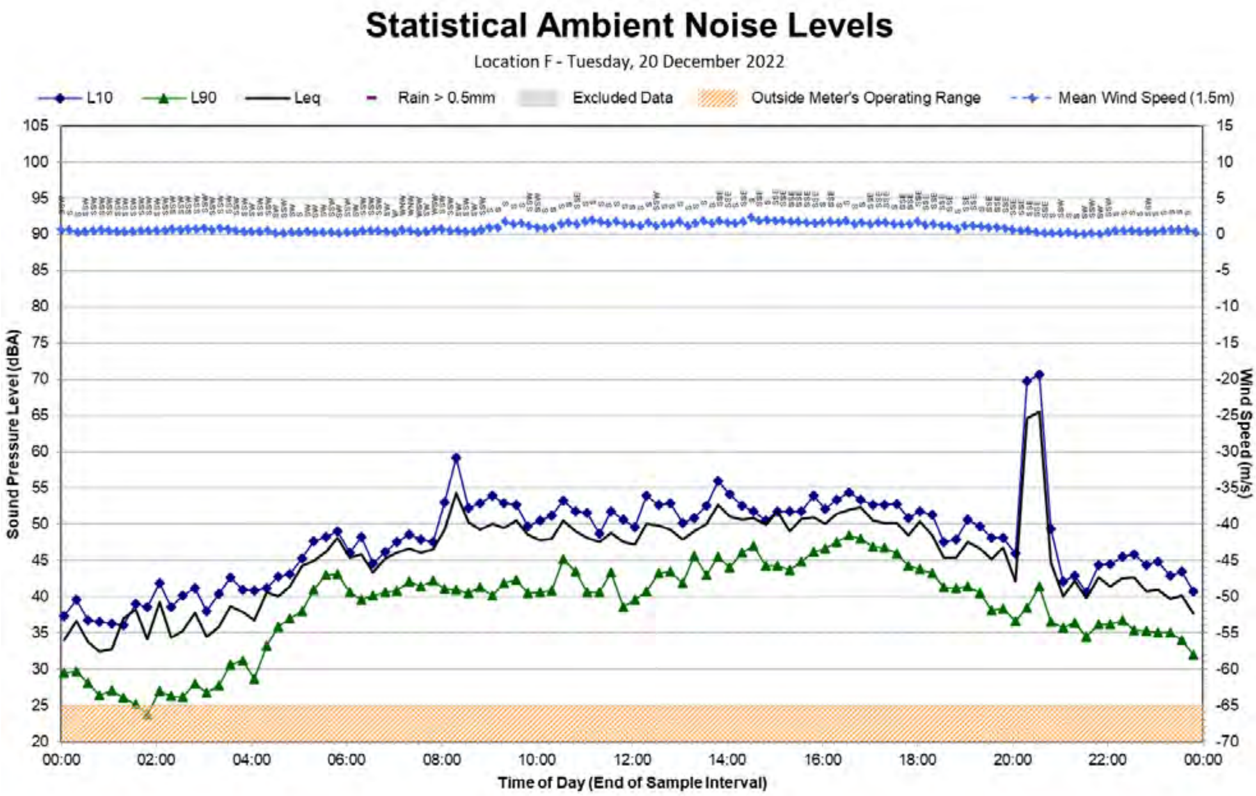
Statistical Ambient Noise Levels
Location D - Sunday, 1 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

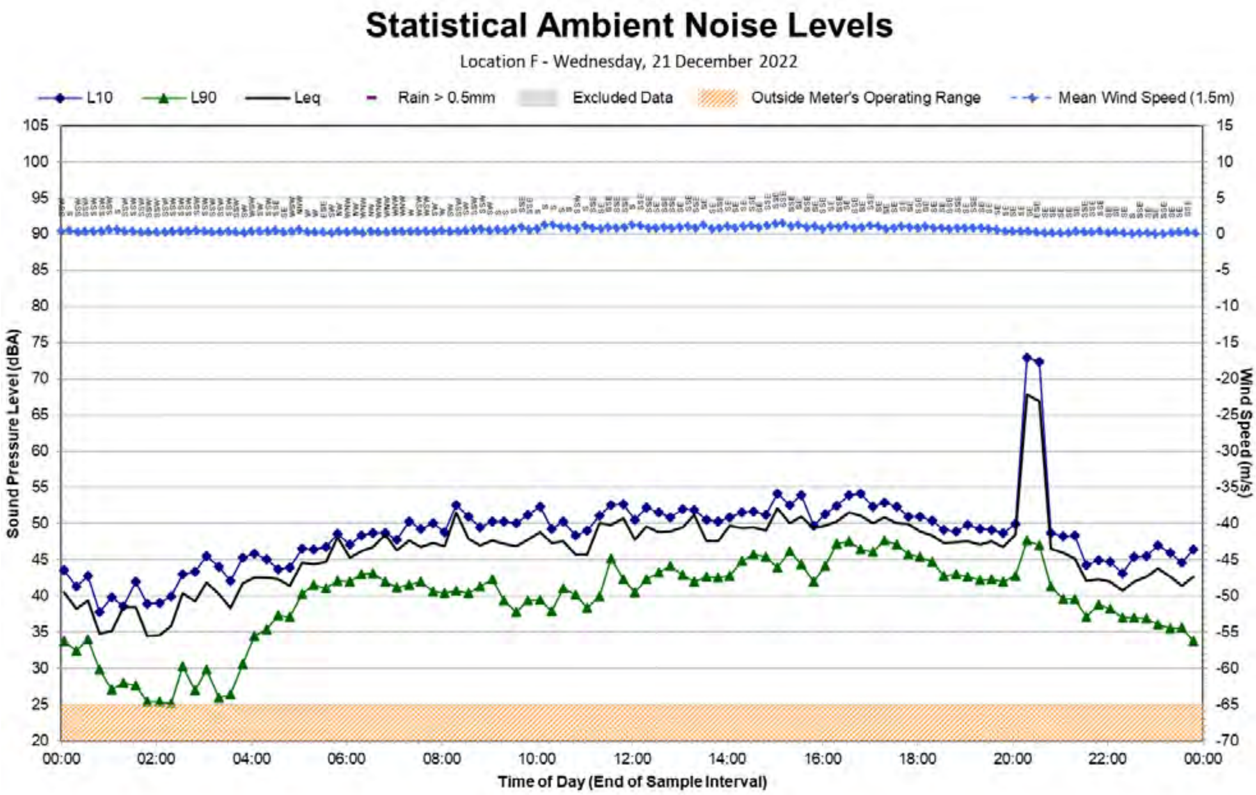



Statistical Ambient Noise Levels
Location D - Monday, 2 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Sunday, 18 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

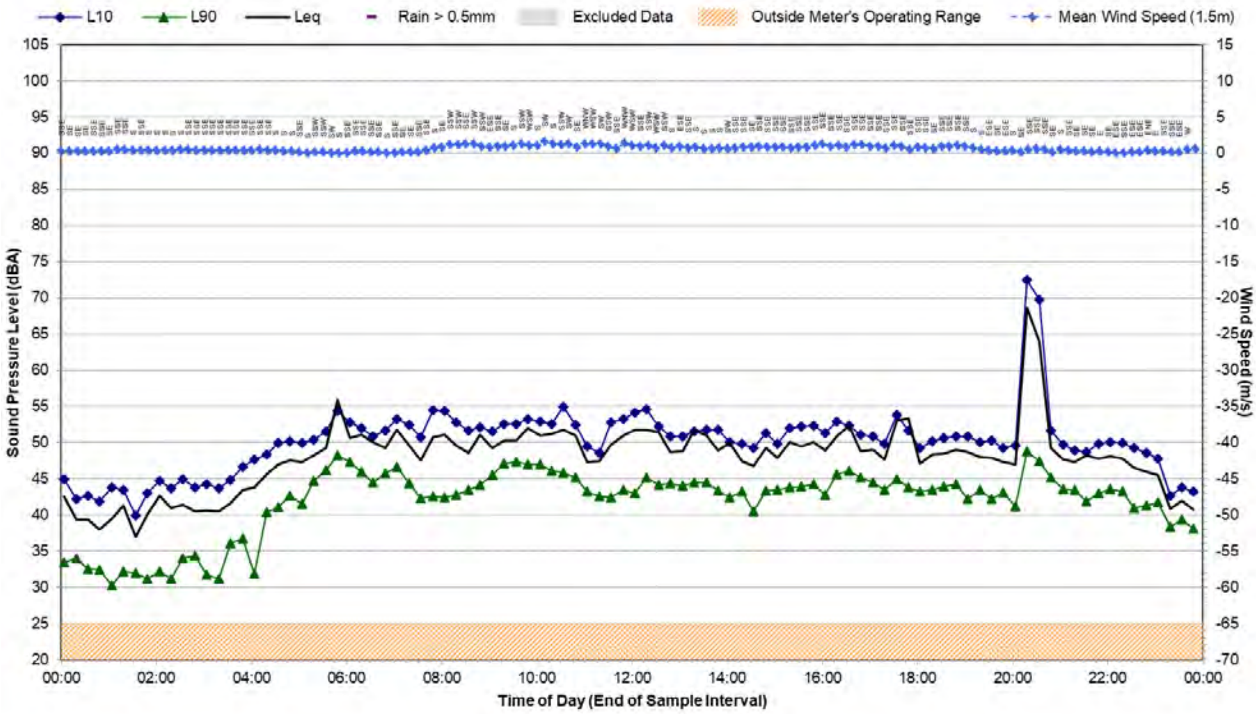

Statistical Ambient Noise Levels
Location F - Monday, 19 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Tuesday, 20 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


Statistical Ambient Noise Levels
Location F - Wednesday, 21 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

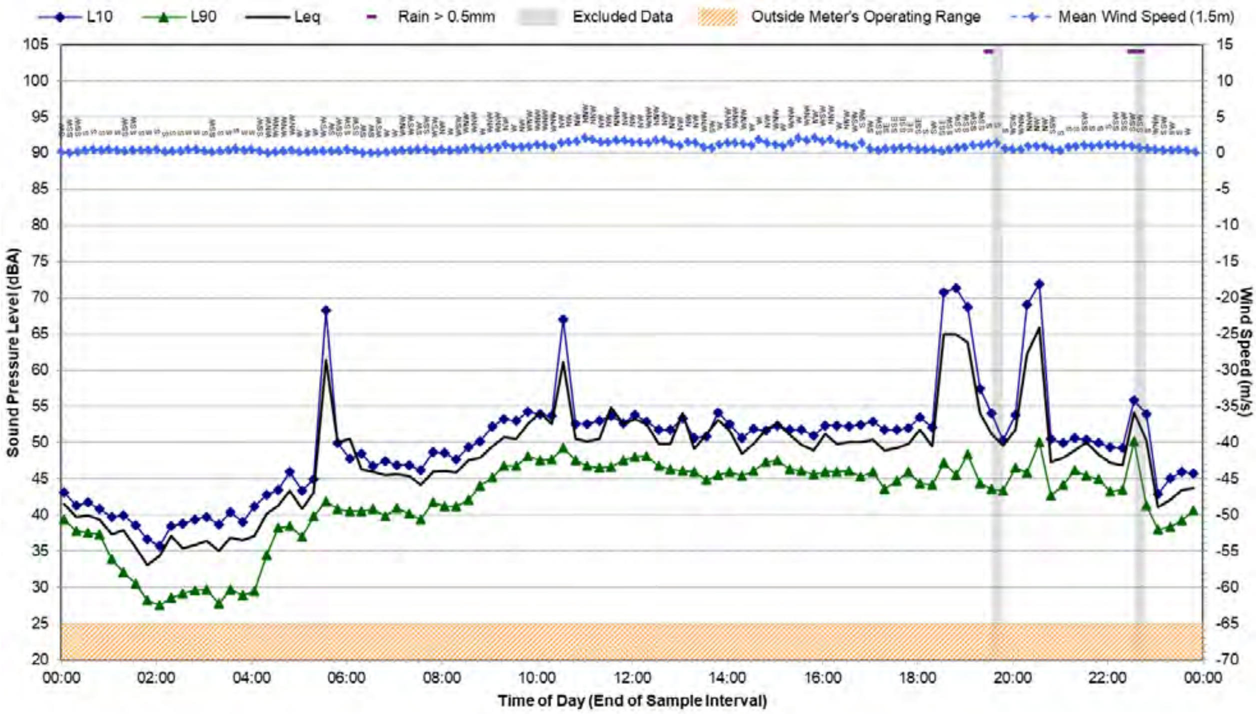
## Statistical Ambient Noise Levels

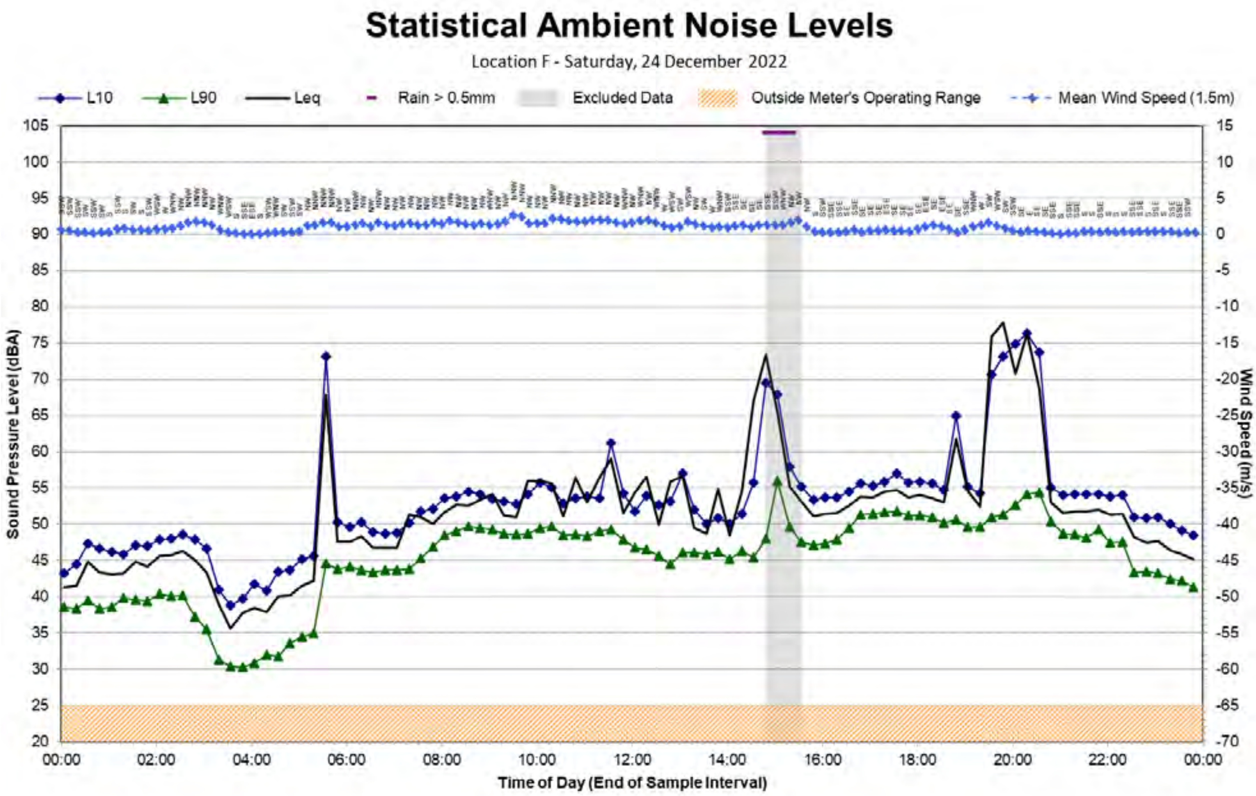
Location F - Thursday, 22 December 2022



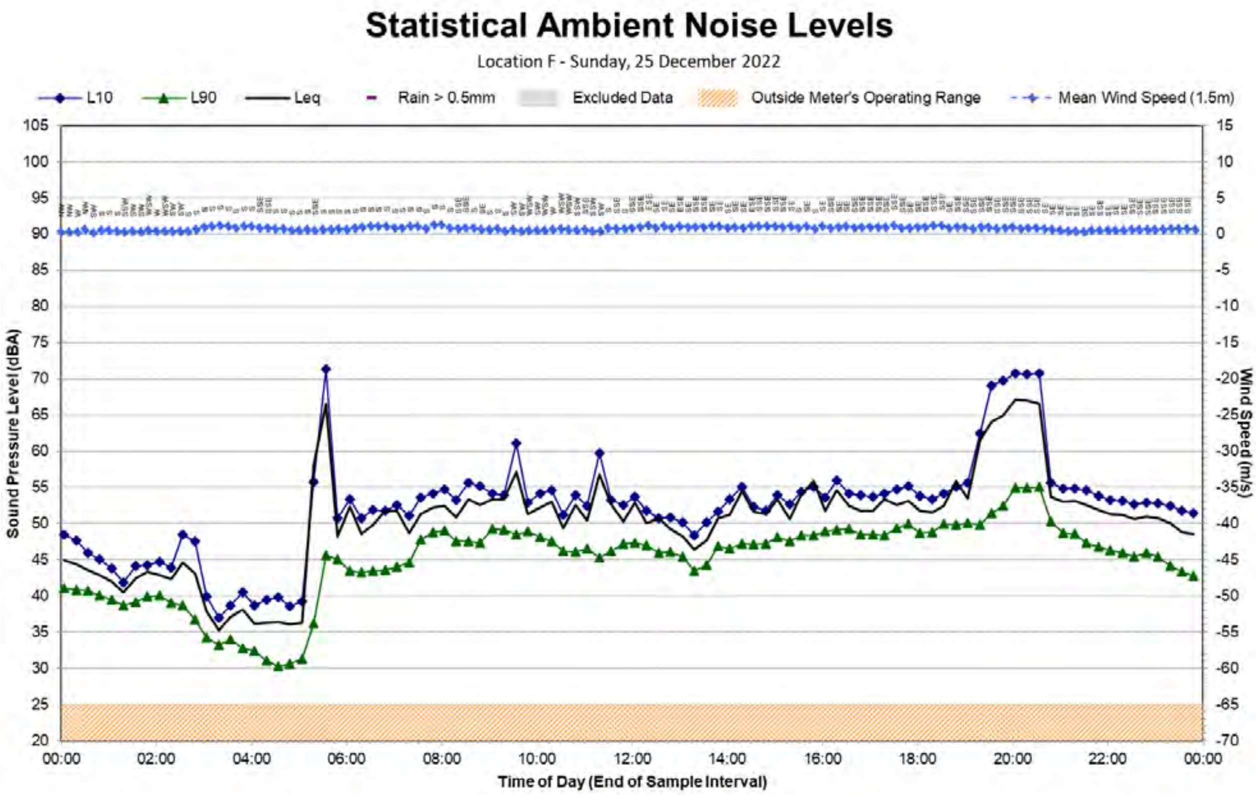

## Statistical Ambient Noise Levels

Location F - Friday, 23 December 2022

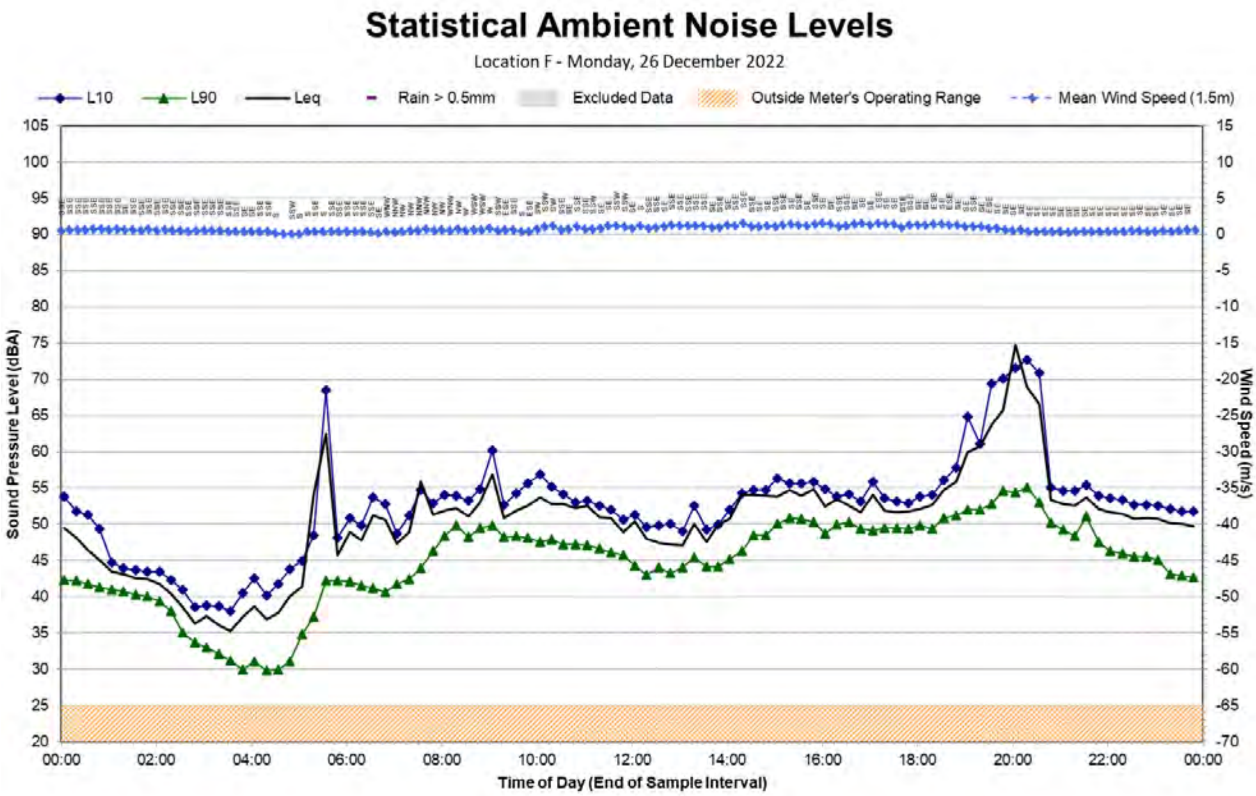


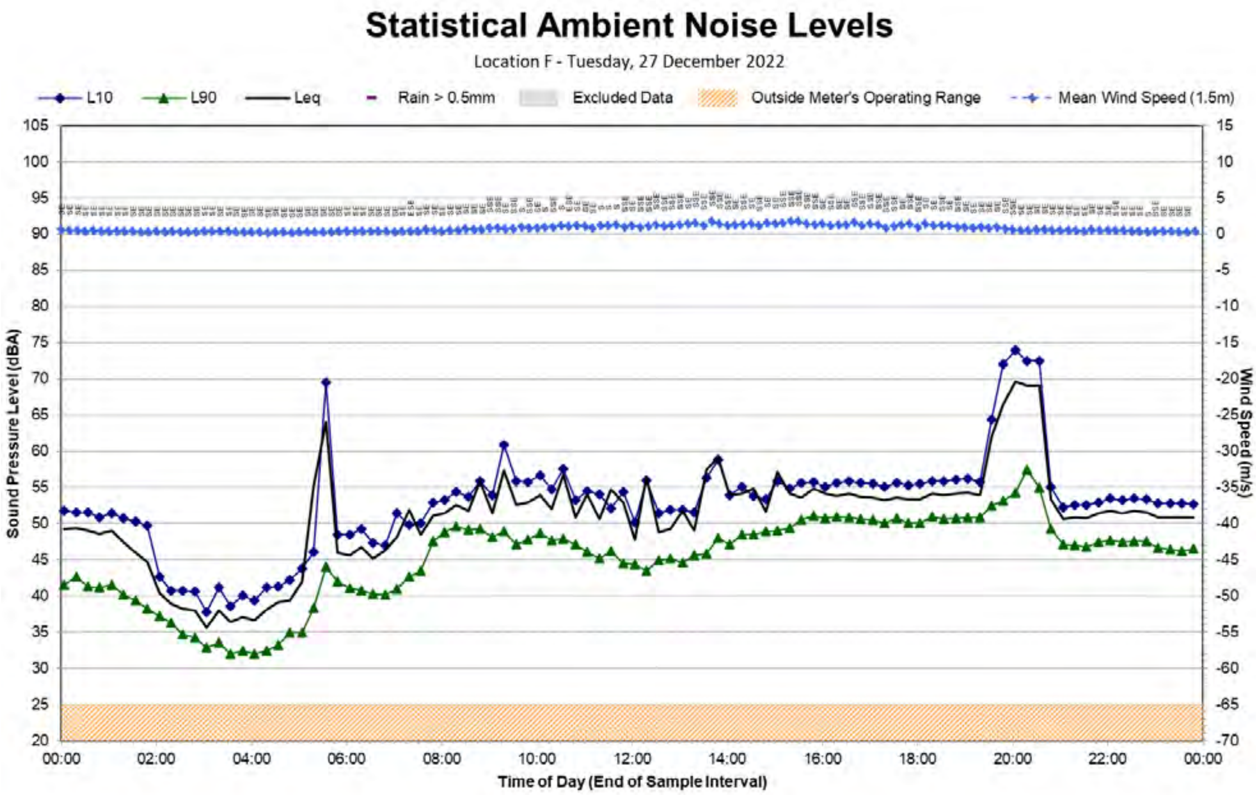


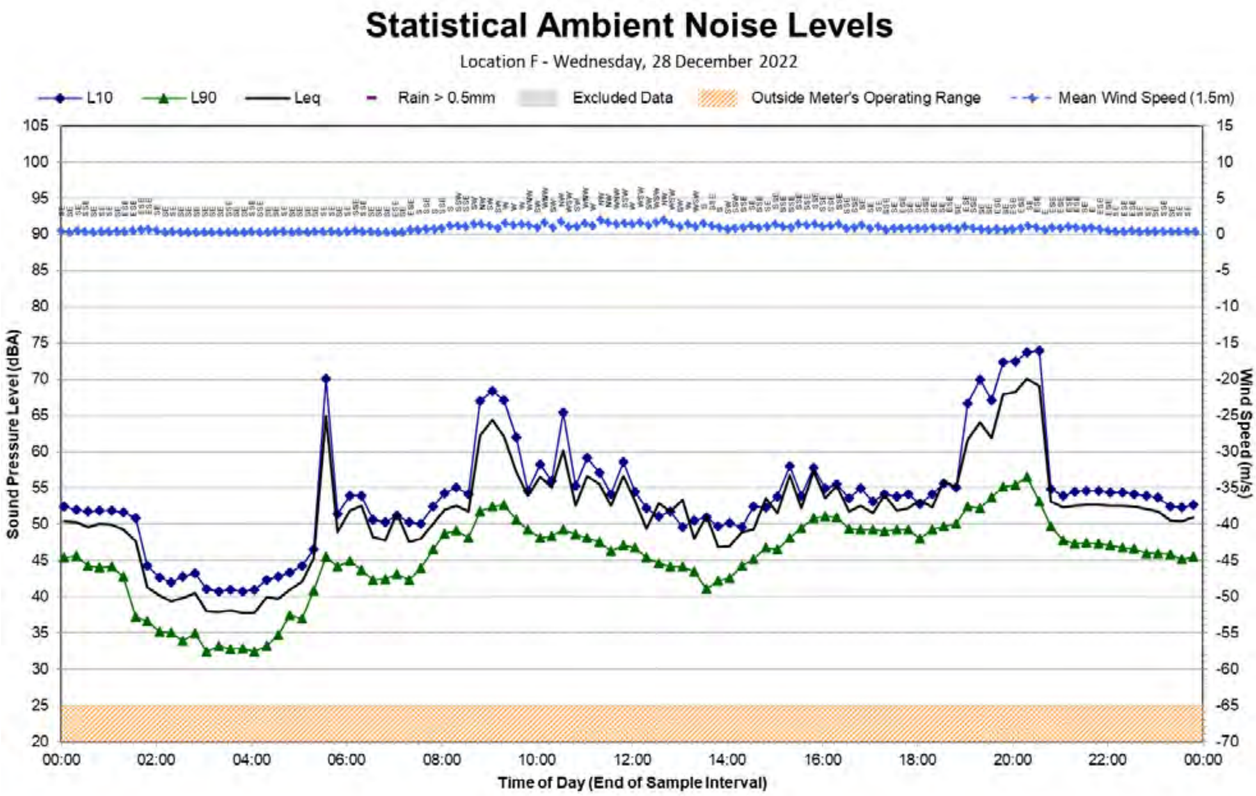
Statistical Ambient Noise Levels
Location F - Saturday, 24 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

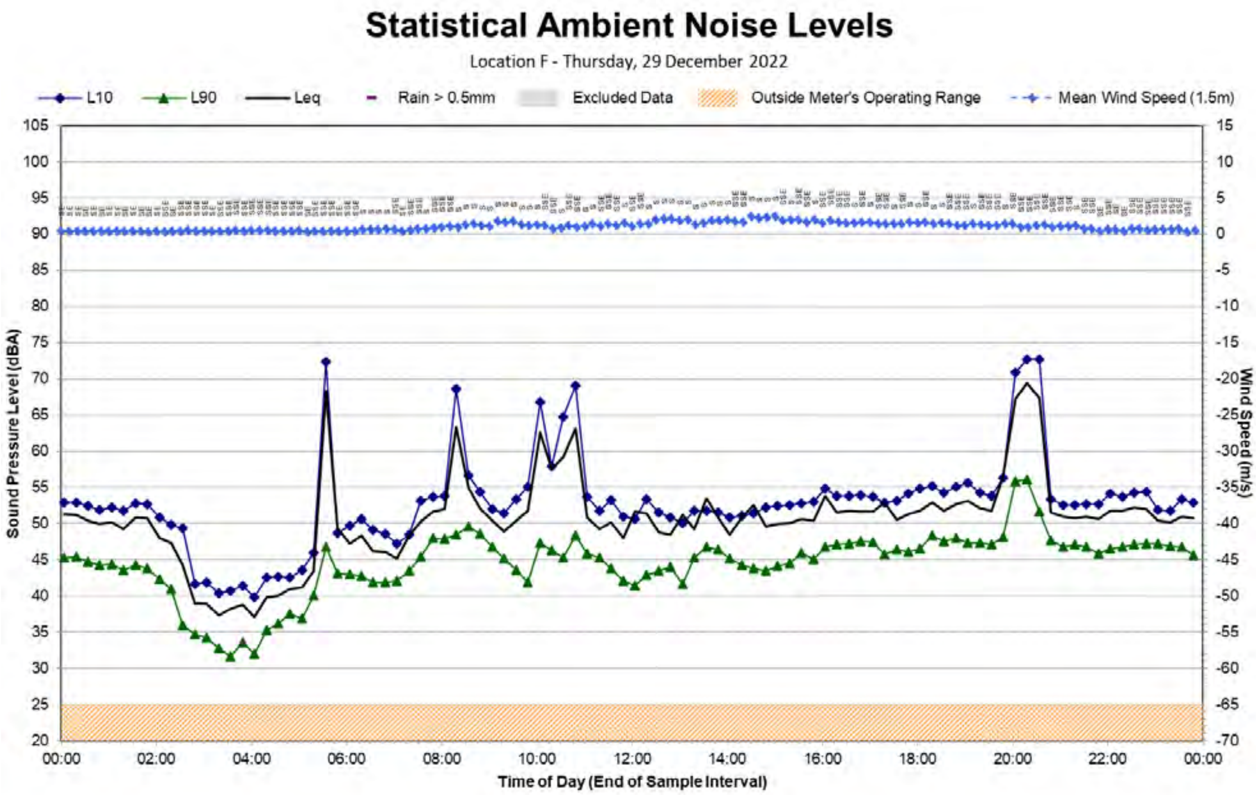



Statistical Ambient Noise Levels
Location F - Sunday, 25 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Monday, 26 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

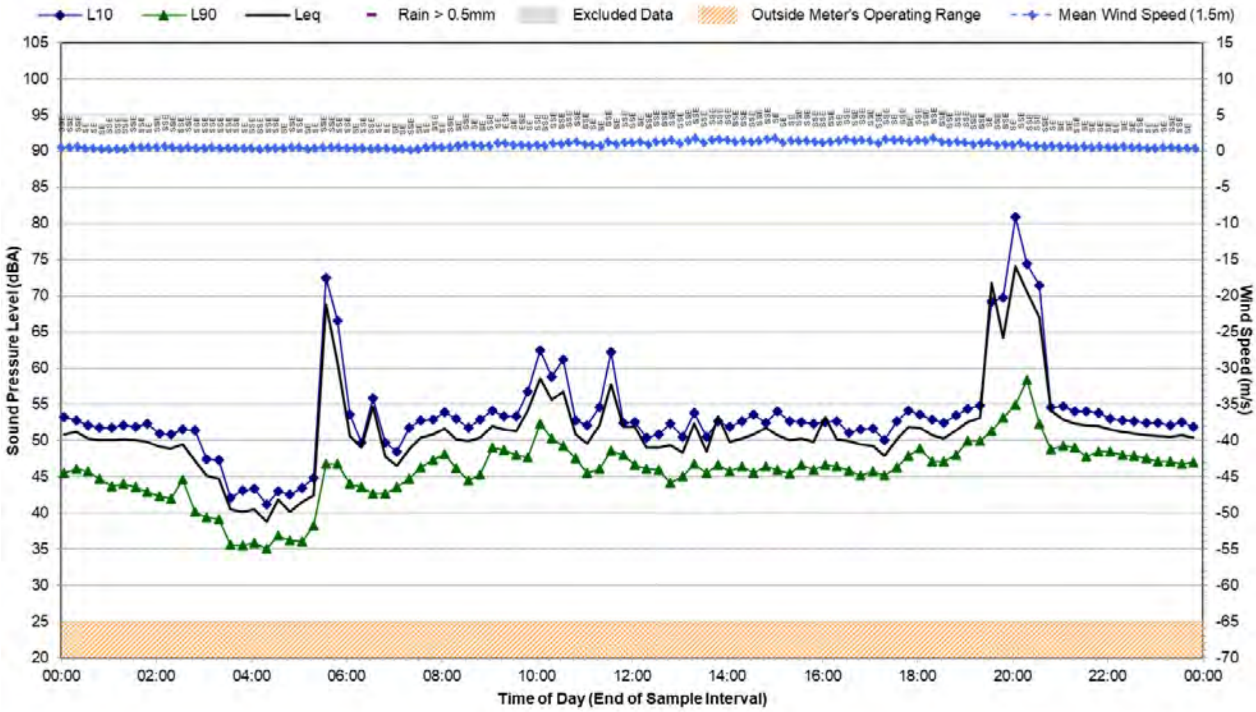

Statistical Ambient Noise Levels
Location F - Tuesday, 27 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Wednesday, 28 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Thursday, 29 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

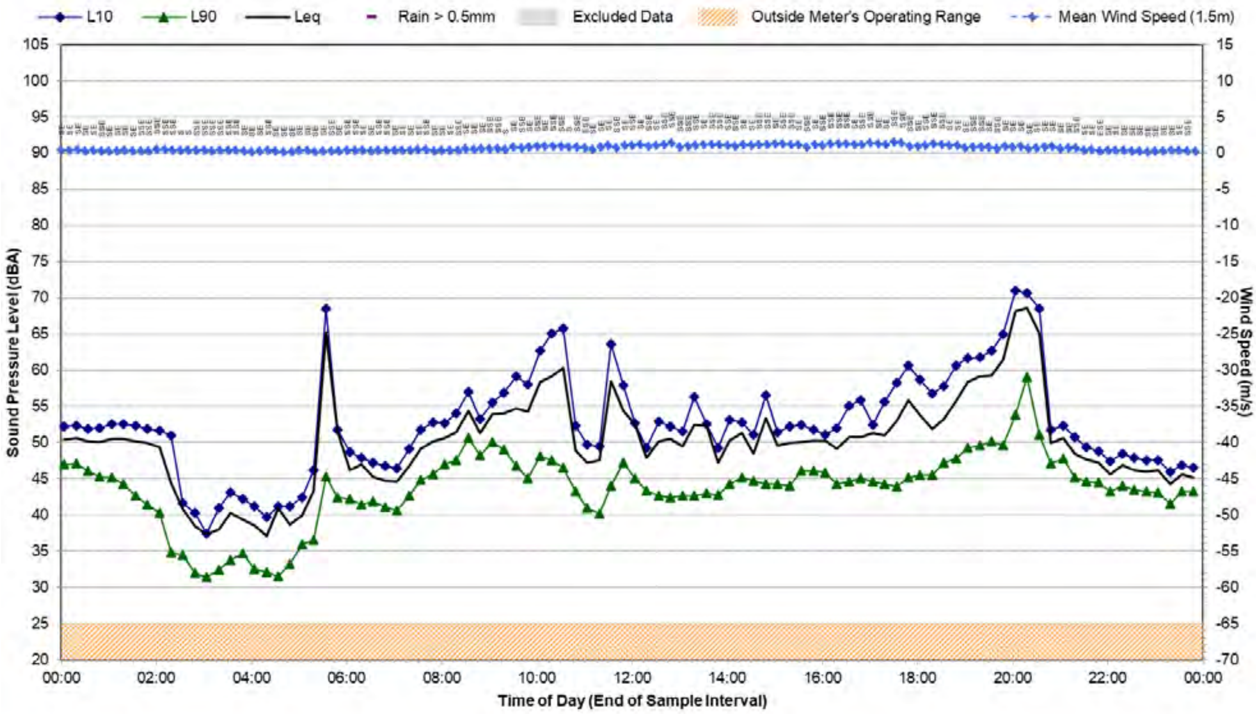
## Statistical Ambient Noise Levels

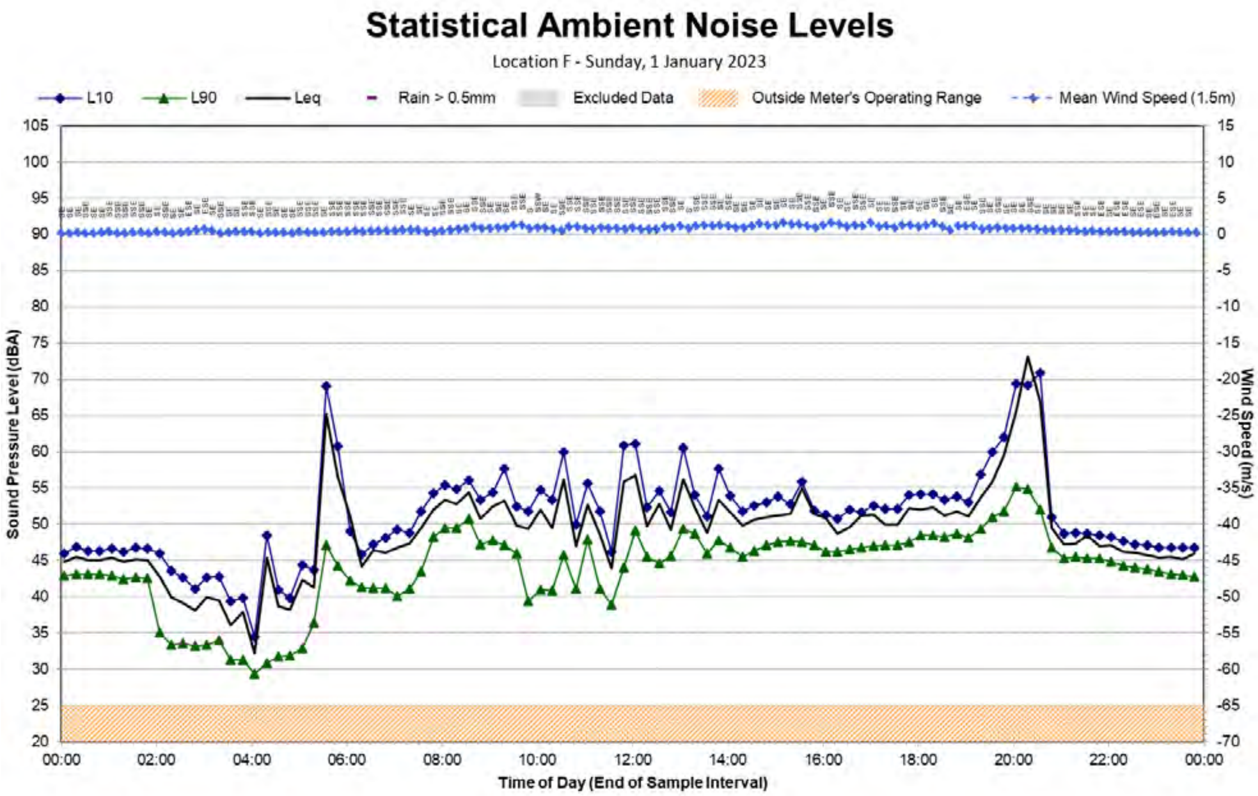
Location F - Friday, 30 December 2022



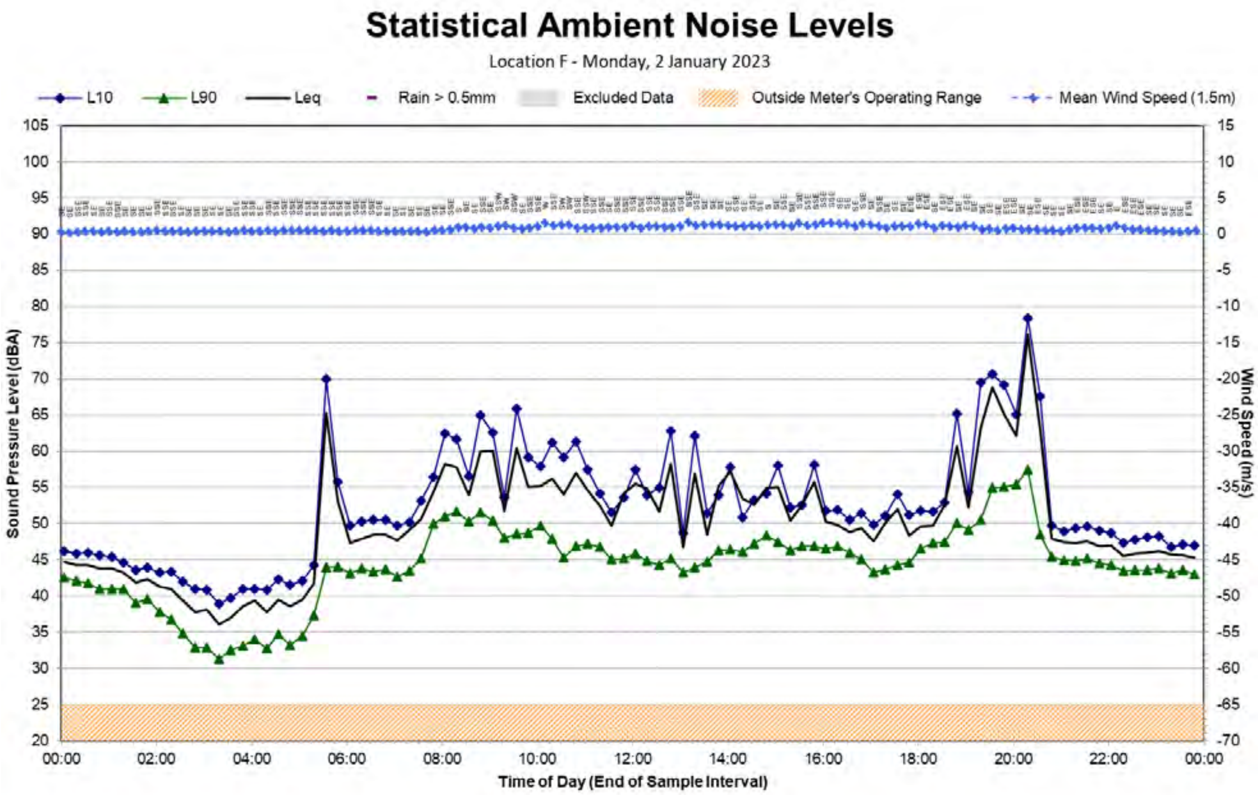

## Statistical Ambient Noise Levels

Location F - Saturday, 31 December 2022

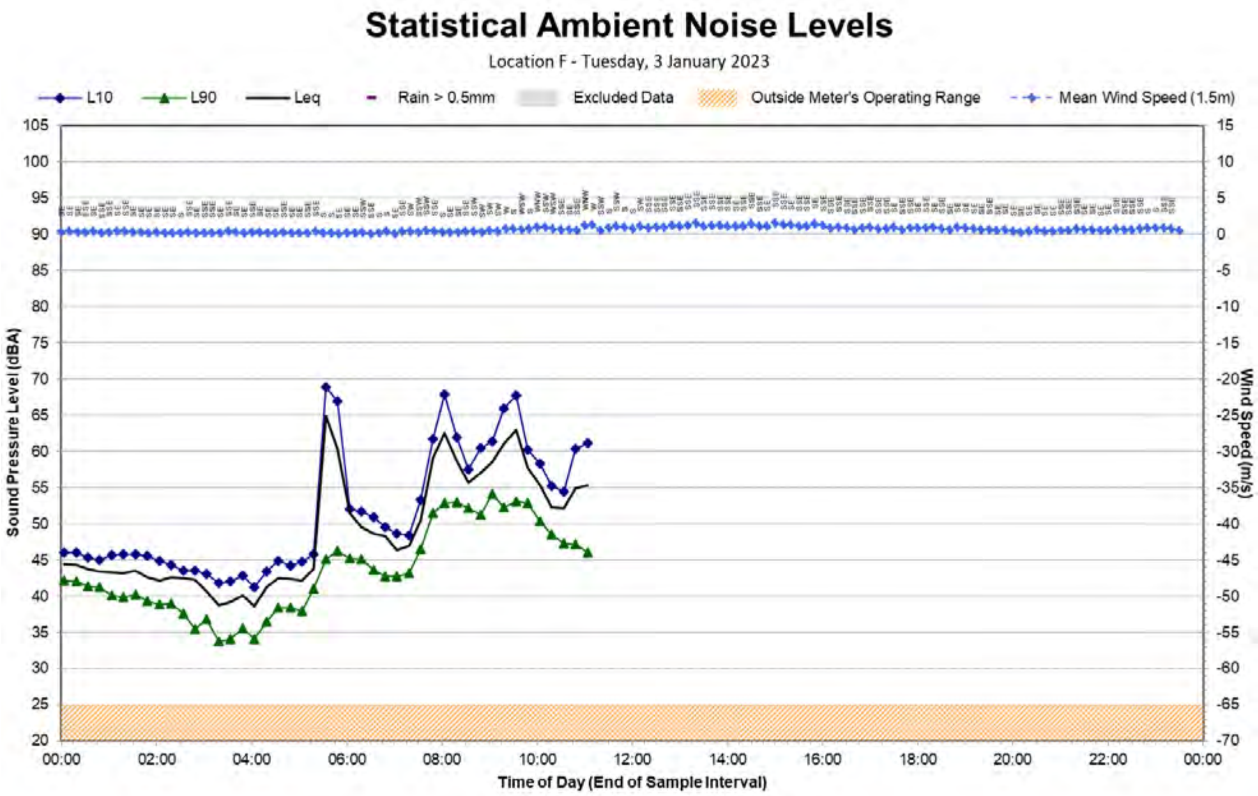


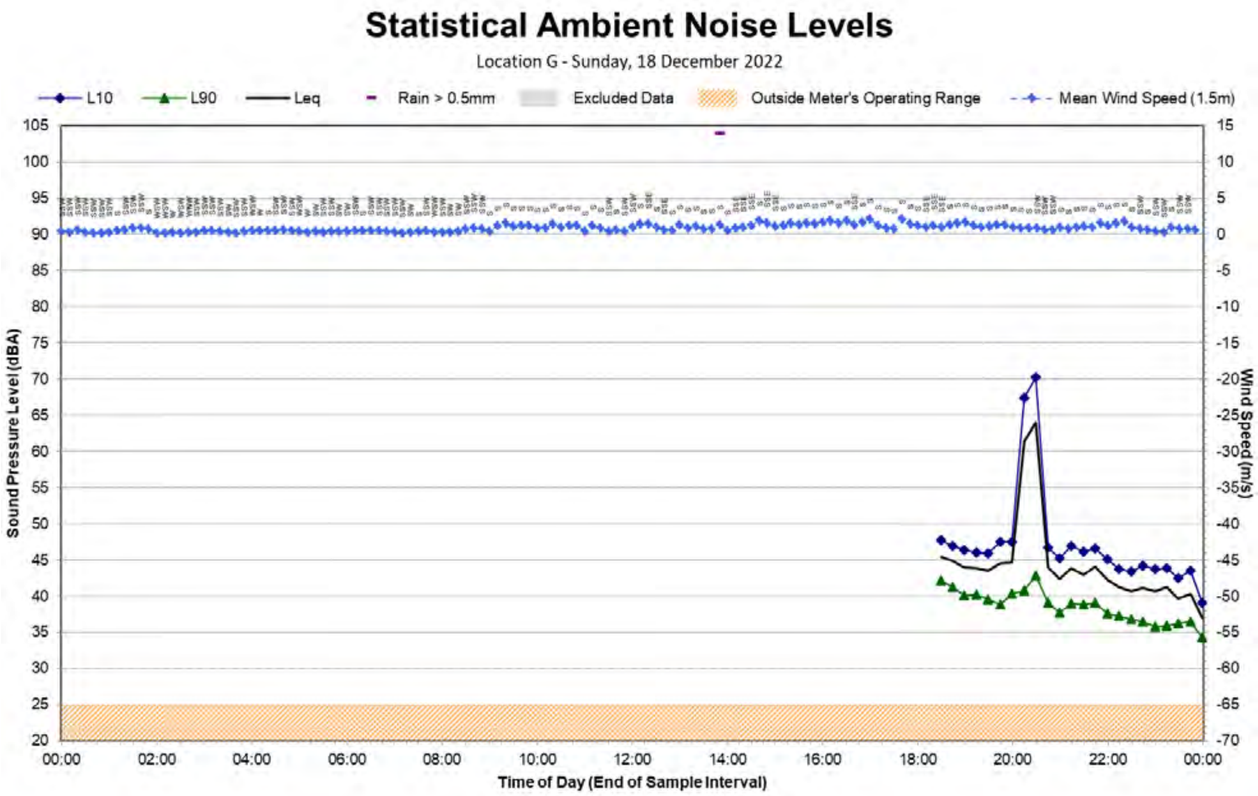


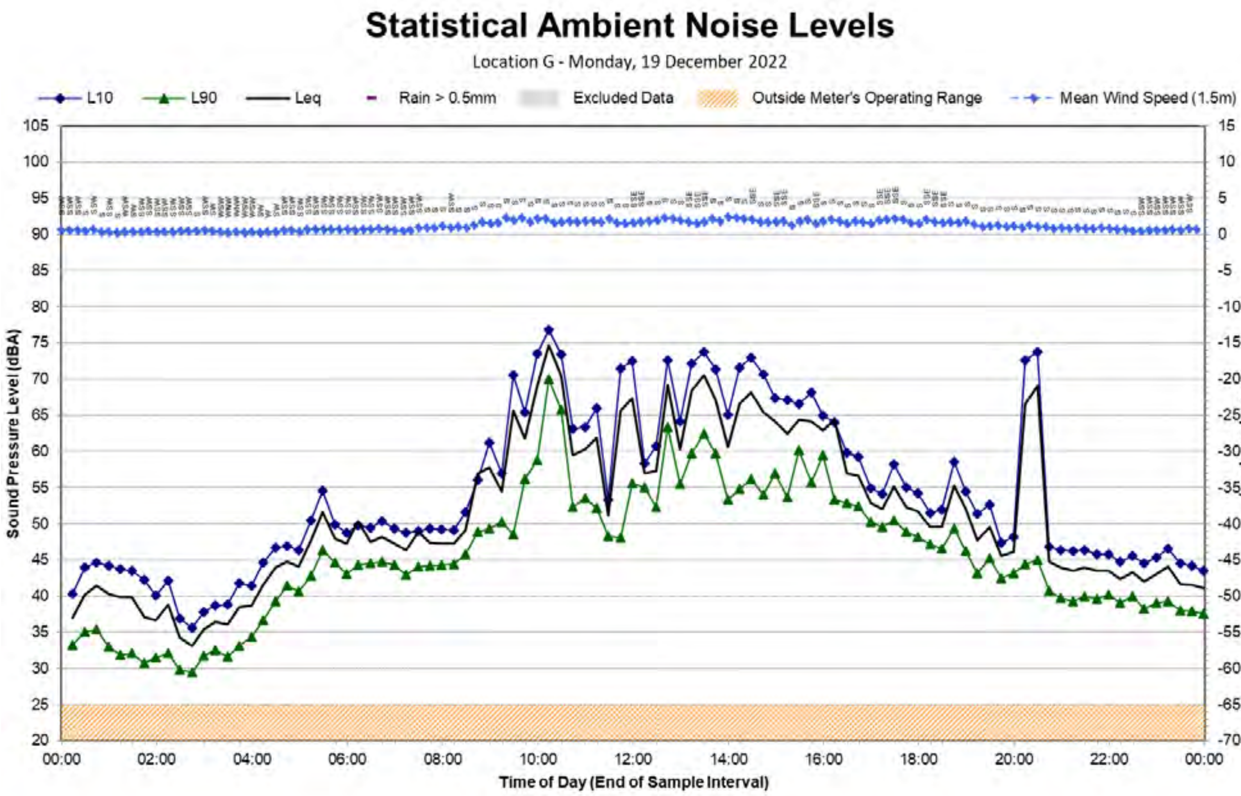
Statistical Ambient Noise Levels
Location F - Sunday, 1 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

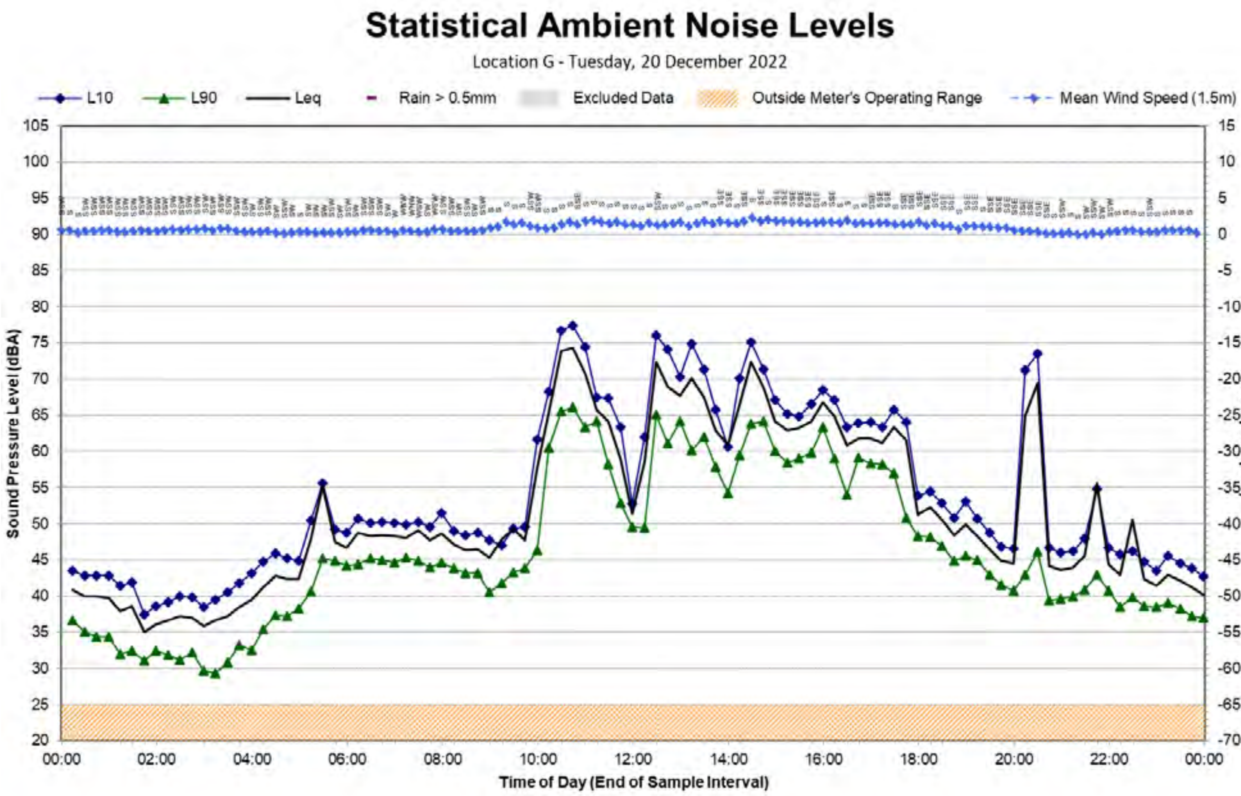
Statistical Ambient Noise Levels
Location F - Monday, 2 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Tuesday, 3 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

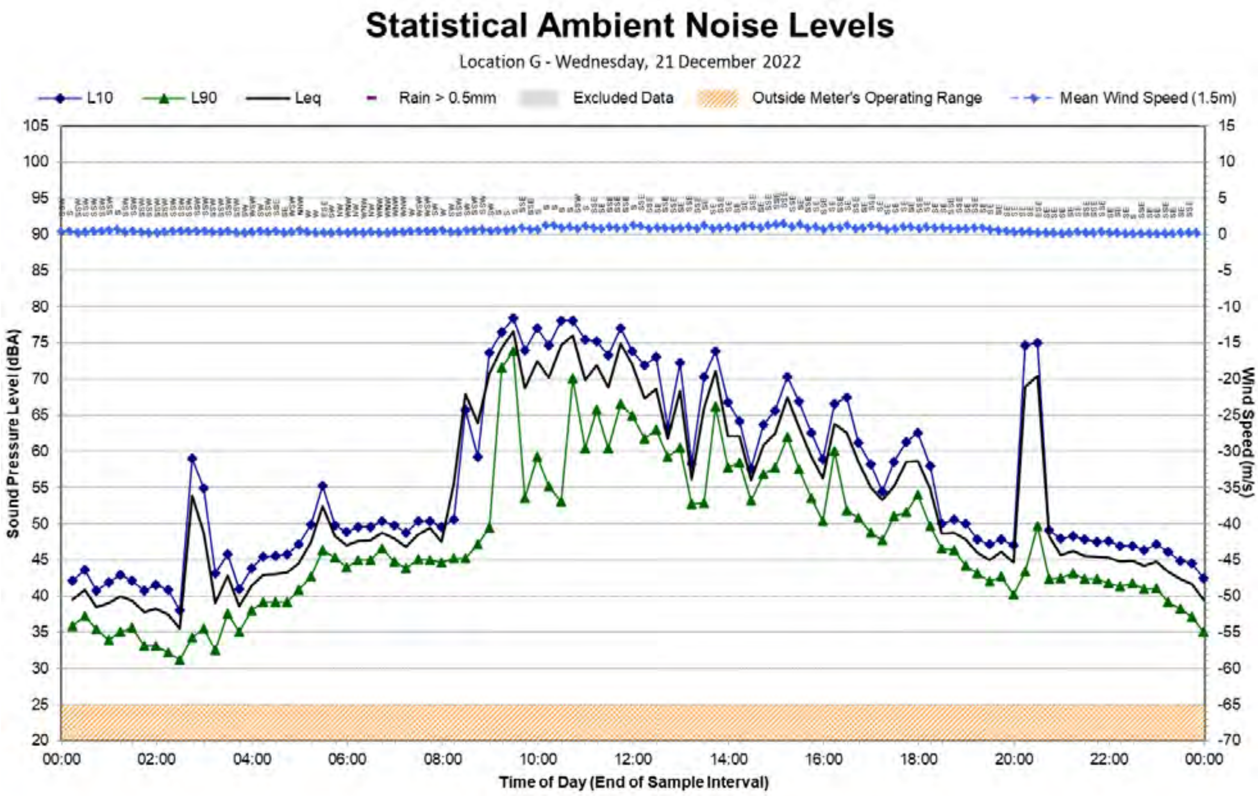

Statistical Ambient Noise Levels
Location G - Sunday, 18 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

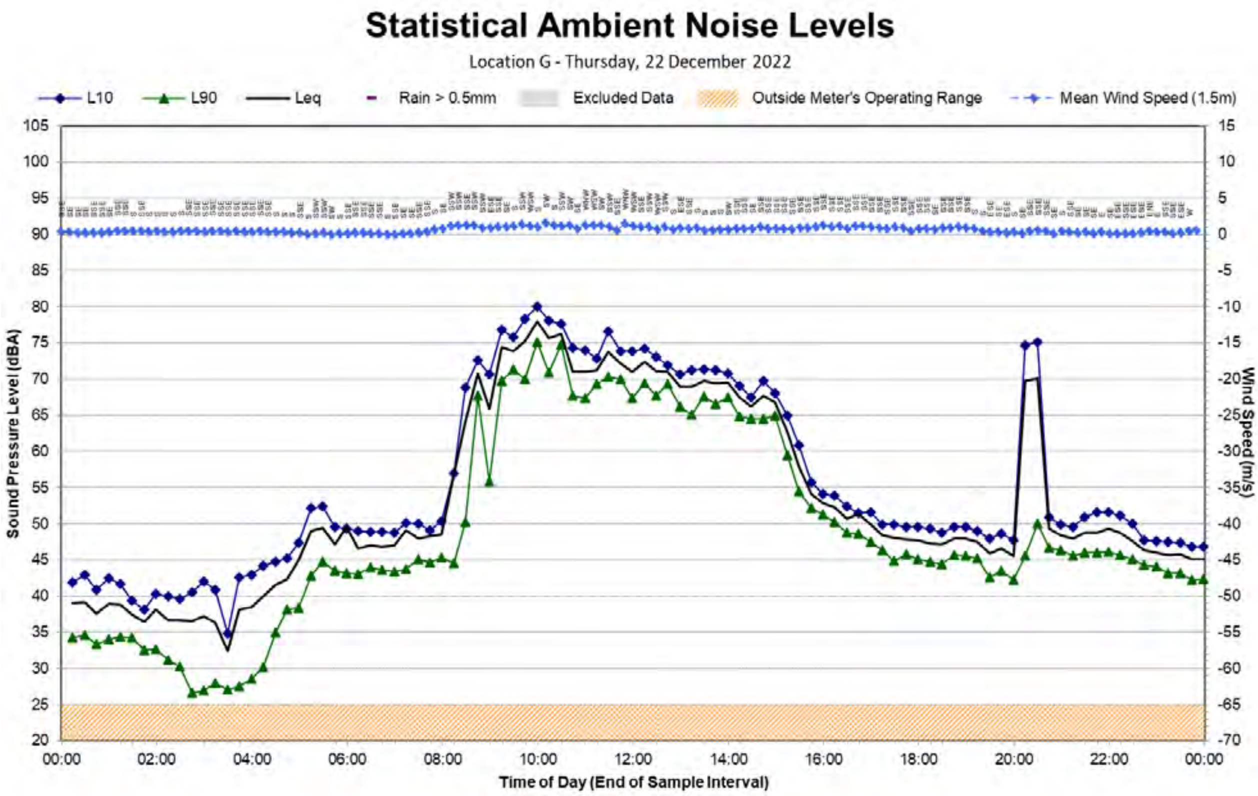


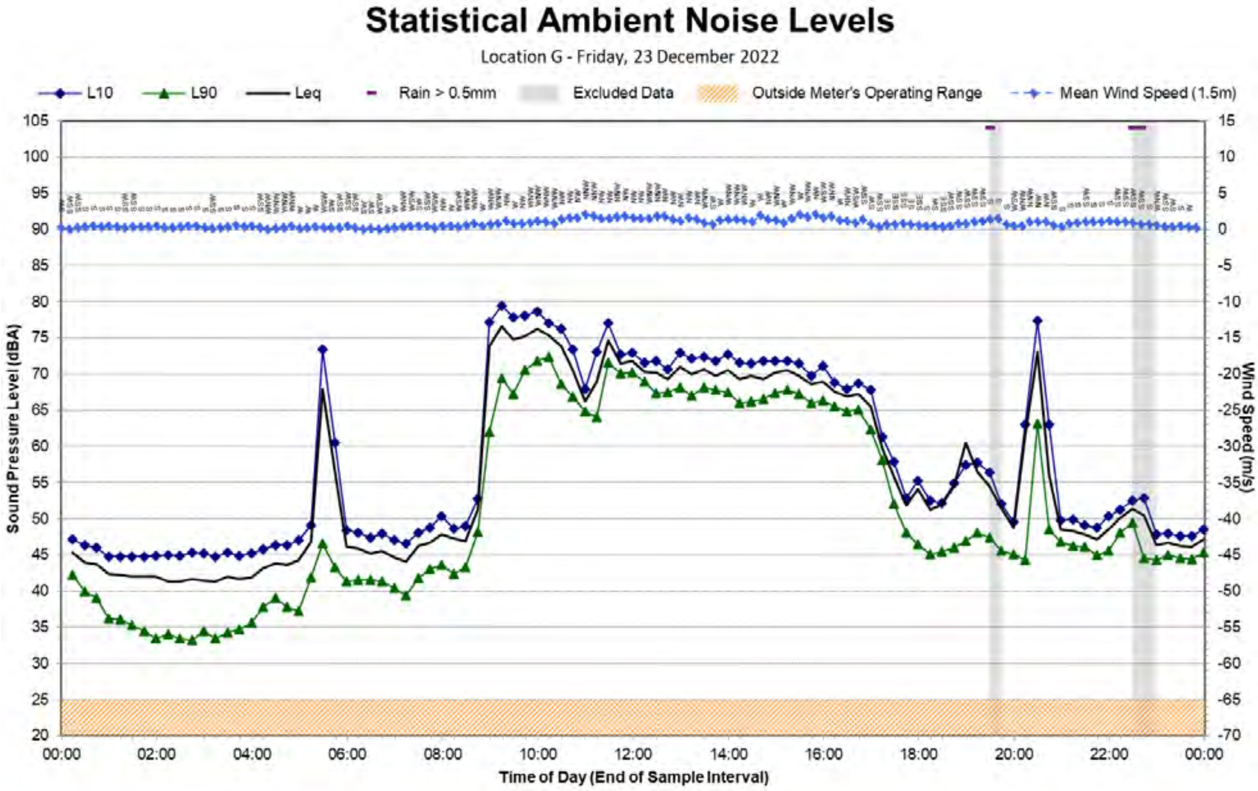
Statistical Ambient Noise Levels
Location G - Monday, 19 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

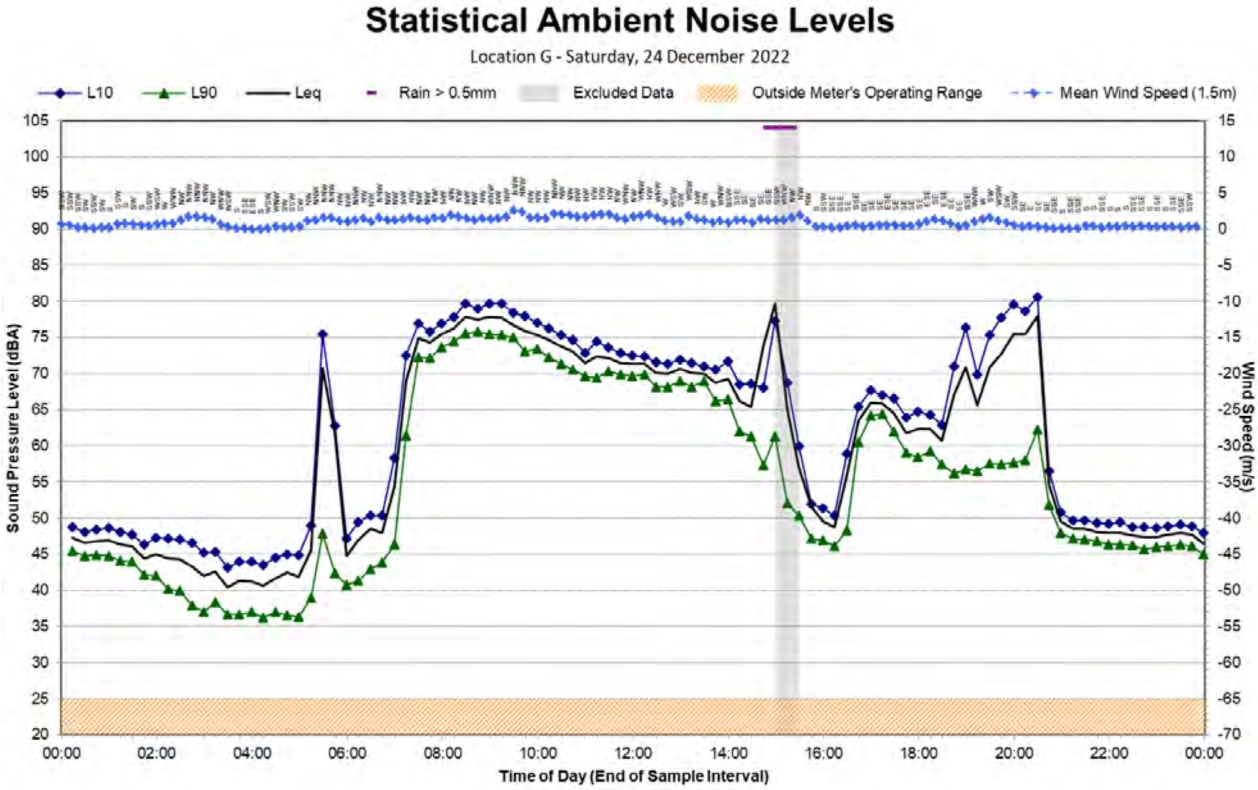



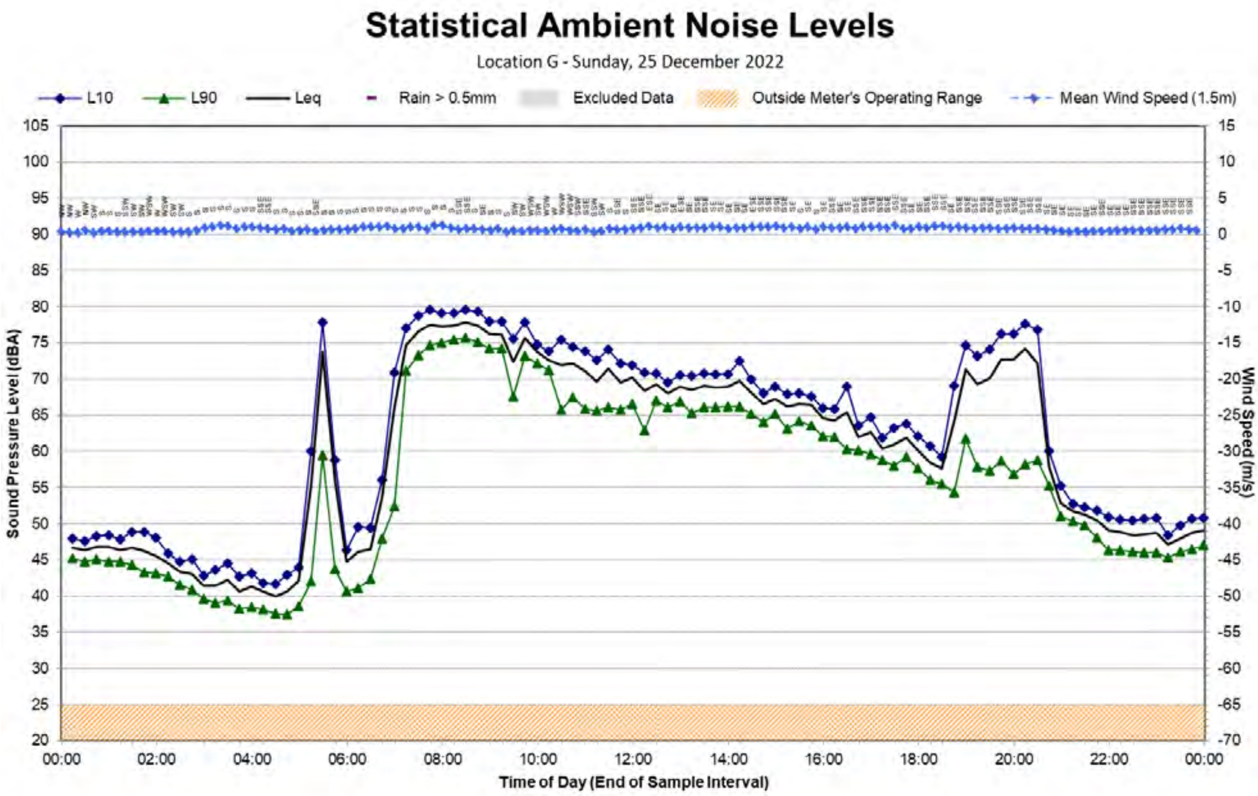
Statistical Ambient Noise Levels
Location G - Tuesday, 20 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

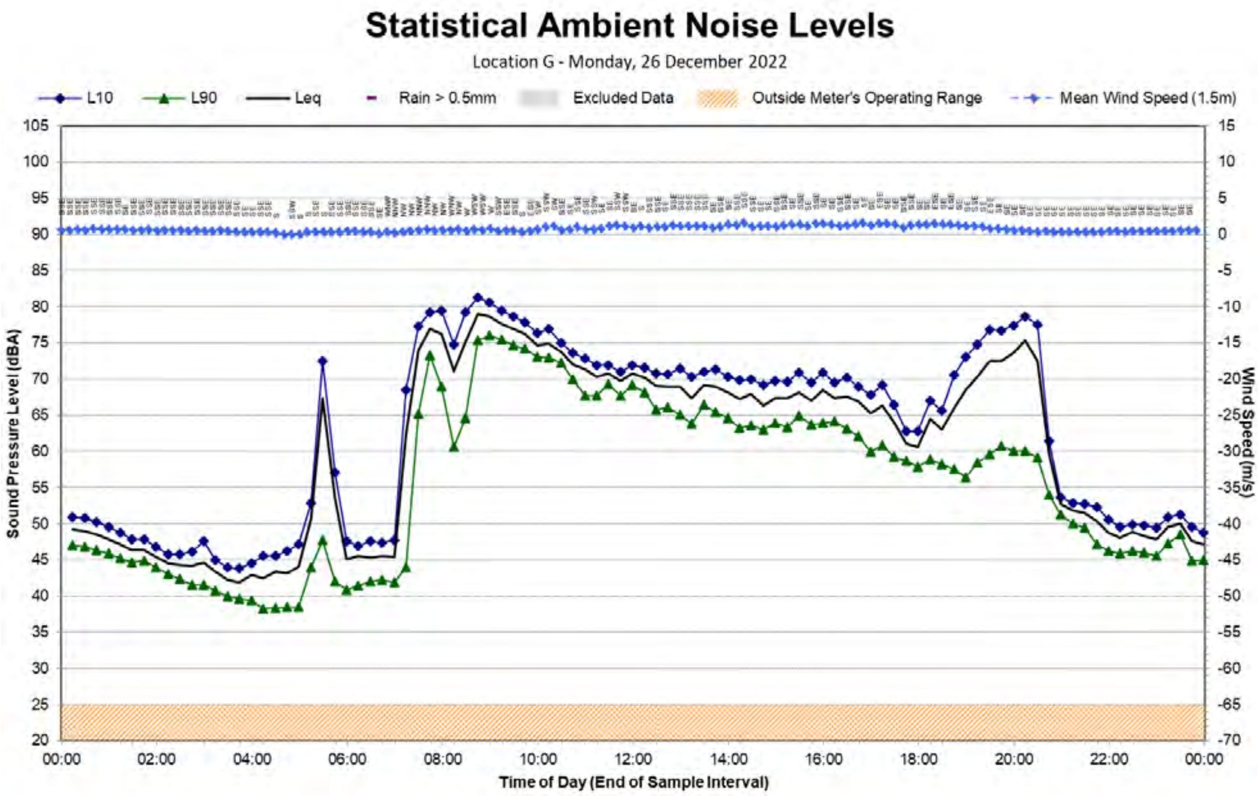

Statistical Ambient Noise Levels
Location G - Wednesday, 21 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

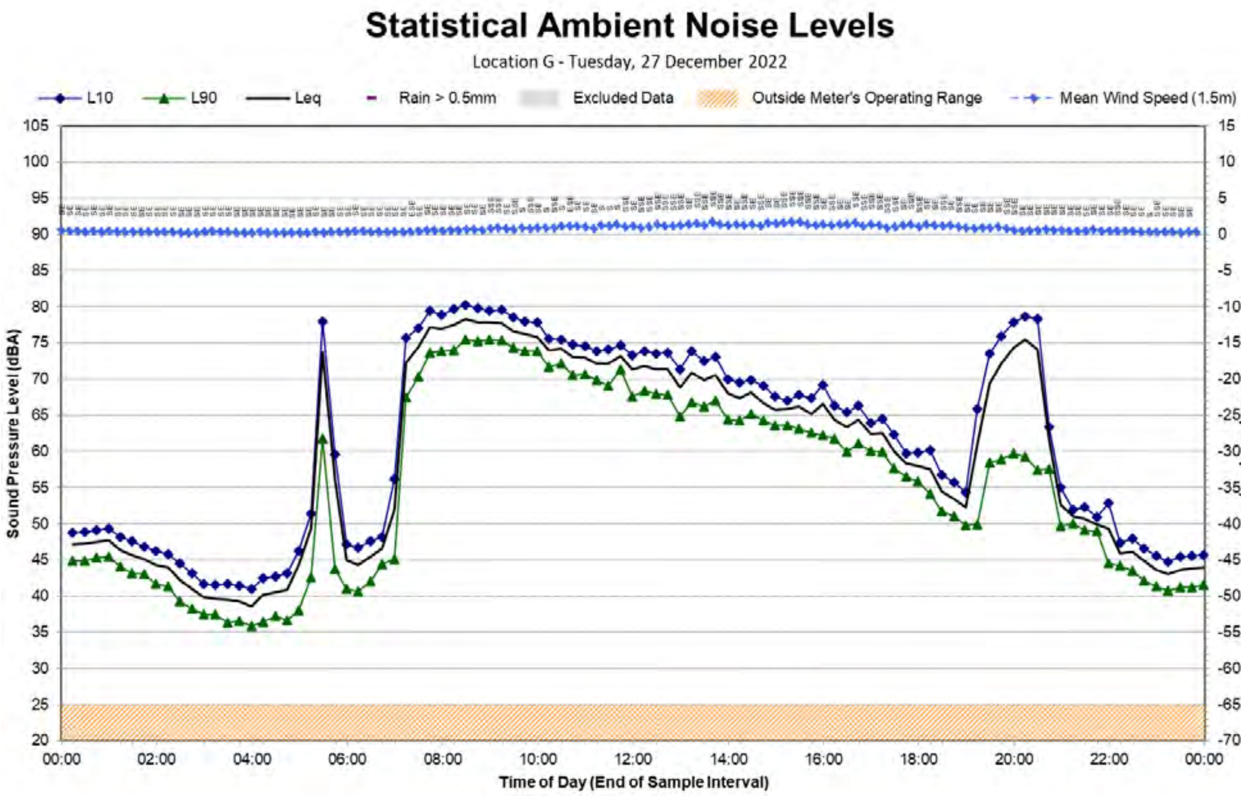

Statistical Ambient Noise Levels
Location G - Thursday, 22 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

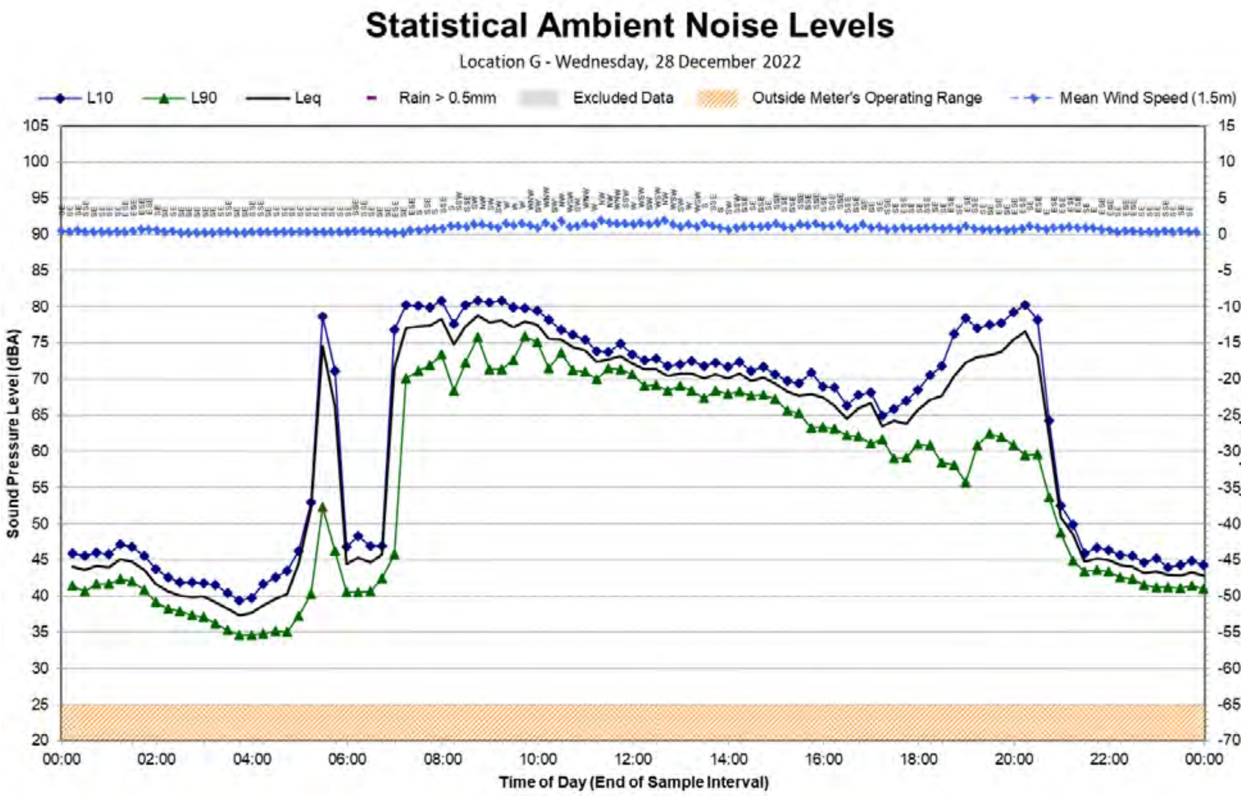

Statistical Ambient Noise Levels
Location G - Friday, 23 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

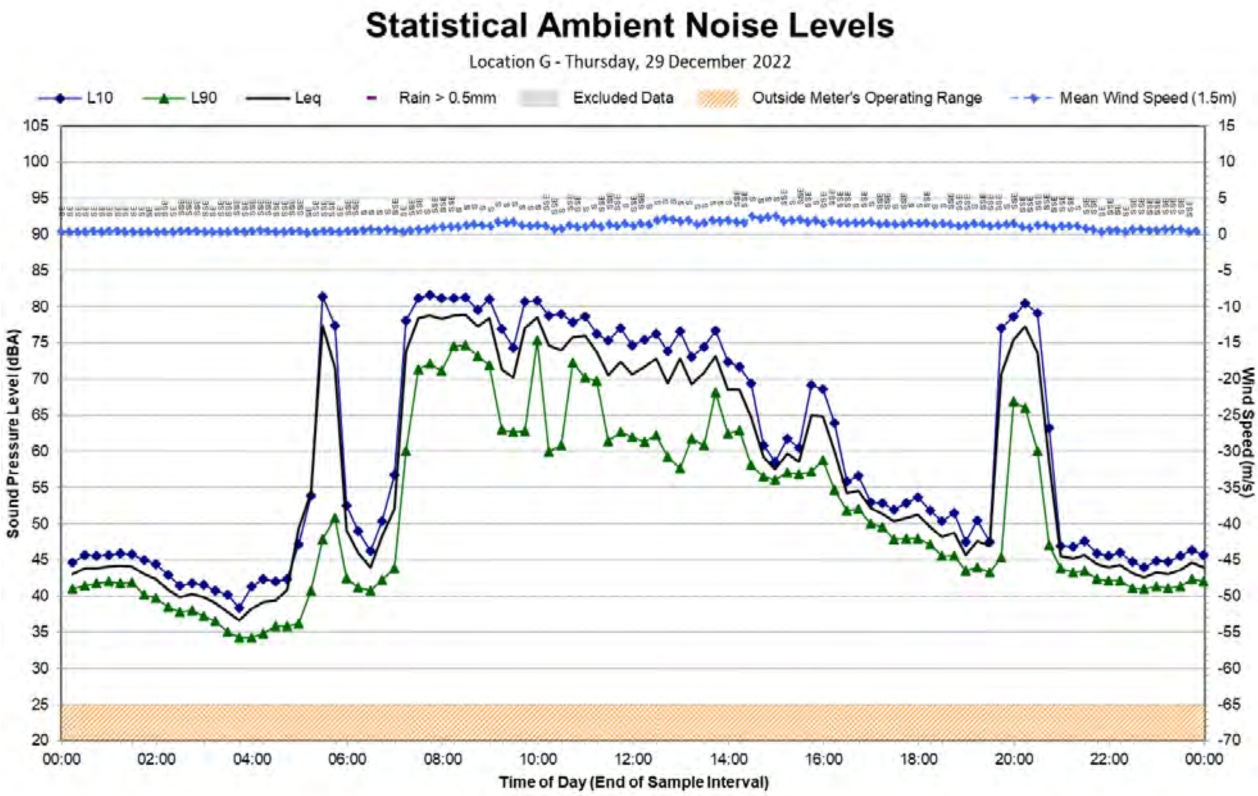

Statistical Ambient Noise Levels
Location G - Saturday, 24 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Sunday, 25 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

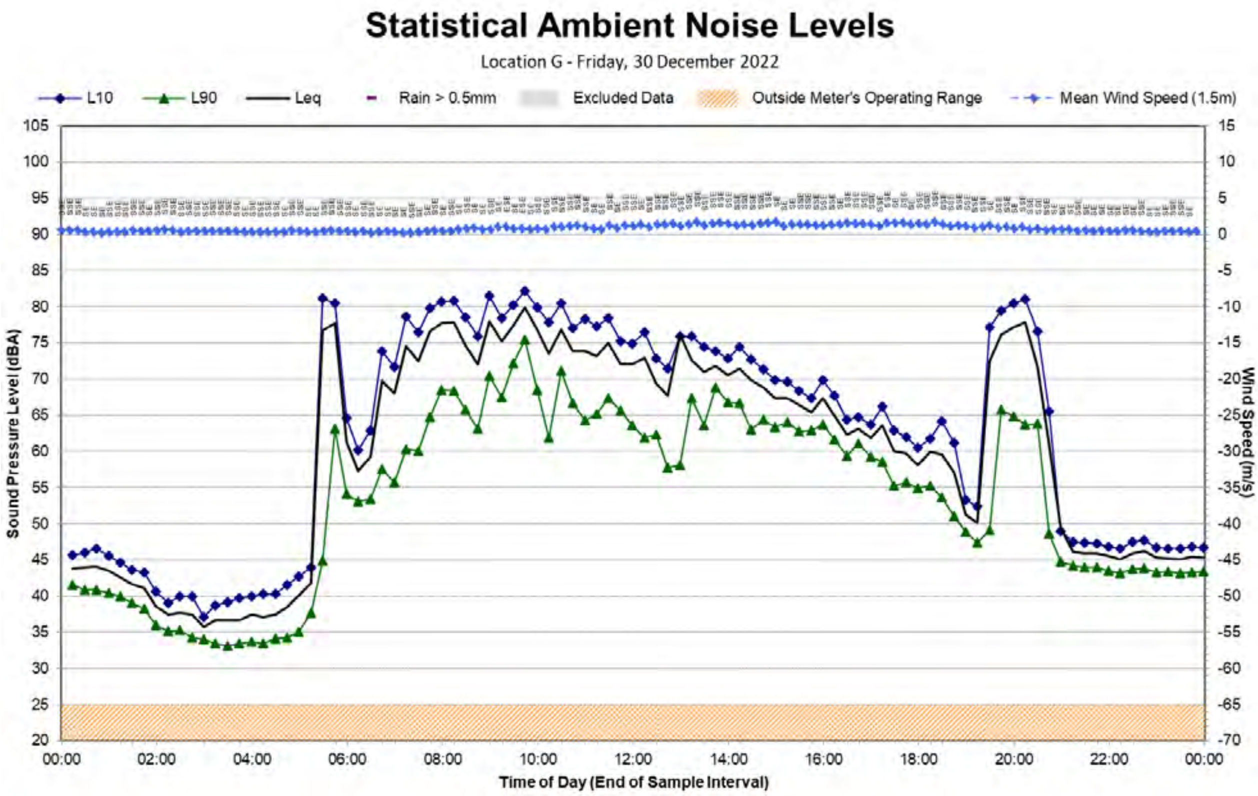

Statistical Ambient Noise Levels
Location G - Monday, 26 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Tuesday, 27 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

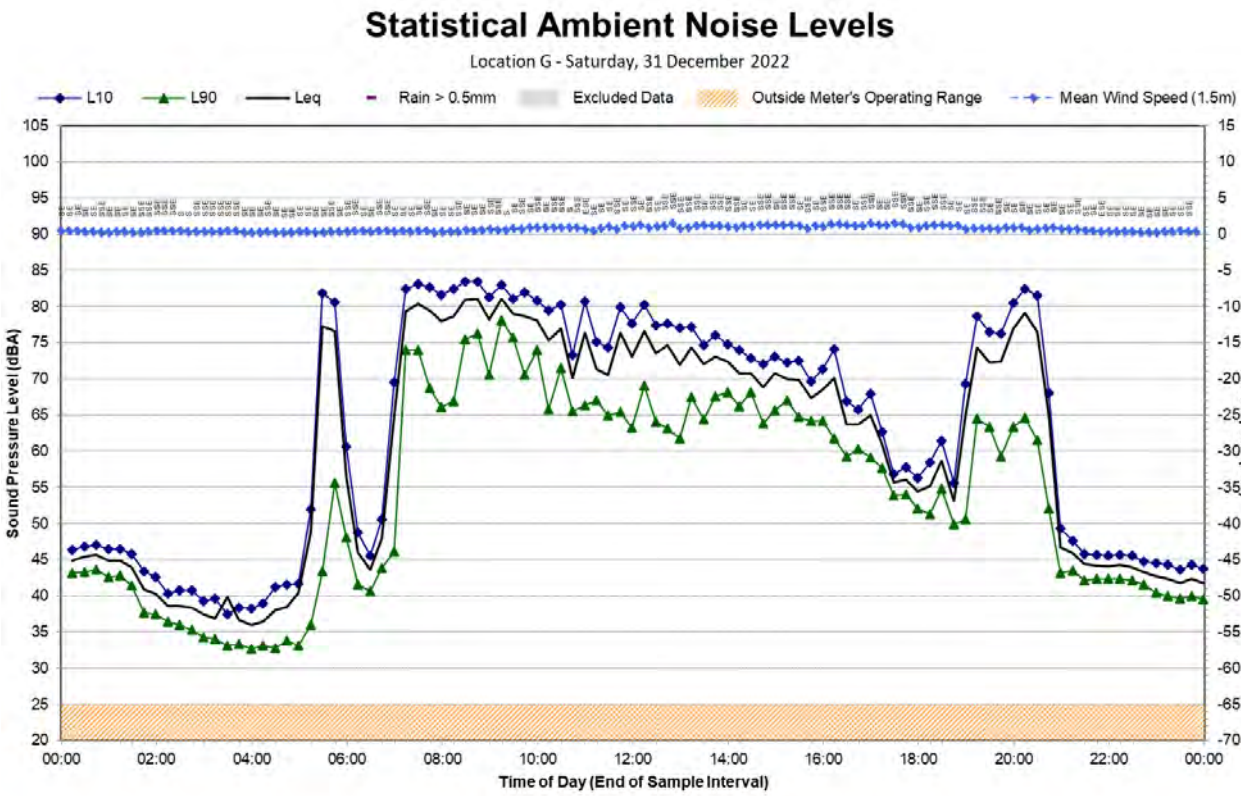

Statistical Ambient Noise Levels
Location G - Wednesday, 28 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

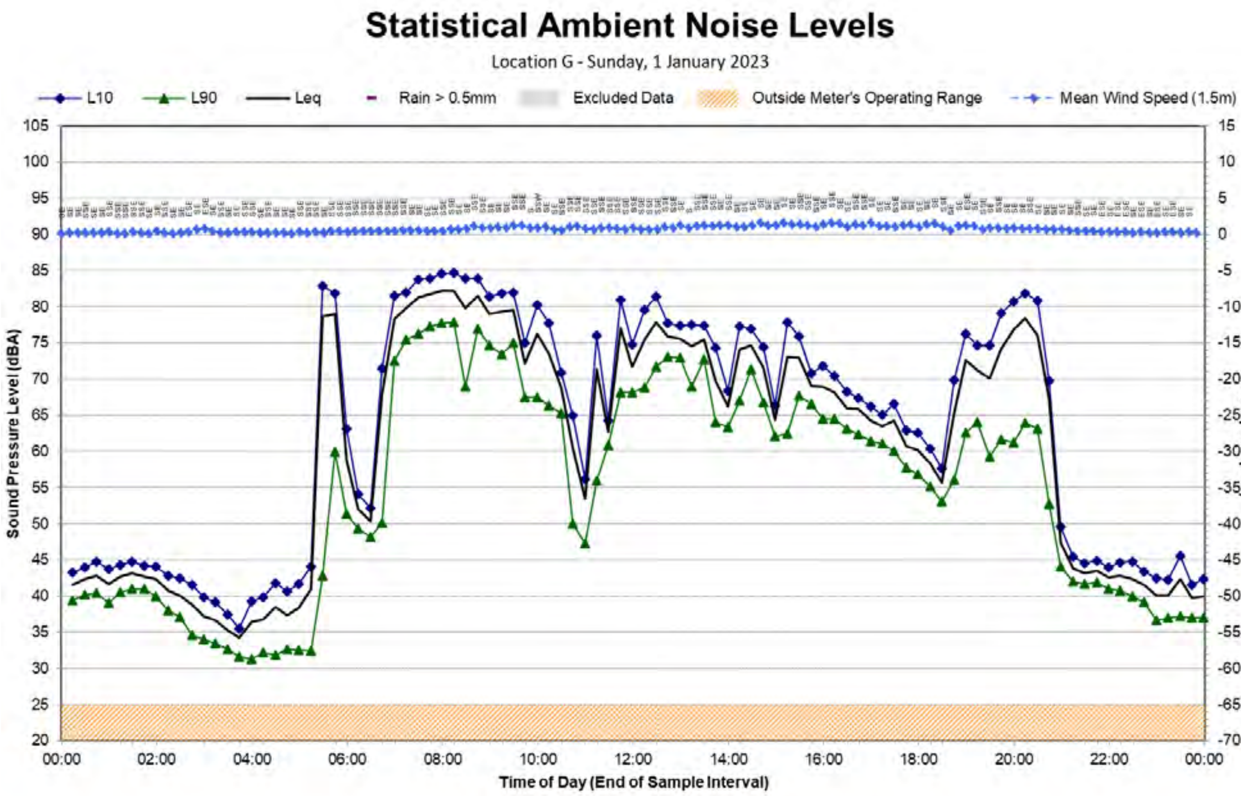


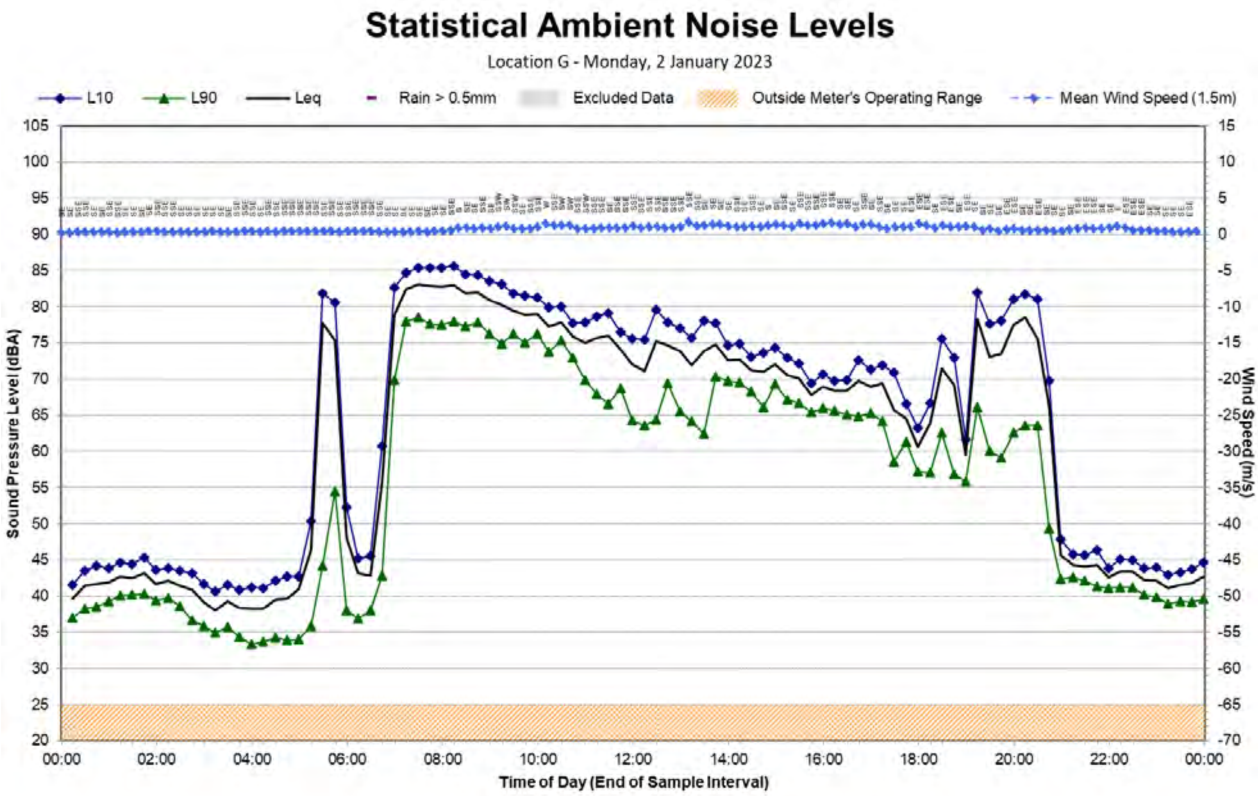
Statistical Ambient Noise Levels
Location G - Thursday, 29 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

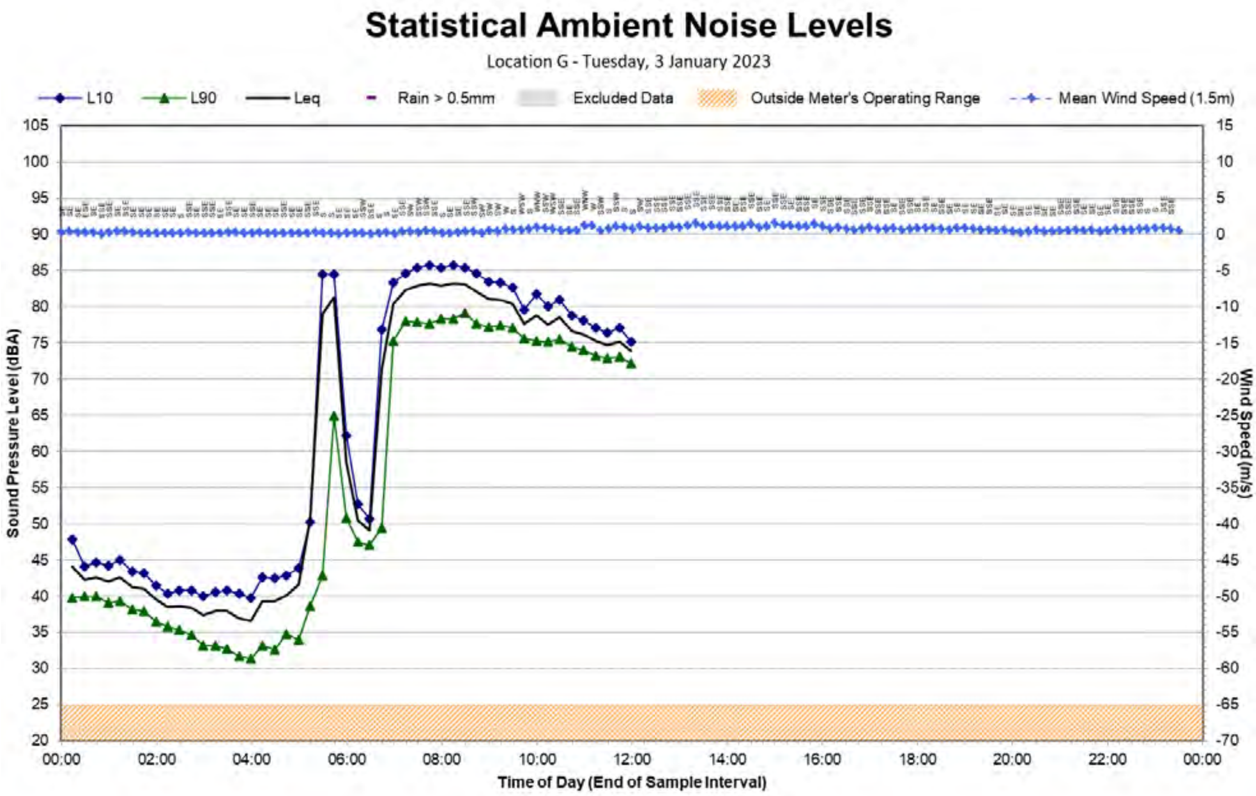



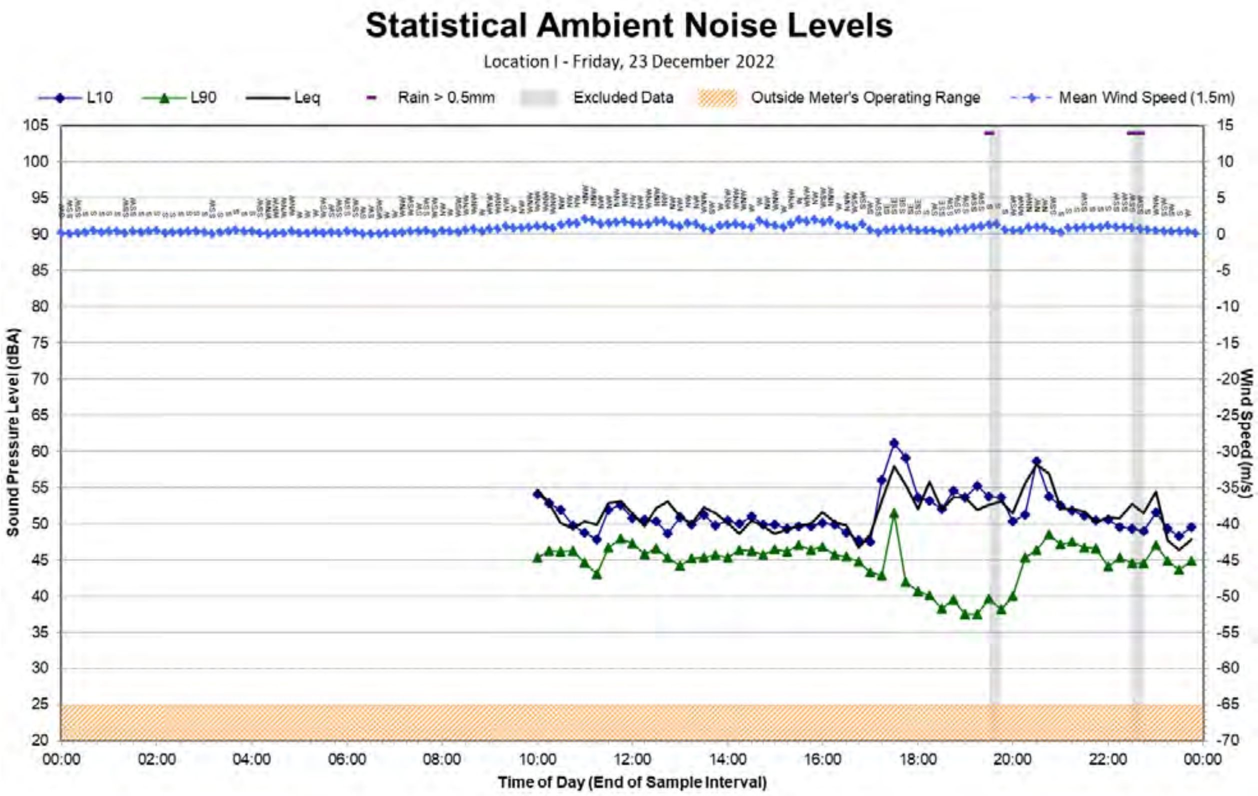
Statistical Ambient Noise Levels
Location G - Friday, 30 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

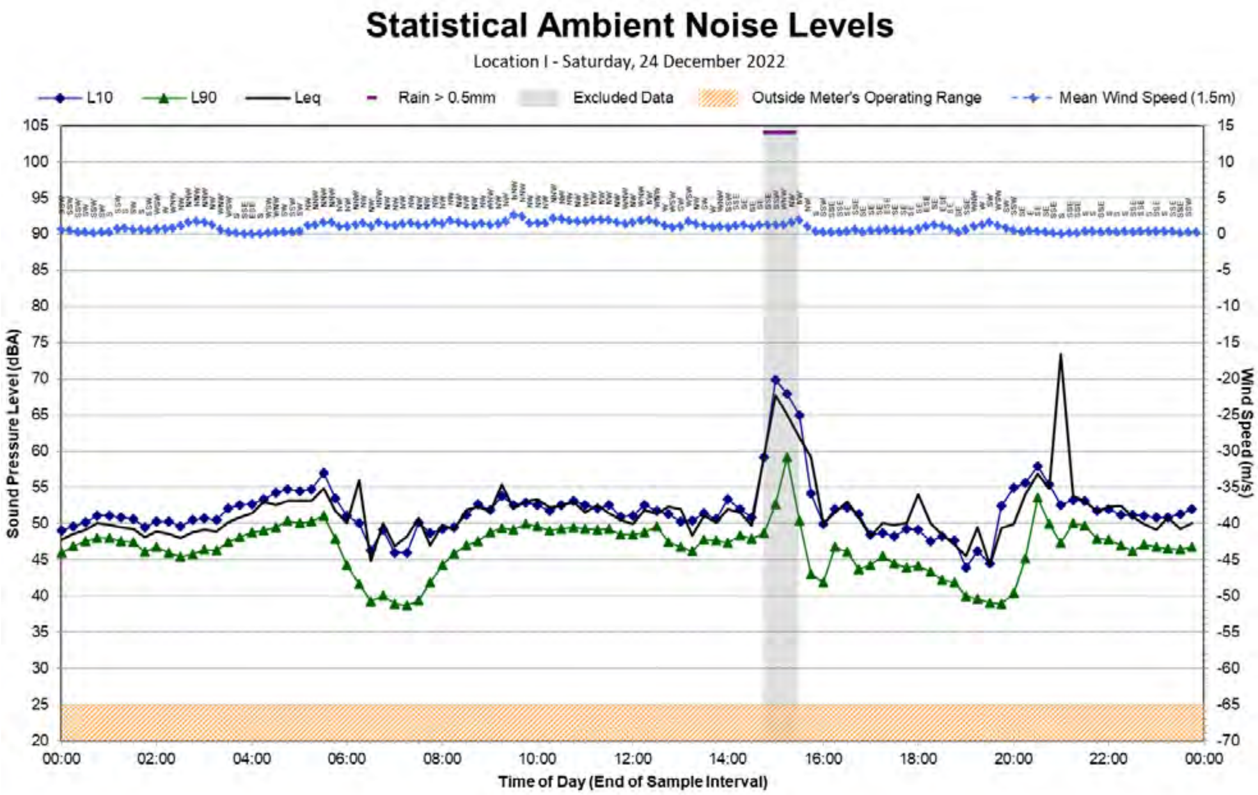

Statistical Ambient Noise Levels
Location G - Saturday, 31 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

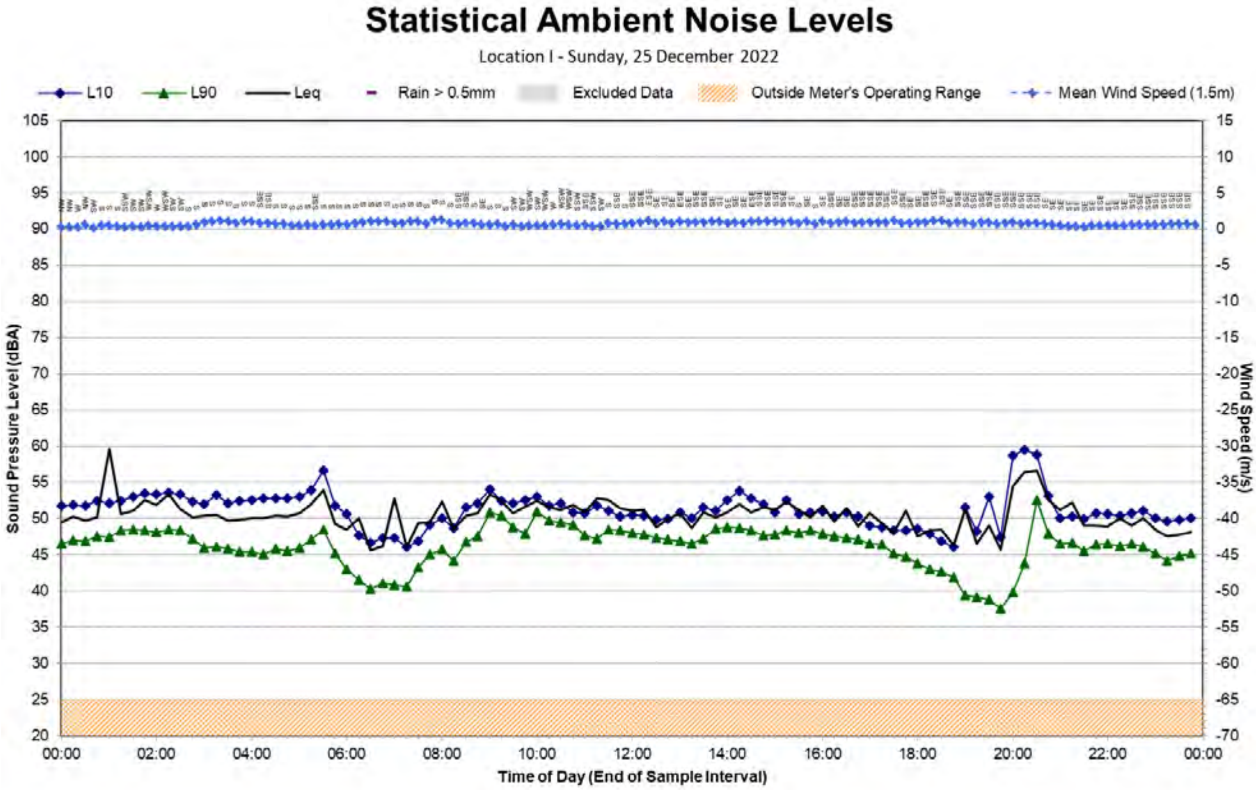

Statistical Ambient Noise Levels
Location G - Sunday, 1 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

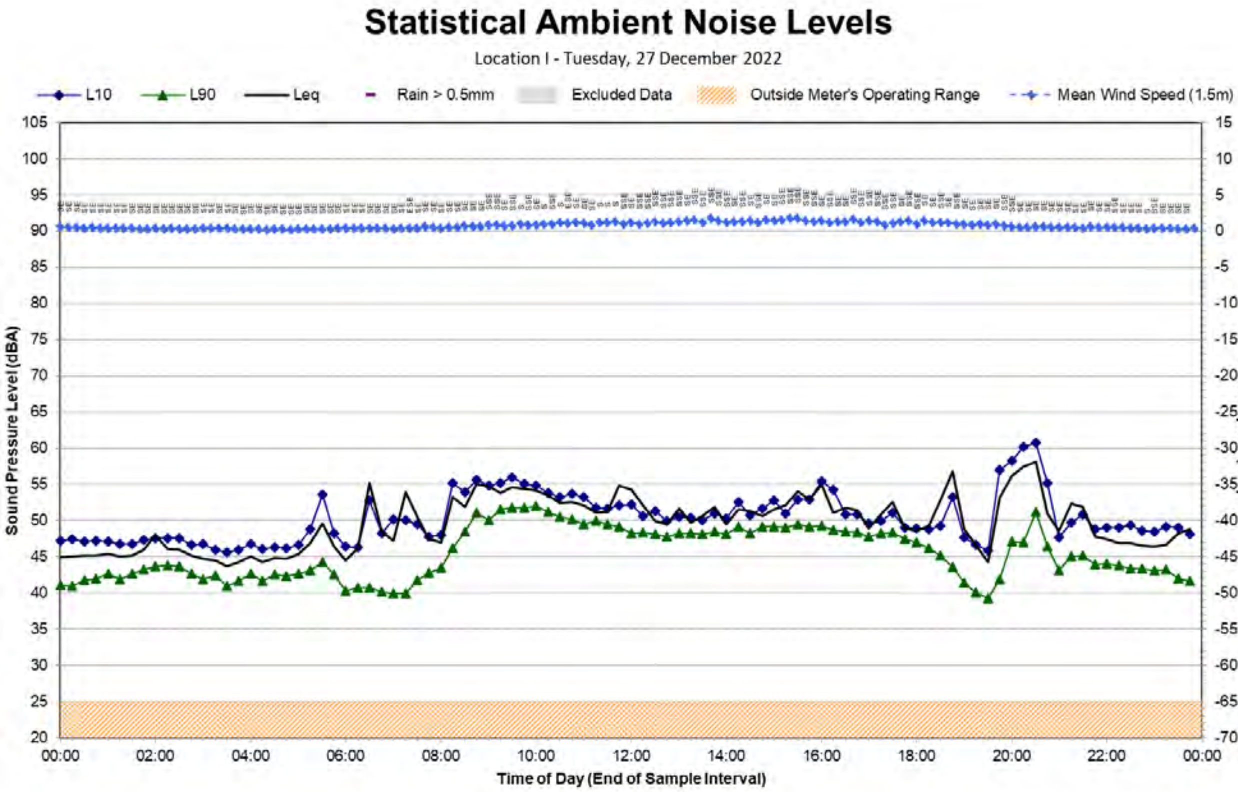

Statistical Ambient Noise Levels
Location G - Monday, 2 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Tuesday, 3 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Friday, 23 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

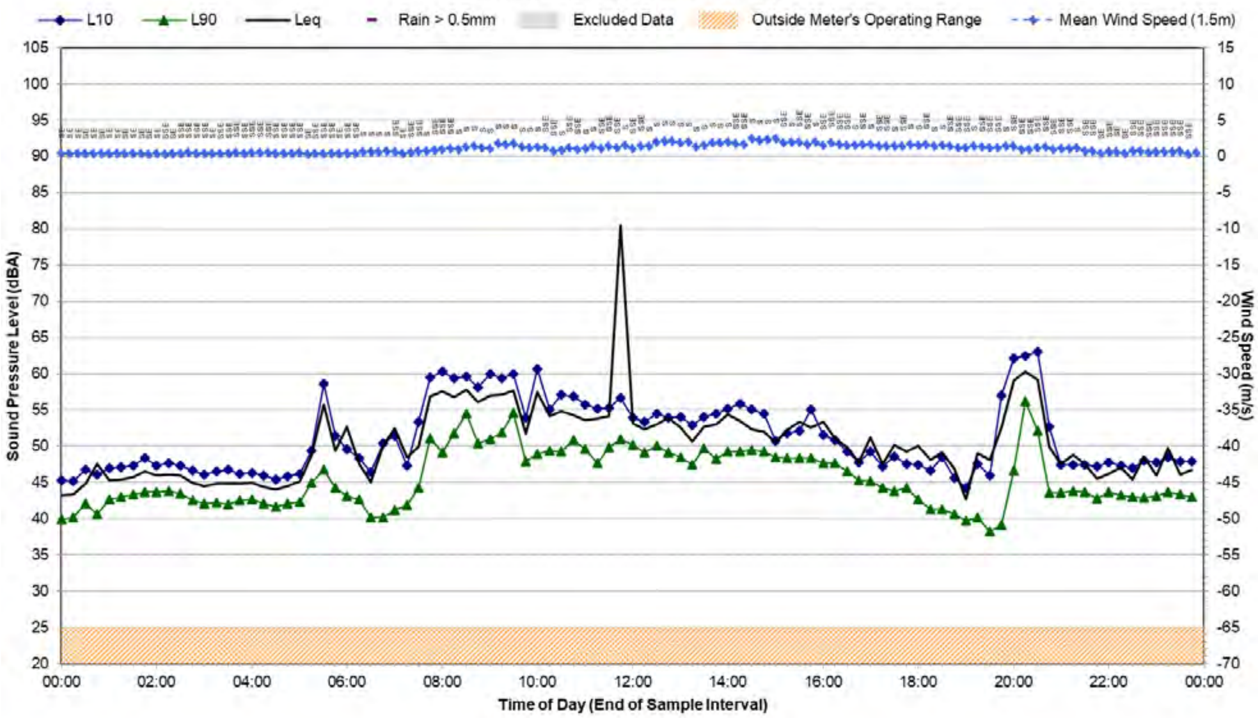

Statistical Ambient Noise Levels
Location I - Saturday, 24 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Sunday, 25 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Tuesday, 27 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

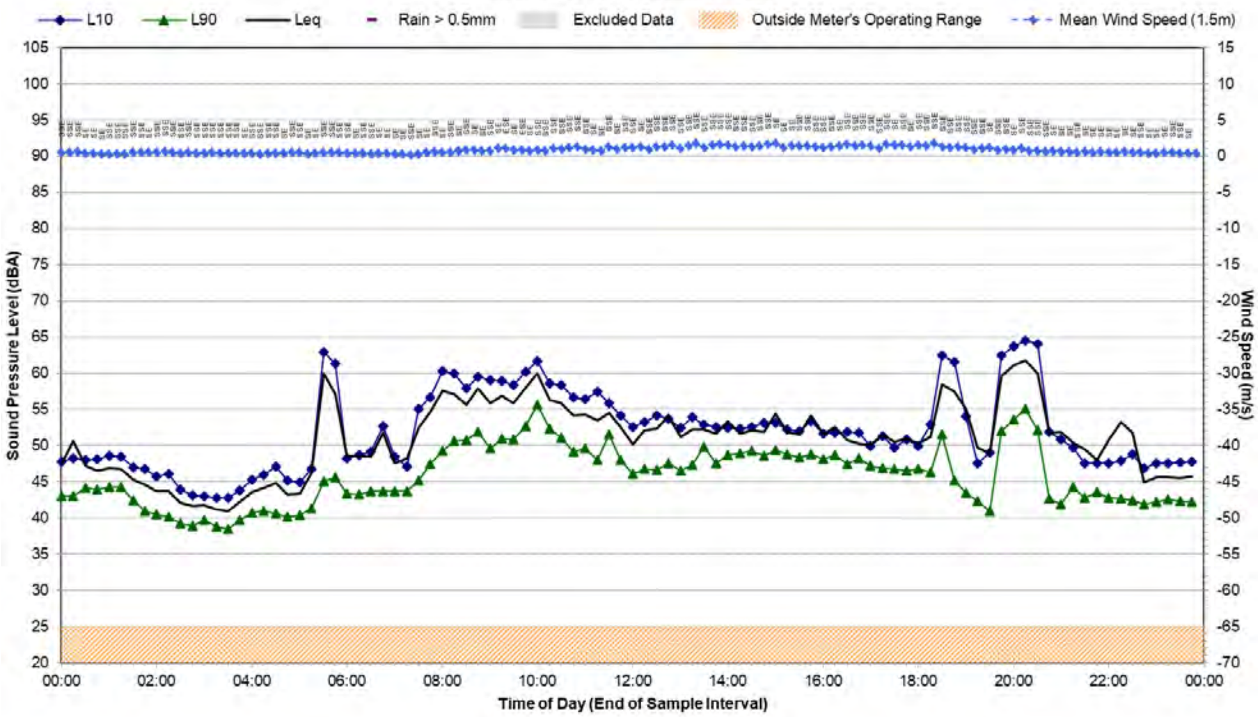
## Statistical Ambient Noise Levels

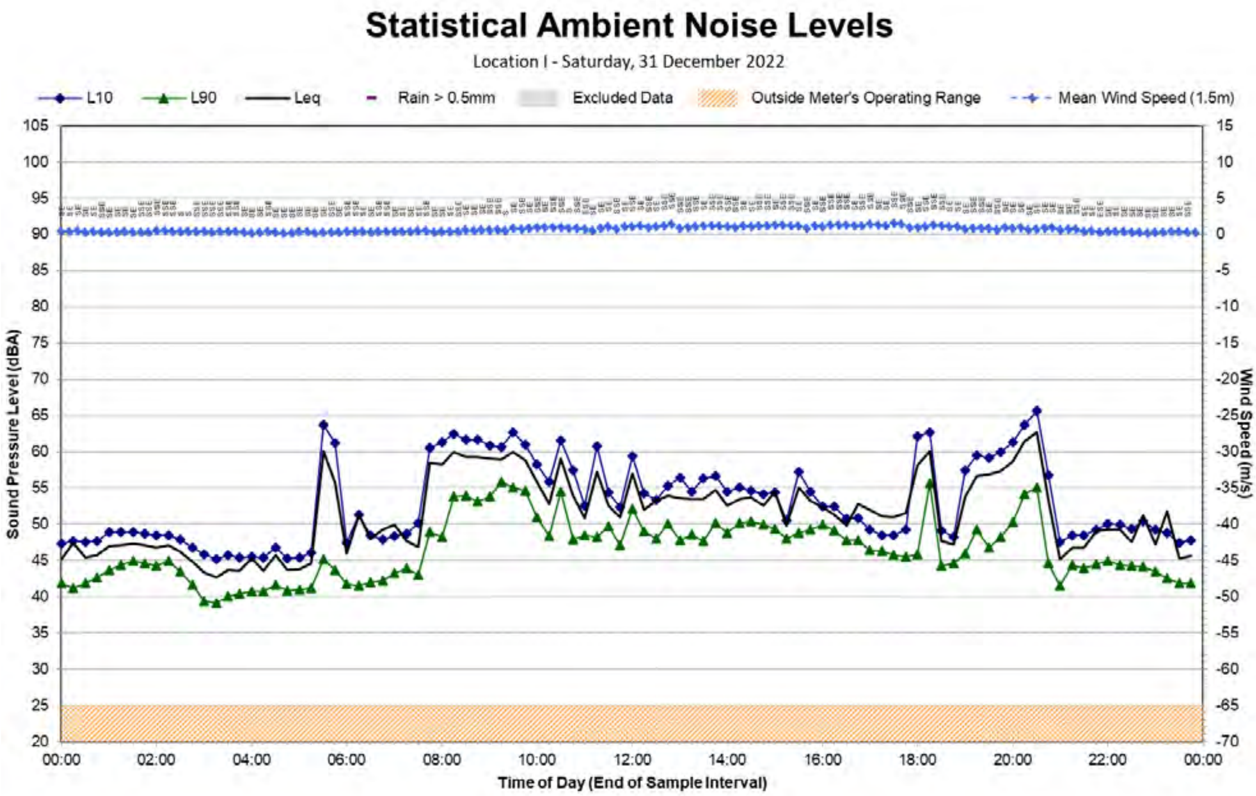
Location I - Thursday, 29 December 2022

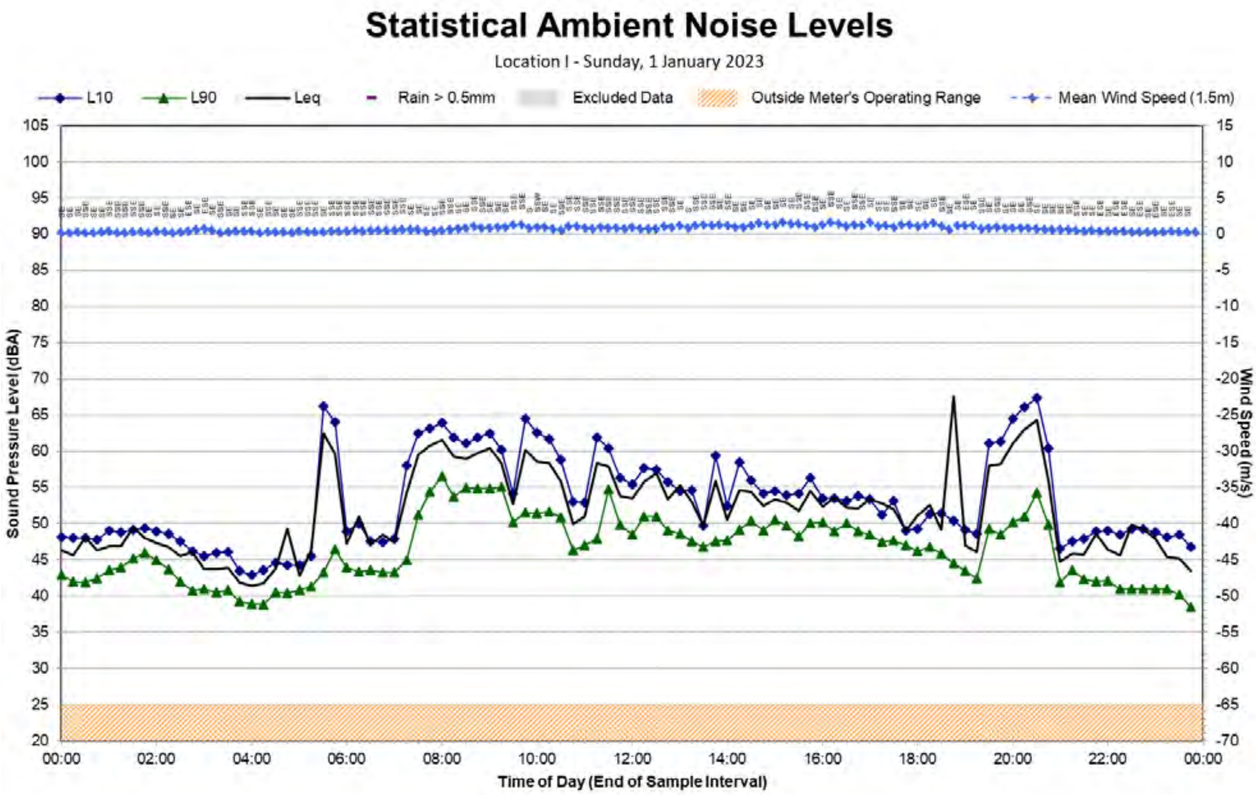


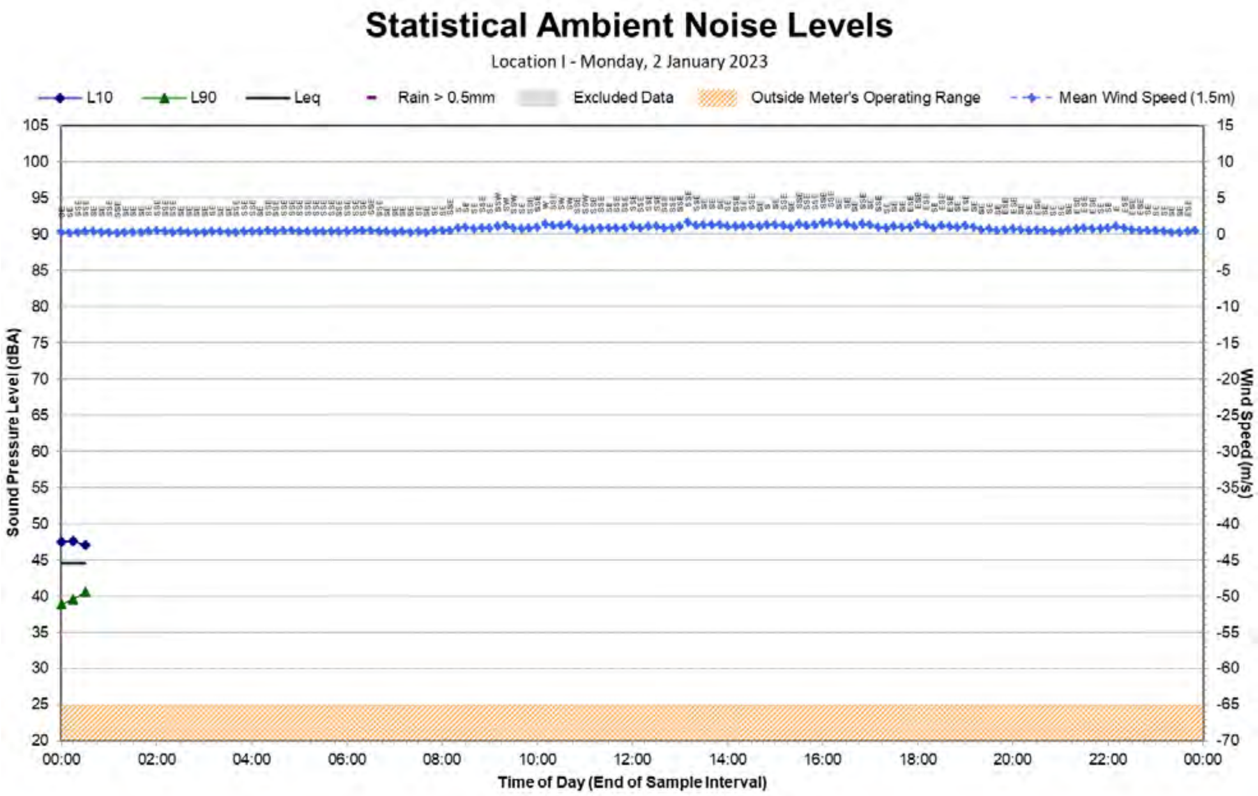

## Statistical Ambient Noise Levels

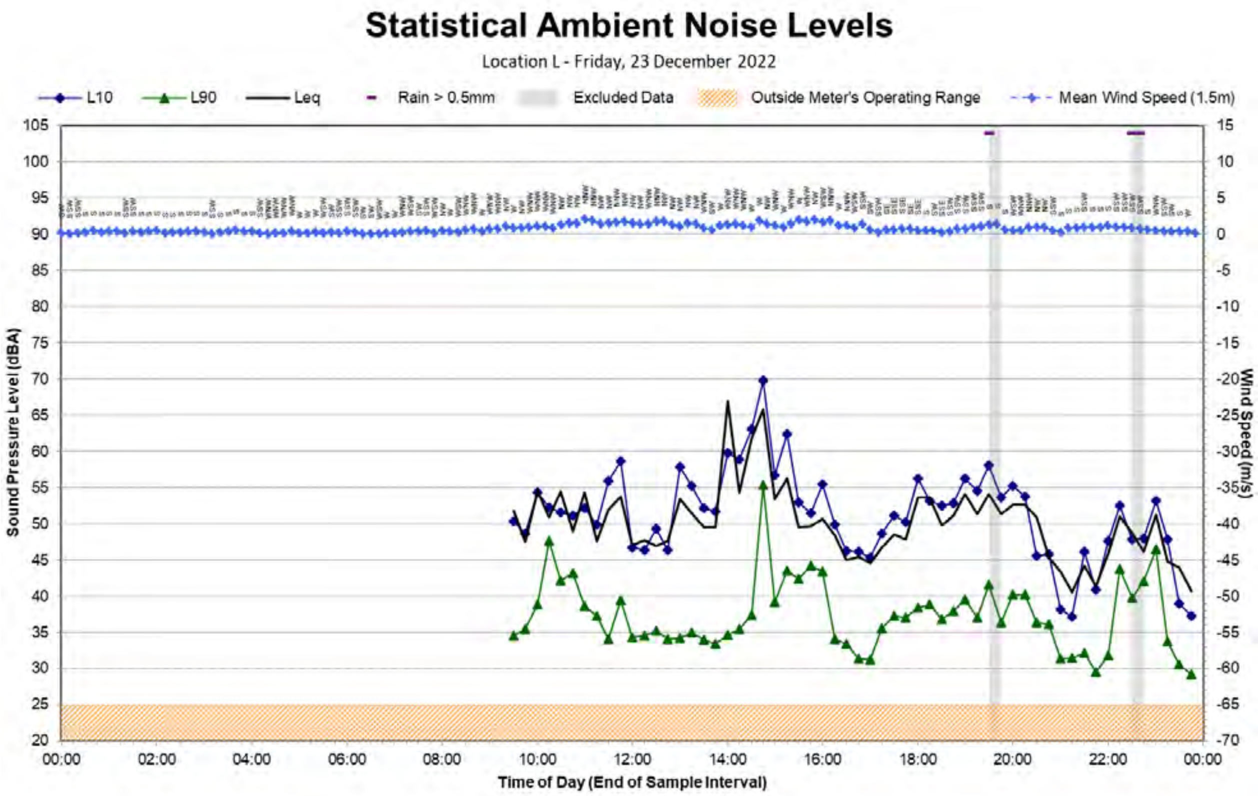
Location I - Friday, 30 December 2022

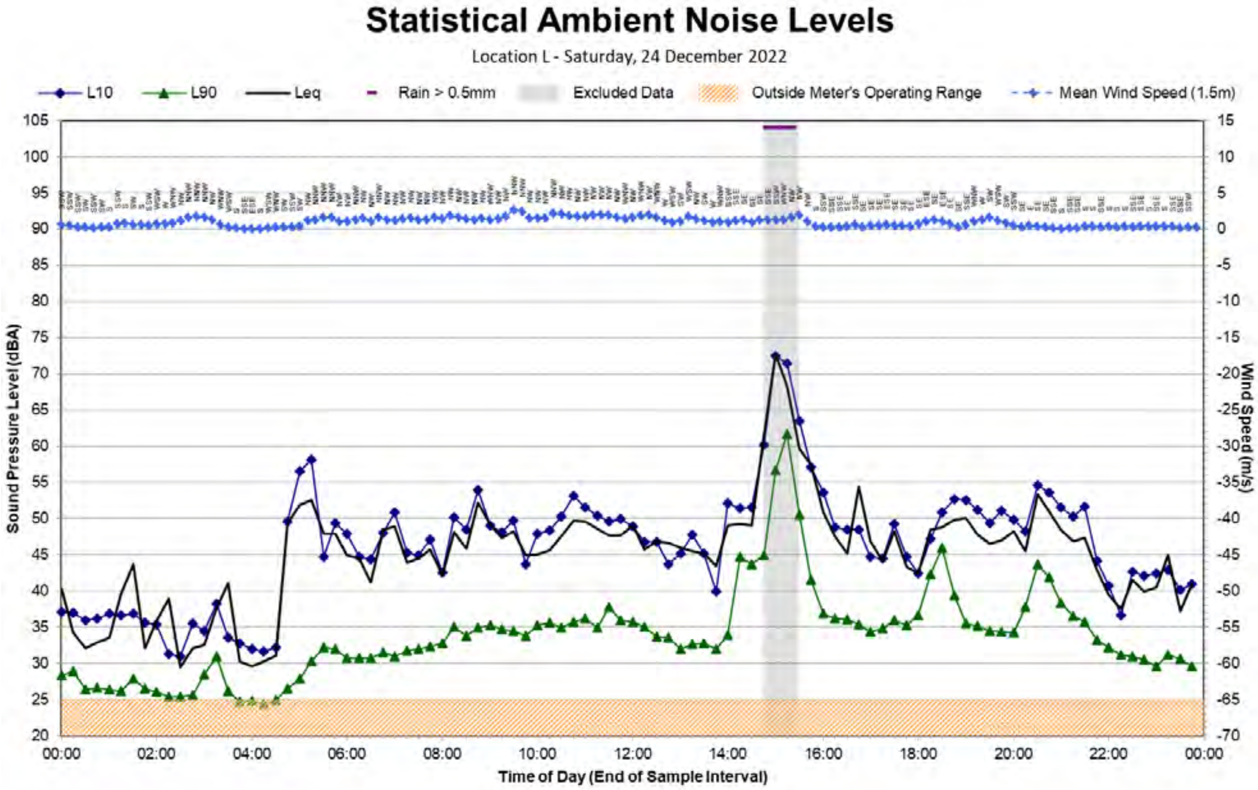


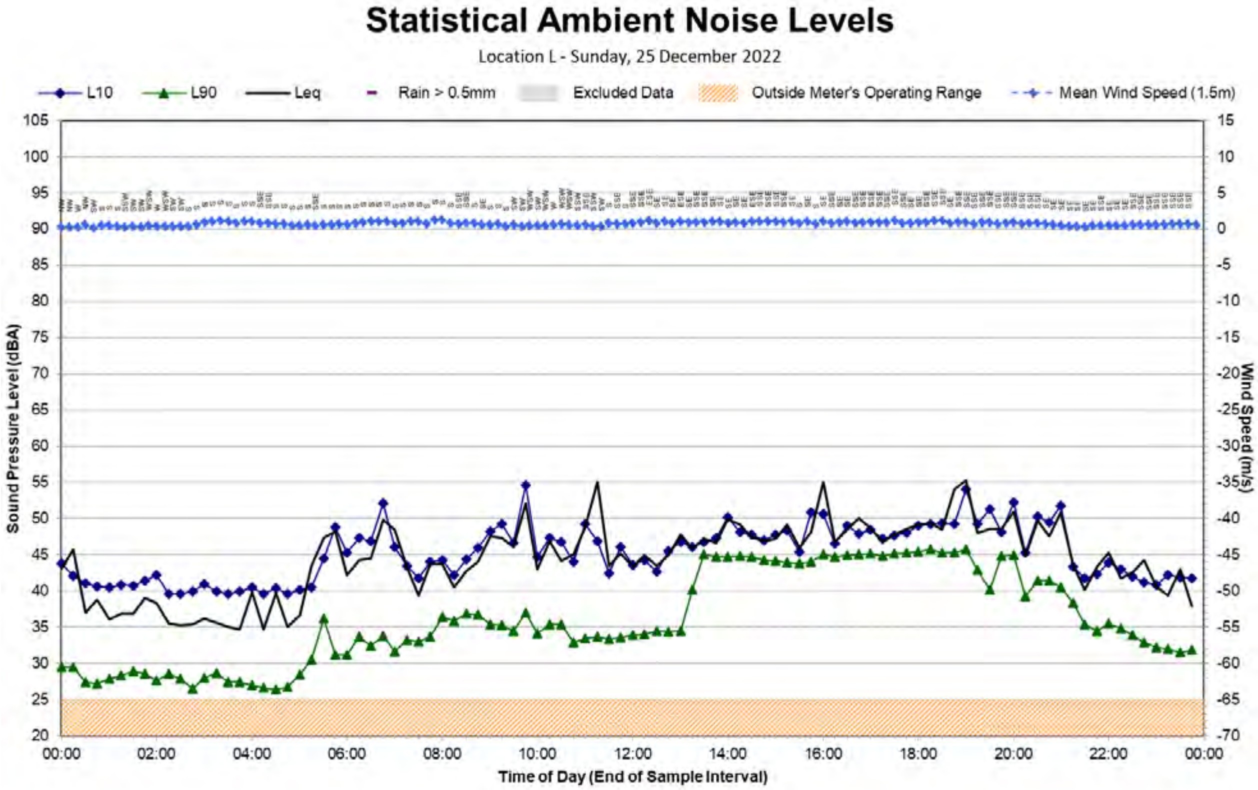

Statistical Ambient Noise Levels
Location I - Saturday, 31 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

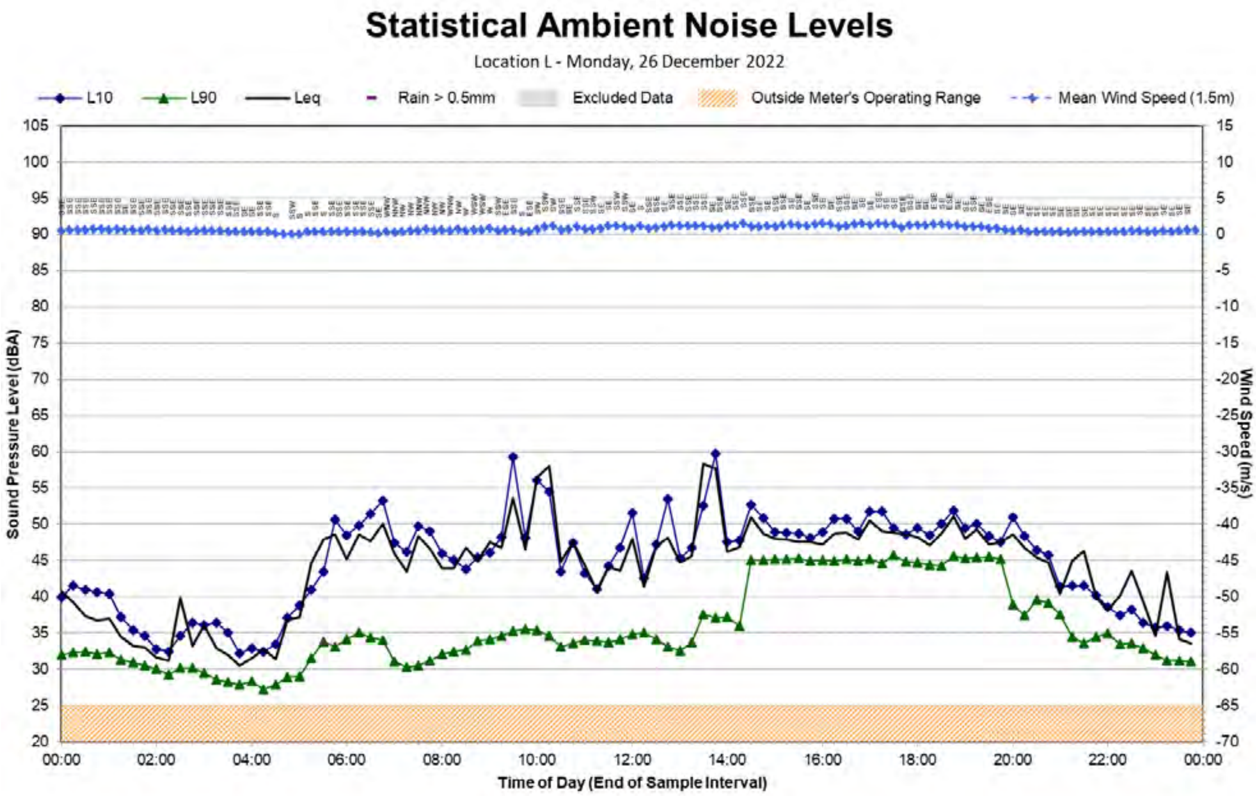

Statistical Ambient Noise Levels
Location I - Sunday, 1 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Monday, 2 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

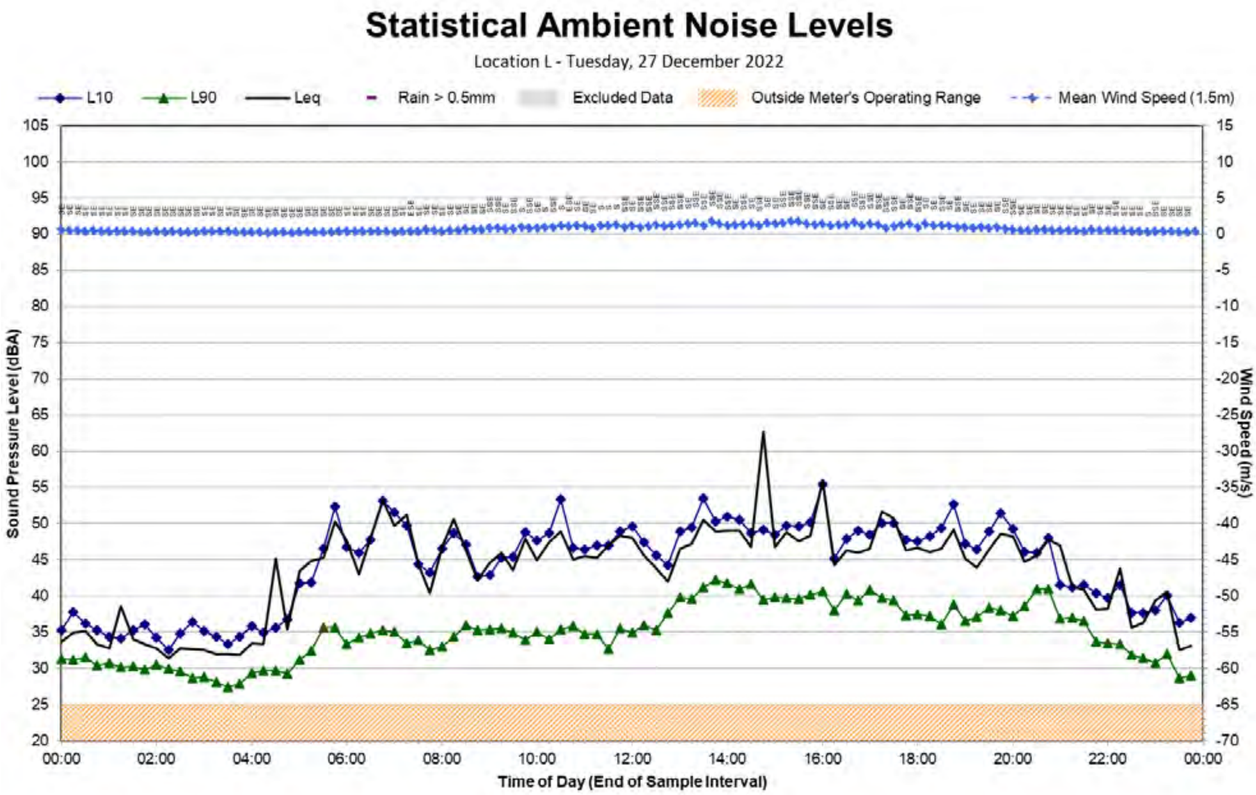

Statistical Ambient Noise Levels
Location L - Friday, 23 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Saturday, 24 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

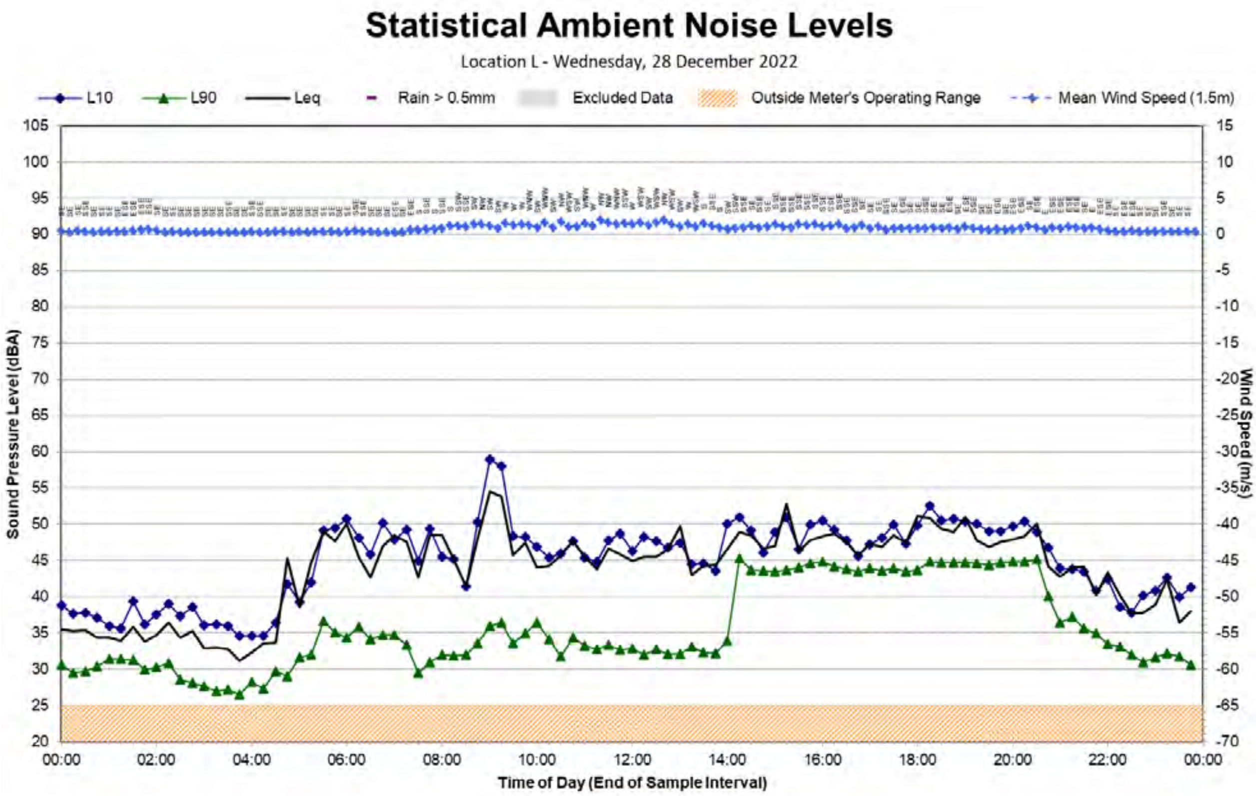

Statistical Ambient Noise Levels
Location L - Sunday, 25 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

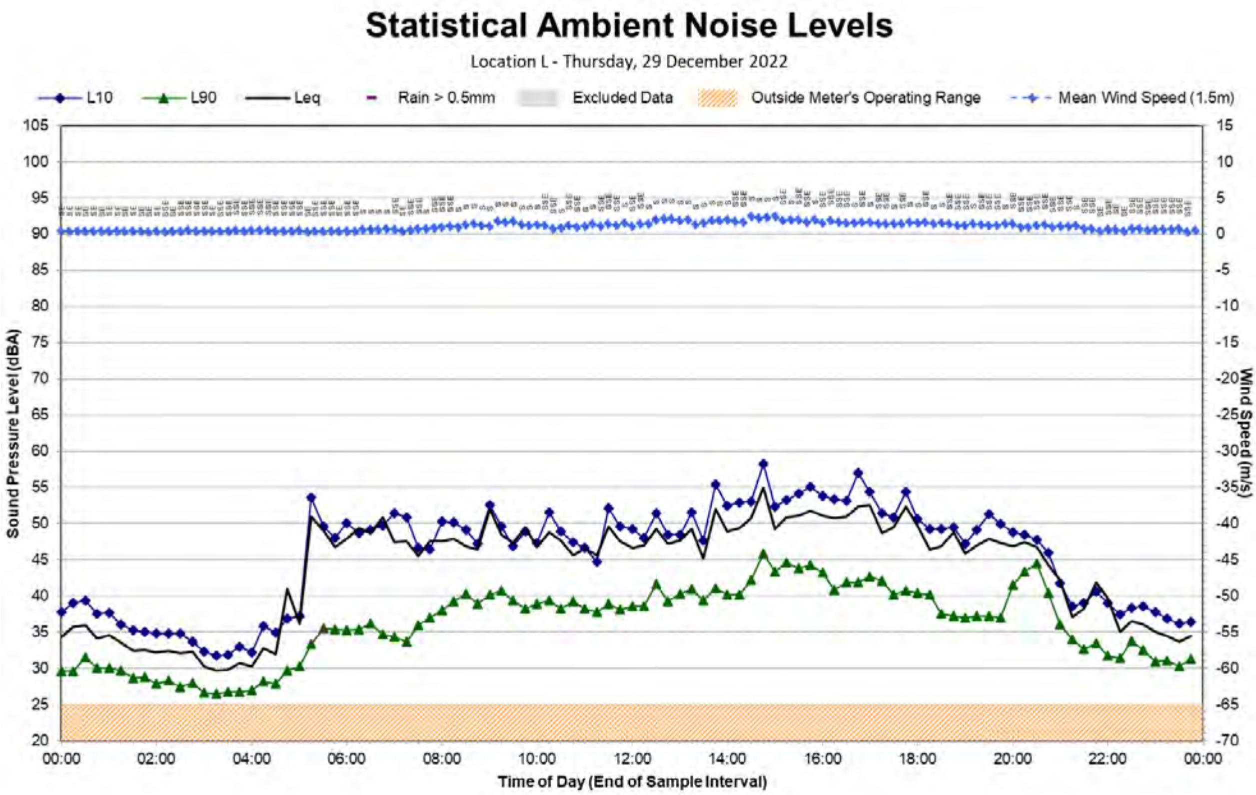


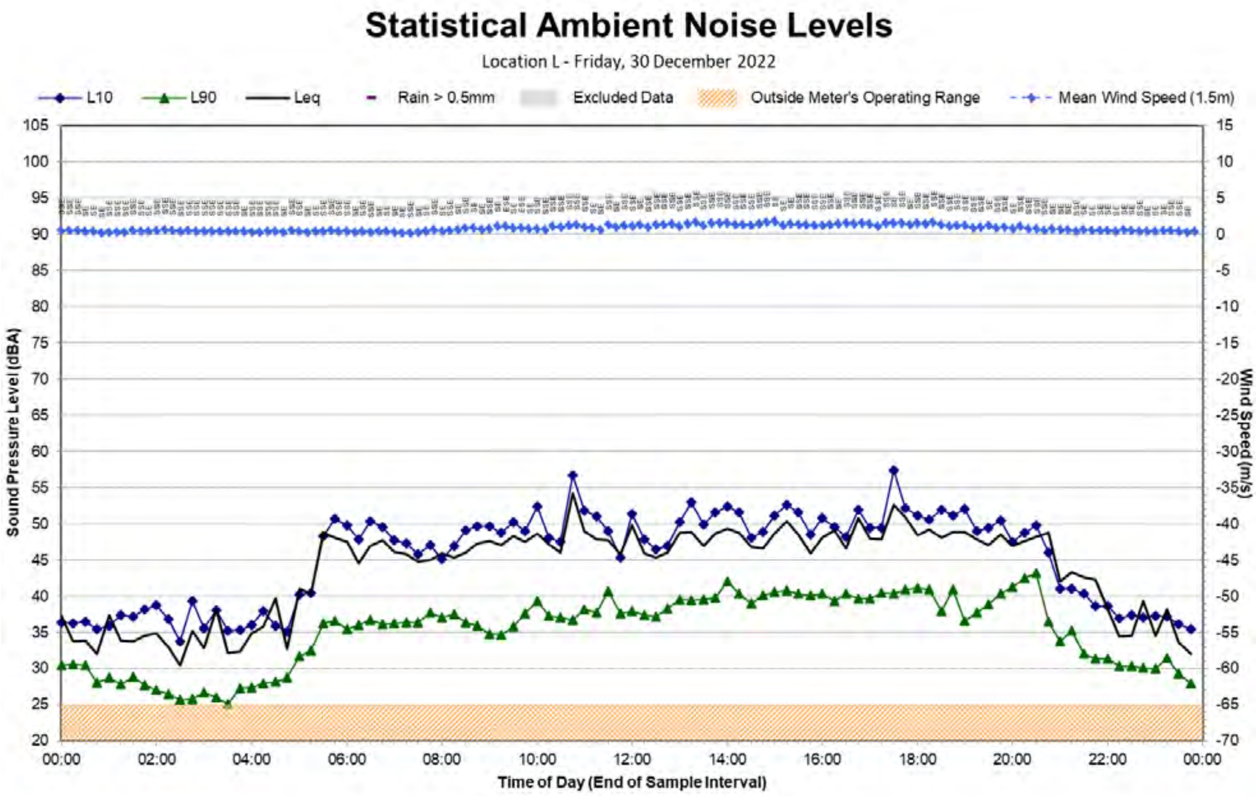
Statistical Ambient Noise Levels
Location L - Monday, 26 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

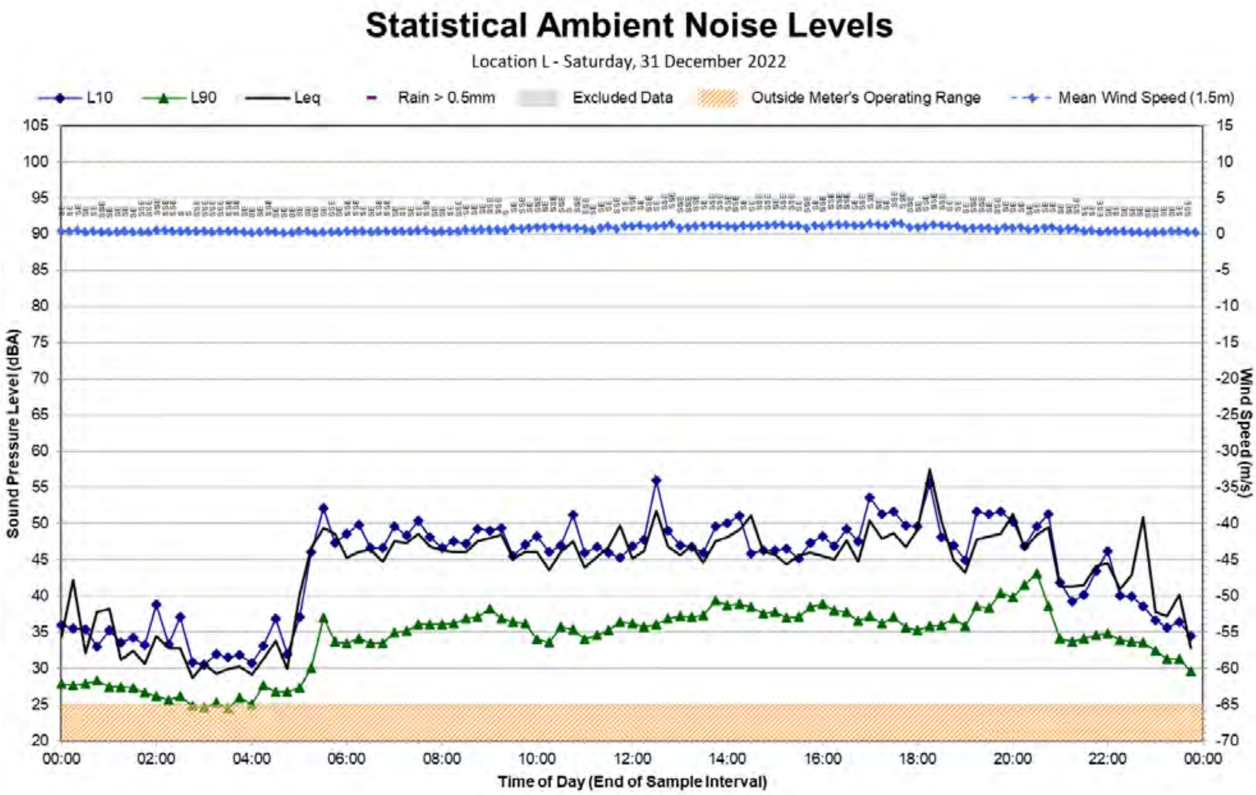



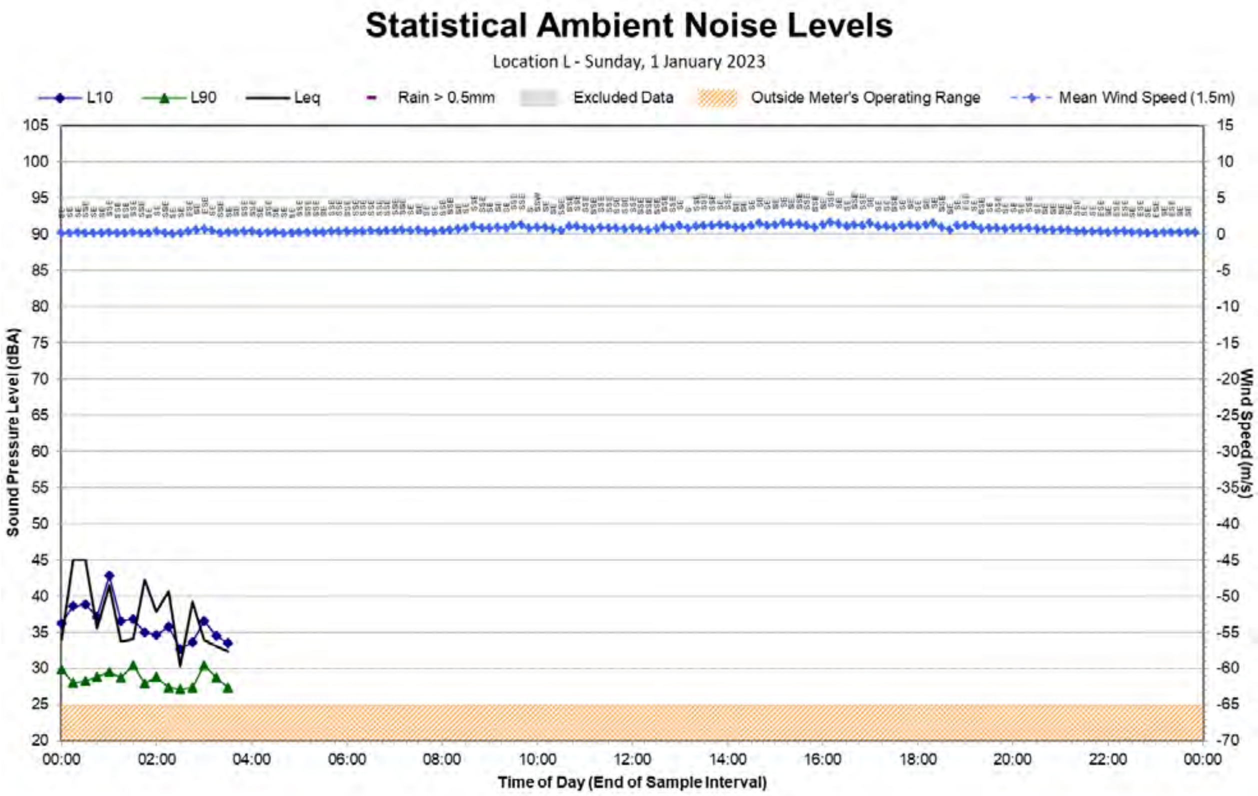
Statistical Ambient Noise Levels
Location L - Tuesday, 27 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

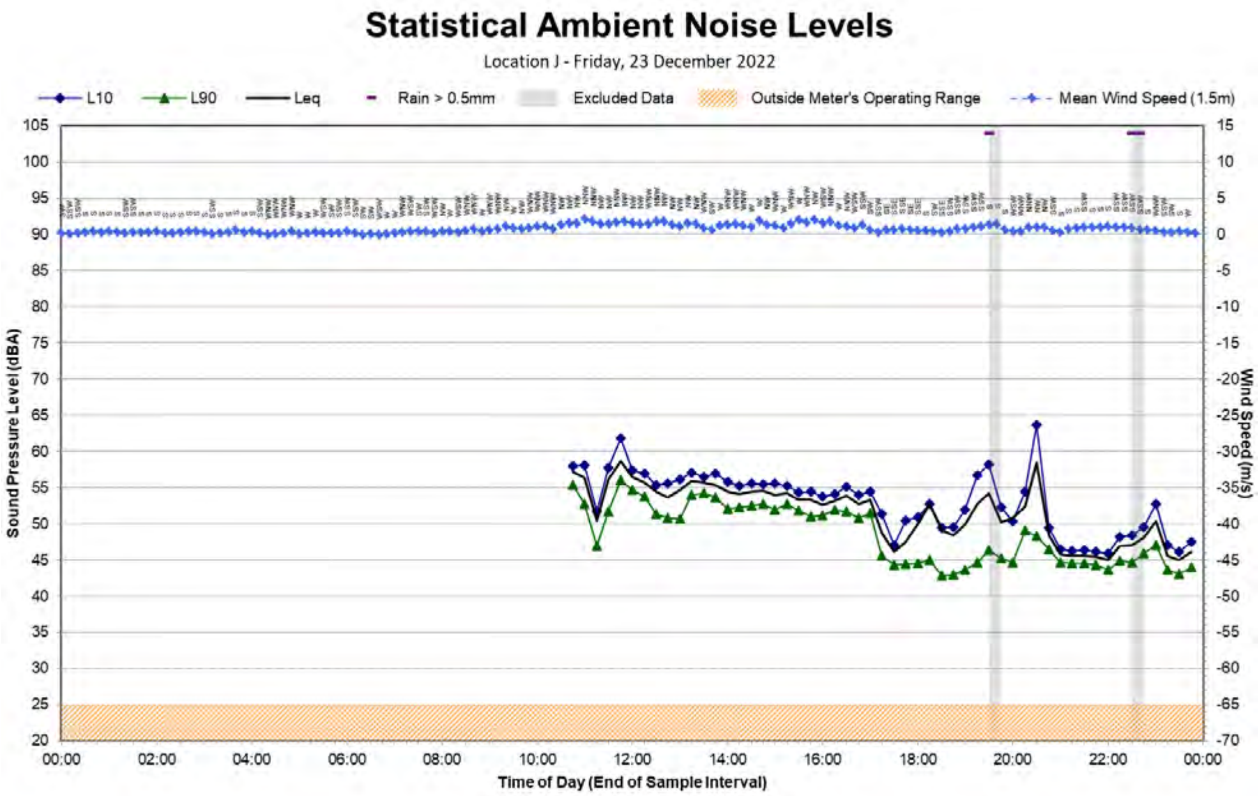

Statistical Ambient Noise Levels
Location L - Wednesday, 28 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

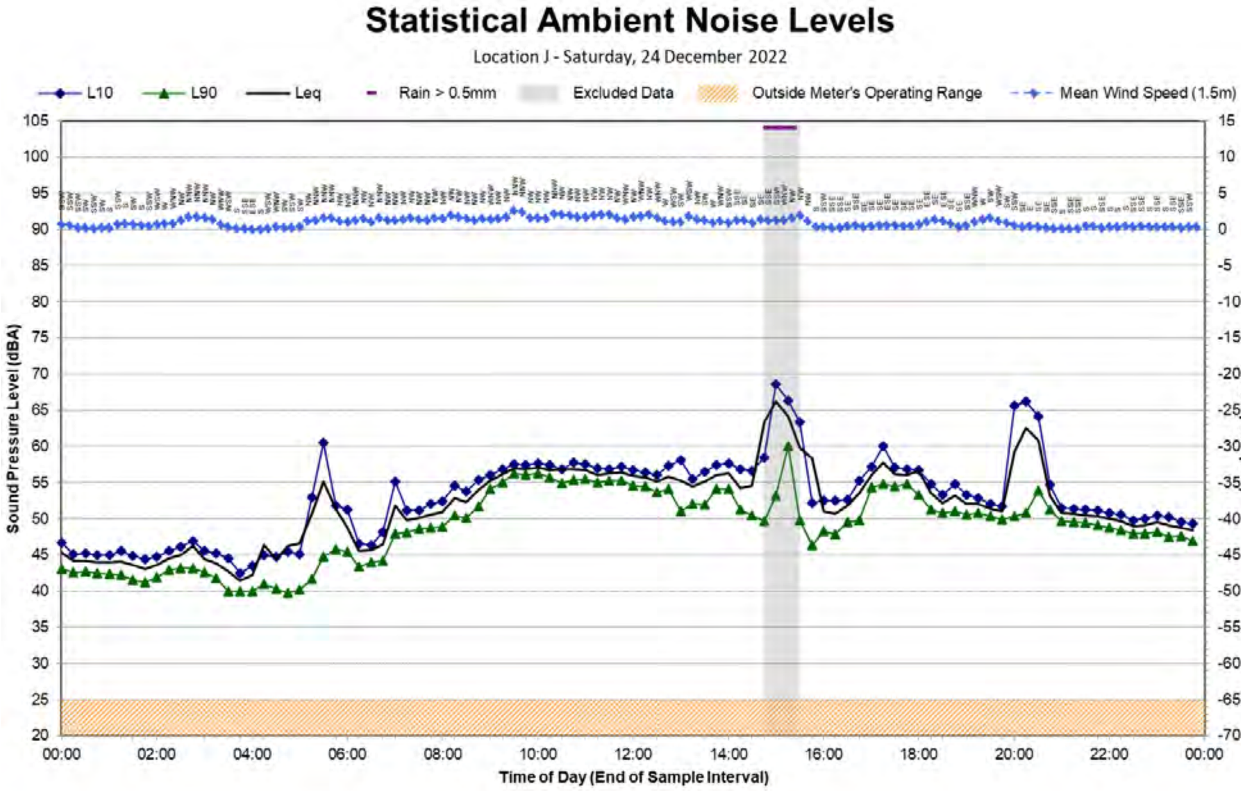

Statistical Ambient Noise Levels
Location L - Thursday, 29 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

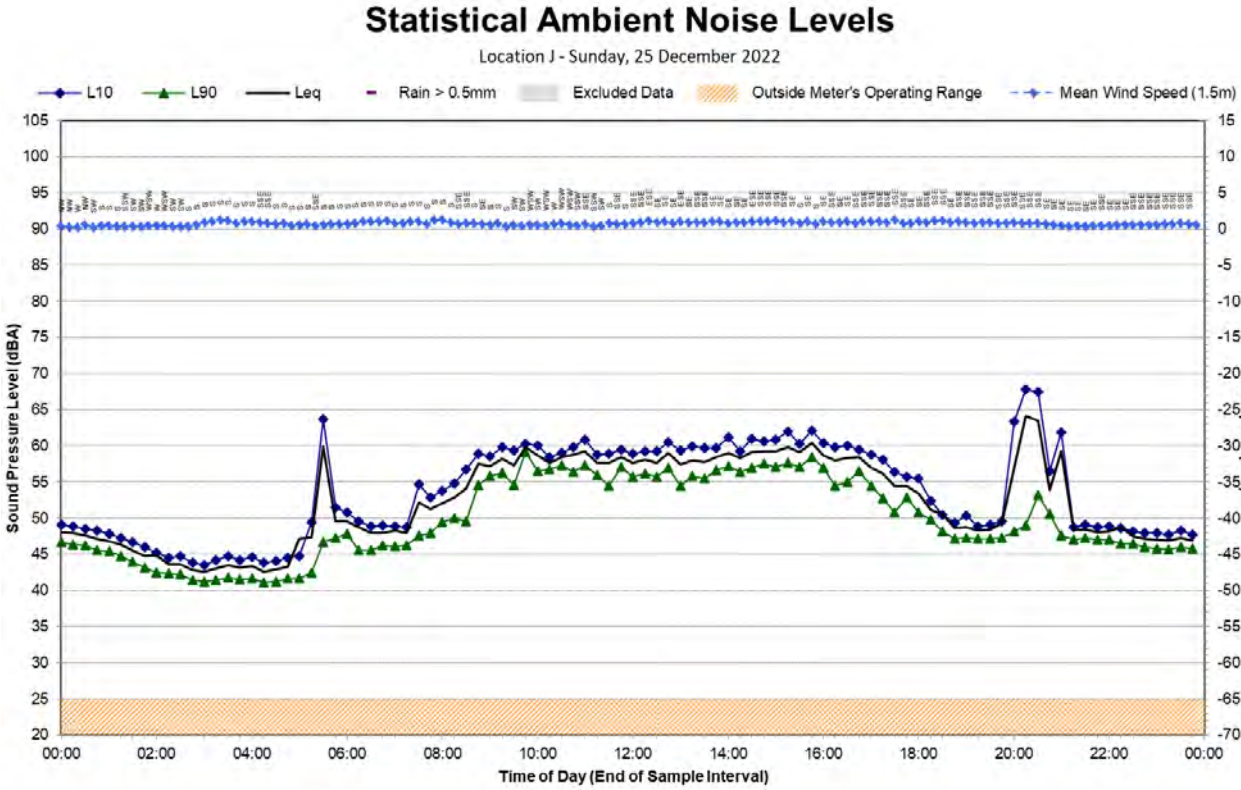

Statistical Ambient Noise Levels
Location L - Friday, 30 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

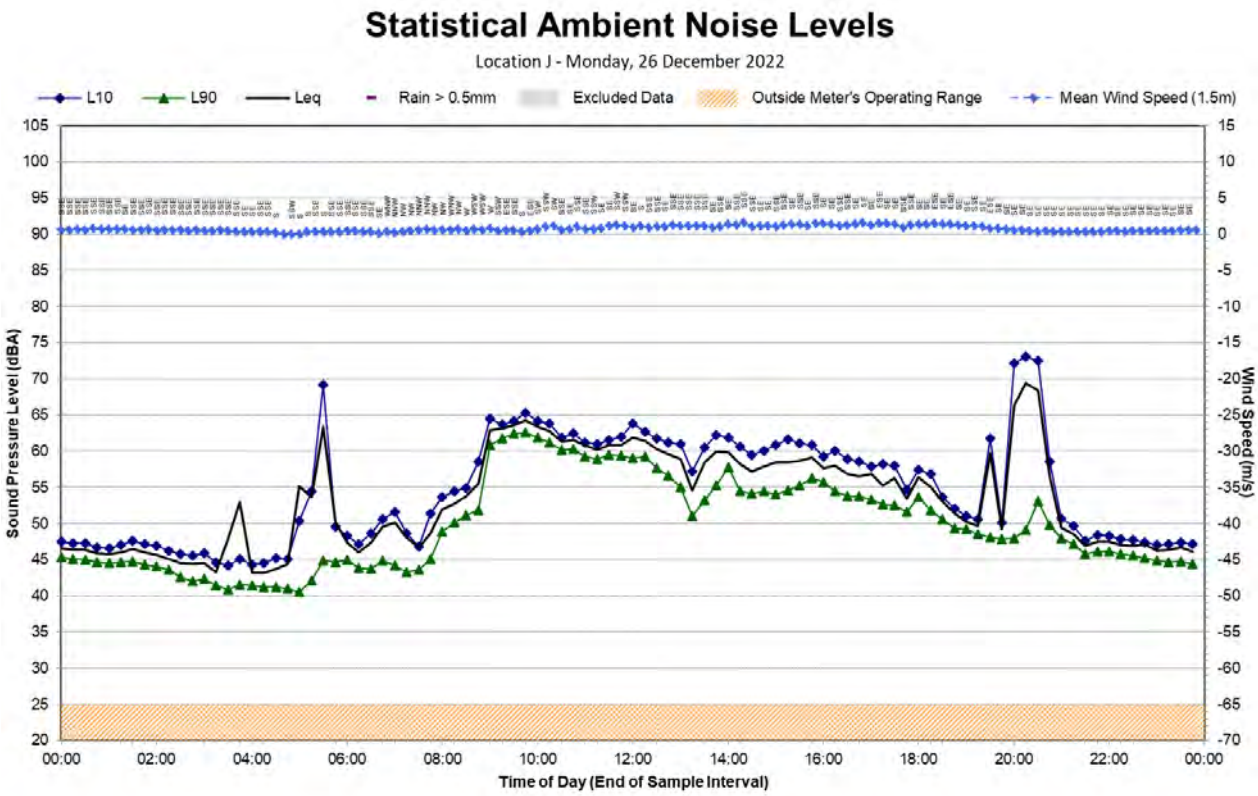

Statistical Ambient Noise Levels
Location L - Saturday, 31 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Sunday, 1 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

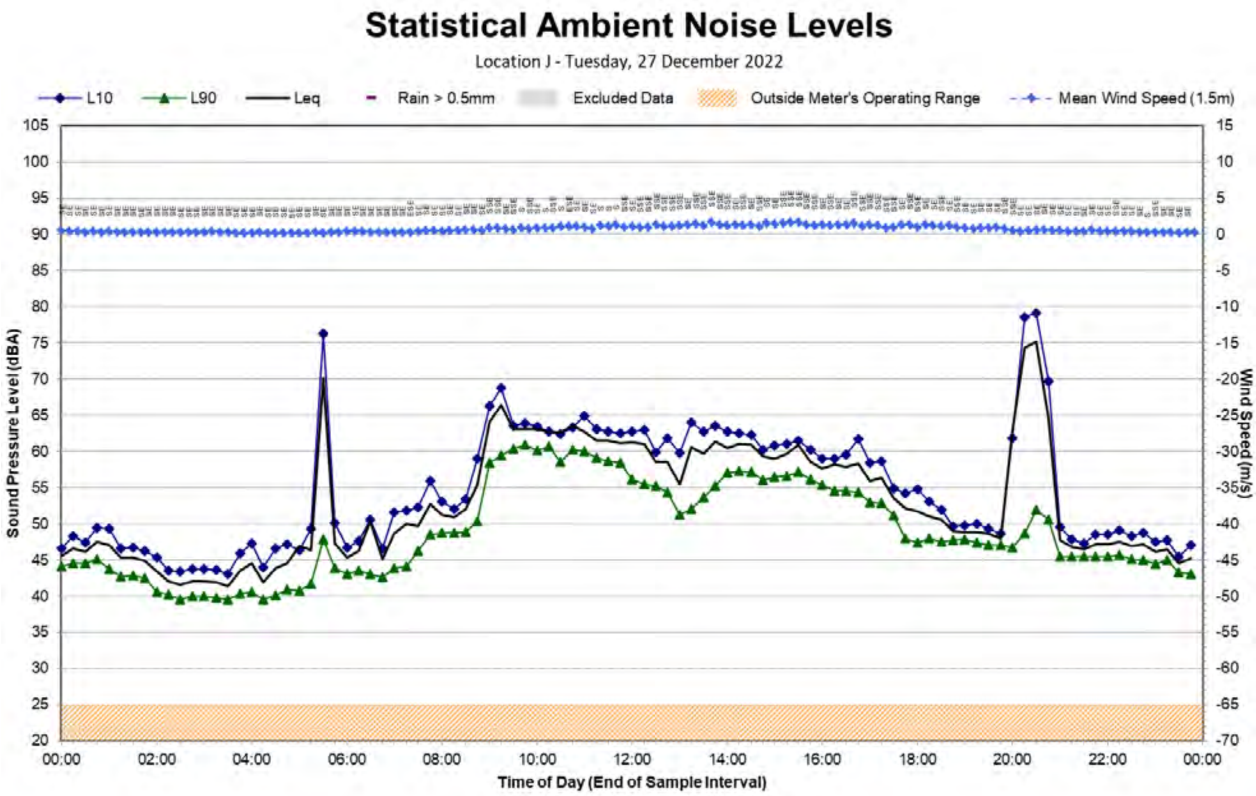

Statistical Ambient Noise Levels
Location J - Friday, 23 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Saturday, 24 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

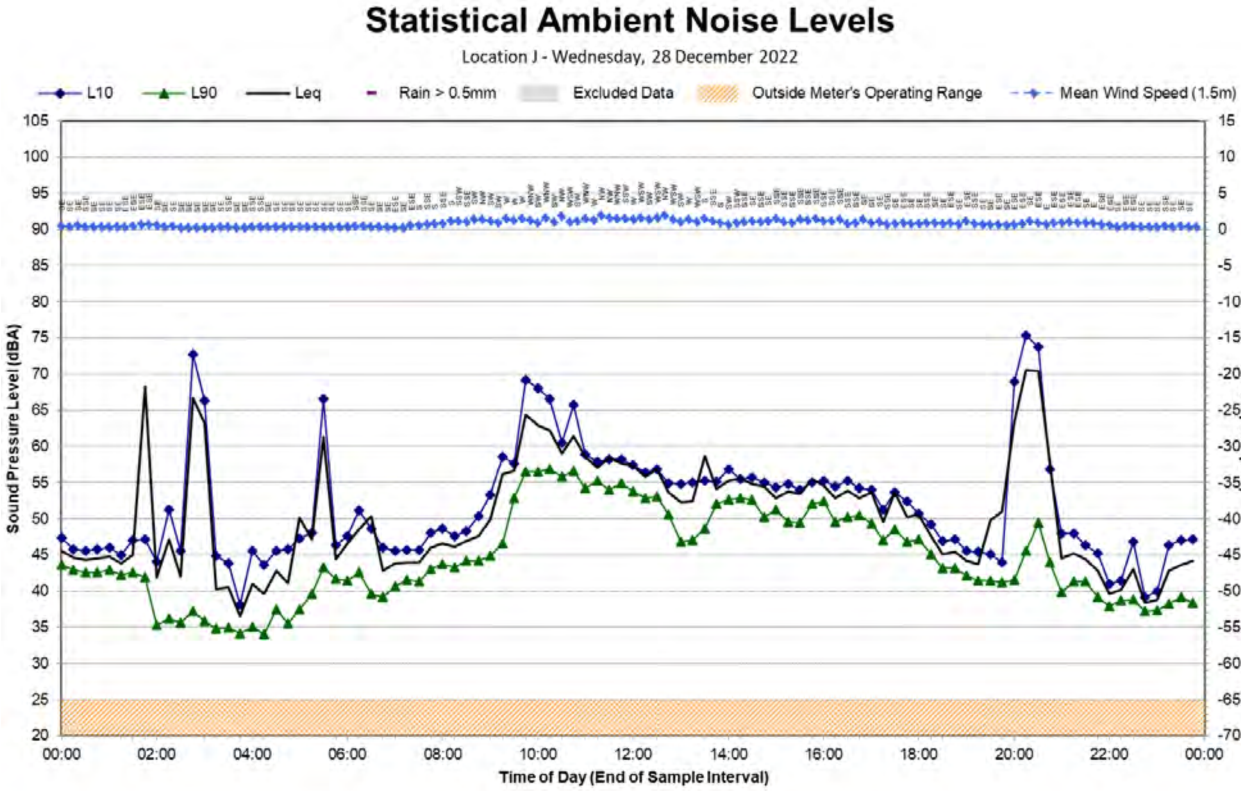

Statistical Ambient Noise Levels
Location J - Sunday, 25 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

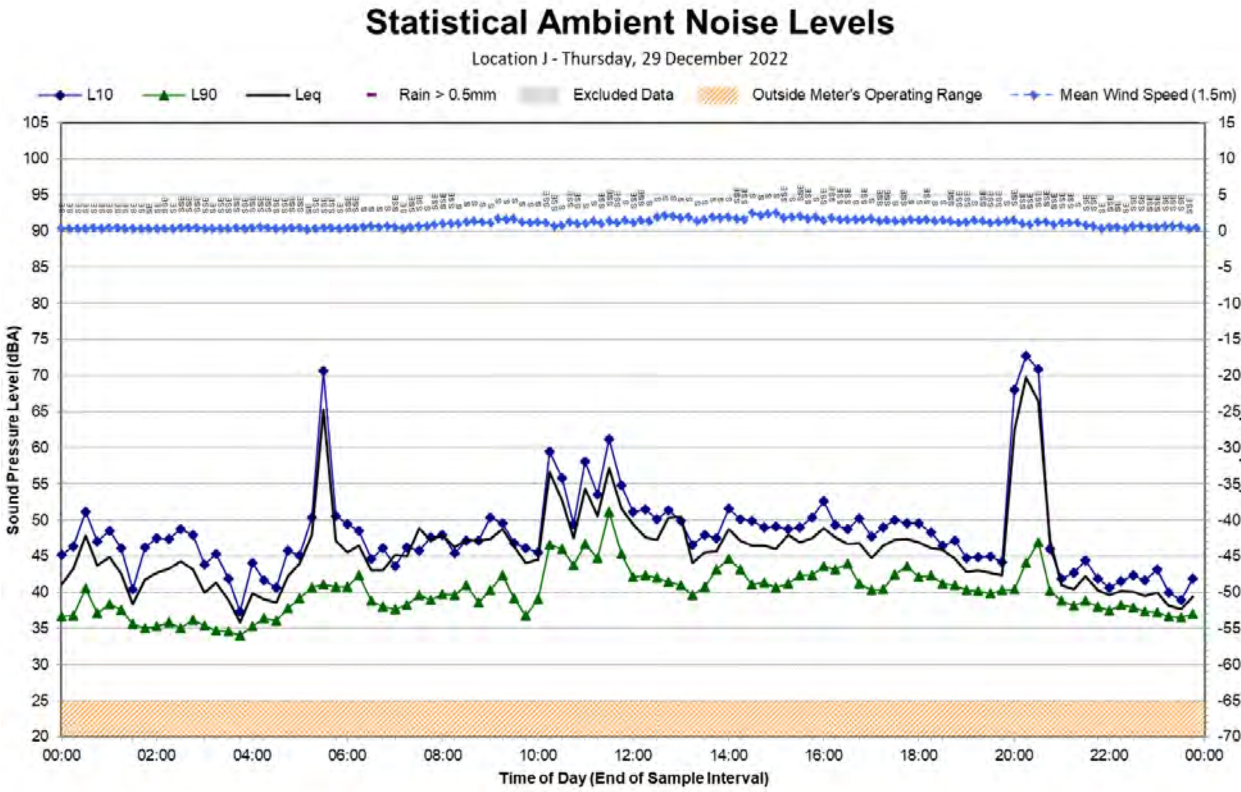


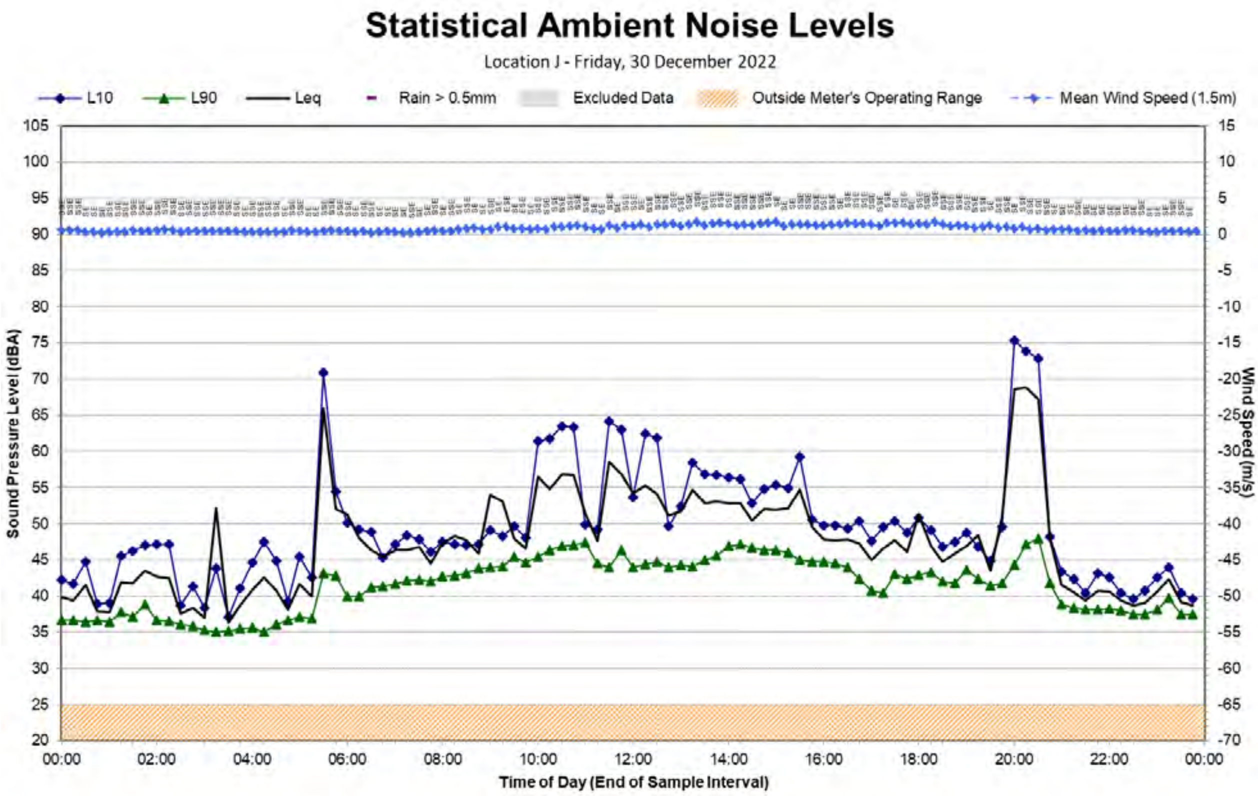
Statistical Ambient Noise Levels
Location J - Monday, 26 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

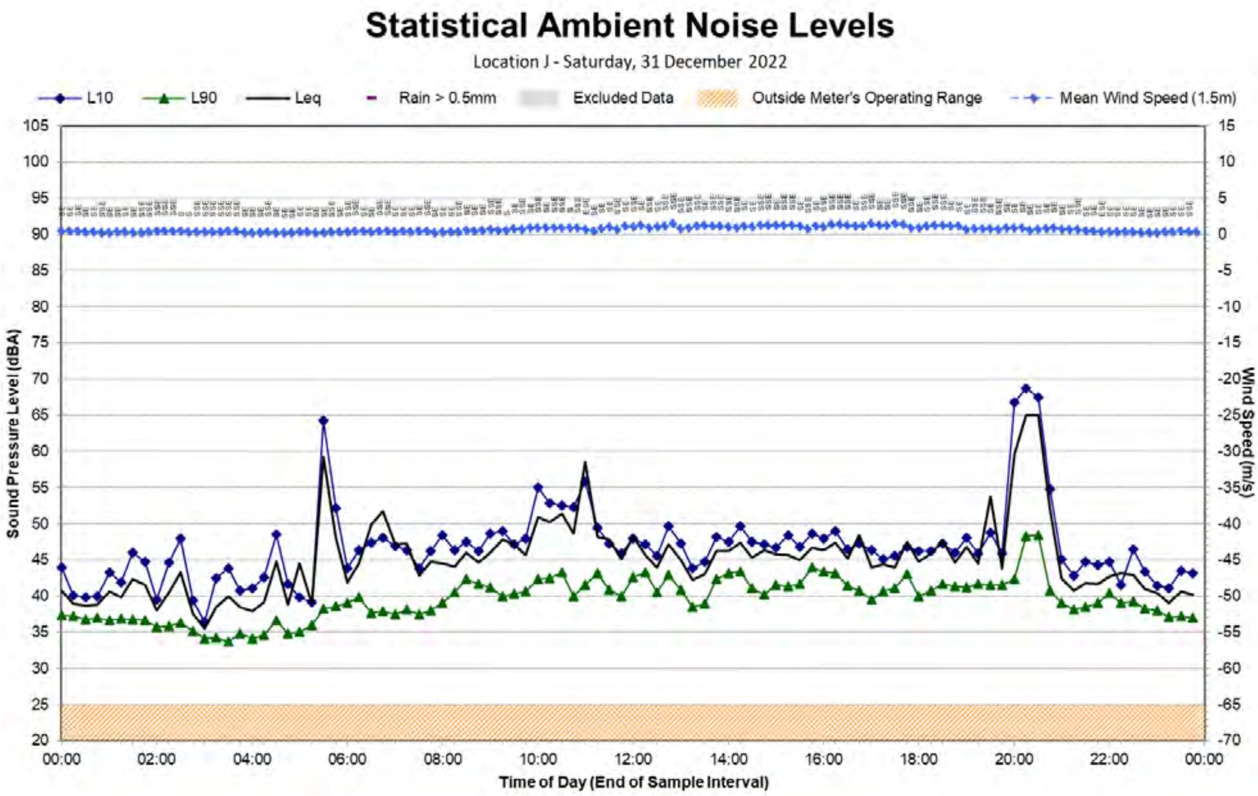
Statistical Ambient Noise Levels
Location J - Tuesday, 27 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Wednesday, 28 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

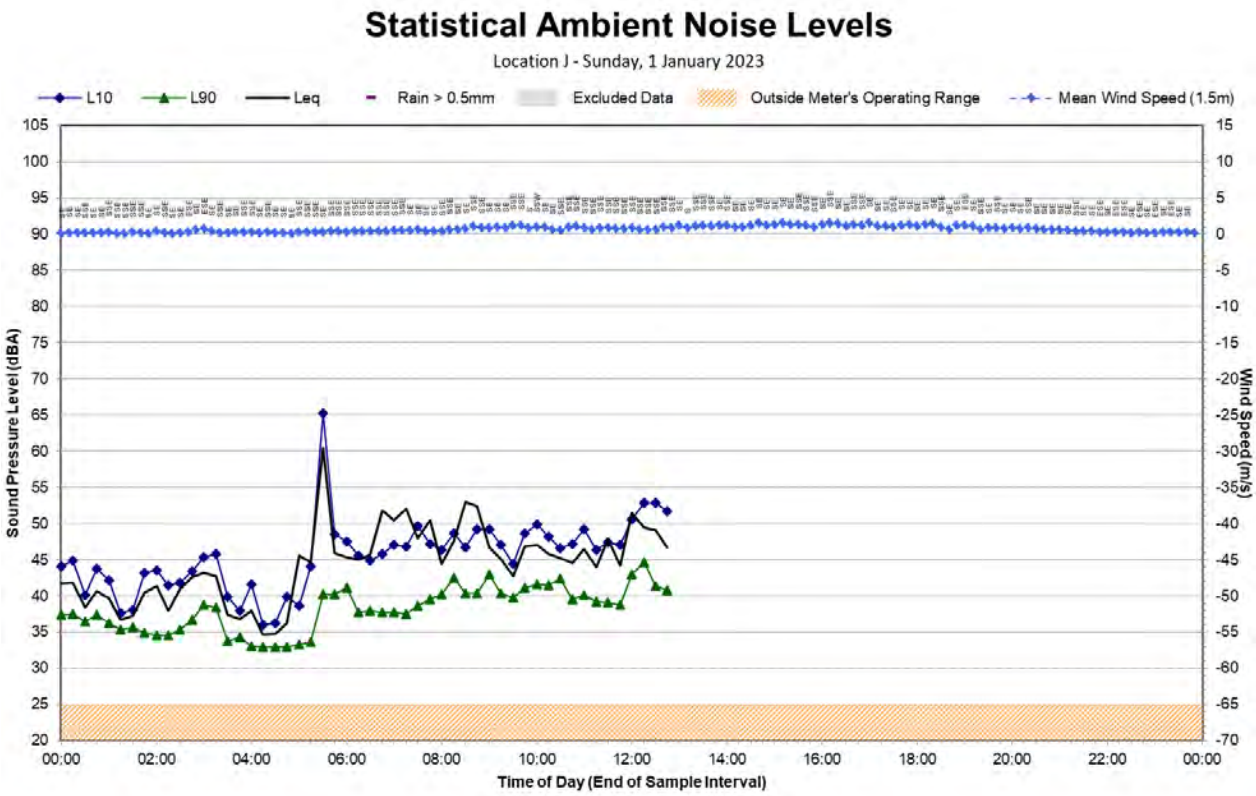

Statistical Ambient Noise Levels
Location J - Thursday, 29 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
Location J - Friday, 30 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

Statistical Ambient Noise Levels
Location J - Saturday, 31 December 2022
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
Location J - Sunday, 1 January 2023
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

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# Appendix 2

## Water Monitoring Results

(No. of pages including blank pages = 28)

# Surface Water 2008 to 2022

**Surface Water Quality Monitoring Results – 2008/2009**

| Sample Site | Date | pH | EC (µS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (µS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jun-08 | 6.6 | 940 | 2 | N | 1 | Dec-08 | 7.0 | 1210 | 6 | N |
| 8 | Jun-08 | 7.1 | 810 | 7 | N | 8 | Dec-08 | 7.3 | 980 | 16 | N |
| 9 | Jun-08 | 7.7 | 740 | 4 | L | 9 | Dec-08 | 6.8 | 1040 | 2 | L |
| 10 | Jun-08 | 7.6 | 1230 | 5 | L | 10 | Dec-08 | 7.2 | 1390 | 2 | N |
| 11 | Jun-08 | 7.1 | 1840 | 2 | N | 11 | Dec-08 | 6.8 | 1610 | 15 | N |
| FMCU | Jun-08 | 6.9 | 620 | 11 | VL | FMCU | Dec-08 | 7.0 | 450 | 2 | N |
| FMCD | Jun-08 | 7.2 | 300 | 6 | N | FMCD | Dec-08 | 6.8 | 160 | 4 | L |
| 1 | Jul-08 | 6.8 | 1160 | 6 | L | 1 | Jan-09 | 6.8 | 1130 | 39 | N |
| 8 | Jul-08 | 7.2 | 1100 | 4 | L | 8 | Jan-09 | 6.8 | 870 | 22 | N |
| 9 | Jul-08 | 7.6 | 1060 | 3 | L | 9 | Jan-09 | 7.0 | 1180 | 7 | L |
| 10 | Jul-08 | 7.3 | 1400 | 4 | M | 10 | Jan-09 | 7.3 | 1350 | 7 | L |
| 11 | Jul-08 | 6.8 | 2060 | 7 | L | 11 | Jan-09 | 6.8 | 1330 | 12 | N |
| FMCU | Jul-08 | 7.4 | 820 | 10 | N | FMCU | Jan-09 | 7.0 | 230 | 9 | N |
| FMCD | Jul-08 | 7.4 | 190 | 2 | VL | FMCD | Jan-09 | 7.3 | 150 | 27 | M |
| 1 | Aug-08 | 6.9 | 1220 | 2 | N | 1 | Feb-09 | 6.8 | 680 | 7 | N |
| 8 | Aug-08 | 7.4 | 1140 | 4 | L | 8 | Feb-09 | 7.0 | 590 | 3 | L |
| 9 | Aug-08 | 7.7 | 1090 | 7 | M | 9 | Feb-09 | 7.3 | 540 | 7 | L |
| 10 | Aug-08 | 7.5 | 1410 | 5 | N | 10 | Feb-09 | 7.1 | 1270 | 3 | L |
| 11 | Aug-08 | 7.0 | 2220 | 4 | N | 11 | Feb-09 | 6.8 | 910 | 11 | N |
| FMCU | Aug-08 | 8.3 | 730 | 14 | N | FMCU | Feb-09 | 6.8 | 350 | 13 | N |
| FMCD | Aug-08 | 7.8 | 170 | 3 | L | FMCD | Feb-09 | 7.4 | 260 | 11 | M |
| 1 | Sep-08 | 7.1 | 890 | 9 | N | 1 | Mar-09 | 6.8 | 650 | 4 | N |
| 8 | Sep-08 | 7.5 | 820 | 2 | L | 8 | Mar-09 | 7.2 | 700 | 3 | N |
| 9 | Sep-08 | 7.8 | 650 | 5 | M | 9 | Mar-09 | 7.5 | 820 | 2 | M |
| 10 | Sep-08 | 7.9 | 1250 | 8 | M | 10 | Mar-09 | 7.4 | 1230 | 6 | M |
| 11 | Sep-08 | 7.3 | 1330 | 14 | N | 11 | Mar-09 | 7.3 | 1060 | 7 | N |
| FMCU | Sep-08 | 7.3 | 460 | 96 | L | FMCU | Mar-09 | 7.3 | 420 | 9 | N |
| FMCD | Sep-08 | 7.3 | 320 | 11 | N | FMCD | Mar-09 | 7.6 | 150 | 7 | M |
| 1 | Oct-08 | 6.7 | 970 | 3 | N | 1 | Apr-09 | 7.0 | 740 | 4 | N |
| 8 | Oct-08 | 7.7 | 1150 | 2 | L | 8 | Apr-09 | 7.4 | 500 | 4 | N |
| 9 | Oct-08 | 7.5 | 910 | 2 | M | 9 | Apr-09 | 7.5 | 1030 | 9 | M |
| 10 | Oct-08 | 7.1 | 1200 | 2 | N | 10 | Apr-09 | 7.3 | 1050 | 10 | M |
| 11 | Oct-08 | 6.8 | 1930 | 2 | N | 11 | Apr-09 | 7.7 | 1020 | 11 | N |
| FMCU | Oct-08 | 6.8 | 540 | 15 | N | FMCU | Apr-09 | 6.7 | 340 | 17 | M |
| FMCD | Oct-08 | 7.1 | 200 | 31 | M | FMCD | Apr-09 | 7.3 | 200 | 51 | H |
| 1 | Nov-08 | 7.1 | 1130 | 4 | N | 1 | May-09 | 7.4 | 810 | 10 | N |
| 8 | Nov-08 | 7.7 | 940 | 15 | N | 8 | May-09 | 7.5 | 660 | 44 | M |
| 9 | Nov-08 | 7.4 | 1050 | 3 | H | 9 | May-09 | 7.9 | 610 | 41 | M |
| 10 | Nov-08 | 7.4 | 510 | 2 | L | 10 | May-09 | 7.7 | 1070 | 5 | M |
| 11 | Nov-08 | 7.2 | 2020 | 6 | N | 11 | May-09 | 7.3 | 940 | 3 | N |
| FMCU | Nov-08 | 7.0 | 570 | 11 | N | FMCU | May-09 | 6.9 | 540 | 10 | N |
| FMCD | Nov-08 | 7.9 | 160 | 2 | M | FMCD | May-09 | 8.0 | 180 | 2 | M |

N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow

**Surface Water Quality Monitoring Results – 2009/2010**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jun-09 | 6.8 | 510 | 15 | N |
| 8 | Jun-09 | 7.4 | 630 | <2 | M |
| 9 | Jun-09 | 7.7 | 390 | 22 | H |
| 10 | Jun-09 | 7.4 | 680 | 23 | M |
| 11 | Jun-09 | 7.1 | 560 | 8 | N |
| FMCU | Jun-09 | 7.6 | 280 | 12 | H |
| FMCD | Jun-09 | 7.2 | 240 | 20 | H |
| 1 | Jul-09 | 7.8 | 880 | 9 | N |
| 8 | Jul-09 | 7.6 | 820 | <2 | L |
| 9 | Jul-09 | 7.9 | 870 | 19 | L |
| 10 | Jul-09 | 7.6 | 1290 | 9 | L |
| 11 | Jul-09 | NS | NS | NS | - |
| FMCU | Jul-09 | 6.6 | 510 | 23 | L |
| FMCD | Jul-09 | 7.5 | 150 | 69 | L |
| 1 | Aug-09 | 7.2 | 990 | 15 | L |
| 8 | Aug-09 | 7.3 | 840 | 11 | L |
| 9 | Aug-09 | 7.6 | 1180 | 25 | L |
| 10 | Aug-09 | 7.3 | 1640 | 16 | L |
| 11 | Aug-09 | 7.3 | 1720 | 18 | L |
| FMCU | Aug-09 | 7.4 | 700 | 21 | N |
| FMCD | Aug-09 | 7.8 | 140 | 2 | L |
| 1 | Sep-09 | 7.8 | 1050 | 5 | N |
| 8 | Sep-09 | 6.4 | 730 | 10 | N |
| 9 | Sep-09 | 7.6 | 1770 | 14 | N |
| 10 | Sep-09 | 7.5 | 1820 | 8 | L |
| 11 | Sep-09 | 6.2 | 1680 | 10 | N |
| FMCU | Sep-09 | NS | NS | NS | N |
| FMCD | Sep-09 | NS | NS | NS | N |
| 1 | Oct-09 | 8.6 | 1050 | 10 | N |
| 8 | Oct-09 | NS | NS | NS | N |
| 9 | Oct-09 | 8.4 | 1500 | 186 | L |
| 10 | Oct-09 | 8.5 | 1770 | 3 | L |
| 11 | Oct-09 | 8.3 | 1480 | 7 | N |
| FMCU | Oct-09 | NS | NS | NS | N |
| FMCD | Oct-09 | NS | NS | NS | N |
| 1 | Nov-09 | 8.8 | 1580 | 22 | L |
| 8 | Nov-09 | NS | NS | NS | N |
| 9 | Nov-09 | NS | NS | NS | N |
| 10 | Nov-09 | 8.5 | 2610 | 10 | L |
| 11 | Nov-09 | 8.8 | 2230 | 26 | L |
| FMCU | Nov-09 | NS | NS | NS | N |
| FMCD | Nov-09 | NS | NS | NS | N |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Dec-09 | NS | NS | NS | N |
| 8 | Dec-09 | NS | NS | NS | N |
| 9 | Dec-09 | NS | NS | NS | N |
| 10 | Dec-09 | NS | NS | NS | N |
| 11 | Dec-09 | 7.4 | 1590 | 18 | N |
| FMCU | Dec-09 | NS | NS | NS | N |
| FMCD | Dec-09 | NS | NS | NS | N |
| 1 | Jan-10 | NS | NS | NS | N |
| 8 | Jan-10 | NS | NS | NS | N |
| 9 | Jan-10 | NS | NS | NS | N |
| 10 | Jan-10 | NS | NS | NS | N |
| 11 | Jan-10 | 7.1 | 2220 | 37 | L |
| FMCU | Jan-10 | NS | NS | NS | N |
| FMCD | Jan-10 | NS | NS | NS | N |
| 1 | Feb-10 | NS | NS | NS | N |
| 8 | Feb-10 | NS | NS | NS | N |
| 9 | Feb-10 | NS | NS | NS | N |
| 10 | Feb-10 | NS | NS | NS | N |
| 11 | Feb-10 | 7.1 | 1820 | 17 | N |
| FMCU | Feb-10 | NS | NS | NS | N |
| FMCD | Feb-10 | NS | NS | NS | N |
| 1 | Mar-10 | NS | NS | NS | N |
| 8 | Mar-10 | NS | NS | NS | N |
| 9 | Mar-10 | NS | NS | NS | N |
| 10 | Mar-10 | NS | NS | NS | N |
| 11 | Mar-10 | 7.5 | 1500 | 8 | L |
| FMCU | Mar-10 | NS | NS | NS | N |
| FMCD | Mar-10 | NS | NS | NS | N |
| 1 | Apr-10 | NS | NS | NS | N |
| 8 | Apr-10 | NS | NS | NS | N |
| 9 | Apr-10 | NS | NS | NS | N |
| 10 | Apr-10 | NS | NS | NS | N |
| 11 | Apr-10 | 7.2 | 1620 | 72 | - |
| FMCU | Apr-10 | NS | NS | NS | N |
| FMCD | Apr-10 | NS | NS | NS | N |
| 1 | May-10 | NS | NS | NS | N |
| 8 | May-10 | NS | NS | NS | N |
| 9 | May-10 | NS | NS | NS | N |
| 10 | May-10 | NS | NS | NS | N |
| 11 | May-10 | NS | NS | NS | N |
| FMCU | May-10 | 7.5 | 322.0 | 14.0 | - |
| FMCD | May-10 | 7.9 | 165 | 360 | - |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow  NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2010/2011**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jun-10 | 7.9 | 460 | 19 | NS | 1 | Dec-10 | 6.7 | 436.0 | 28.0 | Still |
| 8 | Jun-10 | NS | NS | NS | Dry | 8 | Dec-10 | 7.16 | 732 | 6 | Still |
| 9 | Jun-10 | NS | NS | NS | Dry | 9 | Dec-10 | 7.32 | 1070 | 32 | Still |
| 10 | Jun-10 | 7.3 | 880 | 8 | NS | 10 | Dec-10 | 7.17 | 1410 | 10 | Trickle |
| 11 | Jun-10 | 7.5 | 690 | 20 | NS | 11 | Dec-10 | 6.85 | 493 | 36 | Still |
| FMCU | Jun-10 | 6.9 | 388 | NS | NS | FMCU | Dec-10 | 6.8 | 465.0 | 7.0 | Trickle |
| FMCD | Jun-10 | 0 | 0 | 0 | 0 | FMCD | Dec-10 | 7.21 | 1580 | <5 | Slow |
| 1 | Jul-10 | 6.22 | 504 | 18 | Pond | 1 | Jan-11 | 6.9 | 536.0 | 36.0 | Still |
| 8 | Jul-10 | 7.16 | 1110 | 2 | Pond | 8 | Jan-11 | 7.19 | 943 | <5 | Trickle |
| 9 | Jul-10 | 7.2 | 1300 | 27 | Trickle | 9 | Jan-11 | NS | NS | NS | - |
| 10 | Jul-10 | 7.12 | 1350 | 8 | Trickle | 10 | Jan-11 | 7.41 | 1680 | 5 | Still |
| 11 | Jul-10 | 7.06 | 865 | 13 | Pond | 11 | Jan-11 | 7.05 | 568 | 18 | Slow |
| FMCU | Jul-10 | 7.9 | 590 | 8 | Trickle | FMCU | Jan-11 | 6.7 | 528.0 | 14.0 | Still |
| FMCD | Jul-10 | 7.99 | 128 | 1 | Steady | FMCD | Jan-11 | 6.79 | 138 | 6 | Slow |
| 1 | Aug-10 | 6.55 | 492 | 12 | Slow | 1 | Feb-11 | 6.7 | 424.0 | 100 | Still |
| 8 | Aug-10 | 6.75 | 988 | 1 | Trickle | 8 | Feb-11 | 7.25 | 624 | 49 | Still |
| 9 | Aug-10 | 6.92 | 516 | 44 | Trickle | 9 | Feb-11 | NS | NS | NS | - |
| 10 | Aug-10 | 6.67 | 1220 | 10 | Trickle | 10 | Feb-11 | 7.16 | 519 | 31 | Still |
| 11 | Aug-10 | 6.89 | 602 | 13 | Slow | 11 | Feb-11 | 7.44 | 1570 | 20 | Still |
| FMCU | Aug-10 | 7.31 | 543 | 7 | Still | FMCU | Feb-11 | 6.7 | 488.0 | 16.0 | Still |
| FMCD | Aug-10 | 7.38 | 130 | 2 | Steady | FMCD | Feb-11 | 6.85 | 139 | <5 | Slow |
| 1 | Sep-09 | 7.05 | 464 | 4 | Still | 1 | Mar-11 | NS | NS | NS | Dry |
| 8 | Sep-10 | 7.14 | 947 | 3 | Trickle | 8 | Mar-11 | 7.29 | 151 | 20 | Still |
| 9 | Sep-10 | 7.23 | 1410 | 6 | Trickle | 9 | Mar-11 | NS | NS | NS | - |
| 10 | Sep-10 | 7.25 | 1700 | 2 | Trickle | 10 | Mar-11 | NS | NS | NS | Dry |
| 11 | Sep-10 | 7 | 671 | 14 | Still | 11 | Mar-11 | 7.13 | 578 | 16 | Still |
| FMCU | Sep-10 | 7.29 | 534 | 4 | Pond | FMCU | Mar-11 | NS | NS | NS | Dry |
| FMCD | Sep-10 | 7.44 | 121 | 1 | Steady | FMCD | Mar-11 | 6.73 | 122 | <5 | Steady |
| 1 | Oct-10 | 7.19 | 484 | 5 | Still | 1 | Apr-11 | NS | NS | NS | Dry |
| 8 | Oct-10 | 7.29 | 1010 | 2 | Still | 8 | Apr-11 | 7.27 | 650 | 9 | Still |
| 9 | Oct-10 | 7.74 | 1570 | 7 | Trickle | 9 | Apr-11 | NS | NS | NS | - |
| 10 | Oct-10 | 7.59 | 1840 | 6 | Trickle | 10 | Apr-11 | 7.12 | 487 | 230 | Trickle |
| 11 | Oct-10 | 7.22 | 734 | 16 | Still | 11 | Apr-11 | 6.82 | 577 | 48 | Still |
| FMCU | Oct-10 | 7.07 | 456 | 7 | Still | FMCU | Apr-11 | 7.1 | 292.0 | 20.0 | Still |
| FMCD | Oct-10 | 6.93 | 121 | 1 | Steady | FMCD | Apr-11 | 7.26 | 133 | <5 | Steady |
| 1 | Nov-10 | 6.89 | 402 | 12 | Still | 1 | May-11 | NS | NS | NS | Dry |
| 8 | Nov-10 | 7.13 | 461 | 2 | Still | 8 | May-11 | 7.22 | 717 | 5 | Still |
| 9 | Nov-10 | 7.1 | 307 | 45 | Trickle | 9 | May-11 | NS | NS | NS | - |
| 10 | Nov-10 | 7.09 | 751 | 32 | Trickle | 10 | May-11 | 6.99 | 1203 | 5 | Still |
| 11 | Nov-10 | 6.95 | 340 | 6 | Still | 11 | May-11 | 6.87 | 320 | 22 | Still |
| FMCU | Nov-10 | 6.94 | 509 | 16 | Trickle | FMCU | May-11 | 6.5 | 278.0 | 12.0 | Still |
| FMCD | Nov-10 | 7.14 | 294 | 23 | Steady | FMCD | May-11 | 6.78 | 120 | 6 | Steady |

NS - Sample Unobtainable

## Surface Water Quality Monitoring Results – 2011/2012

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jun-11 | 6.55 | 607 | 25 | Slow |
| 8 | Jun-11 | 6.63 | 771 | 20 | Steady |
| 9 | Jun-11 | NS | NS | NS | NS |
| 10 | Jun-11 | 6.69 | 854 | 25 | Steady |
| 11 | Jun-11 | 6.56 | 757 | 14 | Still |
| FMCU | Jun-11 | 7 | 460 | 8 | Slow |
| FMCD | Jun-11 | 7.48 | 138 | 8 | Steady |
| 1 | Jul-11 | 6.59 | 227 | 38 | Steady |
| 8 | Jul-11 | 6.6 | 255 | 16 | Fast |
| 9 | Jul-11 | NS | NS | NS | NS |
| 10 | Jul-11 | 6.65 | 248 | 74 | Fast |
| 11 | Jul-11 | 6.54 | 200 | 91 | Steady |
| FMCU | Jul-11 | 6.87 | 639 | 5 | Trickle |
| FMCD | Jul-11 | 7.03 | 146 | 16 | Steady |
| 1 | Aug-11 | 6.93 | 527 | 24 | Slow |
| 8 | Aug-11 | 6.81 | 301 | 14 | Slow |
| 9 | Aug-11 | NS | NS | NS | NS |
| 10 | Aug-11 | 7.11 | 821 | 102 | Slow |
| 11 | Aug-11 | 6.93 | 1060 | 29 | Slow |
| FMCU | Aug-11 | 7.74 | 611 | NS | Trickle |
| FMCD | Aug-11 | 6.95 | 180 | 5 | Steady |
| 1 | Sep-11 | 6.78 | 674 | 8 | Trickle |
| 8 | Sep-11 | 6.81 | 770 | 7 | Slow |
| 9 | Sep-11 | NS | NS | NS | NS |
| 10 | Sep-11 | 7.18 | 1410 | 5 | 0 |
| 11 | Sep-11 | 6.97 | 866 | 26 | Trickle |
| FMCU | Sep-11 | 6.81 | 502 | 10 | Still |
| FMCD | Sep-11 | 7.08 | 200 | 10 | Steady |
| 1 | Oct-11 | 6.96 | 781 | 5 | Trickle |
| 8 | Oct-11 | 7.09 | 932 | 5 | Trickle |
| 9 | Oct-11 | NS | NS | NS | NS |
| 10 | Oct-11 | 7.08 | 1150 | 6 | Slow |
| 11 | Oct-11 | 7.13 | 606 | 624 | Trickle |
| FMCU | Oct-11 | 6.78 | 597 | 12 | Slow |
| FMCD | Oct-11 | 6.98 | 180 | 11 | Steady |
| 1 | Nov-11 | 7.05 | 455 | 173 | Slow |
| 8 | Nov-11 | 6.97 | 217 | 18 | Fast |
| 9 | Nov-11 | NS | NS | NS | NS |
| 10 | Nov-11 | 7.23 | 285 | 342 | Fast |
| 11 | Nov-11 | 7.22 | 1180 | 16 | Steady |
| FMCU | Nov-11 | 7.1 | 270 | 51 | Still |
| FMCD | Nov-11 | 7.17 | 133 | 132 | Steady |
| 1 | Dec-11 | 7.0 | 545.0 | 30.0 | Slow |
| 8 | Dec-11 | 7.49 | 615 | 10 | Steady |
| 9 | Dec-11 | NS | NS | NS | NS |
| 10 | Dec-11 | 7.32 | 752 | 24 | Slow |
| 11 | Dec-11 | 7.31 | 526 | 49 | Slow |
| FMCU | Dec-11 | 7.2 | 452.0 | 8.0 | Trickle |
| FMCD | Dec-11 | 7.33 | 248 | 5 | Steady |
| 1 | Jan-12 | 7.2 | 673.0 | 14.0 | Still |
| 8 | Jan-12 | 7.33 | 296 | 60 | Steady |
| 9 | Jan-12 | NS | NS | NS | NS |
| 10 | Jan-12 | 7.36 | 1440 | 33 | Steady |
| 11 | Jan-12 | 7.56 | 494 | 85 | Still |
| FMCU | Jan-12 | 7.4 | 511.0 | 18.0 | Still |
| FMCD | Jan-12 | 7.51 | 147 | 10 | Still |
| 1 | Feb-12 | 7.3 | 388.0 | 44.0 | Slow |
| 8 | Feb-12 | 7.5 | 480 | 20 | Slow |
| 9 | Feb-12 | NS | NS | NS | NS |
| 10 | Feb-12 | 7.47 | 618 | 30 | Slow |
| 11 | Feb-12 | 7.4 | 393 | 25 | Slow |
| FMCU | Feb-12 | 7.1 | 384.0 | 16.0 | Slow |
| FMCD | Feb-12 | 7.49 | 253 | 55 | Steady |
| 1 | Mar-12 | 7.0 | 687.0 | 16.0 | Trickle |
| 8 | Mar-12 | 7.64 | 668 | 16 | Slow |
| 9 | Mar-12 | NS | NS | NS | NS |
| 10 | Mar-12 | 7.51 | 850 | 18 | Slow |
| 11 | Mar-12 | 7.31 | 767 | 8 | Slow |
| FMCU | Mar-12 | 6.9 | 199.0 | 21.0 | Fast |
| FMCD | Mar-12 | 6.96 | 186 | 42 | Fast |
| 1 | Apr-12 | 7.0 | 579.0 | 36.0 | Slow |
| 8 | Apr-12 | 7.44 | 448 | 12 | Steady |
| 9 | Apr-12 | NS | NS | NS | NS |
| 10 | Apr-12 | 7.5 | 753 | 24 | Steady |
| 11 | Apr-12 | 7.25 | 510 | 16 | Slow |
| FMCU | Apr-12 | 7.3 | 432.0 | 26.0 | Steady |
| FMCD | Apr-12 | 7.52 | 196 | 228 | Fast |
| 1 | May-12 | 7.0 | 1190.0 | 37.0 | Still |
| 8 | May-12 | 7.36 | 634 | 5 | Slow |
| 9 | May-12 | NS | NS | NS | NS |
| 10 | May-12 | 7.54 | 1440 | 22 | Slow |
| 11 | May-12 | 7.35 | 1010 | 78 | Still |
| FMCU | May-12 | 7.4 | 491.0 | 15.0 | Slow |
| FMCD | May-12 | 7.59 | 192 | 33 | Fast |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2012/2013**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jun-12 | 6.97 | 699 | 22 | - |
| 8 | Jun-12 | 7.35 | 841 | <5 | - |
| 9 | Jun-12 | NS | NS | NS | NS |
| 10 | Jun-12 | 7.41 | 825 | 22 | - |
| 11 | Jun-12 | 7.1 | 822 | 19 | - |
| FMCU | Jun-12 | 7.03 | 228 | 29 | - |
| FMCD | Jun-12 | 7.13 | 215 | 26 | - |
| 1 | Jul-12 | 6.97 | 906 | <5 | - |
| 8 | Jul-12 | 7.3 | 431 | 32 | - |
| 9 | Jul-12 | NS | NS | NS | NS |
| 10 | Jul-12 | 7.66 | 1020 | 12 | - |
| 11 | Jul-12 | 0 | 0 | 0 | NS |
| FMCU | Jul-12 | 7.35 | 624 | 22 | - |
| FMCD | Jul-12 | 7.52 | 230 | 40 | - |
| 1 | Aug-12 | 7.13 | 1330 | 17 | - |
| 8 | Aug-12 | 7.36 | 717 | 174 | - |
| 9 | Aug-12 | NS | NS | NS | NS |
| 10 | Aug-12 | 7.67 | 1520 | 9 | - |
| 11 | Aug-12 | 7.43 | 1070 | 25 | - |
| FMCU | Aug-12 | 7.32 | 477 | 6 | - |
| FMCD | Aug-12 | 7.52 | 235 | 6 | - |
| 1 | Sep-12 | 7.18 | 1590 | 17 | - |
| 8 | Sep-12 | 0 | 0 | 0 | NS |
| 9 | Sep-12 | NS | NS | NS | NS |
| 10 | Sep-12 | 7.62 | 1720 | 106 | - |
| 11 | Sep-12 | 7.4 | 1290 | 95 | - |
| FMCU | Sep-12 | 7.21 | 500 | 7 | - |
| FMCD | Sep-12 | 7.57 | 206 | <5 | - |
| 1 | Oct-12 | 7.24 | 1760 | 18 | - |
| 8 | Oct-12 | 0 | 0 | 0 | NS |
| 9 | Oct-12 | NS | NS | NS | NS |
| 10 | Oct-12 | 7.67 | 1750 | 12 | - |
| 11 | Oct-12 | 7.62 | 1650 | 57 | - |
| FMCU | Oct-12 | 7.37 | 453 | 16 | - |
| FMCD | Oct-12 | 7.65 | 171 | 8 | - |
| 1 | Nov-12 | 0 | 0 | 0 | Dry |
| 8 | Nov-12 | 0 | 0 | 0 | NS |
| 9 | Nov-12 | NS | NS | NS | NS |
| 10 | Nov-12 | 0 | 0 | 0 | NS |
| 11 | Nov-12 | 7.67 | 2550 | 108 | - |
| FMCU | Nov-12 | 7.11 | 549 | 36 | - |
| FMCD | Nov-12 | 7.44 | 149 | 43 | - |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Dec-12 | 0.0 | 0.0 | 0.0 | Dry |
| 8 | Dec-12 | 0 | 0 | 0 | NS |
| 9 | Dec-12 | NS | NS | NS | NS |
| 10 | Dec-12 | 0 | 0 | 0 | NS |
| 11 | Dec-12 | 0 | 0 | 0 | NS |
| FMCU | Dec-12 | 7.4 | 427.0 | 16.0 | - |
| FMCD | Dec-12 | 7.69 | 142 | 5 | - |
| 1 | Jan-13 | 0.0 | 0.0 | 0.0 | Dry |
| 8 | Jan-13 | 0 | 0 | 0 | NS |
| 9 | Jan-13 | NS | NS | NS | NS |
| 10 | Jan-13 | 0 | 0 | 0 | NS |
| 11 | Jan-13 | 0 | 0 | 0 | NS |
| FMCU | Jan-13 | 7.7 | 461.0 | 20.0 | - |
| FMCD | Jan-13 | 7.77 | 157 | <5 | - |
| 1 | Feb-13 | 6.9 | 483.0 | 28.0 | - |
| 8 | Feb-13 | 0 | 0 | 0 | NS |
| 9 | Feb-13 | NS | NS | NS | NS |
| 10 | Feb-13 | 7.08 | 724 | 18 | - |
| 11 | Feb-13 | 6.72 | 391 | 23 | - |
| FMCU | Feb-13 | 6.7 | 325.0 | 5.0 | - |
| FMCD | Feb-13 | 7.21 | 257 | 6 | - |
| 1 | Mar-13 | 7.0 | 922.0 | 24.0 | - |
| 8 | Mar-13 | 0 | 0 | 0 | NS |
| 9 | Mar-13 | NS | NS | NS | NS |
| 10 | Mar-13 | 7.47 | 1210 | 6 | - |
| 11 | Mar-13 | 6.98 | 595 | 13 | - |
| FMCU | Mar-13 | 7.1 | 284.0 | 26.0 | - |
| FMCD | Mar-13 | 7.19 | 300 | <5 | - |
| 1 | Apr-13 | 7.1 | 1030.0 | 8.0 | - |
| 8 | Apr-13 | 0 | 0 | 0 | NS |
| 9 | Apr-13 | NS | NS | NS | NS |
| 10 | Apr-13 | 7.42 | 1490 | 6 | - |
| 11 | Apr-13 | 7.1 | 675 | 10 | - |
| FMCU | Apr-13 | 7.1 | 269.0 | 25.0 | - |
| FMCD | Apr-13 | 7.37 | 172 | 82 | - |
| 1 | May-13 | 7.0 | 648.0 | 22.0 | - |
| 8 | May-13 | 0 | 0 | 0 | NS |
| 9 | May-13 | NS | NS | NS | NS |
| 10 | May-13 | 7.55 | 1070 | 38 | - |
| 11 | May-13 | 7.16 | 603 | 15 | - |
| FMCU | May-13 | 0.0 | 0.0 | 0.0 | NS |
| FMCD | May-13 | 0 | 0 | 0 | NS |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow  NS - Sample Unobtainable

### Surface Water Quality Monitoring Results – 2013/2014

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jun-13 | 6.97 | 702 | <5 | - | 1 | Dec-13 | 6.7 | 706.0 | 9.0 | - |
| 8 | Jun-13 | NF | NF | NF | NF | 8 | Dec-13 | NF | NF | NF | NF |
| 9 | Jun-13 | NS | NS | NS | NS | 9 | Dec-13 | NS | NS | NS | NS |
| 10 | Jun-13 | 7.54 | 1240 | <5 | - | 10 | Dec-13 | 7.02 | 1130 | 13 | - |
| 11 | Jun-13 | 7.09 | 799 | 5 | - | 11 | Dec-13 | 6.85 | 542 | 30 | - |
| FMCU | Jun-13 | 7.17 | 306 | 83 | Low | FMCU | Dec-13 | 6.6 | 337.0 | 6.0 | Pond |
| FMCD | Jun-13 | 7.55 | 140 | <5 | Low | FMCD | Dec-13 | 7.27 | 187 | <5 | Mod |
| 1 | Jul-13 | 6.59 | 593 | 7 | - | 1 | Jan-14 | 6.9 | 740.0 | 84.0 | - |
| 8 | Jul-13 | NF | NF | NF | NF | 8 | Jan-14 | NF | NF | NF | NF |
| 9 | Jul-13 | NS | NS | NS | NS | 9 | Jan-14 | NS | NS | NS | NS |
| 10 | Jul-13 | 6.98 | 787 | 12 | - | 10 | Jan-14 | 7.42 | 1270 | 6 | - |
| 11 | Jul-13 | 6.84 | 392 | 5 | - | 11 | Jan-14 | 7.32 | 896 | 66 | - |
| FMCU | Jul-13 | 7.16 | 334 | 24 | Low | FMCU | Jan-14 | 6.9 | 353.0 | 7.0 | Pond |
| FMCD | Jul-13 | 7.6 | 142 | <5 | Low | FMCD | Jan-14 | 7.19 | 140 | <5 | Mod |
| 1 | Aug-13 | 6.81 | 955 | 9 | - | 1 | Feb-14 | 7.3 | 865.0 | 10.0 | - |
| 8 | Aug-13 | NF | NF | NF | NF | 8 | Feb-14 | NF | NF | NF | NF |
| 9 | Aug-13 | NS | NS | NS | NS | 9 | Feb-14 | NS | NS | NS | NS |
| 10 | Aug-13 | 7.44 | 1350 | <5 | - | 10 | Feb-14 | 7.66 | 1690 | <5 | - |
| 11 | Aug-13 | 7.16 | 569 | 31 | - | 11 | Feb-14 | 0 | 0 | 0 | Dry |
| FMCU | Aug-13 | 7 | 354 | <5 | Pond | FMCU | Feb-14 | 7.5 | 460.0 | 25.0 | Pond |
| FMCD | Aug-13 | 7.5 | 132 | <5 | Mod | FMCD | Feb-14 | 7.65 | 146 | <5 | Low |
| 1 | Sep-13 | 7.32 | 1120 | 18 | - | 1 | Mar-14 | 7.0 | 276.0 | 32.0 | - |
| 8 | Sep-13 | NF | NF | NF | NF | 8 | Mar-14 | NF | NF | NF | NF |
| 9 | Sep-13 | NS | NS | NS | NS | 9 | Mar-14 | NS | NS | NS | NS |
| 10 | Sep-13 | 7.81 | 1500 | 9 | - | 10 | Mar-14 | 7.4 | 815 | 14 | - |
| 11 | Sep-13 | 7.74 | 1040 | 14 | - | 11 | Mar-14 | 6.85 | 532 | 20 | - |
| FMCU | Sep-13 | 7.21 | 377 | <5 | Pond | FMCU | Mar-14 | 6.9 | 169.0 | 18.0 | Pond |
| FMCD | Sep-13 | 7.52 | 128 | <5 | Low | FMCD | Mar-14 | 7.23 | 139 | 11 | Low |
| 1 | Oct-13 | 7.28 | 1090 | 9 | - | 1 | Apr-14 | 6.9 | 166.0 | 24.0 | - |
| 8 | Oct-13 | NF | NF | NF | NF | 8 | Apr-14 | NF | NF | NF | NF |
| 9 | Oct-13 | NS | NS | NS | NS | 9 | Apr-14 | NS | NS | NS | NS |
| 10 | Oct-13 | 7.64 | 1920 | <5 | - | 10 | Apr-14 | 7.32 | 533 | 28 | - |
| 11 | Oct-13 | 8.03 | 1260 | 126 | - | 11 | Apr-14 | 7.03 | 531 | 27 | - |
| FMCU | Oct-13 | 7.31 | 428 | 12 | Pond | FMCU | Apr-14 | 6.6 | 140.0 | 11.0 | Pond |
| FMCD | Oct-13 | 7.33 | 132 | <5 | Low | FMCD | Apr-14 | 7.18 | 134 | 21 | Mod |
| 1 | Nov-13 | 7.21 | 1060 | 5 | - | 1 | May-14 | 6.7 | 502.0 | 6.0 | - |
| 8 | Nov-13 | NF | NF | NF | NF | 8 | May-14 | NF | NF | NF | NF |
| 9 | Nov-13 | NS | NS | NS | NS | 9 | May-14 | NS | NS | NS | NS |
| 10 | Nov-13 | 7.6 | 2060 | 34 | - | 10 | May-14 | 7.16 | 730 | <5 | - |
| 11 | Nov-13 | 7.05 | 585 | 16 | - | 11 | May-14 | 6.77 | 513 | <5 | - |
| FMCU | Nov-13 | 6.85 | 202 | 6 | Pond | FMCU | May-14 | 6.8 | 209.0 | 9.0 | Pond |
| FMCD | Nov-13 | 6.88 | 274 | 5 | Mod | FMCD | May-14 | 7.44 | 131 | <5 | Mod |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

## Surface Water Quality Monitoring Results – 2014

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jun-14 | 7.11 | 481 | 10 | Low |
| 8 | Jun-14 | 0 | 0 | 0 | Dry |
| 9 | Jun-14 | 0 | 0 | 0 | Not |
| 10 | Jun-14 | 0 | 936 | 8 | Low |
| 11 | Jun-14 | 6.99 | 352 | 290 | Low |
| FMCU | Jun-14 | 7.05 | 185 | 7 | Low |
| FMCD | Jun-14 | 7.19 | 119 | 25 | Mod |
| 1 | Jul-14 | 7.01 | 530 | <5 | 0 |
| 8 | Jul-14 | 0 | 0 | 0 | Dry |
| 9 | Jul-14 | 0 | 0 | 0 | Not |
| 10 | Jul-14 | 0 | 1490 | <5 | Low |
| 11 | Jul-14 | 7.07 | 756 | <5 | 0 |
| FMCU | Jul-14 | 7.35 | 223 | 6 | Poole |
| FMCD | Jul-14 | 7.74 | 129 | <5 | Low |
| 1 | Aug-14 | 6.73 | 200 | 26 | No |
| 8 | Aug-14 | 0 | 0 | 0 | Dry |
| 9 | Aug-14 | 0 | 0 | 0 | No |
| 10 | Aug-14 | 0 | 931 | 40 | Low |
| 11 | Aug-14 | 6.8 | 860 | 8 | Low |
| FMCU | Aug-14 | 6.8 | 151 | <5 | Low |
| FMCD | Aug-14 | 7.09 | 140 | <5 | Low |
| 1 | Sep-14 | 7.03 | 497 | <5 | Low |
| 8 | Sep-14 | 0 | 0 | 0 | Dry |
| 9 | Sep-14 | 0 | 0 | 0 | 0 |
| 10 | Sep-14 | 0 | 1120 | <5 | Low |
| 11 | Sep-14 | 7.1 | 512 | <5 | Low |
| FMCU | Sep-14 | 0 | 0 | 0 | No |
| FMCD | Sep-14 | 7.53 | 144 | <5 | Low |
| 1 | Oct-14 | 7.01 | 420 | 18 | Low |
| 8 | Oct-14 | 0 | 0 | 0 | No |
| 9 | Oct-14 | 0 | 0 | 0 | 0 |
| 10 | Oct-14 | 0 | 1410 | 22 | Low |
| 11 | Oct-14 | 7.29 | 585 | 24 | Low |
| FMCU | Oct-14 | 0 | 0 | 0 | No |
| FMCD | Oct-14 | 7.54 | 127 | <5 | Low |
| 1 | Nov-14 | 0 | 0 | 0 | No |
| 8 | Nov-14 | 0 | 0 | 0 | No |
| 9 | Nov-14 | 0 | 0 | 0 | 0 |
| 10 | Nov-14 | 0 | 1120 | 7 | Low |
| 11 | Nov-14 | 6.9 | 670 | 87 | Low |
| FMCU | Nov-14 | 0 | 0 | 0 | No |
| FMCD | Nov-14 | 7.42 | 203 | <5 | Low |
| 1 | Dec-14 | 0.0 | 0.0 | 0.0 | No |
| 8 | Dec-14 | 0 | 0 | 0 | 0 |
| 9 | Dec-14 | 0 | 0 | 0 | 0 |
| 10 | Dec-14 | 0 | 0 | 0 | No |
| 11 | Dec-14 | 0 | 0 | 0 | No |
| FMCU | Dec-14 | 0.0 | 0.0 | 0.0 | No |
| FMCD | Dec-14 | 7.43 | 189 | <5 | Low |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

### Surface Water Quality Monitoring Results – 2015

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jan-15 | 6.52 | 218 | 64 | Low |
| 8 | Jan-15 | 5.55 | 116.3 | 17 | Low |
| 9 | Jan-15 | NS | NS | NS | NS |
| 10 | Jan-15 | 7.02 | 673 | 104 | Mod |
| 11 | Jan-15 | 6.17 | 229 | 51 | Mod |
| FMCU | Jan-15 | 6.49 | 204 | 13 | |
| FMCD | Jan-15 | 6.97 | 201 | 10 | |
| 1 | Feb-15 | 6.44 | 2910 | 14 | Low |
| 8 | Feb-15 | NS | NS | NS | No |
| 9 | Feb-15 | NS | NS | NS | NS |
| 10 | Feb-15 | 6.95 | 766 | <5 | Low |
| 11 | Feb-15 | 6.75 | 545 | 19 | Low |
| FMCU | Feb-15 | NS | NS | NS | N |
| FMCD | Feb-15 | 7.12 | 164.5 | <5 | Low |
| 1 | Mar-15 | NS | NS | NS | N |
| 8 | Mar-15 | NS | NS | NS | N |
| 9 | Mar-15 | NS | NS | NS | NS |
| 10 | Mar-15 | 6.89 | 1107 | <5 | Low |
| 11 | Mar-15 | NS | NS | NS | N |
| FMCU | Mar-15 | NS | NS | NS | N |
| FMCD | Mar-15 | 7.53 | 170 | <5 | Low |
| 1 | Apr-15 | 6.67 | 382 | 22 | Low |
| 8 | Apr-15 | 6.45 | 506 | <5 | Low |
| 9 | Apr-15 | NS | NS | NS | NS |
| 10 | Apr-15 | 6.69 | 803 | <5 | Low |
| 11 | Apr-15 | 6.62 | 1334 | 53 | Low |
| FMCU | Apr-15 | 7.11 | 307 | 14 | Low |
| FMCD | Apr-15 | 6.13 | 372 | 9 | Low |
| 1 | May-15 | 6.28 | 838 | 6 | Low |
| 8 | May-15 | 6.15 | 478 | <5 | Low |
| 9 | May-15 | NS | NS | NS | NS |
| 10 | May-15 | 6.46 | 977 | <5 | Low |
| 11 | May-15 | 6.23 | 1140 | 23 | Low |
| FMCU | May-15 | 7.04 | 214 | 13 | Mod |
| FMCD | May-15 | 6.71 | 217 | 9 | Mod |
| 1 | Jun-15 | 6.02 | 599 | <5 | Low |
| 8 | Jun-15 | 5.97 | 482 | <5 | Low |
| 9 | Jun-15 | NS | NS | NS | NS |
| 10 | Jun-15 | 6.35 | 834 | <5 | Low |
| 11 | Jun-15 | 6.15 | 1426 | <5 | Low |
| FMCU | Jun-15 | 6.33 | 202 | 6 | Low |
| FMCD | Jun-15 | 6.08 | 200 | <5 | Mod |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jul-15 | 7.0 | 872.0 | <5 | Low |
| 8 | Jul-15 | 6.56 | 642 | <5 | Low |
| 9 | Jul-15 | NS | NS | NS | NS |
| 10 | Jul-15 | 7.03 | 1364 | <5 | Low |
| 11 | Jul-15 | 7.22 | 1492 | <5 | Low |
| FMCU | Jul-15 | NS | NS | NS | N |
| FMCD | Jul-15 | 7.27 | 223 | <5 | Low |
| 1 | Aug-15 | 5.8 | 762.0 | <5 | Low |
| 8 | Aug-15 | 7.62 | 533 | 7 | N |
| 9 | Aug-15 | NS | NS | NS | NS |
| 10 | Aug-15 | 7.52 | 1315 | <5 | Low |
| 11 | Aug-15 | 7.67 | 1072 | 7 | N |
| FMCU | Aug-15 | 7.9 | 267.0 | <5 | N |
| FMCD | Aug-15 | 7.92 | 145.7 | 17 | Low |
| 1 | Sep-15 | 7.3 | 698.0 | 15.0 | No |
| 8 | Sep-15 | 7.25 | 499 | <5 | No |
| 9 | Sep-15 | NS | NS | NS | NS |
| 10 | Sep-15 | 7.7 | 1237 | <5 | Low |
| 11 | Sep-15 | 6.72 | 714 | 8 | N |
| FMCU | Sep-15 | 7.2 | 252.0 | 8.0 | N |
| FMCD | Sep-15 | 8 | 135.4 | <5 | Low |
| 1 | Oct-15 | 7.0 | 578.0 | 13.0 | N |
| 8 | Oct-15 | 7.04 | 459 | 9 | N |
| 9 | Oct-15 | NS | NS | NS | NS |
| 10 | Oct-15 | 7.57 | 1332 | 8 | Low |
| 11 | Oct-15 | 6.92 | 822 | 18 | No |
| FMCU | Oct-15 | 7.0 | 226.9 | <5 | No |
| FMCD | Oct-15 | 7.6 | 134.9 | <5 | Low |
| 1 | Nov-15 | 7.3 | 442.0 | <5 | Low |
| 8 | Nov-15 | 6.99 | 452 | <5 | N |
| 9 | Nov-15 | NS | NS | NS | NS |
| 10 | Nov-15 | 7.38 | 1022 | <5 | Low |
| 11 | Nov-15 | 7.13 | 1945 | 40 | Low |
| FMCU | Nov-15 | 7.5 | 232.5 | <5 | N |
| FMCD | Nov-15 | 7.4 | 148.9 | <5 | Low |
| 1 | Dec-15 | 7.1 | 286.0 | 30.0 | N |
| 8 | Dec-15 | 7.07 | 294 | <5 | Low |
| 9 | Dec-15 | NS | NS | NS | NS |
| 10 | Dec-15 | 7.28 | 901 | 6 | Low |
| 11 | Dec-15 | 7.08 | 626 | 10 | N |
| FMCU | Dec-15 | 7.2 | 208.3 | 14.0 | N |
| FMCD | Dec-15 | 7.58 | 175.1 | <5 | Low |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow  NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2016**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jan-16 | 6.85 | 765 | 6 | N | 1 | Jul-16 | 7.4 | 238.0 | 12.0 | N |
| 8 | Jan-16 | 7.22 | 545 | 5 | N | 8 | Jul-16 | 6.96 | 427 | 5 | N |
| 9 | Jan-16 | NS | NS | NS | NS | 9 | Jul-16 | NS | NS | NS | NS |
| 10 | Jan-16 | 7.2 | 1215 | 6 | N | 10 | Jul-16 | 7.34 | 1267 | <5 | L |
| 11 | Jan-16 | 6.87 | 828 | 6 | L | 11 | Jul-16 | 7.08 | 1245 | 14 | N |
| FMCU | Jan-16 | 6.65 | 200.9 | 5 | | FMCU | Jul-16 | 7.3 | 169.7 | 5.0 | |
| FMCD | Jan-16 | 7.08 | 208.2 | 5 | | FMCD | Jul-16 | 7.67 | 158.1 | 10 | |
| 1 | Feb-16 | 7.09 | 1004 | 5 | N | 1 | Aug-16 | 7.1 | 432.0 | 5.0 | N |
| 8 | Feb-16 | 7.04 | 541 | 5 | L | 8 | Aug-16 | 6.95 | 408 | 5 | N |
| 9 | Feb-16 | NS | NS | NS | NS | 9 | Aug-16 | NS | NS | NS | NS |
| 10 | Feb-16 | 7.24 | 1230 | <5 | N | 10 | Aug-16 | 7.22 | 1569 | <5 | L |
| 11 | Feb-16 | 7.07 | 1091 | 16 | L | 11 | Aug-16 | 7.34 | 972 | 7 | N |
| FMCU | Feb-16 | 7.19 | 259 | 5 | N | FMCU | Aug-16 | 7.5 | 173.2 | 5.0 | |
| FMCD | Feb-16 | 7.3 | 193.6 | 5 | N | FMCD | Aug-16 | 8.06 | 148.8 | 5 | |
| 1 | Mar-16 | 7.4 | 1060 | 5 | N | 1 | Sep-16 | 7.3 | 374.0 | 10.0 | N |
| 8 | Mar-16 | 7.34 | 556 | 5 | N | 8 | Sep-16 | 6.91 | 374 | 5 | N |
| 9 | Mar-16 | NS | NS | NS | NS | 9 | Sep-16 | NS | NS | NS | NS |
| 10 | Mar-16 | 7.5 | 1421 | 5 | L | 10 | Sep-16 | 7.27 | 1303 | <5 | N |
| 11 | Mar-16 | 7.39 | 1388 | 16 | N | 11 | Sep-16 | 7.07 | 321 | 8 | N |
| FMCU | Mar-16 | 7.17 | 289 | 18 | N | FMCU | Sep-16 | 7.3 | 197.4 | 5.0 | |
| FMCD | Mar-16 | 7.8 | 183.2 | 5 | N | FMCD | Sep-16 | 0 | 134.5 | 17 | |
| 1 | Apr-16 | 7.81 | 498 | 151 | N | 1 | Oct-16 | 7.3 | 400.0 | 10.0 | N |
| 8 | Apr-16 | 7.34 | 270 | 10 | N | 8 | Oct-16 | 7.21 | 394 | 7 | N |
| 9 | Apr-16 | NS | NS | NS | NS | 9 | Oct-16 | NS | NS | NS | NS |
| 10 | Apr-16 | 7.42 | 1484 | 6 | L | 10 | Oct-16 | 7.39 | 1653 | 8 | N |
| 11 | Apr-16 | 7.69 | 1105 | 15 | N | 11 | Oct-16 | 7.29 | 152.1 | 10 | N |
| FMCU | Apr-16 | 7.36 | 229.5 | 5 | N | FMCU | Oct-16 | 7.4 | 194.9 | 5.0 | N |
| FMCD | Apr-16 | 8.07 | 133.8 | 5 | N | FMCD | Oct-16 | 7.8 | 172.8 | 5 | N |
| 1 | May-16 | 7.35 | 487 | 22 | N | 1 | Nov-16 | 7.3 | 403.0 | 10.0 | N |
| 8 | May-16 | 7.3 | 479 | 5 | N | 8 | Nov-16 | 7.13 | 398 | 5 | N |
| 9 | May-16 | NS | NS | NS | NS | 9 | Nov-16 | NS | NS | NS | NS |
| 10 | May-16 | 7.35 | 1701 | <5 | M | 10 | Nov-16 | 7.18 | 1893 | 11 | N |
| 11 | May-16 | 7.53 | 1421 | 22 | N | 11 | Nov-16 | 7.16 | 154.2 | 5 | N |
| FMCU | May-16 | 6.97 | 226 | 5 | | FMCU | Nov-16 | 7.2 | 175.1 | 8.0 | |
| FMCD | May-16 | 7.65 | 133.6 | 5 | | FMCD | Nov-16 | 7.62 | 145.2 | 5 | |
| 1 | Jun-16 | 7.19 | 226 | 32 | N | 1 | Dec-16 | 7.0 | 378.0 | 63.0 | N |
| 8 | Jun-16 | 6.92 | 437 | 5 | N | 8 | Dec-16 | 6.86 | 328 | 11 | N |
| 9 | Jun-16 | NS | NS | NS | NS | 9 | Dec-16 | NS | NS | NS | NS |
| 10 | Jun-16 | 7.23 | 1044 | <5 | L | 10 | Dec-16 | 7.28 | 1946 | 12 | N |
| 11 | Jun-16 | 7 | 901 | 6 | N | 11 | Dec-16 | 0 | 0 | 0 | N |
| FMCU | Jun-16 | 6.8 | 176.3 | 5 | | FMCU | Dec-16 | 7.1 | 213.9 | 30.0 | N |
| FMCD | Jun-16 | 7.6 | 142.9 | 18 | | FMCD | Dec-16 | 7.29 | 176.6 | 5 | N |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2017**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jan-17 | 6.91 | 259 | 113 | NF |
| 8 | Jan-17 | NS | NS | NS | NF |
| 9 | Jan-17 | NS | NS | NS | |
| 10 | Jan-17 | NS | NS | NS | NF |
| 11 | Jan-17 | 6.51 | 142.1 | 9 | NF |
| FMCU | Jan-17 | 7.05 | 181.7 | 22 | |
| FMCD | Jan-17 | 7.19 | 164.4 | 9 | |
| 1 | Feb-17 | 6.93 | 443 | 16 | NF |
| 8 | Feb-17 | NS | NS | NS | NF |
| 9 | Feb-17 | NS | NS | NS | |
| 10 | Feb-17 | NS | NS | NS | NF |
| 11 | Feb-17 | 6.6 | 171.9 | 22 | NF |
| FMCU | Feb-17 | 6.98 | 198.3 | 23 | |
| FMCD | Feb-17 | 7.49 | 173.2 | 5 | |
| 1 | Mar-17 | 6.34 | 404 | 5 | LF |
| 8 | Mar-17 | 5.89 | 580 | <5 | LF |
| 9 | Mar-17 | NS | NS | NS | |
| 10 | Mar-17 | 6.76 | 1092 | 9 | LF |
| 11 | Mar-17 | 6.5 | 904 | 10 | NF |
| FMCU | Mar-17 | 6.09 | 252.9 | 8 | |
| FMCD | Mar-17 | 7.45 | 241 | 9 | |
| 1 | Apr-17 | 6.92 | 592 | 11 | NF |
| 8 | Apr-17 | 6.33 | 521 | <5 | LF |
| 9 | Apr-17 | NS | NS | NS | |
| 10 | Apr-17 | 6.85 | 1044 | <5 | LF |
| 11 | Apr-17 | 6.94 | 978 | 10 | NF |
| FMCU | Apr-17 | 6.55 | 289 | 6 | |
| FMCD | Apr-17 | 7.29 | 186.6 | <5 | |
| 1 | May-17 | 6.93 | 603 | 17 | NF |
| 8 | May-17 | 6.7 | 685 | 16 | NF |
| 9 | May-17 | NS | NS | NS | |
| 10 | May-17 | 7.34 | 1493 | 30 | NF |
| 11 | May-17 | 5.88 | 348 | 14 | NF |
| FMCU | May-17 | 7.48 | 291 | <5 | |
| FMCD | May-17 | 6.94 | 168.6 | <5 | |
| 1 | Jun-17 | 6.67 | 450 | 6 | LF |
| 8 | Jun-17 | 6.67 | 455 | <5 | NF |
| 9 | Jun-17 | NS | NS | NS | |
| 10 | Jun-17 | 6.68 | 811 | 8 | NF |
| 11 | Jun-17 | 6.75 | 1278 | 15 | NF |
| FMCU | Jun-17 | 7.38 | 267 | 8 | |
| FMCD | Jun-17 | 8.24 | 186 | 5 | |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jul-17 | 7.8 | 565.0 | 5.0 | NF |
| 8 | Jul-17 | 7.04 | 506 | <5 | NF |
| 9 | Jul-17 | NS | NS | NS | |
| 10 | Jul-17 | 7 | 1438 | <5 | NF |
| 11 | Jul-17 | 7.37 | 387 | 14 | NF |
| FMCU | Jul-17 | 7.5 | 298.0 | 14.0 | Light brown |
| FMCD | Jul-17 | 8.15 | 110.1 | <5 | |
| 1 | Aug-17 | 8.1 | 494.0 | 5.0 | NF |
| 8 | Aug-17 | 7.33 | 536 | <5 | NF |
| 9 | Aug-17 | NS | NS | NS | |
| 10 | Aug-17 | 7.27 | 1361 | <5 | NF |
| 11 | Aug-17 | 7.31 | 476 | 176 | NF |
| FMCU | Aug-17 | 6.7 | 303.0 | 122.0 | |
| FMCD | Aug-17 | 6.83 | 110.8 | 86 | |
| 1 | Sep-17 | 7.4 | 586.0 | 37.0 | NF |
| 8 | Sep-17 | 7.21 | 581 | 28 | NF |
| 9 | Sep-17 | NS | NS | NS | |
| 10 | Sep-17 | 6.89 | 2071 | 30 | NF |
| 11 | Sep-17 | 7.64 | 222 | 24 | NF |
| FMCU | Sep-17 | 7.4 | 340.0 | <5 | |
| FMCD | Sep-17 | 7.22 | 202.3 | <5 | |
| 1 | Oct-17 | NS | NS | NS | NF |
| 8 | Oct-17 | NS | NS | NS | NF |
| 9 | Oct-17 | NS | NS | NS | |
| 10 | Oct-17 | 7.07 | 2240 | 111 | NF |
| 11 | Oct-17 | NS | NS | NS | NF |
| FMCU | Oct-17 | 6.2 | 468.0 | 23.0 | Pooled |
| FMCD | Oct-17 | 8.15 | 225 | <5 | |
| 1 | Nov-17 | 7.3 | 202.1 | 33.0 | NF |
| 8 | Nov-17 | 6.28 | 348 | <5 | NF |
| 9 | Nov-17 | NS | NS | NS | |
| 10 | Nov-17 | 7 | 456 | 21 | NF |
| 11 | Nov-17 | NS | NS | NS | NF |
| FMCU | Nov-17 | 6.5 | 163.5 | 10.0 | |
| FMCD | Nov-17 | 7.53 | 149.2 | 5 | |
| 1 | Dec-17 | 6.4 | 242.0 | 24.0 | NF |
| 8 | Dec-17 | NS | NS | NS | NF |
| 9 | Dec-17 | NS | NS | NS | |
| 10 | Dec-17 | 6.43 | 1185 | 41 | NF |
| 11 | Dec-17 | NS | NS | NS | NF |
| FMCU | Dec-17 | 6.5 | 190.8 | 16.0 | |
| FMCD | Dec-17 | 7.75 | 170.9 | <5 | |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

## Surface Water Quality Monitoring Results – 2018

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jan-18 | NS | NS | NS | N |
| 8 | Jan-18 | NS | NS | NS | N |
| 9 | Jan-18 | NS | NS | NS | N |
| 10 | Jan-18 | NS | NS | NS | |
| 11 | Jan-18 | 6.69 | 178.2 | 16 | |
| FMCU | Jan-18 | NS | NS | NS | L |
| FMCD | Jan-18 | 7.2 | 190.9 | 5 | |
| 1 | Feb-18 | NS | NS | NS | N |
| 8 | Feb-18 | NS | NS | NS | N |
| 9 | Feb-18 | NS | NS | NS | N |
| 10 | Feb-18 | NS | NS | NS | |
| 11 | Feb-18 | 6.59 | 158.9 | 13 | |
| FMCU | Feb-18 | 5.42 | 313 | 16 | |
| FMCD | Feb-18 | 7.98 | 208.2 | 10 | |
| 1 | Mar-18 | NS | NS | NS | N |
| 8 | Mar-18 | 6.87 | 389 | 7 | |
| 9 | Mar-18 | NS | NS | NS | |
| 10 | Mar-18 | 6.91 | 1071 | 235 | |
| 11 | Mar-18 | 7.03 | 275 | 5 | |
| FMCU | Mar-18 | 6.67 | 245 | 6 | |
| FMCD | Mar-18 | 7.89 | 151.8 | 8 | |
| 1 | Apr-18 | 7.14 | 580 | 10 | |
| 8 | Apr-18 | 6.85 | 583 | 8 | |
| 9 | Apr-18 | NS | NS | NS | |
| 10 | Apr-18 | 6.82 | 1121 | 16 | |
| 11 | Apr-18 | 7.4 | 311 | 5 | |
| FMCU | Apr-18 | 6.06 | 291 | 7 | |
| FMCD | Apr-18 | 7.12 | 157.1 | 5 | |
| 1 | May-18 | 7.08 | 625 | 10 | |
| 8 | May-18 | 6.8 | 650 | 9 | |
| 9 | May-18 | NS | NS | NS | |
| 10 | May-18 | 7.35 | 1436 | 5 | |
| 11 | May-18 | 7.2 | 182.8 | 5 | |
| FMCU | May-18 | 7.11 | 288 | 6 | |
| FMCD | May-18 | 8.44 | 154.8 | 5 | |
| 1 | Jun-18 | 6.96 | 302 | 9 | |
| 8 | Jun-18 | 6.15 | 410 | 5 | |
| 9 | Jun-18 | NS | NS | NS | |
| 10 | Jun-18 | 6.96 | 1157 | 8 | |
| 11 | Jun-18 | 6.85 | 359 | 5 | |
| FMCU | Jun-18 | 6.63 | 193.9 | 5 | |
| FMCD | Jun-18 | 7.8 | 147.7 | 26 | |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jul-18 | NS | NS | NS | N |
| 8 | Jul-18 | 7.13 | 630 | 24 | |
| 9 | Jul-18 | NS | NS | NS | |
| 10 | Jul-18 | 7.19 | 1776 | 11 | |
| 11 | Jul-18 | 7 | 276 | 5 | |
| FMCU | Jul-18 | 6.8 | 210.0 | 5.0 | |
| FMCD | Jul-18 | 8.02 | 255 | 5 | |
| 1 | Aug-18 | 7.3 | 253.0 | 31.0 | |
| 8 | Aug-18 | NS | NS | NS | N |
| 9 | Aug-18 | NS | NS | NS | |
| 10 | Aug-18 | 7.25 | 1343 | 5 | |
| 11 | Aug-18 | 6.95 | 134.4 | 5 | |
| FMCU | Aug-18 | 6.3 | 239.0 | 13.0 | |
| FMCD | Aug-18 | 7.35 | 149.5 | 7 | |
| 1 | Sep-18 | 6.9 | 225.6 | 57.0 | |
| 8 | Sep-18 | NS | NS | NS | N |
| 9 | Sep-18 | NS | NS | NS | |
| 10 | Sep-18 | 6.9 | 1469 | 5 | |
| 11 | Sep-18 | 6.85 | 139.9 | 5 | |
| FMCU | Sep-18 | 6.8 | 193.9 | 10.0 | |
| FMCD | Sep-18 | 7.76 | 126.6 | 6 | |
| 1 | Oct-18 | 6.7 | 486.0 | 5.0 | |
| 8 | Oct-18 | 6.58 | 367 | 5 | |
| 9 | Oct-18 | NS | NS | NS | |
| 10 | Oct-18 | 6.98 | 1077 | 5 | |
| 11 | Oct-18 | 6.74 | 272 | 5 | |
| FMCU | Oct-18 | 6.5 | 434.0 | 10.0 | |
| FMCD | Oct-18 | 8.03 | 148.4 | 11 | |
| 1 | Nov-18 | 6.7 | 324.0 | 10.0 | |
| 8 | Nov-18 | 6.89 | 441 | 12 | |
| 9 | Nov-18 | NS | NS | NS | |
| 10 | Nov-18 | 6.94 | 1437 | 12 | |
| 11 | Nov-18 | 6.74 | 182.9 | 22 | |
| FMCU | Nov-18 | 6.9 | 440.0 | 15.0 | |
| FMCD | Nov-18 | 8.08 | 166.9 | 5 | |
| 1 | Dec-18 | 6.4 | 294.0 | 15.0 | |
| 8 | Dec-18 | 6.32 | 326 | 6 | |
| 9 | Dec-18 | NS | NS | NS | |
| 10 | Dec-18 | 6.95 | 523 | 23 | |
| 11 | Dec-18 | 6.65 | 204 | 14 | |
| FMCU | Dec-18 | 6.9 | 239.0 | 5.0 | |
| FMCD | Dec-18 | 7.24 | 240 | 26 | |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2019**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jan-19 | 6.92 | 350 | 15 | N | 1 | Jul-19 | 7.0 | 296.6 | 15.0 | N |
| 8 | Jan-19 | NS | NS | NS | N | 8 | Jul-19 | 7.2 | 451.3 | 11 | N |
| 9 | Jan-19 | NS | NS | NS | N | 9 | Jul-19 | NS | NS | NS | N |
| 10 | Jan-19 | 6.78 | 1676 | 9 | N | 10 | Jul-19 | 7.36 | 751.6 | 5 | N |
| 11 | Jan-19 | 7.26 | 163.5 | 5 | N | 11 | Jul-19 | 7.37 | 183.9 | 5 | N |
| FMCU | Jan-19 | 6.95 | 314 | 28 | N | FMCU | Jul-19 | 6.7 | 219.3 | 5.0 | N |
| FMCD | Jan-19 | 7.44 | 190.3 | 5 | M | FMCD | Jul-19 | 7.69 | 237 | 5 | L |
| 1 | Feb-19 | 6.98 | 443 | 26 | N | 1 | Aug-19 | NS | NS | NS | N |
| 8 | Feb-19 | NS | NS | NS | N | 8 | Aug-19 | NS | NS | NS | N |
| 9 | Feb-19 | NS | NS | NS | N | 9 | Aug-19 | NS | NS | NS | N |
| 10 | Feb-19 | NS | NS | NS | N | 10 | Aug-19 | 7.19 | 1004 | 9 | N |
| 11 | Feb-19 | 7.26 | 196.6 | 10 | N | 11 | Aug-19 | 7.47 | 257 | 5 | L |
| FMCU | Feb-19 | NS | NS | NS | N | FMCU | Aug-19 | NS | NS | NS | N |
| FMCD | Feb-19 | 7.84 | 147.9 | 5 | M | FMCD | Aug-19 | 7.88 | 256 | 5 | L |
| 1 | Mar-19 | 6.55 | 193.9 | 50 | N | 1 | Sep-19 | 6.8 | 315.0 | 20.0 | N |
| 8 | Mar-19 | 6.41 | 498 | 26 | N | 8 | Sep-19 | NS | NS | NS | N |
| 9 | Mar-19 | NS | NS | NS | N | 9 | Sep-19 | NS | NS | NS | N |
| 10 | Mar-19 | 6.54 | 410 | 28 | N | 10 | Sep-19 | 7 | 666 | 10 | N |
| 11 | Mar-19 | 6.94 | 214 | 5 | N | 11 | Sep-19 | 7.27 | 588 | 10 | N |
| FMCU | Mar-19 | 7.09 | 163 | 10 | N | FMCU | Sep-19 | 6.9 | 162.9 | 18.0 | N |
| FMCD | Mar-19 | 7.64 | 224 | 26 | L | FMCD | Sep-19 | 7.57 | 225 | 5 | L |
| 1 | Apr-19 | 5.73 | 329 | 27 | N | 1 | Oct-19 | 7.1 | 341.0 | 5.0 | N |
| 8 | Apr-19 | 6.3 | 275.2 | 10 | N | 8 | Oct-19 | NS | NS | NS | N |
| 9 | Apr-19 | NS | NS | NS | N | 9 | Oct-19 | NS | NS | NS | N |
| 10 | Apr-19 | 6.64 | 673.7 | 22 | N | 10 | Oct-19 | 7.7 | 931 | 8 | N |
| 11 | Apr-19 | 7.25 | 241 | 5 | N | 11 | Oct-19 | 7.68 | 160.3 | 5 | N |
| FMCU | Apr-19 | 6.87 | 189 | 5 | N | FMCU | Oct-19 | 6.9 | 210.6 | 21.0 | N |
| FMCD | Apr-19 | 7.45 | 283 | 5 | L | FMCD | Oct-19 | 7.68 | 232.7 | 5 | L |
| 1 | May-19 | 6.83 | 330 | 48 | N | 1 | Nov-19 | 6.7 | 369.0 | 44.0 | N |
| 8 | May-19 | NS | NS | NS | N | 8 | Nov-19 | NS | NS | NS | N |
| 9 | May-19 | NS | NS | NS | N | 9 | Nov-19 | NS | NS | NS | N |
| 10 | May-19 | 6.85 | 961 | 10 | N | 10 | Nov-19 | 7.28 | 1100 | 6 | N |
| 11 | May-19 | 6.94 | 249 | 5 | N | 11 | Nov-19 | 6.65 | 314 | 24 | N |
| FMCU | May-19 | 7 | 178.9 | 12 | N | FMCU | Nov-19 | NS | NS | NS | D |
| FMCD | May-19 | 8.07 | 241 | 5 | L | FMCD | Nov-19 | 7.86 | 274 | 10 | L |
| 1 | Jun-19 | 7.1 | 294 | NS | N | 1 | Dec-19 | NS | NS | NS | N |
| 8 | Jun-19 | NS | NS | NS | N | 8 | Dec-19 | NS | NS | NS | N |
| 9 | Jun-19 | NS | NS | NS | N | 9 | Dec-19 | NS | NS | NS | N |
| 10 | Jun-19 | 6.82 | 1027 | NS | N | 10 | Dec-19 | 7.23 | 1285 | 12 | N |
| 11 | Jun-19 | 7.09 | 238 | NS | N | 11 | Dec-19 | 6.65 | 366 | 38 | N |
| FMCU | Jun-19 | 7.22 | 151.8 | 10 | N | FMCU | Dec-19 | NS | NS | NS | D |
| FMCD | Jun-19 | 8.1 | 219 | 6 | L | FMCD | Dec-19 | 7.79 | 332 | 68 | N |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow  NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2020**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|
| 1 | Jan-20 | NS | NS | NS | N |
| 8 | Jan-20 | NS | NS | NS | N |
| 9 | Jan-20 | NS | NS | NS | NS |
| 10 | Jan-20 | NS | NS | NS | NS |
| 11 | Jan-20 | 6.94 | 527 | 16 | N |
| EM1 | Jan-20 | 7.26 | 172.3 | 46 | N |
| EM3 | Jan-20 | 7.86 | 259 | 5 | N |
| 1 | Feb-20 | 6.62 | 272.7 | 16 | L |
| 8 | Feb-20 | 6.33 | 469 | 15 | N |
| 9 | Feb-20 | NS | NS | NS | NS |
| 10 | Feb-20 | 6.82 | 600 | 29 | L |
| 11 | Feb-20 | 6.55 | 662 | 32 | N |
| EM1 | Feb-20 | 6.66 | 276.4 | <5 | L |
| EM3 | Feb-20 | 6.79 | 274.5 | 5 | N |
| 1 | Mar-20 | 7.26 | 295 | 36 | N |
| 8 | Mar-20 | 6.8 | 474 | 522 | N |
| 9 | Mar-20 | NS | NS | NS | NS |
| 10 | Mar-20 | 6.96 | 359 | 8 | N |
| 11 | Mar-20 | 9.28 | 549 | 14 | N |
| EM1 | Mar-20 | 6.71 | 350 | 12 | N |
| EM3 | Mar-20 | 8.97 | 9.5 | 5 | L |
| 1 | Apr-20 | 6.74 | 291.1 | 15 | N |
| 8 | Apr-20 | 6.7 | 585.8 | <5 | N |
| 9 | Apr-20 | NS | NS | NS | NS |
| 10 | Apr-20 | 7.15 | 749.6 | 12 | N |
| 11 | Apr-20 | 6.71 | 714.6 | 20 | N |
| EM1 | Apr-20 | 7.19 | 335.4 | 14 | N |
| EM3 | Apr-20 | 7.63 | 177.9 | 5 | N |
| 1 | May-20 | 7.3 | 253.2 | <5 | N |
| 8 | May-20 | 6.94 | 327.7 | 6 | N |
| 9 | May-20 | NS | NS | NS | NS |
| 10 | May-20 | 7.23 | 851 | 20 | N |
| 11 | May-20 | 6.75 | 597.3 | 8 | N |
| EM1 | May-20 | 7.31 | 233.4 | 17 | N |
| EM3 | May-20 | 7.33 | 240.5 | 5 | L |
| 1 | Jun-20 | 7.26 | 172.3 | 46 | N |
| 8 | Jun-20 | 6.68 | 380.1 | <5 | L |
| 9 | Jun-20 | NS | NS | NS | NS |
| 10 | Jun-20 | 7.42 | 468.3 | 9 | L |
| 11 | Jun-20 | 7.37 | 1216 | 10 | N |
| EM1 | Jun-20 | 6.79 | 161.2 | 22 | N |
| EM3 | Jun-20 | 7.15 | 153.7 | 5 | M |
| 1 | Jul-20 | 7.1 | 250.8 | 13.0 | N |
| 8 | Jul-20 | 6.29 | 235.8 | <5 | N |
| 9 | Jul-20 | NS | NS | NS | NS |
| 10 | Jul-20 | 7.35 | 366 | 15 | L |
| 11 | Jul-20 | 8.73 | 947 | 76 | N |
| EM1 | Jul-20 | 6.92 | 210.6 | 19 | N |
| EM3 | Jul-20 | 7.19 | 169.6 | 155 | L |
| 1 | Aug-20 | 6.8 | 583.0 | 6.0 | N |
| 8 | Aug-20 | 6.64 | 507 | <5 | L |
| 9 | Aug-20 | NS | NS | NS | NS |
| 10 | Aug-20 | 7.3 | 864 | 6 | L |
| 11 | Aug-20 | 6.87 | 915 | 7 | N |
| EM1 | Aug-20 | 6.77 | 338.2 | <5 | N |
| EM3 | Aug-20 | 7.16 | 225 | 5 | L |
| 1 | Sep-20 | 7.1 | 564.0 | 5.0 | N |
| 8 | Sep-20 | 6.31 | 559 | 7 | N |
| 9 | Sep-20 | NS | NS | NS | NS |
| 10 | Sep-20 | 7.43 | 1051 | 5 | N |
| 11 | Sep-20 | 7.02 | 888 | 7 | N |
| EM1 | Sep-20 | 6.96 | 307 | 7 | N |
| EM3 | Sep-20 | 6.68 | 157.8 | 5 | L |
| 1 | Oct-20 | 7.1 | 524.0 | 42.0 | N |
| 8 | Oct-20 | 6.39 | 480 | 11 | L |
| 9 | Oct-20 | NS | NS | NS | NS |
| 10 | Oct-20 | 7.28 | 1300 | 13 | L |
| 11 | Oct-20 | 7 | 976 | 22 | N |
| EM1 | Oct-20 | 7.02 | 335.1 | 8 | N |
| EM3 | Oct-20 | 6.47 | 156.3 | 15 | L |
| 1 | Nov-20 | 6.9 | 450.0 | 14.0 | N |
| 8 | Nov-20 | 6.31 | 431 | 8 | N |
| 9 | Nov-20 | NS | NS | NS | NS |
| 10 | Nov-20 | 6.99 | 940 | 6 | N |
| 11 | Nov-20 | 6.99 | 1416 | <5 | N |
| EM1 | Nov-20 | 6.67 | 301.2 | 7 | L |
| EM3 | Nov-20 | 7.04 | 177 | 7 | L |
| 1 | Dec-20 | 7.0 | 394.0 | 25.0 | L |
| 8 | Dec-20 | 6.43 | 546 | 8 | L |
| 9 | Dec-20 | NS | NS | NS | NS |
| 10 | Dec-20 | 7.28 | 707 | 5 | L |
| 11 | Dec-20 | 6.91 | 1169 | 25 | N |
| EM1 | Dec-20 | 6.62 | 268.3 | 15 | L |
| EM3 | Dec-20 | 7.07 | 188.8 | 6 | L |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2021**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jan-20 | NS | NS | NS | N | 1 | Jul-20 | 7.1 | 250.8 | 13.0 | N |
| 8 | Jan-20 | NS | NS | NS | N | 8 | Jul-20 | 6.29 | 235.8 | <5 | N |
| 9 | Jan-20 | NS | NS | NS | NS | 9 | Jul-20 | NS | NS | NS | NS |
| 10 | Jan-20 | NS | NS | NS | NS | 10 | Jul-20 | 7.35 | 366 | 15 | L |
| 11 | Jan-20 | 6.94 | 527 | 16 | N | 11 | Jul-20 | 8.73 | 947 | 76 | N |
| EM1 | Jan-20 | 7.26 | 172.3 | 46 | N | EM1 | Jul-20 | 6.92 | 210.6 | 19 | N |
| EM3 | Jan-20 | 7.86 | 259 | 5 | N | EM3 | Jul-20 | 7.19 | 169.6 | 155 | L |
| 1 | Feb-20 | 6.62 | 272.7 | 16 | L | 1 | Aug-20 | 6.8 | 583.0 | 6.0 | N |
| 8 | Feb-20 | 6.33 | 469 | 15 | N | 8 | Aug-20 | 6.64 | 507 | <5 | L |
| 9 | Feb-20 | NS | NS | NS | NS | 9 | Aug-20 | NS | NS | NS | NS |
| 10 | Feb-20 | 6.82 | 600 | 29 | L | 10 | Aug-20 | 7.3 | 864 | 6 | L |
| 11 | Feb-20 | 6.55 | 662 | 32 | N | 11 | Aug-20 | 6.87 | 915 | 7 | N |
| EM1 | Feb-20 | 6.66 | 276.4 | <5 | L | EM1 | Aug-20 | 6.77 | 338.2 | <5 | N |
| EM3 | Feb-20 | 6.79 | 274.5 | 5 | N | EM3 | Aug-20 | 7.16 | 225 | 5 | L |
| 1 | Mar-20 | 7.26 | 295 | 36 | N | 1 | Sep-20 | 7.1 | 564.0 | 5.0 | N |
| 8 | Mar-20 | 6.8 | 474 | 522 | N | 8 | Sep-20 | 6.31 | 559 | 7 | N |
| 9 | Mar-20 | NS | NS | NS | NS | 9 | Sep-20 | NS | NS | NS | NS |
| 10 | Mar-20 | 6.96 | 359 | 8 | N | 10 | Sep-20 | 7.43 | 1051 | 5 | N |
| 11 | Mar-20 | 9.28 | 549 | 14 | N | 11 | Sep-20 | 7.02 | 888 | 7 | N |
| EM1 | Mar-20 | 6.71 | 350 | 12 | N | EM1 | Sep-20 | 6.96 | 307 | 7 | N |
| EM3 | Mar-20 | 8.97 | 9.5 | 5 | L | EM3 | Sep-20 | 6.68 | 157.8 | 5 | L |
| 1 | Apr-20 | 6.74 | 291.1 | 15 | N | 1 | Oct-20 | 7.1 | 524.0 | 42.0 | N |
| 8 | Apr-20 | 6.7 | 585.8 | <5 | N | 8 | Oct-20 | 6.39 | 480 | 11 | L |
| 9 | Apr-20 | NS | NS | NS | NS | 9 | Oct-20 | NS | NS | NS | NS |
| 10 | Apr-20 | 7.15 | 749.6 | 12 | N | 10 | Oct-20 | 7.28 | 1300 | 13 | L |
| 11 | Apr-20 | 6.71 | 714.6 | 20 | N | 11 | Oct-20 | 7 | 976 | 22 | N |
| EM1 | Apr-20 | 7.19 | 335.4 | 14 | N | EM1 | Oct-20 | 7.02 | 335.1 | 8 | N |
| EM3 | Apr-20 | 7.63 | 177.9 | 5 | N | EM3 | Oct-20 | 6.47 | 156.3 | 15 | L |
| 1 | May-20 | 7.3 | 253.2 | <5 | N | 1 | Nov-20 | 6.9 | 450.0 | 14.0 | N |
| 8 | May-20 | 6.94 | 327.7 | 6 | N | 8 | Nov-20 | 6.31 | 431 | 8 | N |
| 9 | May-20 | NS | NS | NS | NS | 9 | Nov-20 | NS | NS | NS | NS |
| 10 | May-20 | 7.23 | 851 | 20 | N | 10 | Nov-20 | 6.99 | 940 | 6 | N |
| 11 | May-20 | 6.75 | 597.3 | 8 | N | 11 | Nov-20 | 6.99 | 1416 | <5 | N |
| EM1 | May-20 | 7.31 | 233.4 | 17 | N | EM1 | Nov-20 | 6.67 | 301.2 | 7 | L |
| EM3 | May-20 | 7.33 | 240.5 | 5 | L | EM3 | Nov-20 | 7.04 | 177 | 7 | L |
| 1 | Jun-20 | 7.26 | 172.3 | 46 | N | 1 | Dec-20 | 7.0 | 394.0 | 25.0 | L |
| 8 | Jun-20 | 6.68 | 380.1 | <5 | L | 8 | Dec-20 | 6.43 | 546 | 8 | L |
| 9 | Jun-20 | NS | NS | NS | NS | 9 | Dec-20 | NS | NS | NS | NS |
| 10 | Jun-20 | 7.42 | 468.3 | 9 | L | 10 | Dec-20 | 7.28 | 707 | 5 | L |
| 11 | Jun-20 | 7.37 | 1216 | 10 | N | 11 | Dec-20 | 6.91 | 1169 | 25 | N |
| EM1 | Jun-20 | 6.79 | 161.2 | 22 | N | EM1 | Dec-20 | 6.62 | 268.3 | 15 | L |
| EM3 | Jun-20 | 7.15 | 153.7 | 5 | M | EM3 | Dec-20 | 7.07 | 188.8 | 6 | L |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow  NS - Sample Unobtainable

**Surface Water Quality Monitoring Results – 2022**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Jan-22 | 7.16 | 684 | 12 | Still | 1 | Jul-22 | 7.2 | 1053.0 | <5 | Trickl |
| 8 | Jan-22 | 6.69 | 575 | 9 | Still | 8 | Jul-22 | 6.97 | 478.1 | <5 | Stead |
| 9 | Jan-22 | NS | NS | NS | NS | 9 | Jul-22 | NS | NS | NS | NS |
| 10 | Jan-22 | 7.28 | 1028 | 6 | Still | 10 | Jul-22 | 7.35 | 800.1 | 9 | Slow |
| 11 | Jan-22 | 7.23 | 665 | 8 | Still | 11 | Jul-22 | 7.31 | 910.2 | 6 | Stead |
| EM1 | Jan-22 | 6.86 | 315 | 9 | Still | EM1 | Jul-22 | 6.86 | 315 | 9 | Still |
| EM3 | Jan-22 | 7.14 | 230.8 | <5 | Trickl | EM3 | Jul-22 | 7.14 | 230.8 | <5 | Trickl |
| 1 | Feb-22 | 7.1 | 674.4 | 16 | Still | 1 | Aug-22 | 7.0 | 1565.0 | <5 | Still |
| 8 | Feb-22 | 7.07 | 472.8 | 151 | Trickl | 8 | Aug-22 | 7.02 | 653.3 | <5 | Trickl |
| 9 | Feb-22 | NS | NS | NS | NS | 9 | Aug-22 | NS | NS | NS | NS |
| 10 | Feb-22 | 7.23 | 1261 | 13 | Trickl | 10 | Aug-22 | 7.4 | 1329 | <5 | Trickl |
| 11 | Feb-22 | 7.19 | 603.1 | 52 | Still | 11 | Aug-22 | 7.4 | 2950 | <5 | Trickl |
| EM1 | Feb-22 | 6.79 | 276 | 17 | Still | EM1 | Aug-22 | 7.28 | 589.9 | <5 | Stead |
| EM3 | Feb-22 | 7.25 | 155.3 | <5 | Trickl | EM3 | Aug-22 | 7.4 | 242.9 | 10 | Stead |
| 1 | Mar-22 | 7.3 | 542.1 | 14 | Trickl | 1 | Sep-22 | 6.8 | 1371.0 | <5 | Still |
| 8 | Mar-22 | 6.96 | 515.3 | <5 | Trickl | 8 | Sep-22 | 6.8 | 658.8 | <5 | Trickl |
| 9 | Mar-22 | NS | NS | NS | NS | 9 | Sep-22 | NS | NS | NS | NS |
| 10 | Mar-22 | 7.04 | 719.6 | 19 | Trickl | 10 | Sep-22 | 7.26 | 1190 | <5 | Slow |
| 11 | Mar-22 | 7.18 | 1044 | 13 | Trickl | 11 | Sep-22 | 7.28 | 2006 | <5 | Trickl |
| EM1 | Mar-22 | 7.6 | 290.6 | 14 | Stead | EM1 | Sep-22 | 7.35 | 429 | 18 | Stead |
| EM3 | Mar-22 | 7.38 | 267.8 | <5 | Slow | EM3 | Sep-22 | 7.53 | 410 | 22 | Stead |
| 1 | Apr-22 | 6.78 | 625.4 | <5 | Slow | 1 | Oct-22 | 7.4 | 885.0 | 8.0 | Slow |
| 8 | Apr-22 | 6.94 | 471.3 | <5 | Slow | 8 | Oct-22 | 6.88 | 540 | <5 | Stead |
| 9 | Apr-22 | NS | NS | NS | NS | 9 | Oct-22 | NS | NS | NS | NS |
| 10 | Apr-22 | 7.16 | 589.1 | 11 | Slow | 10 | Oct-22 | 7.14 | 572 | 23 | Slow |
| 11 | Apr-22 | 7.08 | 1335 | 9 | Slow | 11 | Oct-22 | 8.09 | 1078 | 13 | Slow |
| EM1 | Apr-22 | 7.1 | 319 | 17 | Trickl | EM1 | Oct-22 | 7.35 | 420.1 | <5 | Slow |
| EM3 | Apr-22 | 7.1 | 259.8 | <5 | Trickl | EM3 | Oct-22 | 7.17 | 231.8 | <5 | Slow |
| 1 | May-22 | 7.32 | 504.8 | 27 | Slow | 1 | Nov-22 | 7.1 | 1574.0 | 6.0 | Still |
| 8 | May-22 | 6.66 | 303.7 | 6 | Slow | 8 | Nov-22 | 6.76 | 629.1 | <5 | Trickl |
| 9 | May-22 | NS | NS | NS | NS | 9 | Nov-22 | NS | NS | NS | NS |
| 10 | May-22 | 7.21 | 486.8 | 10 | Slow | 10 | Nov-22 | 7.22 | 1329 | <5 | Trickl |
| 11 | May-22 | 7.28 | 495.2 | 10 | Stead | 11 | Nov-22 | 7.3 | 1902 | 6 | Still |
| EM1 | May-22 | 7.64 | 274.2 | 16 | Stead | EM1 | Nov-22 | 7.09 | 471.3 | 8 | Still |
| EM3 | May-22 | 7.13 | 194.6 | 10 | Stead | EM3 | Nov-22 | 7.2 | 218.3 | <5 | Trickl |
| 1 | Jun-22 | 6.88 | 956.3 | 10 | Slow | 1 | Dec-22 | 7.3 | 1642.0 | 15.0 | Still |
| 8 | Jun-22 | 6.88 | 446.7 | <5 | Trickl | 8 | Dec-22 | 7.11 | 551.5 | 6 | Still |
| 9 | Jun-22 | NS | NS | NS | NS | 9 | Dec-22 | NS | NS | NS | NS |
| 10 | Jun-22 | 7.21 | 1080 | 7 | Trickl | 10 | Dec-22 | 7.38 | 1473 | 6 | Still |
| 11 | Jun-22 | 7.2 | 1347 | <5 | Trickl | 11 | Dec-22 | 7.42 | 1825 | 14 | Still |
| EM1 | Jun-22 | 6.88 | 361.4 | <5 | Trickl | EM1 | Dec-22 | 7.22 | 474.9 | <5 | Still |
| EM3 | Jun-22 | 6.35 | 180.1 | <5 | Trickl | EM3 | Dec-22 | 7 | 160.3 | 10 | Still |

D - Dry, N - Nil Flow, L - Low Flow, M - Medium Flow, H - High Flow  NS - Sample Unobtainable

# Groundwater 2008 to 2022

### Groundwater Quality Monitoring Results – 2008/2009

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Jun-08 | 6.1 | 3740 | 362 | 6 | Dec-08 | 6.1 | 3750 | 356 |
| 7 | Jun-08 | 6.8 | 2200 | 1130 | 7 | Dec-08 | 6.8 | 2490 | 416 |
| 12 | Jun-08 | 6.1 | 4640 | 148 | 12 | Dec-08 | 6.9 | 11300 | 173 |
| 13 | Jun-08 | 6.8 | 12830 | 32 | 13 | Dec-08 | 7 | 13280 | 11 |
| JRD1 | Jun-08 | 7 | 2660 | 132 | JRD1 | Dec-08 | 6.9 | 3800 | 28 |
| JRD2 | Jun-08 | 6.7 | 600 | 130 | JRD2 | Dec-08 | 6.4 | 410 | 180 |
| 6 | Jul-08 | 6.1 | 3970 | 174 | 6 | Jan-09 | 6.6 | 4260 | 1160 |
| 7 | Jul-08 | 7.1 | 2590 | 616 | 7 | Jan-09 | 6.5 | 2250 | 160 |
| 12 | Jul-08 | 6.7 | 6720 | 121 | 12 | Jan-09 | 6.8 | 12440 | 1550 |
| 13 | Jul-08 | 6.7 | 14710 | 6 | 13 | Jan-09 | 6.8 | 14450 | 7 |
| JRD1 | Jul-08 | 6.8 | 3210 | 28 | JRD1 | Jan-09 | 6.8 | 3830 | 13 |
| JRD2 | Jul-08 | 7 | 3040 | 15 | JRD2 | Jan-09 | 7.1 | 3080 | 16 |
| 6 | Aug-08 | 6.1 | 3930 | 804 | 6 | Feb-09 | 6.3 | 3090 | 165 |
| 7 | Aug-08 | 6.7 | 2350 | 98 | 7 | Feb-09 | 6.6 | 2070 | 177 |
| 12 | Aug-08 | 6.8 | 10130 | 216 | 12 | Feb-09 | | | |
| 13 | Aug-08 | 7 | 13610 | 15 | 13 | Feb-09 | 6.9 | 13090 | 18 |
| JRD1 | Aug-08 | 7.0 | 3220 | 35 | JRD1 | Feb-09 | 6.9 | 3790 | 59 |
| JRD2 | Aug-08 | 7.2 | 2980 | 57 | JRD2 | Feb-09 | 6.7 | 500 | 63 |
| 6 | Sep-08 | 6.2 | 2860 | 261 | 6 | Mar-09 | 6.3 | 3820 | 204 |
| 7 | Sep-08 | 6.9 | 2300 | 130 | 7 | Mar-09 | 6.5 | 2090 | 534 |
| 12 | Sep-08 | 6.6 | 1630 | 152 | 12 | Mar-09 | 6.3 | 2390 | 106 |
| 13 | Sep-08 | 6.8 | 13580 | 30 | 13 | Mar-09 | 7 | 13250 | 9 |
| JRD1 | Sep-08 | 7.3 | 3230 | 71 | JRD1 | Mar-09 | 6.8 | 3870 | 14 |
| JRD2 | Sep-08 | 6.5 | 220 | 78 | JRD2 | Mar-09 | 6.7 | 490 | 27 |
| 6 | Oct-08 | 6.4 | 3950 | 14 | 6 | Apr-09 | 6.7 | 3340 | 192 |
| 7 | Oct-08 | 6.6 | 2260 | 878 | 7 | Apr-09 | 6.3 | 2060 | 196 |
| 12 | Oct-08 | 6.8 | 11530 | 407 | 12 | Apr-09 | 6.8 | 7970 | 727 |
| 13 | Oct-08 | 6.8 | 13910 | 9 | 13 | Apr-09 | 6.8 | 14680 | 2 |
| JRD1 | Oct-08 | 6.8 | 3650 | 28 | JRD1 | Apr-09 | 6.6 | 3770 | 11 |
| JRD2 | Oct-08 | 6 | 220 | 125 | JRD2 | Apr-09 | 7 | 2620 | 15 |
| 6 | Nov-08 | 6 | 3750 | 550 | 6 | May-09 | 6.8 | 4250 | 136 |
| 7 | Nov-08 | 6.9 | 2250 | 670 | 7 | May-09 | 7 | 2530 | 264 |
| 12 | Nov-08 | 6.7 | 8880 | 182 | 12 | May-09 | 6.7 | 11550 | 454 |
| 13 | Nov-08 | 7 | 13180 | 3 | 13 | May-09 | 6.9 | 13410 | 18 |
| JRD1 | Nov-08 | 6.7 | 3830 | 12 | JRD1 | May-09 | 6.7 | 3260 | 23 |
| JRD2 | Nov-08 | 6.9 | 240 | 178 | JRD2 | May-09 | 6.9 | 560 | 25 |

## Groundwater Quality Monitoring Results – 2009/2010

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jun-09 | 6.5 | 4460 | 459 |
| 7 | Jun-09 | 6.5 | 2140 | 551 |
| 12 | Jun-09 | NS | NS | NS |
| 13 | Jun-09 | 7.1 | 11920 | 15 |
| JRD1 | Jun-09 | 6.8 | 2250 | 29 |
| JRD2 | Jun-09 | 7.4 | 730 | 91 |
| 6 | Jul-09 | 6.6 | 4290 | 945 |
| 7 | Jul-09 | 6.8 | 2260 | 103 |
| 12 | Jul-09 | 6.7 | 5330 | 1380 |
| 13 | Jul-09 | 6.8 | 14850 | 25 |
| JRD1 | Jul-09 | 6.6 | 3720 | 21 |
| JRD2 | Jul-09 | 7 | 2660 | 15 |
| 6 | Aug-09 | 6.7 | 4580 | 807 |
| 7 | Aug-09 | 6.8 | 2380 | 16 |
| 12 | Aug-09 | 6.9 | 8730 | 15 |
| 13 | Aug-09 | 7.1 | 12600 | 20 |
| JRD1 | Aug-09 | 6.8 | 3090.0 | 52.0 |
| JRD2 | Aug-09 | 7 | 1160 | 97 |
| 6 | Sep-09 | 6.6 | 4380 | 119 |
| 7 | Sep-09 | 6.6 | 2460 | 12 |
| 12 | Sep-09 | NS | NS | NS |
| 13 | Sep-09 | 6.6 | 13490 | 14 |
| JRD1 | Sep-09 | 6.8 | 3130 | 66 |
| JRD2 | Sep-09 | 7.9 | 1230 | 61 |
| 6 | Oct-09 | 6.9 | 3940 | 51 |
| 7 | Oct-09 | 6.8 | 2000 | 147 |
| 12 | Oct-09 | NS | NS | NS |
| 13 | Oct-09 | 7.2 | 11610 | 12 |
| JRD1 | Oct-09 | 7.1 | 3250 | 106 |
| JRD2 | Oct-09 | 7.6 | 1770 | 61 |
| 6 | Nov-09 | 7.2 | 8400 | 266 |
| 7 | Nov-09 | 6.8 | 3590 | 246 |
| 12 | Nov-09 | NS | NS | NS |
| 13 | Nov-09 | 7.3 | 260 | 14 |
| JRD1 | Nov-09 | 6.9 | 10230 | 47 |
| JRD2 | Nov-09 | 7.1 | 350.0 | 47.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Dec-09 | 6.9 | 4270.0 | 193.0 |
| 7 | Dec-09 | 6.9 | 2390 | 14 |
| 12 | Dec-09 | NS | NS | NS |
| 13 | Dec-09 | 7 | 12390 | 26 |
| JRD1 | Dec-09 | 6.7 | 3650 | 63 |
| JRD2 | Dec-09 | 7.3 | 1920.0 | 87.0 |
| 6 | Jan-10 | 6.7 | 5310 | 173 |
| 7 | Jan-10 | NS | NS | NS |
| 12 | Jan-10 | 6.7 | 13200.0 | 37.0 |
| 13 | Jan-10 | 6.5 | 12990 | 31 |
| JRD1 | Jan-10 | 6.8 | 3580 | 22 |
| JRD2 | Jan-10 | 7.3 | 2050.0 | 44.0 |
| 6 | Feb-10 | 6.9 | 4570 | 193 |
| 7 | Feb-10 | NS | NS | NS |
| 12 | Feb-10 | 6.9 | 12280 | 46 |
| 13 | Feb-10 | 7.1 | 11560 | 28 |
| JRD1 | Feb-10 | 6.9 | 3750 | 40 |
| JRD2 | Feb-10 | 7.3 | 960 | 139 |
| 6 | Mar-10 | 6.7 | 4180 | 394 |
| 7 | Mar-10 | NS | NS | NS |
| 12 | Mar-10 | 6.5 | 6880 | 30 |
| 13 | Mar-10 | 7 | 11430 | 32 |
| JRD1 | Mar-10 | 6.8 | 4040 | 38 |
| JRD2 | Mar-10 | 7.4 | 1220 | 100 |
| 6 | Apr-10 | 6.4 | 3900.0 | 397.0 |
| 7 | Apr-10 | NS | NS | NS |
| 12 | Apr-10 | 8.2 | 8440 | 67 |
| 13 | Apr-10 | 7 | 11430 | 32 |
| JRD1 | Apr-10 | 6.7 | 3930 | 52 |
| JRD2 | Apr-10 | 6.3 | 1990 | 101 |
| 6 | May-10 | 6.89 | 1590 | 268 |
| 7 | May-10 | NS | NS | NS |
| 12 | May-10 | 6.75 | 8310 | 34 |
| 13 | May-10 | NS | NS | NS |
| JRD1 | May-10 | 6.73 | 3780 | 23 |
| JRD2 | May-10 | 7.41 | 1590 | 136 |

### Groundwater Quality Monitoring Results – 2010/2011

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jun-10 | 6.9 | 3320 | 206 |
| 7 | Jun-10 | NS | NS | NS |
| 12 | Jun-10 | 7.3 | 3200 | 63 |
| 13 | Jun-10 | 7.6 | 10300 | 12 |
| JRD1 | Jun-10 | 7.5 | 3780 | 43 |
| JRD2 | Jun-10 | 7.2 | 315 | 14 |
| 6 | Jul-10 | 7.23 | 3920 | 194 |
| 7 | Jul-10 | 6.81 | 2630 | 22 |
| 12 | Jul-10 | 6.41 | 7790 | 50 |
| 13 | Jul-10 | 6.64 | 13100 | 6 |
| JRD1 | Jul-10 | 6.65 | 3520 | 22 |
| JRD2 | Jul-10 | 7.1 | 338 | 52 |
| 6 | Aug-10 | 6.37 | 4020 | 234 |
| 7 | Aug-10 | 6.8 | 2680 | 62 |
| 12 | Aug-10 | 6.85 | 7840 | 12 |
| 13 | Aug-10 | 6.65 | 13400 | 16 |
| JRD1 | Aug-10 | 7.2 | 3960.0 | 22.0 |
| JRD2 | Aug-10 | 7.2 | 2380 | 48 |
| 6 | Sep-10 | 7.05 | 3700 | 412 |
| 7 | Sep-10 | 4.76 | 2580 | 36 |
| 12 | Sep-10 | 6.78 | 7800 | 22 |
| 13 | Sep-10 | 6.78 | 11800 | 5 |
| JRD1 | Sep-10 | 8.03 | 3840 | 16 |
| JRD2 | Sep-10 | 7.05 | 2460 | 34 |
| 6 | Oct-10 | 6.58 | 2320 | 152 |
| 7 | Oct-10 | 7.03 | 2660 | 86 |
| 12 | Oct-10 | 6.6 | 10800 | 17 |
| 13 | Oct-10 | 6.99 | 12000 | 9 |
| JRD1 | Oct-10 | 8.05 | 4380 | 76 |
| JRD2 | Oct-10 | 7.27 | 2500 | 17 |
| 6 | Nov-10 | 6.64 | 1090 | 141 |
| 7 | Nov-10 | 7.21 | 2870 | 65 |
| 12 | Nov-10 | 6.44 | 3260 | 30 |
| 13 | Nov-10 | 6.97 | 13100 | 10 |
| JRD1 | Nov-10 | 8.34 | 4720 | 57 |
| JRD2 | Nov-10 | 7.2 | 2520.0 | 58.0 |
| 6 | Dec-10 | 6.5 | 1410.0 | 244.0 |
| 7 | Dec-10 | 7.01 | 2670 | 232 |
| 12 | Dec-10 | 6.31 | 2390 | 71 |
| 13 | Dec-10 | 6.84 | 11000 | 5 |
| JRD1 | Dec-10 | 8.31 | 4460 | 229 |
| JRD2 | Dec-10 | 7.0 | 1120.0 | 99.0 |
| 6 | Jan-11 | 6.51 | 3020 | 708 |
| 7 | Jan-11 | 6.92 | 2800 | 68 |
| 12 | Jan-11 | 6.4 | 7560.0 | 40.0 |
| 13 | Jan-11 | 6.86 | 12400 | 30 |
| JRD1 | Jan-11 | 7.87 | 4990 | 51 |
| JRD2 | Jan-11 | 7.2 | 2110.0 | 222.0 |
| 6 | Feb-11 | 6.47 | 2850 | 173 |
| 7 | Feb-11 | 6.8 | 2760.0 | 147.0 |
| 12 | Feb-11 | 6.35 | 7480 | 94 |
| 13 | Feb-11 | 6.6 | 12400 | 25 |
| JRD1 | Feb-11 | 7.93 | 4660 | 69 |
| JRD2 | Feb-11 | 7.03 | 2500 | 62 |
| 6 | Mar-11 | 6.68 | 2590 | 380 |
| 7 | Mar-11 | 7.04 | 2560 | 39 |
| 12 | Mar-11 | 6.58 | 13800 | 12 |
| 13 | Mar-11 | 6.86 | 12200 | 24 |
| JRD1 | Mar-11 | 8.23 | 4710 | 32 |
| JRD2 | Mar-11 | 7.68 | 2080 | 69 |
| 6 | Apr-11 | 7.4 | 3950.0 | 287.0 |
| 7 | Apr-11 | 7.69 | 2780 | 150 |
| 12 | Apr-11 | 7.46 | 14200 | 82 |
| 13 | Apr-11 | 6.86 | 12200 | 24 |
| JRD1 | Apr-11 | 8.38 | 4840 | 24 |
| JRD2 | Apr-11 | 7.77 | 2520 | 50 |
| 6 | May-11 | 6.7 | 4140 | 84 |
| 7 | May-11 | 7.01 | 2860 | 18 |
| 12 | May-11 | 6.5 | 9230 | 24 |
| 13 | May-11 | 6.88 | 12600 | 42 |
| JRD1 | May-11 | 8.2 | 4970 | 76 |
| JRD2 | May-11 | 7.15 | 2080 | 70 |

**Groundwater Quality Monitoring Results – 2011/2012**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jun-11 | 6.72 | 4020 | 143 |
| 7 | Jun-11 | 6.84 | 2720 | 18 |
| 12 | Jun-11 | 6.46 | 6820 | 18 |
| 13 | Jun-11 | 6.99 | 8970 | 16 |
| JRD1 | Jun-11 | 8.18 | 4750 | 26 |
| JRD2 | Jun-11 | 7.08 | 2280 | 94 |
| 6 | Jul-11 | 7.17 | 4120 | 123 |
| 7 | Jul-11 | 7.2 | 2380 | 40 |
| 12 | Jul-11 | 6.7 | 1840 | 210 |
| 13 | Jul-11 | 7.37 | 11000 | 14 |
| JRD1 | Jul-11 | 8.18 | 4720 | 18 |
| JRD2 | Jul-11 | 6.32 | 441 | 32 |
| 6 | Aug-11 | 6.78 | 3530 | - |
| 7 | Aug-11 | 6.47 | 2160 | 258 |
| 12 | Aug-11 | 7.33 | 1540 | - |
| 13 | Aug-11 | 6.98 | 3770 | - |
| JRD1 | Aug-11 | 8.3 | 4640.0 | - |
| JRD2 | Aug-11 | 7.04 | 337 | - |
| 6 | Sep-11 | 6.77 | 3890 | 144 |
| 7 | Sep-11 | 6.56 | 2190 | 154 |
| 12 | Sep-11 | 6.29 | 4560 | 40 |
| 13 | Sep-11 | 6.89 | 11000 | 17 |
| JRD1 | Sep-11 | NS | NS | NS |
| JRD2 | Sep-11 | 6.25 | 351 | 48 |
| 6 | Oct-11 | 6.69 | 2370 | 94 |
| 7 | Oct-11 | 6.31 | 1540 | 113 |
| 12 | Oct-11 | 6.01 | 1080 | 108 |
| 13 | Oct-11 | 6.88 | 10200 | 36 |
| JRD1 | Oct-11 | NS | NS | NS |
| JRD2 | Oct-11 | 6.21 | 408 | 45 |
| 6 | Nov-11 | 7.28 | 3730 | 194 |
| 7 | Nov-11 | 7.06 | 2010 | 15 |
| 12 | Nov-11 | 6.83 | 4290 | 101 |
| 13 | Nov-11 | 7.34 | 11400 | 15 |
| JRD1 | Nov-11 | 8.25 | 4620 | 52 |
| JRD2 | Nov-11 | 7.1 | 386.0 | 54.0 |
| 6 | Dec-11 | 7.0 | 2680.0 | 262.0 |
| 7 | Dec-11 | 6.78 | 2050 | 142 |
| 12 | Dec-11 | 6.18 | 2720 | 80 |
| 13 | Dec-11 | 7.28 | 9180 | 66 |
| JRD1 | Dec-11 | NS | NS | NS |
| JRD2 | Dec-11 | 6.8 | 313.0 | 76.0 |
| 6 | Jan-12 | 7.08 | 2740 | 542 |
| 7 | Jan-12 | 7.18 | 2190 | 240 |
| 12 | Jan-12 | 6.4 | 9120.0 | 22.0 |
| 13 | Jan-12 | 7.24 | 11000 | 21 |
| JRD1 | Jan-12 | 8.17 | 4120 | 36 |
| JRD2 | Jan-12 | 7.1 | 389.0 | 28.0 |
| 6 | Feb-12 | 7.1 | 3260 | 66 |
| 7 | Feb-12 | 7.2 | 2180.0 | 40.0 |
| 12 | Feb-12 | 6.12 | 1460 | 27 |
| 13 | Feb-12 | 7.21 | 8210 | 22 |
| JRD1 | Feb-12 | 8.26 | 4260 | 14 |
| JRD2 | Feb-12 | 8.06 | 471 | 18 |
| 6 | Mar-12 | 7.11 | 3140 | 35 |
| 7 | Mar-12 | 7.04 | 2190 | 124 |
| 12 | Mar-12 | 6.17 | 517 | 46 |
| 13 | Mar-12 | 7.03 | 3710 | 14 |
| JRD1 | Mar-12 | 8.05 | 4170 | 40 |
| JRD2 | Mar-12 | 7.26 | 390 | 48 |
| 6 | Apr-12 | 7.3 | 3120.0 | 222.0 |
| 7 | Apr-12 | 7.55 | 2740 | 105 |
| 12 | Apr-12 | 6.5 | 2170 | 161 |
| 13 | Apr-12 | 7.03 | 3710 | 14 |
| JRD1 | Apr-12 | 8.18 | 4500 | 57 |
| JRD2 | Apr-12 | 8 | 506 | 50 |
| 6 | May-12 | 7.16 | 3170 | 174 |
| 7 | May-12 | 7.49 | 2720 | 106 |
| 12 | May-12 | 6.37 | 1250 | 130 |
| 13 | May-12 | 7.34 | 11200 | 80 |
| JRD1 | May-12 | 8.17 | 4380 | 26 |
| JRD2 | May-12 | 6.57 | 315 | 69 |

## Groundwater Quality Monitoring Results – 2012/2013

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jun-12 | 7.04 | 662 | 6400 |
| 7 | Jun-12 | 7.14 | 2340 | 78 |
| 12 | Jun-12 | 6.28 | 452 | 40 |
| 13 | Jun-12 | 7.3 | 7560 | 87 |
| JRD1 | Jun-12 | 8.36 | 4280 | 40 |
| JRD2 | Jun-12 | 6.78 | 256 | 88 |
| 6 | Jul-12 | 7.15 | 3320 | 384 |
| 7 | Jul-12 | 7.47 | 2750 | 94 |
| 12 | Jul-12 | 6.44 | 1980 | 84 |
| 13 | Jul-12 | 7.25 | 11200 | 57 |
| JRD1 | Jul-12 | 8.63 | 4590 | 54 |
| JRD2 | Jul-12 | 6.9 | 317 | 72 |
| 6 | Aug-12 | 0 | NS | NS |
| 7 | Aug-12 | 7.41 | 2760 | 78 |
| 12 | Aug-12 | 6.39 | 1030 | 63 |
| 13 | Aug-12 | 7.48 | 9580 | 63 |
| JRD1 | Aug-12 | 8.4 | 4530.0 | 17.0 |
| JRD2 | Aug-12 | 6.93 | 336 | 118 |
| 6 | Sep-12 | NS | NS | NS |
| 7 | Sep-12 | 7.53 | 2820 | 166 |
| 12 | Sep-12 | 6.57 | 1400 | 99 |
| 13 | Sep-12 | 7.37 | 11500 | 19 |
| JRD1 | Sep-12 | 8.42 | 4550 | 22 |
| JRD2 | Sep-12 | 7.22 | 421 | 53 |
| 6 | Oct-12 | NS | NS | NS |
| 7 | Oct-12 | 7.08 | 2410 | 61 |
| 12 | Oct-12 | 6.59 | 1910 | 118 |
| 13 | Oct-12 | 7.29 | 12400 | 11 |
| JRD1 | Oct-12 | 8.44 | 4660 | 12 |
| JRD2 | Oct-12 | 7.24 | 404 | 37 |
| 6 | Nov-12 | NS | NS | NS |
| 7 | Nov-12 | 7.07 | 2490 | 232 |
| 12 | Nov-12 | 6.78 | 3060 | 96 |
| 13 | Nov-12 | 7.09 | 12400 | 44 |
| JRD1 | Nov-12 | 8.31 | 4730 | 8 |
| JRD2 | Nov-12 | 7.0 | 434.0 | 25.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Dec-12 | NS | NS | NS |
| 7 | Dec-12 | 7.1 | 1190 | 90 |
| 12 | Dec-12 | 7.42 | 4340 | 93 |
| 13 | Dec-12 | 7.56 | 11600 | 66 |
| JRD1 | Dec-12 | 8.41 | 4480 | 22 |
| JRD2 | Dec-12 | 8.0 | 474.0 | 50.0 |
| 6 | Jan-13 | NS | NS | NS |
| 7 | Jan-13 | 6.78 | 2170 | 34 |
| 12 | Jan-13 | 7.0 | 5770.0 | 130.0 |
| 13 | Jan-13 | 7.45 | 12100 | 158 |
| JRD1 | Jan-13 | 8.3 | 4590 | 22 |
| JRD2 | Jan-13 | 7.6 | 483.0 | 25.0 |
| 6 | Feb-13 | NS | NS | NS |
| 7 | Feb-13 | 7.4 | 2760.0 | 16.0 |
| 12 | Feb-13 | 6.45 | 1010 | 27 |
| 13 | Feb-13 | 7.4 | 8840 | 69 |
| JRD1 | Feb-13 | 8.26 | 4810 | 31 |
| JRD2 | Feb-13 | 6.66 | 351 | 28 |
| 6 | Mar-13 | NS | NS | NS |
| 7 | Mar-13 | 7.19 | 2550 | 18 |
| 12 | Mar-13 | 6.31 | 636 | 73 |
| 13 | Mar-13 | 7.26 | 6050 | 328 |
| JRD1 | Mar-13 | 8.33 | 4460 | 38 |
| JRD2 | Mar-13 | 6.66 | 242 | 120 |
| 6 | Apr-13 | NS | NS | NS |
| 7 | Apr-13 | 6.79 | 1280 | 72 |
| 12 | Apr-13 | 6.73 | 1800 | 61 |
| 13 | Apr-13 | 7.26 | 6050 | 328 |
| JRD1 | Apr-13 | 8.31 | 4540 | 32 |
| JRD2 | Apr-13 | 6.77 | 255 | 67 |
| 6 | May-13 | NS | NS | NS |
| 7 | May-13 | 7.12 | 2160 | 136 |
| 12 | May-13 | 6.78 | 2520 | 81 |
| 13 | May-13 | 7.46 | 6660 | 130 |
| JRD1 | May-13 | 8.37 | 4610 | 37 |
| JRD2 | May-13 | 7.31 | 407 | 656 |

### Groundwater Quality Monitoring Results – 2013/2014

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jun-13 | NS | NS | NS |
| 7 | Jun-13 | 6.98 | 2910 | <5 |
| 12 | Jun-13 | 6.92 | 3750 | 664 |
| 13 | Jun-13 | 7.62 | 6280 | 136 |
| JRD1 | Jun-13 | 8.28 | 4560 | 94 |
| JRD2 | Jun-13 | 7.16 | 372 | 201 |
| 6 | Jul-13 | 6.45 | 807 | 11600 |
| 7 | Jul-13 | 7.26 | 2530 | 1620 |
| 12 | Jul-13 | 6.85 | 4200 | 3530 |
| 13 | Jul-13 | 7.2 | 6910 | 1520 |
| JRD1 | Jul-13 | 8.46 | 4350 | 68 |
| JRD2 | Jul-13 | 7.22 | 1870 | 795 |
| 6 | Aug-13 | 6.86 | 2590 | 6840 |
| 7 | Aug-13 | NS | NS | NS |
| 12 | Aug-13 | 7.02 | 5310 | 3070 |
| 13 | Aug-13 | 7.82 | 10200 | 820 |
| JRD1 | Aug-13 | 8.3 | 4320 | 150.0 |
| JRD2 | Aug-13 | 7.43 | 2500 | 402 |
| 6 | Sep-13 | 7.04 | 2410 | 4800 |
| 7 | Sep-13 | NS | NS | NS |
| 12 | Sep-13 | 6.9 | 6590 | 892 |
| 13 | Sep-13 | 7.42 | 5950 | 180 |
| JRD1 | Sep-13 | 8.04 | 4390 | 30 |
| JRD2 | Sep-13 | 7.55 | 2350 | 178 |
| 6 | Oct-13 | 6.69 | 2350 | 2560 |
| 7 | Oct-13 | NS | NS | NS |
| 12 | Oct-13 | 7.12 | 9590 | 157 |
| 13 | Oct-13 | 7.49 | 5320 | 43 |
| JRD1 | Oct-13 | 8.31 | 4350 | 9 |
| JRD2 | Oct-13 | 7.54 | 2400 | 271 |
| 6 | Nov-13 | 7.06 | 2300 | 207 |
| 7 | Nov-13 | NS | NS | NS |
| 12 | Nov-13 | 6.94 | 11100 | 332 |
| 13 | Nov-13 | 7.64 | 5950 | 22 |
| JRD1 | Nov-13 | 8.39 | 4560 | 18 |
| JRD2 | Nov-13 | 7.5 | 2530 | 100.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Dec-13 | 6.8 | 967 | 44.0 |
| 7 | Dec-13 | NS | NS | NS |
| 12 | Dec-13 | 6.07 | 1940 | 14 |
| 13 | Dec-13 | 7.42 | 5670 | 118 |
| JRD1 | Dec-13 | NS | NS | NS |
| JRD2 | Dec-13 | 6.2 | 282 | <5 |
| 6 | Jan-14 | 6.86 | 2260 | 655 |
| 7 | Jan-14 | NS | NS | NS |
| 12 | Jan-14 | 6.7 | 8240 | 120.0 |
| 13 | Jan-14 | 7.28 | 6170 | 135 |
| JRD1 | Jan-14 | 8.39 | 4440 | 45 |
| JRD2 | Jan-14 | 7.4 | 2140 | 371.0 |
| 6 | Feb-14 | 7.12 | 2350 | 1950 |
| 7 | Feb-14 | NS | NS | NS |
| 12 | Feb-14 | NS | NS | NS |
| 13 | Feb-14 | 7.51 | 6430 | 78 |
| JRD1 | Feb-14 | 8.35 | 4520 | 28 |
| JRD2 | Feb-14 | 7.48 | 2390 | 497 |
| 6 | Mar-14 | 6.98 | 2240 | 512 |
| 7 | Mar-14 | NS | NS | NS |
| 12 | Mar-14 | NS | NS | NS |
| 13 | Mar-14 | 7.47 | 5480 | 133 |
| JRD1 | Mar-14 | 8.35 | 4220 | 70 |
| JRD2 | Mar-14 | 7.4 | 1800 | 932 |
| 6 | Apr-14 | 7.2 | 2400 | 790.0 |
| 7 | Apr-14 | NS | NS | NS |
| 12 | Apr-14 | NS | NS | NS |
| 13 | Apr-14 | 7.47 | 5480 | 133 |
| JRD1 | Apr-14 | 8.36 | 4330 | 121 |
| JRD2 | Apr-14 | 7.4 | 2150 | 364 |
| 6 | May-14 | 7.04 | 2350 | 3590 |
| 7 | May-14 | NS | NS | NS |
| 12 | May-14 | NS | NS | NS |
| 13 | May-14 | 7.3 | 5260 | 36 |
| JRD1 | May-14 | 8.35 | 4200 | 57 |
| JRD2 | May-14 | 7.55 | 1440 | 230 |

**Groundwater Quality Monitoring Results – 2014**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jun-14 | 0 | 0 | 0 |
| 7 | Jun-14 | 0 | 0 | 0 |
| 12 | Jun-14 | 0 | 0 | 0 |
| 13 | Jun-14 | 0 | 0 | 0 |
| JRD1 | Jun-14 | 0 | 0 | 0 |
| JRD2 | Jun-14 | 0 | 0 | 0 |
| 6 | Jul-14 | 7.04 | 2110 | 872 |
| 7 | Jul-14 | 0 | 0 | 0 |
| 12 | Jul-14 | 0 | 0 | 0 |
| 13 | Jul-14 | 7.43 | 5380 | 415 |
| JRD1 | Jul-14 | 8.35 | 4100 | 18 |
| JRD2 | Jul-14 | 7.36 | 2380 | 242 |
| 6 | Aug-14 | 6.64 | 174 | 2220 |
| 7 | Aug-14 | 0 | 0 | 0 |
| 12 | Aug-14 | 0 | 0 | 0 |
| 13 | Aug-14 | 6.48 | 4350 | 0 |
| JRD1 | Aug-14 | 8.5 | 3990 | 6.3 |
| JRD2 | Aug-14 | 7.8 | 2280 | 693 |
| 6 | Sep-14 | 7.29 | 2370 | 1300 |
| 7 | Sep-14 | 0 | 0 | 0 |
| 12 | Sep-14 | 0 | 0 | 0 |
| 13 | Sep-14 | 0 | 0 | 0 |
| JRD1 | Sep-14 | 0 | 0 | 0 |
| JRD2 | Sep-14 | 7.67 | 2290 | 71 |
| 6 | Oct-14 | 7.58 | 2400 | 342 |
| 7 | Oct-14 | 0 | 0 | 0 |
| 12 | Oct-14 | 0 | 0 | 0 |
| 13 | Oct-14 | 7.33 | 5280 | 22 |
| JRD1 | Oct-14 | 0 | 0 | 0 |
| JRD2 | Oct-14 | 7.36 | 690 | 92 |
| 6 | Nov-14 | 7.29 | 2500 | 63 |
| 7 | Nov-14 | 0 | 0 | 0 |
| 12 | Nov-14 | 0 | 0 | 0 |
| 13 | Nov-14 | 7.35 | 6130 | 88 |
| JRD1 | Nov-14 | 0 | 0 | 0 |
| JRD2 | Nov-14 | 7.4 | 2160 | 93.0 |
| 6 | Dec-14 | 6.8 | 2280 | 234.0 |
| 7 | Dec-14 | 0 | 0 | 0 |
| 12 | Dec-14 | 0 | 0 | 0 |
| 13 | Dec-14 | 7.15 | 4910 | 75 |
| JRD1 | Dec-14 | 0 | 0 | 0 |
| JRD2 | Dec-14 | 6.6 | 439 | 102.0 |

**Groundwater Quality Monitoring Results – 2015**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) | Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Jan-15 | 6.64 | 2190 | 550 | 6 | Jul-15 | 6.9 | 2099 | 90.0 |
| 7 | Jan-15 | 0 | 0 | 0 | 7 | Jul-15 | 0 | 0 | 0 |
| 12 | Jan-15 | 0 | 0 | 0 | 12 | Jul-15 | 0 | 0 | 0 |
| 13 | Jan-15 | 7.06 | 5490 | 75 | 13 | Jul-15 | 7.28 | 2540 | 94 |
| JRD1 | Jan-15 | NS | NS | NS | JRD1 | Jul-15 | NS | NS | NS |
| JRD2 | Jan-15 | 6.6 | 1784 | 171 | JRD2 | Jul-15 | 7.3 | 914 | 9.0 |
| 6 | Feb-15 | 6.74 | 2310 | 38 | 6 | Aug-15 | 7.4 | 2260 | 62 |
| 7 | Feb-15 | 0 | 0 | 0 | 7 | Aug-15 | 0 | 0 | 0 |
| 12 | Feb-15 | 0 | 0 | 0 | 12 | Aug-15 | 0.0 | 0 | 0.0 |
| 13 | Feb-15 | 6.97 | 5480 | 40 | 13 | Aug-15 | 7.45 | 4780 | 122 |
| JRD1 | Feb-15 | NS | NS | NS | JRD1 | Aug-15 | NS | NS | NS |
| JRD2 | Feb-15 | 6.58 | 446 | 24 | JRD2 | Aug-15 | 7.7 | 2168 | 24.0 |
| 6 | Mar-15 | 6.78 | 2350 | 424 | 6 | Sep-15 | 6.65 | 2399 | 31 |
| 7 | Mar-15 | 0 | 0 | 0 | 7 | Sep-15 | 0.0 | 0 | 0.0 |
| 12 | Mar-15 | 0 | 0 | 0 | 12 | Sep-15 | 0 | 0 | 0 |
| 13 | Mar-15 | 6.91 | 5890 | 76 | 13 | Sep-15 | 7.1 | 4810 | 62 |
| JRD1 | Mar-15 | NS | NS | NS | JRD1 | Sep-15 | NS | NS | NS |
| JRD2 | Mar-15 | 6.68 | 788 | 110 | JRD2 | Sep-15 | 6.94 | 2580 | 38 |
| 6 | Apr-15 | 6.45 | 2440 | 626 | 6 | Oct-15 | 6.74 | 2267 | 68 |
| 7 | Apr-15 | 0 | 0 | 0 | 7 | Oct-15 | 0 | 0 | 0 |
| 12 | Apr-15 | 0 | 0 | 0 | 12 | Oct-15 | 0 | 0 | 0 |
| 13 | Apr-15 | 6.68 | 3220 | 86 | 13 | Oct-15 | 7.01 | 4040 | 23 |
| JRD1 | Apr-15 | NS | NS | NS | JRD1 | Oct-15 | NS | NS | NS |
| JRD2 | Apr-15 | 6.74 | 2080 | 130 | JRD2 | Oct-15 | 7.13 | 1961 | 100 |
| 6 | May-15 | 6.53 | 2270 | 44 | 6 | Nov-15 | 6.8 | 2450 | 103.0 |
| 7 | May-15 | 0 | 0 | 0 | 7 | Nov-15 | 0 | 0 | 0 |
| 12 | May-15 | 0 | 0 | 0 | 12 | Nov-15 | 0 | 0 | 0 |
| 13 | May-15 | 6.95 | 4030 | 27 | 13 | Nov-15 | 7.01 | 4040 | 23 |
| JRD1 | May-15 | NS | NS | NS | JRD1 | Nov-15 | NS | NS | NS |
| JRD2 | May-15 | 6.83 | 1910 | 41 | JRD2 | Nov-15 | 7.12 | 2335 | 196 |
| 6 | Jun-15 | 6.47 | 2290 | 38 | 6 | Dec-15 | 6.81 | 2417 | 342 |
| 7 | Jun-15 | 0 | 0 | 0 | 7 | Dec-15 | 0 | 0 | 0 |
| 12 | Jun-15 | 0 | 0 | 0 | 12 | Dec-15 | 0 | 0 | 0 |
| 13 | Jun-15 | 6.92 | 4250 | 71 | 13 | Dec-15 | 7.15 | 5290 | 30 |
| JRD1 | Jun-15 | NS | NS | NS | JRD1 | Dec-15 | NS | NS | NS |
| JRD2 | Jun-15 | 6.7 | 2030 | 37.0 | JRD2 | Dec-15 | 7.13 | 2160 | 108 |

**Groundwater Quality Monitoring Results – 2016**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-16 | 6.72 | 2425 | 128 |
| 12 | Jan-16 | 0 | 0 | 0 |
| 13 | Jan-16 | 7.03 | 3060 | 584 |
| JRD1 | Jan-16 | NS | NS | NS |
| JRD2 | Jan-16 | 6.29 | 527 | 142 |
| 6 | Feb-16 | 6.64 | 2580 | 63 |
| 12 | Feb-16 | 0 | 0 | 0 |
| 13 | Feb-16 | 6.89 | 3670 | 20 |
| JRD1 | Feb-16 | NS | NS | NS |
| JRD2 | Feb-16 | 6.96 | 2113 | 15 |
| 6 | Mar-16 | 6.67 | 2650 | 25 |
| 12 | Mar-16 | 0 | 0 | 0 |
| 13 | Mar-16 | 6.99 | 4410 | 33 |
| JRD1 | Mar-16 | NS | NS | NS |
| JRD2 | Mar-16 | 7.05 | 2436 | 38 |
| 6 | Apr-16 | 6.72 | 2194 | 50 |
| 12 | Apr-16 | 0 | 0 | 0 |
| 13 | Apr-16 | 7.13 | 4240 | 31 |
| JRD1 | Apr-16 | NS | NS | NS |
| JRD2 | Apr-16 | 7.14 | 2360 | 36 |
| 6 | May-16 | 6.8 | 2550 | 154 |
| 12 | May-16 | 0 | 0 | 0 |
| 13 | May-16 | 6.99 | 4840 | 45 |
| JRD1 | May-16 | NS | NS | NS |
| JRD2 | May-16 | 7.12 | 2650 | 21 |
| 6 | Jun-16 | 6.7 | 2230 | 148 |
| 12 | Jun-16 | 0 | 0 | 0 |
| 13 | Jun-16 | 6.99 | 4540 | 19 |
| JRD1 | Jun-16 | NS | NS | NS |
| JRD2 | Jun-16 | 7.1 | 2470 | 24.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jul-16 | 6.7 | 2390 | 47.0 |
| 12 | Jul-16 | 0 | 0 | 0 |
| 13 | Jul-16 | 7.09 | 5310 | 146 |
| JRD1 | Jul-16 | NS | NS | NS |
| JRD2 | Jul-16 | 7.1 | 2660 | 75.0 |
| 6 | Aug-16 | 6.68 | 2560 | 10 |
| 12 | Aug-16 | 0.0 | 0 | 0.0 |
| 13 | Aug-16 | 6.98 | 4200 | 9 |
| JRD1 | Aug-16 | NS | NS | NS |
| JRD2 | Aug-16 | 7.0 | 2120 | 106.0 |
| 6 | Sep-16 | 6.73 | 2480 | 65 |
| 12 | Sep-16 | 0 | 0 | 0 |
| 13 | Sep-16 | 7.06 | 4040 | 10 |
| JRD1 | Sep-16 | NS | NS | NS |
| JRD2 | Sep-16 | 7.04 | 2330 | 12 |
| 6 | Oct-16 | 6.9 | 2560 | 148 |
| 12 | Oct-16 | 0 | 0 | 0 |
| 13 | Oct-16 | 7.06 | 4240 | 18 |
| JRD1 | Oct-16 | NS | NS | NS |
| JRD2 | Oct-16 | 6.98 | 2550 | 28 |
| 6 | Nov-16 | 6.8 | 2550 | 160.0 |
| 12 | Nov-16 | 0 | 0 | 0 |
| 13 | Nov-16 | 7.06 | 4240 | 18 |
| JRD1 | Nov-16 | NS | NS | NS |
| JRD2 | Nov-16 | 6.91 | 1015 | 42 |
| 6 | Dec-16 | 6.57 | 2502 | 47 |
| 12 | Dec-16 | 0 | 0 | 0 |
| 13 | Dec-16 | 6.98 | 4520 | 30 |
| JRD1 | Dec-16 | NS | NS | NS |
| JRD2 | Dec-16 | 6.96 | 2515 | 30 |

### Groundwater Quality Monitoring Results – 2017

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-17 | 6.93 | 2469 | 152 |
| 13 | Jan-17 | NS | NS | NS |
| JRD2 | Jan-17 | 7.05 | 2522 | 32 |
| 6 | Feb-17 | 6.68 | 2163 | 89 |
| 13 | Feb-17 | NS | NS | NS |
| JRD2 | Feb-17 | 6.81 | 2202 | 44 |
| 6 | Mar-17 | 6.62 | 2470 | 100 |
| 13 | Mar-17 | NS | NS | NS |
| JRD2 | Mar-17 | 5.99 | 304 | 252 |
| 6 | Apr-17 | 6.6 | 2219 | 104 |
| 13 | Apr-17 | NS | NS | NS |
| JRD2 | Apr-17 | 6.26 | 506 | 33 |
| 6 | May-17 | 6.69 | 2350 | 98 |
| 13 | May-17 | NS | NS | NS |
| JRD2 | May-17 | 7.26 | 583 | 32 |
| 6 | Jun-17 | 6.54 | 1720 | 30 |
| 13 | Jun-17 | NS | NS | NS |
| JRD2 | Jun-17 | 5.8 | 330 | 152.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jul-17 | 6.5 | 2230 | 92.0 |
| 13 | Jul-17 | NS | NS | NS |
| JRD2 | Jul-17 | 6.9 | 1661 | 62.0 |
| 6 | Aug-17 | 6.75 | 2130 | 611 |
| 13 | Aug-17 | NS | NS | NS |
| JRD2 | Aug-17 | 7.1 | 1533 | 28.0 |
| 6 | Sep-17 | 6.63 | 2250 | 183 |
| 13 | Sep-17 | NS | NS | NS |
| JRD2 | Sep-17 | 6.85 | 2410 | 11 |
| 6 | Oct-17 | 6.51 | 2340 | 55 |
| 13 | Oct-17 | NS | NS | NS |
| JRD2 | Oct-17 | 6.98 | 2480 | 27 |
| 6 | Nov-17 | 5.4 | 363 | 658.0 |
| 13 | Nov-17 | NS | NS | NS |
| JRD2 | Nov-17 | 6.6 | 425 | 146 |
| 6 | Dec-17 | 5.93 | 1875 | 378 |
| 13 | Dec-17 | NS | NS | NS |
| JRD2 | Dec-17 | 6.41 | 1330 | 28 |

### Groundwater Quality Monitoring Results – 2018

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-18 | NS | NS | NS |
| 13 | Jan-18 | NS | NS | NS |
| JRD2 | Jan-18 | 7.11 | 1432 | 51 |
| 6 | Feb-18 | 5.87 | 203 | 190 |
| 13 | Feb-18 | NS | NS | NS |
| JRD2 | Feb-18 | 6.81 | 1373 | 98 |
| 6 | Mar-18 | 5.98 | 171 | 27 |
| 13 | Mar-18 | NS | NS | NS |
| JRD2 | Mar-18 | 6.91 | 1100 | 12 |
| 6 | Apr-18 | 6.59 | 2220 | 114 |
| 13 | Apr-18 | NS | NS | NS |
| JRD2 | Apr-18 | 6.79 | 2230 | 5 |
| 6 | May-18 | 6.8 | 2180 | 108 |
| 13 | May-18 | NS | NS | NS |
| JRD2 | May-18 | 7.02 | 2060 | 60 |
| 6 | Jun-18 | 6.67 | 2400 | 38 |
| 13 | Jun-18 | NS | NS | NS |
| JRD2 | Jun-18 | 7.0 | 2350 | 18.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jul-18 | 6.7 | 2310 | 34.0 |
| 13 | Jul-18 | NS | NS | NS |
| JRD2 | Jul-18 | 6.7 | 1252 | 29.0 |
| 6 | Aug-18 | 6.26 | 2036 | 161 |
| 13 | Aug-18 | NS | NS | NS |
| JRD2 | Aug-18 | 6.4 | 1770 | 44.0 |
| 6 | Sep-18 | 6.64 | 2280 | 37 |
| 13 | Sep-18 | NS | NS | NS |
| JRD2 | Sep-18 | 7.24 | 1182 | 78 |
| 6 | Oct-18 | 6.63 | 2240 | 72 |
| 13 | Oct-18 | NS | NS | NS |
| JRD2 | Oct-18 | 6.86 | 1198 | 81 |
| 6 | Nov-18 | 6.8 | 2360 | 27.0 |
| 13 | Nov-18 | NS | NS | NS |
| JRD2 | Nov-18 | 6.97 | 961 | 52 |
| 6 | Dec-18 | 6.26 | 1177 | 616 |
| 13 | Dec-18 | NS | NS | NS |
| JRD2 | Dec-18 | 5.88 | 178 | 158 |

**Groundwater Quality Monitoring Results – 2019**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-19 | 6.59 | 2420 | 77 |
| 13 | Jan-19 | NS | NS | NS |
| JRD2 | Jan-19 | 6.27 | 146 | 68 |
| 6 | Feb-19 | 6.82 | 2310 | 60 |
| 13 | Feb-19 | NS | NS | NS |
| JRD2 | Feb-19 | 6.66 | 1103 | 119 |
| 6 | Mar-19 | 6.65 | 2170 | 134 |
| 13 | Mar-19 | NS | NS | NS |
| JRD2 | Mar-19 | 6.87 | 2290 | 98 |
| 6 | Apr-19 | 6.7 | 2340 | 74 |
| 13 | Apr-19 | NS | NS | NS |
| JRD2 | Apr-19 | 7.19 | 2550 | 34 |
| 6 | May-19 | 6.84 | 2360 | 55 |
| 13 | May-19 | NS | NS | NS |
| JRD2 | May-19 | 7.03 | 2460 | 5 |
| 6 | Jun-19 | 6.7 | 1960 | 28 |
| 13 | Jun-19 | NS | NS | NS |
| JRD2 | Jun-19 | 7.1 | 2410 | 27.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jul-19 | 6.8 | 1997 | 90.0 |
| 13 | Jul-19 | NS | NS | NS |
| JRD2 | Jul-19 | 7.1 | 2540 | 6.0 |
| 6 | Aug-19 | 6.88 | 2350 | 26 |
| 13 | Aug-19 | NS | NS | NS |
| JRD2 | Aug-19 | 7.1 | 2500 | 28.0 |
| 6 | Sep-19 | 6.66 | 2080 | 26 |
| 13 | Sep-19 | NS | NS | NS |
| JRD2 | Sep-19 | 6.68 | 2100 | 136 |
| 6 | Oct-19 | 6.89 | 2404 | 23 |
| 13 | Oct-19 | NS | NS | NS |
| JRD2 | Oct-19 | 7.16 | 2548 | 24 |
| 6 | Nov-19 | 7.0 | 2370 | 28.0 |
| 13 | Nov-19 | NS | NS | NS |
| JRD2 | Nov-19 | 7.28 | 2490 | 13 |
| 6 | Dec-19 | 6.93 | 2410 | 18 |
| 13 | Dec-19 | NS | NS | NS |
| JRD2 | Dec-19 | 7.22 | 2470 | 5 |

**Groundwater Quality Monitoring Results – 2020**

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-20 | 6.76 | 2210 | 42 |
| 13 | Jan-20 | NS | NS | NS |
| JRD2 | Jan-20 | 7.01 | 2310 | 23 |
| 6 | Feb-20 | NS | NS | NS |
| 13 | Feb-20 | NS | NS | NS |
| JRD2 | Feb-20 | 6.28 | 620 | 70 |
| 6 | Mar-20 | 6.76 | 2615 | 443 |
| 13 | Mar-20 | NS | NS | NS |
| JRD2 | Mar-20 | 6.3 | 720 | 83 |
| 6 | Apr-20 | 6.92 | 2710 | 46 |
| 13 | Apr-20 | NS | NS | NS |
| JRD2 | Apr-20 | 7.35 | 2188 | 49 |
| 6 | May-20 | 6.88 | 2689 | 70 |
| 13 | May-20 | NS | NS | NS |
| JRD2 | May-20 | 7.13 | 2557 | 64 |
| 6 | Jun-20 | 5.89 | 188 | 75 |
| 13 | Jun-20 | NS | NS | NS |
| JRD2 | Jun-20 | 7.2 | 1853 | 58.0 |

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jul-20 | 6.0 | 275 | 168.0 |
| 13 | Jul-20 | NS | NS | NS |
| JRD2 | Jul-20 | 7.1 | 2590 | 11.0 |
| 6 | Aug-20 | 5.77 | 272 | 124 |
| 13 | Aug-20 | NS | NS | NS |
| JRD2 | Aug-20 | 6.0 | 714 | 13.0 |
| 6 | Sep-20 | 6.84 | 2065 | 627 |
| 13 | Sep-20 | NS | NS | NS |
| JRD2 | Sep-20 | 7.17 | 1875 | 51 |
| 6 | Oct-20 | 6.64 | 2391 | 181 |
| 13 | Oct-20 | NS | NS | NS |
| JRD2 | Oct-20 | 7.13 | 2551 | 58 |
| 6 | Nov-20 | 5.9 | 120 | 127.0 |
| 13 | Nov-20 | NS | NS | NS |
| JRD2 | Nov-20 | 6.26 | 924 | 280 |
| 6 | Dec-20 | 6.58 | 2116 | 526 |
| 13 | Dec-20 | NS | NS | NS |
| JRD2 | Dec-20 | 6.26 | 869 | 194 |

## Groundwater Quality Monitoring Results – 2021

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-21 | 6.76 | 1825 | 164 |
| 13 | Jan-21 | 7.2 | 1791 | 71 |
| JRD2 | Jan-21 | NS | NS | NS |
| 6 | Feb-21 | 6.13 | 139 | 126 |
| 13 | Feb-21 | 6.91 | 2211 | 35 |
| JRD2 | Feb-21 | NS | NS | NS |
| 6 | Mar-21 | 6.03 | 602 | 203 |
| 13 | Mar-21 | 5.23 | 491 | 88 |
| JRD2 | Mar-21 | NS | NS | NS |
| 6 | Apr-21 | 6.71 | 2484 | 20 |
| 13 | Apr-21 | 6.57 | 1921 | 54 |
| JRD2 | Apr-21 | NS | NS | NS |
| 6 | May-21 | 6.7 | 2166 | 81 |
| 13 | May-21 | 6.77 | 2067 | 50 |
| JRD2 | May-21 | NS | NS | NS |
| 6 | Jun-21 | 6.65 | 2103 | 55 |
| 13 | Jun-21 | 7.09 | 2523 | 186 |
| JRD2 | Jun-21 | NS | NS | NS |
| 6 | Jul-21 | 6.6 | 2267 | 70 |
| 13 | Jul-21 | 6.89 | 2409 | 51 |
| JRD2 | Jul-21 | NS | NS | NS |
| 6 | Aug-21 | 6.61 | 2308 | 44 |
| 13 | Aug-21 | NS | NS | NS |
| JRD2 | Aug-21 | NS | NS | NS |
| 6 | Sep-21 | 6.57 | 2488 | 214 |
| 13 | Sep-21 | 7.02 | 2546 | 367 |
| JRD2 | Sep-21 | NS | NS | NS |
| 6 | Oct-21 | 6.81 | 2341 | 105 |
| 13 | Oct-21 | 7 | 2182 | 8 |
| JRD2 | Oct-21 | NS | NS | NS |
| 6 | Nov-21 | 7.3 | 2602 | 447.0 |
| 13 | Nov-21 | 7 | 2182 | 8 |
| JRD2 | Nov-21 | NS | NS | NS |
| 6 | Dec-21 | 6.8 | 1921 | 72 |
| 13 | Dec-21 | 6.02 | 614 | 295 |
| JRD2 | Dec-21 | NS | NS | NS |

## Groundwater Quality Monitoring Results – 2022

| Sample Site | Date | pH | EC (uS/cm) | TSS (mg/L) |
|---|---|---|---|---|
| 6 | Jan-22 | 6.59 | 2122 | 71 |
| 13 | Jan-22 | 6.09 | 1033 | 88 |
| JRD2 | Jan-22 | 0 | 0 | 0 |
| 6 | Feb-22 | 6.56 | 2194 | 66 |
| 13 | Feb-22 | 6.71 | 1917 | 59 |
| JRD2 | Feb-22 | 0 | 0 | 0 |
| 6 | Mar-22 | 6.65 | 2067 | 46 |
| 13 | Mar-22 | 5.92 | 608 | 68 |
| JRD2 | Mar-22 | 0 | 0 | 0 |
| 6 | Apr-22 | 6.57 | 2035 | 139 |
| 13 | Apr-22 | 5.92 | 560 | 126 |
| JRD2 | Apr-22 | 0 | 0 | 0 |
| 6 | May-22 | 6.63 | 1452 | 387 |
| 13 | May-22 | 6.06 | 397.2 | 138 |
| JRD2 | May-22 | 0 | 0 | 0 |
| 6 | Jun-22 | 6.71 | 1838 | 192 |
| 13 | Jun-22 | 5.85 | 432.1 | 52 |
| JRD2 | Jun-22 | 0.0 | 0 | 0.0 |
| 6 | Jul-22 | 6.7 | 1614 | 101.0 |
| 13 | Jul-22 | 5.85 | 312.8 | 166 |
| JRD2 | Jul-22 | 0.0 | 0 | 0.0 |
| 6 | Aug-22 | 6.68 | 2197 | 50 |
| 13 | Aug-22 | 6.17 | 499 | 72 |
| JRD2 | Aug-22 | 0.0 | 0 | 0.0 |
| 6 | Sep-22 | 6.51 | 1820 | 71 |
| 13 | Sep-22 | 5.76 | 362 | 15 |
| JRD2 | Sep-22 | 0 | 0 | 0 |
| 6 | Oct-22 | 6.68 | 2170 | 34 |
| 13 | Oct-22 | 6.08 | 366 | 30 |
| JRD2 | Oct-22 | 0 | 0 | 0 |
| 6 | Nov-22 | 6.6 | 1960 | 21.0 |
| 13 | Nov-22 | 6.08 | 366 | 30 |
| JRD2 | Nov-22 | 0 | 0 | 0 |
| 6 | Dec-22 | 6.67 | 2126 | 35 |
| 13 | Dec-22 | 6.42 | 476 | 35 |
| JRD2 | Dec-22 | 0 | 0 | 0 |

# Appendix 3

## Abel Mine Subsidence Management Plan End of Year Report 2022

(No. of pages including blank pages = 23)



DONALDSONCOAL
Part of the Yancoal Australia Group

# Abel Mine
## Subsidence Management Plan
## End of Year Report 2022

**31 March 2023**

**Approved by**

**William Farnworth**
Operations Manager
Donaldson Coal

## TABLE OF CONTENTS



**TABLES**



**ATTACHMENTS**

# 1 INTRODUCTION

This Subsidence Management Plan End of Year Report fulfils the requirements of Condition 19 of the Abel Subsidence Management Plan (SMP) Approval Conditions for Area 1 and Condition 18 of the Approval Conditions for Area 2, 3 and 4.

A summary of monitoring results for the period January to December 2022 is presented in this report. Mining activities were suspended on 28th April 2016 due to the Mine being placed on Care and Maintenance. Therefore, no pillar extraction was undertaken during this reporting period.

Subsidence surveys, photographic monitoring and visual inspections were conducted over all pillar extraction areas in accordance with the approved Subsidence Monitoring Programs, with environmental monitoring conducted in accordance with the approved Environmental Management Plan.

# 2 PURPOSE AND SCOPE

The purpose of this document is to comply with the relevant approval condition which states:

*"The Leaseholder shall prepare an end of year report. This report shall be submitted to the Director Environmental Sustainability, within the first three months of the subsequent year. The end of year report must:*

*(a) include a summary of the subsidence and environmental results for the year;*

*(b) include an analysis of these monitoring results against the relevant;*

- *impact assessment criteria;*
- *monitoring results from previous years; and*
- *predictions in the SMP.*

*(c) identify any trends in the monitoring results over the life of the activity; and*

*(d) describe what actions were taken to ensure adequate management of any potential subsidence impacts due to mining."*

# 3 SMP PILLAR EXTRACTION DURING REPORTING PERIOD

**Area 1**

SMP Approval was granted for Abel Area 1 (Panels 1 to 14 inclusive plus East Mains) on 27 May 2010. Pillar extraction has continued in East Mains during 2014. A Variation application for SMP Area 1 was submitted on the 8 August 2011 and was approved on the 29 September 2011. This variation was related to Panels 9 – 13 being removed from the SMP approved area. No extraction took place in this area during this period.

**Area 2**

SMP Approval was granted for Abel Area 2 (Panels 14 – 26) on 7 December 2011. A variation was submitted on 19 December 2011 relating to the removal of Panel 14 and the shortening of Panels 15 – 19. The second variation submitted, relating to partial pillar extraction Panel 20 – 22, was approved on the 3 September 2012. A third variation submitted, relating to Panels 19 & 19A, was approved on the 21 December 2012. A fourth variation submitted relating to Panel 22, was approved on the 16 April 2013. No extraction took place in this area during this period.

**Area 3**

SMP Approval was granted for Abel Area 3 (Panels 23 – 26 and part East Install Headings) on 16 July 2013. A variation was submitted to increase the width to part of Panel 24 and was approved on the 23 December 2013. No extraction took place in this area during this period.

**Area 4**

SMP/EP Approval was granted for Abel Area 4 (Panels 27 – 35) on the 19th September 2014. A variation was submitted to remove the Subsidence Control Zones around the protected farm dams and was approved on the 11th November 2014. The second variation submitted, relating to Panel 28 panel layout, was approved on 1 April 2015. The third variation submitted, relating to modifying the layout of Panels 29, 31, 33 and 35 which is now to be extracted in the Lower Donaldson Seam, was approved on 13 August 2015. The fourth variation submitted, relating to the removal of the Subsidence Control Zones beneath a principal residence. No extraction took place in this area during this period.

**Table 1** below provides approval, plus mining commencement and completion dates for the Panels extracted since approval was granted.

**Table 1 – Approval and Extraction Dates**

| Panel | Approval Date | Extraction Commenced | Extraction Completed |
|---|---|---|---|
| Panel 1 | 27 May 2010 | 12 July 2010 | 22 December 2010 |
| Panel 2 | 27 May 2010 | 17 September 2010 | 12 November 2010 |
| Panel 3 | 27 May 2010 | 7 January 2011 | 19 April 2011 |
| Panel 4 | 27 May 2010 | 14 March 2011 | 20 July 2011 |
| Panel 5 | 27 May 2010 | 30 May 2011 | 24 September 2011 |
| Panel 6 | 27 May 2010 | 22 September 2011 | 2 February 2012 |
| Panel 7 | 27 May 2010 | 19 November 2011 | 31 May 2012 |
| Panel 8 | 7 December 2011 | 31 March 2012 | 17 July 2012 |
| Panel 15 | 7 December 2011 | 20 February 2012 | 26 March 2012 |
| Panel 20 | 3 September 2012 | 12 September 2012 | 3 December 2012 |
| Panel 21 | 3 September 2012 | 8 November 2012 | 18 April 2013 |
| East Mains | 27 May 2010 | 18 July 2012 | 5 July 2014 |
| East Install Headings | 7 December 2011 | 4 December 2012 | 17 September 2014 |
| Tailgate Headings | 7 December 2011 | 5 June 2012 | 10 September 2012 |
| Panel 19A | 21 December 2012 | 20 January 2013 | 25 May 2013 |
| Panel 19 | 21 December 2012 | 25 May 2013 | 7 August 2013 |
| Panel 22 | 16 April 2013 | 19 April 2013 | 19 July 2013 |
| Panel 23 | 16 July 2013 | 22 July 2013 | 10 March 2014 |
| Panel 24 | 16 July 2013 | 16 September 2013 | 10 July 2014 |
| Panel 25 | 16 July 2013 | 11 May 2014 | 8 May 2015 |
| Panel 26 | 16 July 2013 | 11 August 2014 | 17 June 2015 |
| Panel 27 | 19 September 2014 | 30 September 2014 | 12 August 2015 |
| Panel 28 | 19 September 2014 | 11 May 2015 | 3 February 2016 |
| Panel 30 | 19 September 2014 | 22 June 2015 | 28 April 2016 |
| Panel 31 | 19 September 2014 | 25 February 2016 | 28 April 2016 |

# 4 SUBSIDENCE AND ENVIRONMENTAL PROGRAMS AND MANAGEMENT PLANS

Subsidence Monitoring Programs consisting of a combination of subsidence surveys, visual inspections and photographic monitoring, have been developed in consultation with and approved by the Principal Subsidence Engineer, DPE for all Panels extracted to date. All required subsidence monitoring lines have been installed and subsidence surveys completed in accordance with the agreed Subsidence Monitoring Programs.

Management Plans have been prepared for the following infrastructure outlined in **Table 2** and have been approved by the Director of Mine Safety Operations.

**Table 2 – Approved Management Plans**

| Infrastructure Owners | Management Plans | Approved |
|---|---|---|
| Ausgrid | Ausgrid Powerline Management Plan SMP Area 2 – Tailgate Headings | 21 June 2012 |
| | Ausgrid Powerline Management Plan SMP Area 2 - Panels 20 - 22 | 2 November 2012 |
| | Ausgrid Powerline Management Plan SMP Area 1 – East Mains | 12 July 2013 |
| | Ausgrid Powerline Management Plan SMP Area 3 | 17 July 2013 |
| | Ausgrid Powerline<br><br>Management Plan EP / SMP Area 4 | 1 October 2014 |
| Telstra | Telstra Corporation Management Plan SMP Area 2 (Panels 21 & 22) | 21 December 2012 |
| | Telstra Corporation Management Plan SMP Area 3 (Panels 23 & 24) | 17 July 2013 |
| | Telstra Corporation Management Plan SMP Area 3 Optic Fibre (Panels 23 & 24) | 6 December 2013 |
| | Telstra Corporation Management Plan SMP Area 3 (Panels 25 ) | 11 April 2014 |
| | Telstra Corporation Management Plan SMP Area 3 (Panels 26 ) | 3 September 2014 |
| Telstra | Telstra Corporation Management Plan EP / SMP | 1 October 2014 |

| Infrastructure Owners | Management Plans | Approved |
|---|---|---|
| | Area 4 (Panels 27, 28, 29 ) | |
| TransGrid | TransGrid Towers Management Plan SMP Area 1 | 22 March 2012 |
| | TransGrid Towers Management Plan SMP Area 2 | 16 January 2013 |
| Cessnock City Council | Blackhill Road and Taylors Road Management Plan SMP Area 2 | 7 December 2012 |
| | Blackhill Road Management Plan SMP Area 3 | 11 September 2013 |
| | Public Roads Management Plan | 23 December 2014 |
| Hunter Water | Hunter Water Corporation Water Pipeline Management Plan SMP Area 2 | 21 June 2012 |
| | Hunter Water Corporation Water Pipeline Management Plan SMP Area 1 – East Mains | 12 December 2012 |

# 5 SUMMARY OF SUBSIDENCE IMPACTS

Visual inspections and photographic monitoring of various surface features were conducted throughout the year.

No surveys for subsidence, tilt and strain were undertaken during the year.

## 5.1 Impacts on General Surface and Roads / Tracks

Surface cracking had occurred generally as predicted on the surface above Panels 28, 30 & 31 in the both the cleared and vegetated areas, private access tracks, and sealed private access road, and sealed local government roads whilst mining was being undertaken.

Remedial works were carried out in consultation and agreement with the landholders and infrastructure owners.

## 5.2 Impacts on Hunter Water Corporation Waterline

No further impacts observed. Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

### 5.3 Impacts on Ausgrid Powerlines

No further impacts observed. Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

### 5.4 Impacts on TransGrid Transmission Towers

No further impacts observed. Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

### 5.5 Impacts on Blackhill Road

No further impacts observed. Impacts were within predictions and infrastructure remained in a safe and serviceable condition.

### 5.6 Notification under SMP Approval Conditions

There have been no observed and/or reported subsidence impacts, incidents, service difficulties, community complaints, or any other relevant information, that would require notification under the approval conditions.

## 6 SUBSIDENCE SURVEY SUMMARY AND ANALYSIS

All required subsidence surveys have been completed and were completed shortly after mining effects ceased. A record of all completed subsidence surveys is shown in **Table 3**.

A summary of subsidence, strain and tilt results are detailed in **Table 4** with comparison to the SMP predictions.

All required subsidence monitoring lines have been installed and all pre-mining subsidence surveys completed in accordance with the agreed Subsidence Monitoring Programs.

**Table 3 – Subsidence Monitoring Survey Dates**

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| ***Panel 1*** | *Subsidence Survey* | Installation and pre-mining survey<br><br>7/07/2010 | Weekly Surveys | 11/02/2011<br><br>24/06/2011<br><br>1/08/2012 |
| ***Panel 2*** | *Subsidence Survey* | | | 22/12/2010<br><br>21/06/2011<br><br>20/06/2012<br><br>9/10/2013 |

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| ***Panel 3*** | *Subsidence Survey* | *23/12/2010* | Weekly Surveys | *10/06/2011*<br>*25/10/2011*<br>*9/05/2012* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *23/12/2010* | | |
| ***Panel 4*** | *Subsidence Survey* | *4/03/2011* | Weekly Surveys | *24/08/2011*<br>*9/05/2011*<br>*3/09/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *4/03/2011* | | |
| ***Panel 5*** | *Subsidence Survey* | *27/05/2011* | | *4/11/2011*<br>*2/05/2012*<br>*18/02/2013*<br>*14/09/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *27/05/2011* | | |
| ***Panel 6*** | *Subsidence Survey* | *14/09/2011* | | *1/05/2012*<br>*4/09/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *14/09/2011* | | |
| ***Panel 7*** | *Subsidence Survey* | *8/02/2012* | | *2/08/2012*<br>*28/05/2013*<br>*13/09/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic* | *8/02/2012* | | |

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| | *monitoring* | | | |
| ***Panel 8*** | *Subsidence Survey* | *13/02/2012* | | *31/10/2012*<br>*17/05/2013*<br>*6/09/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *13/02/2012* | | |
| ***Panel 15*** | *Subsidence Survey* | *9/02/2012* | | *27/04/2012*<br>*14/01/2013*<br>*17/05/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *9/02/2012* | | |
| ***Panel 20*** | *Subsidence Survey* | *29/08/2012* | | *10/01/2013*<br>*8/01/2014*<br>*9/07/2014* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *29/08/2012* | | |
| ***Panel 19*** | *Subsidence Survey* | *1/05/2013* | | *14/09/2013*<br>*9/07/2014* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *1/05/2013* | | |
| ***Panel 19A*** | *Subsidence Survey* | *7/01/2013* | | *4/06/2013*<br>*14/09/2013*<br>*5/11/2013*<br>*7/01/2014*<br>*7/07/2014* |

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *7/01/2013* | | |
| ***Panel 21*** | *Subsidence Survey* | *7/11/2012* | | *16/05/2013*<br>*24/01/2014*<br>*1/09/2014* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *7/11/2012* | | |
| ***Panel 22*** | *Subsidence Survey* | *11/04/2013* | | *30/07/2013*<br>*28/01/2014*<br>*19/02/2015* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *11/04/2013* | | |
| ***Panel 23*** | *Subsidence Survey* | *12/07/2013* | | *8/04/2014*<br>*3/03/2015*<br>*28/10/2015* |
| | *Visual inspection* | | Daily | |
| | *Photographic monitoring* | *12/07/2013* | | |
| ***Panel 24*** | *Subsidence Survey* | *19/02/2013* | | *1/10/2014*<br>*3/03/2015*<br>*22/10/2015* |
| | *Visual inspection* | | Daily | |
| | *Photographic monitoring* | *19/02/2013* | | |
| ***Panel 25*** | *Subsidence Survey* | *13/03/2014* | | *3/12/2015*<br>*22/09/2015* |

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| | *Visual inspection* | | Daily | |
| | *Photographic monitoring* | *13/03/2014* | | |
| ***Panel 26*** | *Subsidence Survey* | *9/05/2014* | | *6/08/2015*<br>*31/01/2017* |
| | *Visual inspection* | | Daily | |
| | *Photographic monitoring* | *9/05/2014* | | |
| ***Panel 27*** | *Subsidence Survey* | *16/10/2014* | | *3/09/2015*<br>*31/01/2017* |
| | *Visual inspection* | | Daily | |
| | *Photographic monitoring* | *22/09/2014* | | |
| ***Panel 28*** | *Subsidence Survey* | *6/05/2014* | | *20/12/2016*<br>*28/11/2017* |
| | *Visual inspection* | | *3 times a week* | |
| | *Photographic monitoring* | *6/05/2014* | | |
| ***Panel 30*** | *Subsidence Survey* | *30/11/2015* | | *20/12/2016* |
| | *Visual inspection* | | *3 times a week* | |
| | *Photographic monitoring* | *30/11/2015* | | |
| ***Panel 31*** | *Subsidence Survey* | *25/02/2016* | | *5/12/2016* |
| | *Visual inspection* | | *3 times a week* | |
| | *Photographic monitoring* | *25/02/2016* | | |
| ***East Install Headings*** | *Subsidence Survey* | *14/11/2012* | | *23/01/2013*<br>*8/01/2014* |
| | *Visual inspection* | | Weekly Surveys | |

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| | *Photographic monitoring* | *14/11/2012* | | |
| ***Tailgate Headings*** | *Subsidence Survey* | *18/05/2012* | | *19/12/2012*<br>*13/06/2013*<br>*14/01/2014* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *18/05/2012* | | |
| ***East Mains Headings*** | *Subsidence Survey* | *9/07/2012* | | *14/01/2013*<br>*30/05/2013* |
| | *Visual inspection* | | Weekly Surveys | |
| | *Photographic monitoring* | *9/07/2012* | | |
| ***Blackhill Road*** | *Subsidence Survey* | *19/02/2013* | *As detailed in Management Plan* | Same date as Panel surveys |
| | *Visual inspection* | | *Daily Surveys* | |
| | *Photographic monitoring* | *19/02/2013* | | |
| ***Hunter Water Corporation Pipeline*** | *Subsidence Survey* | 7/07/2010 over P1<br>8/09/2010 over P2 | Weekly Surveys | *11/02/2011 & 24/06/2011 Over P1*<br>*22/12/2010 & 21/06/2011 Over P2* |
| | *Visual inspection* | | *As detailed in Management Plan* | |
| | *Photographic monitoring* | | | |
| ***Ausgrid Power Poles*** | *Subsidence Survey* | Same date as Panel surveys | Weekly Surveys | Same date as Panel surveys |
| | *Visual inspection* | | Weekly Surveys | |

| Survey / Monitoring Line | Survey / Monitoring Description | Pre – Mining Survey | Survey / Inspection / Monitoring Dates | Post – Mining |
|---|---|---|---|---|
| | *Photographic monitoring* | Same date as Panel surveys | | |
| ***TransGrid Transmission Towers*** | *Subsidence Survey* | 28/03/2012 | *As detailed in Management Plan* | Same date as Panel surveys |
| | *Visual inspection* | | Daily Surveys | |
| | *Photographic monitoring* | 28/03/2012 | | |

**Table 4 – Comparison of Subsidence Monitoring Results to SMP Predictions**

| PANEL 1 (W = 120 m; T = 2.35 - 3.0m) | | | |
|---|---|---|---|
| **>75m Cover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 0.95 - 1.25m | 0.72 - 1.228m | Measured subsidence < predictions |
| **Tensile Strain** | 10 - 18 mm/m | 4 - 12 mm/m (18 mm/m) | Measured tensile strains < predictions. |
| **Compressive Strain** | 13 - 23 mm/m | 5 - 14 mm/m | Measured compressive strains < predictions |
| **Tilt** | 22 - 40 mm/m | 22 - 46 mm/m | Measured tilts < predictions. One exceedance of 15%. |
| **Other** | | Cracked Joint to Hunter Water Pipeline Repaired 11kv Power Line | All necessary repairs have been carried out. |

| PANEL 2 (W= 150m ; T = 2.5 m) | | | |
|---|---|---|---|
| **< 75m Cover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 1.30 - 1.38m | 0.977 - 1.041 m | Measured subsidence < predictions |
| **Tensile Strain** | 18 - 31 mm/m | 4 - 6 mm/m (5 mm/m) | Measured tensile strains < predictions |
| **Compressive Strain** | 23 - 40 mm/m | 4 - 7 mm/m | Measured compressive strains < predictions |
| **Tilt** | 40 - 67 mm/m | 22 - 32 mm/m | Measured tilts < predictions |
| **Other** | | | |
| **>75m Cover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 1.20 - 1.32m | 0.94 - 0.966m | Measured subsidence < predictions |
| **Tensile Strain** | 13 - 20 mm/m | 9 mm/m (15 mm/m) | Measured tensile strains < predictions |
| **Compressive Strain** | 17 - 25 mm/m | 6 mm/m | Measured compressive strains < predictions |
| **Tilt** | 30 - 45 mm/m | 27 mm/m | Measured tilts < predictions |
| **Other** | | | |

| PANEL 3 (W=160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| < 75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.33 - 1.34 m | 1.003 m | Measured subsidence < predictions |
| Tensile Strain | 19 - 31 mm/m | 8 - 9 mm/m (26 mm/m) | Measured tensile strains < predictions |
| Compressive Strain | 24 - 40 mm/m | 5 - 7 mm/m | Measured compressive strains < predictions |
| Tilt | 42 - 67 mm/m | 28 - 39 mm/m | Measured tilts < predictions |
| Other | | | |
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.26 - 1.27 m | 0.884 - 0.982 m | Measured subsidence < predictions |
| Tensile Strain | 14 - 21mm/m | 8 mm/m (10 mm/m) | Measured tensile strains < predictions |
| Compressive Strain | 18 - 27 mm/m | 4 mm/m | Measured compressive strains < predictions |
| Tilt | 33 - 49 mm/m | 30 mm/m | Measured tilts < predictions |
| Other | | | |

| PANEL 4 (W= 160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| < 75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.27-1.29m | 1.065m | Measured subsidence < predictions |
| Tensile Strain | 19 - 31 mm/m | 6 - 10 mm/m (37.5 mm/m) | Measured tensile strains < predictions with 1 exceedance of 20% at clay cap. |
| Compressive Strain | 24 - 40 mm/m | 6 - 18 mm/m | Measured compressive strains < predictions |
| Tilt | 42 - 67 mm/m | 36 - 60 mm/m | Measured tilts < predictions |
| Other | | | |
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.29 - 1.32m | 1.054 m | Measured subsidence < predictions |
| Tensile Strain | 14 - 21mm/m | 5 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 18 - 27 mm/m | 5 mm/m | Measured compressive strains < predictions |
| Tilt | 42 - 67 mm/m | 25 - 36 mm/m | Measured tilts < predictions |
| Other | | | |

| PANEL 5 (W= 160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| < 75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.27-1.43 | 1.154m | Measured subsidence < predictions |
| Tensile Strain | 14 - 15 mm/m | 10 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 15 - 19 mm/m | 4 mm/m | Measured compressive strains < predictions |
| Tilt | 41 - 46 mm/m | 68 mm/m | Measured tilts < predictions with 1 minor exceedance |
| Other | | | |
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.42 - 1.43m | 1.002 m | Measured subsidence < predictions |
| Tensile Strain | 11 - 15 mm/m | 2 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 15 - 18 mm/m | 13 mm/m | Measured compressive strains < predictions |
| Tilt | 38 - 46 mm/m | 29.8 mm/m | Measured tilts < predictions |
| Other | | | |

| PANEL 6 (W= 160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| < 75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.21 - 1.32m | 1.215m | Measured subsidence < predictions |
| Tensile Strain | 14 mm/m | 8 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 17 - 18 mm/m | 21 mm/m | Measured compressive strains < predictions with 1 minor exceedance |
| Tilt | 39 - 41 mm/m | 89.6 mm/m | Measured tilts < predictions with 1 minor exceedance |
| Other | | | |
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.32 - 1.42m | 1.066 m | Measured subsidence < predictions |
| Tensile Strain | 11 - 14mm/m | 9 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 14 - 17 mm/m | 7 mm/m | Measured compressive strains < predictions |
| Tilt | 38 - 41 mm/m | 30 mm/m | Measured tilts < predictions |
| Other | | | |

| PANEL 7 (W= 160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| < 75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.27 - 1.32m | 0.771m | Measured subsidence < predictions |
| Tensile Strain | 11 - 14 mm/m | 5 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 14 - 18 mm/m | 2 mm/m | Measured compressive strains < predictions |
| Tilt | 41 mm/m | 12 mm/m | Measured tilts < predictions |
| Other | | | |
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.32 - 1.43m | 1.336 m | Measured subsidence < predictions |
| Tensile Strain | 11 - 15mm/m | 23 mm/m | Measured tensile strains < predictions with 1 minor exceedance |
| Compressive Strain | 14 - 18 mm/m | 36 mm/m | Measured compressive strains < predictions with 1 minor exceedance |
| Tilt | 41 mm/m | 42.5 mm/m | Measured tilts < predictions with 1 minor exceedance |
| Other | | | |

| PANEL 8 (W= 160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| < 75m Cover | Predicted | Final Measured | Comment |
| Subsidence | < 1.32m | 0.830m | Measured subsidence < predictions |
| Tensile Strain | 14 - 15 mm/m | 2 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 17 - 19 mm/m | 3 mm/m | Measured compressive strains < predictions |
| Tilt | 42 mm/m | 11.4 mm/m | Measured tilts < predictions |
| Other | | | |
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.25 - 1.32m | 0.845 m | Measured subsidence < predictions |
| Tensile Strain | 10 - 14mm/m | 11 mm/m | Measured tensile strains < predictions with 1 minor exceedance |
| Compressive Strain | 13 - 17 mm/m | 6 mm/m | Measured compressive strains < predictions with 1 minor exceedance |
| Tilt | 41 mm/m | 33.8 mm/m | Measured tilts < predictions |
| Other | | | |

| PANEL 15 (W= 160.5 m; T = 2.5 m) | | | |
|---|---|---|---|
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.17 - 1.23m | 1.164m | Measured subsidence < predictions |
| Tensile Strain | 7 - 12mm/m | 15 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 9 - 15 mm/m | 13 mm/m | Measured compressive strains < predictions |
| Tilt | 19 - 32 mm/m | 49 mm/m | Measured tilts < predictions with 2 minor exceedance |
| Other | | | |

| PANEL 20 (W= 128 m; T = 2.7 m) | | | |
|---|---|---|---|
| >75m Cover | Predicted | Final Measured | Comment |
| Subsidence | 150 mm | 62 mm | Measured subsidence < predictions |
| Tensile Strain | 2 mm/m | 1 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 2 mm/m | 2 mm/m | Measured compressive strains < predictions |
| Tilt | 3 mm/m | 2.5 mm/m | Measured tilts < predictions |
| Other | | | |

| PANEL 21 (W= 212 m; T = 2.7 m) | | | |
|---|---|---|---|
| **125m Cover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 150 mm | 96 mm | Measured subsidence < predictions |
| **Tensile Strain** | 2 mm/m | 1 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 2 mm/m | 1 mm/m | Measured compressive strains < predictions |
| **Tilt** | 3 mm/m | 2.1 mm/m | Measured tilts < predictions |
| **Other** | | | |

| TAILGATE HEADINGS (W= 80.5 m; T = 2.8 m) | | | |
|---|---|---|---|
| **<110mCover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 0.88 – 0.99m | 0.250m | Measured subsidence < predictions |
| **Tensile Strain** | 8 - 9mm/m | 2 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 8 - 9 mm/m | 2 mm/m | Measured compressive strains < predictions |
| **Tilt** | 18 - 33 mm/m | 7 mm/m | Measured tilts < predictions |
| **Other** | | | |

| EAST INSTALL HEADINGS (W= 105m; T = 2.7 m) | | | |
|---|---|---|---|
| **100m Cover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 0.9m | 1.286m | Measured subsidence > predictions |
| **Tensile Strain** | 13 – 19 mm/m | 12 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 16 - 24 mm/m | 9 mm/m | Measured compressive strains < predictions |
| **Tilt** | 24 - 35 mm/m | 44 mm/m | Measured tilts > predictions |
| **Other** | | | |

| EAST MAINS HEADINGS (W= 125m; T = 2.7 m) | | | |
|---|---|---|---|
| **100m Cover** | **Predicted** | **Final Measured** | **Comment** |
| **Subsidence** | 1.59m | 1.408m | Measured subsidence < predictions |
| **Tensile Strain** | 10 - 16 mm/m | 11 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 13 - 20 mm/m | 15 mm/m | Measured compressive strains < predictions |
| **Tilt** | 49 mm/m | 48.6 mm/m | Measured tilts < predictions |
| **Other** | | | |

**Panel 19A (W= 227.9m; T = 2.6 m)**

| 100m Cover | Predicted | Final Measured | Comment |
|---|---|---|---|
| **Subsidence** | 1.42m | 1.261m | Measured subsidence < predictions |
| **Tensile Strain** | 8 - 14 mm/m | 3 - 12 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 11 - 18 mm/m | 4 - 13 mm/m | Measured compressive strains < predictions |
| **Tilt** | 40 mm/m | 29 - 48 mm/m | Measured tilts < predictions with only a minor exceedance |
| **Other** | | | |

**PANEL 22 (W= 180.3 m; T = 2.8 m)**

| 125m Cover | Predicted | Final Measured | Comment |
|---|---|---|---|
| **Subsidence** | 150 mm | 44 mm | Measured subsidence < predictions |
| **Tensile Strain** | 2 mm/m | 1 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 2 mm/m | 1 mm/m | Measured compressive strains < predictions |
| **Other** | | | |

**PANEL 23 (W= 215 m; T = 2.5 m)**

| <130m Cover | Predicted | Final Measured | Comment |
|---|---|---|---|
| **Subsidence** | 1.30m | 0.983m | Measured subsidence < predictions |
| **Tensile Strain** | 30 mm/m | 13 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 30 mm/m | 13 mm/m | Measured compressive strains < predictions |
| **Other** | | | |

**PANEL 24 (W= 220 m; T = 2.5 m)**

| <130m Cover | Predicted | Final Measured | Comment |
|---|---|---|---|
| **Subsidence** | 1.30m | 1.061m | Measured subsidence < predictions |
| **Tensile Strain** | 30 mm/m | 7 mm/m | Measured tensile strains < predictions |
| **Compressive Strain** | 30 mm/m | 9 mm/m | Measured compressive strains < predictions |
| **Other** | | | |

| PANEL 25 (W= 220 m; T = 2.5 m) | | | |
|---|---|---|---|
| <130m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.30m | 1.087m | Measured subsidence < predictions |
| Tensile Strain | 30 mm/m | 21 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 30 mm/m | 9 mm/m | Measured compressive strains < predictions |
| Other | | | |

| PANEL 26 (W= 220 m; T = 2.5 m) | | | |
|---|---|---|---|
| <130m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.30m | 1.130m | Measured subsidence < predictions |
| Tensile Strain | 30 mm/m | 9 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 30 mm/m | 13 mm/m | Measured compressive strains < predictions |
| Other | | | |

| PANEL 27 (W= 190 m; T = 2.5 m) | | | |
|---|---|---|---|
| <170m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.40m | 1.005m | Measured subsidence < predictions |
| Tensile Strain | 30 mm/m | 2 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 30 mm/m | 8 mm/m | Measured compressive strains < predictions |
| Other | | | |

| PANEL 28 (W= 190 m; T = 2.5 m) | | | |
|---|---|---|---|
| <190m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.40m | 1.319m | Measured subsidence < predictions |
| Tensile Strain | 30 mm/m | 1 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 30 mm/m | 10 mm/m | Measured compressive strains < predictions |
| Other | | | |

| PANEL 30 (W= 190 m; T = 2.5 m) | | | |
|---|---|---|---|
| <200m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.40m | 1.131m | Measured subsidence < predictions |
| Tensile Strain | 30 mm/m | 11 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 30 mm/m | 11 mm/m | Measured compressive strains < predictions |
| Other | | | |

| PANEL 31 (W= 170 m; T = 2.5 m) | | | |
|---|---|---|---|
| <200m Cover | Predicted | Final Measured | Comment |
| Subsidence | 1.40m | 0.307 m | Measured subsidence < predictions |
| Tensile Strain | 30 mm/m | 6 mm/m | Measured tensile strains < predictions |
| Compressive Strain | 30 mm/m | 7 mm/m | Measured compressive strains < predictions |
| Other | | | |

## 7 PHOTOGRAPHIC MONITORING AND VISUAL INSPECTION SUMMARY AND ANALYSIS

Dates of photographic monitoring and visual inspections are shown in **Table 3.** No impacts or changes have been noted in either photographic monitoring or visual inspections and these results have been detailed in the Subsidence Management Status Report submitted in September 2018.

No evidence of impacts has been observed or noted during these inspections and monitoring.

Comparison of pre and post mining photographic monitoring did not reveal any evidence of impact.

## 8 ENVIRONMENTAL MONITORING SUMMARY AND ANALYSIS

**Water**

Monthly monitoring of regional groundwater levels and quality was undertaken throughout the year in accordance with the Site Water Management Plan.

A summary of groundwater and surface water quality is provided in **Tables 5** and **6.**

**Table 5 – Summary of Groundwater Quality Monitoring Results 1 January to 31 December 2022.**

| Sampling Site | pH | EC (µS/cm) | TSS (mg/L) |
|---|---|---|---|
| 6 | 6.51 – 6.71 (6.62) | 1452 – 2197 (1,966) | 21– 387 (101) |
| 13 | No Access to site | No Access to site | No Access to site |
| JRD2 | 5.76 – 6.71 (6.11) | 313 – 1,917 (618) | 15 – 166 (74) |

**Table 6 – Summary of Surface Water Quality Monitoring Results 1 January to 31 December 2022**

| Sampling Site | pH | EC (µS/cm) | Turbidity (NTU) | TSS (mg/L) |
|---|---|---|---|---|
| 1 | 6.78 - 7.42 (7.11) | 505 - 1642 (1006) | 7 – 57.3 (27.8) | <5 – 27 (10.6) |
| 8 | 6.66 – 7.11 (6.89) | 304 – 659 (525) | 10.9 – 66.6 (24.4) | <5 – 151 (17.6) |
| 10 | 7.04 – 7.4 (7.24) | 487 – 1,473 (988) | 2.6 – 62.9 (20.6) | <5 – 23 (9.9) |
| 11 | 7.08 – 8.09 (7.33) | 495 – 2950 (1347) | 4.1 – 66.3 (25.9) | <5 -52 (12.2) |
| FMCU | 6.79 - 7.64 (7.18) | 274 – 590 (381) | 20.7 – 80.4 (42.5) | <5 – 22 (11.8) |
| FMCD | 6.47 – 7.34 (6.95) | 140 – 451 (275) | 19.6 – 55.9 (35.3) | <5 – 19 (7.8) |

# 9 TRENDS IN MONITORING RESULTS

**Surface Water**

The pH values at all sites were slightly acidic to slightly alkaline. All results were within the upper and lower water quality trigger values for Lowland Rivers in NSW outlined in the Guidelines for Fresh and Marine Water Quality (ANZECC 2000). Previously there have been short term declines in pH following significant rainfall events such as in November 2013 (261.8mm rainfall), April 2015 (412mm rainfall), January 2016 (430.8mm) and March 2021 (234.8mm). This also occurred in March 2022 (271.4mm) and July 2022 (310.8). Overall, during the reporting period there were no significant differences in pH between the upstream and downstream sites.

The electrical conductivity (EC) results range between 140µS/cm and 2950µS/cm for all sites. There was one occasion were electrical conductivity was recorded outside of water quality trigger values for Lowland Rivers in NSW (125 to 2,200µS/cm) (ANZECC 2000). EC showed a reduction in March and July 2022 after a significant period of rainfall.

The average EC values upstream are typically similar or slightly higher than the corresponding downstream values. No other long-term trends in EC are apparent.

Turbidity levels at all sites exceeded the water quality trigger values for Lowland Rivers in NSW (6 to 50 NTU) outlined in the Guidelines for Fresh and Marine Water Quality (ANZECC 2000). Total suspended solids (TSS) exceeded the industry standard for TSS criteria (50mg/L) at Sites 8 and 11 on one occasion each.
Sites 1, 8 and 10 are upstream monitoring locations and it is not considered that the mine activities contributed to these levels but rather localised conditions.

No long-term trends are apparent within the monitoring data with widely varying results with spikes in turbidity and TSS not necessarily correlated with monthly rainfall. Baseline monitoring results for both upstream and downstream sites have previously recorded significantly elevated TSS which are considered to form part of the natural variation.

**Groundwater Levels**

Piezometers located within and to the south of the Abel mine area are behaving predictably, with drawdown in the Donaldson Seams and by a lesser amount in most overburden piezometers responding as expected to mining activities. Piezometers to the west of the Abel mine area appear to be influenced by mining activity at Bloomfield Colliery.

Monitoring confirms that there is no evidence of any drawdown response in the alluvium or regolith groundwater. In particular, Piezometers 81A and 81B are located adjacent the Pambalong Nature Reserve. Historical monitoring results from 81A (single vibrating wire transducer placed within the Lower Donaldson Seam) showed a drawdown response to mining the Donaldson Seam within the Abel Mine. However, Piezometer 81B is screened within overlying shallow Permian strata with water levels remaining stable throughout mining. The lack of response in the shallow piezometer indicates there has been no mining impact on the Pambalong Nature Reserve.

Piezometers 63A and B are located to the east of the Abel Mine adjacent to the F3 Freeway and near the Hexham Swamp. However, it appears that the shallow Piezometer 63B has failed or the bore has collapsed. Notwithstanding this, review of the responses from other shallow alluvium and regolith bores is still consistent with there being no impact on the Hexham Swamp.

During the period access to Site 13 was restricted with no access granted by the property owner.

## 10 MANAGEMENT ACTIONS

Actions taken to ensure adequate management of any potential subsidence impacts due to mining include:

- Various monitoring programs, subsidence surveys, visual inspections, photographic monitoring to detect any impact;

- TARPs (Trigger, Action, Response Plans) forming part of approved Public Safety Management Plans and Environmental Monitoring Programs which include mitigation/remediation options and notification procedures relating to subsidence monitoring, surface cracking on both roads / fire trails and vegetated areas and impacts on rock mass / steep slopes and Aboriginal sites.