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 2021 – 31 December 2021

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DONALDSON COAL

PTY LTD

ABN: 87 073 088 945

Annual Review

for the

Abel Underground Coal Mine

1 January 2021 – 31 December 2021

Compiled for:

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Ref No. 737/25b

March 2022

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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
MOP/RMP start date	02/05/2016
MOP/RMP end date	01/05/2022
Annual Review start date	01/01/2021
Annual Review end date	31/12/2021

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 2021 to 31 December 2021 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	23 March 2022

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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 was one administrative non-compliance during the reporting period. The non-compliance recorded during the reporting period has been ranked according to the risk matrix included in **Table 1.2**.

Table 1.1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	Yes / No
Project Approval 05_0136	No
Mining Lease 1618	Yes
Mining Lease 1653	Yes
Water Supply Works Approval 20WA218986 and Water Access Licence 41525	Not Determined[1]
1. Updated licence with conditions not yet received.	

Table 1.2
Non-compliances

Relevant Approval	Cond #	Condition Description (summary)	Compliance Status	Comment	Where Addressed in Annual Review
PA 05_0136	2/11a	Ensure that all new buildings and structures, and any alterations or additions are constructed in accordance with the relevant requirements of the BCA.	Non-compliant	Construction Certificates have been received for buildings within the surface infrastructure area but not Occupation Certificates. Certifying body inspected once and requested changes. Changes have been made and the Certifying body requested to reinspect. Occupation certificates yet to be issued.	Section 11

Compliance Status Key

Risk level	Colour code	Description
High	*Non-compliant*	*Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.*
Medium	*Non-compliant*	*Non-compliance with:* *potential for serious environmental consequences, but is unlikely to occur; or* *potential for moderate environmental consequences, but is likely to occur.*
Low	*Non-compliant*	*Non-compliance with:* *potential for moderate environmental consequences, but is unlikely to occur; or* *potential for low environmental consequences, but is likely to occur.*
Administrative non-compliance	*Non-compliant*	*Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).*

2. INTRODUCTION

2.1 OVERVIEW OF OPERATIONS

The Abel Underground Coal Mine (the "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 sixth Annual Review submitted for the mine, following nine Annual Environmental Management Reports, and is applicable for the period 1 January to 31 December 2021 ("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.

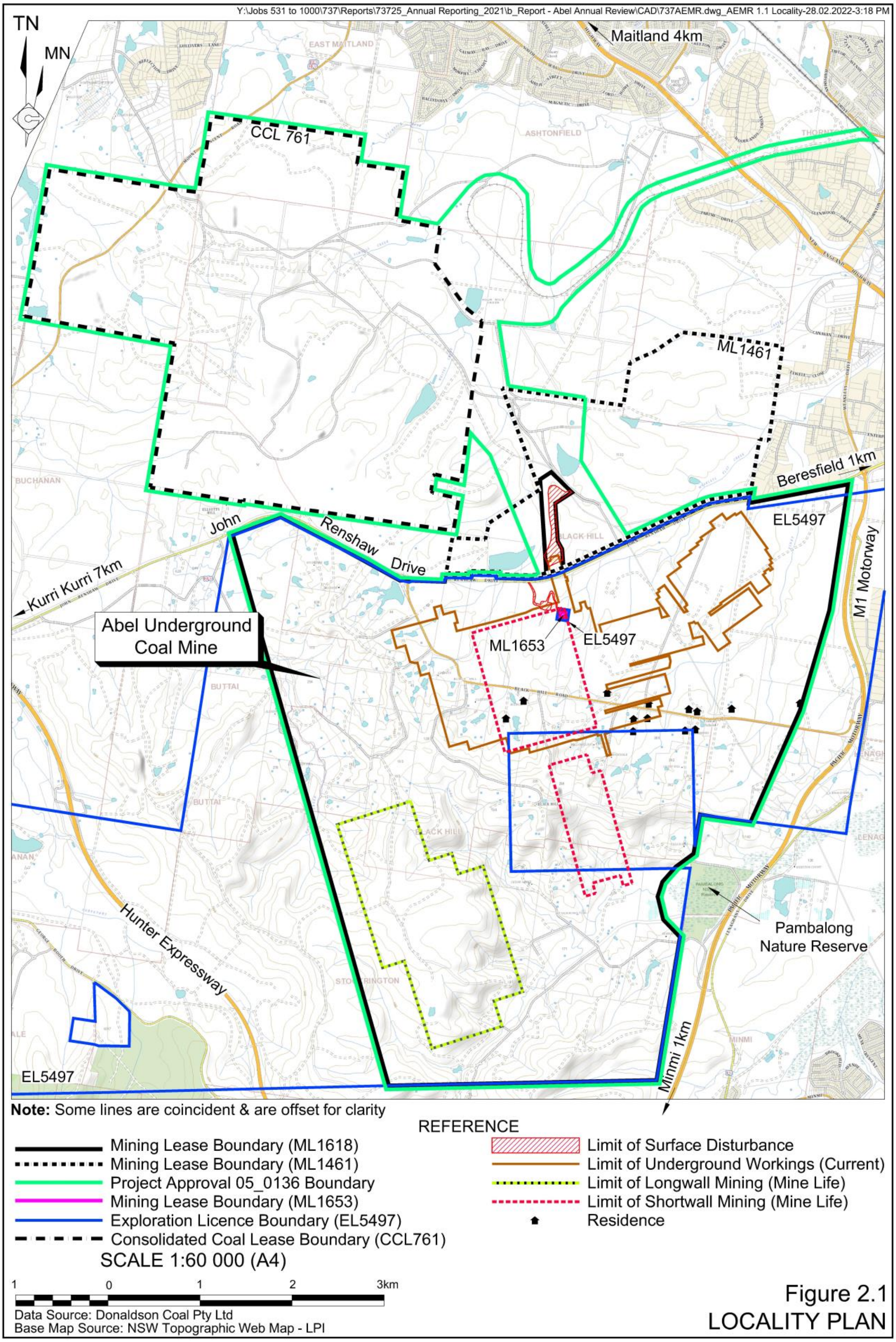

Figure 2.1
LOCALITY PLAN

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 GREENHILLS NSW 2323	Fax:	02 4015 1159
Email:	donaldson@doncoal.com.au		
Physical Address:	Abel Underground Coal Mine		
	1132 John Renshaw Drive 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

<table>
<tr><th>Consent/Lease/Licence</th><th>Issue Date</th><th>Expiry Date</th><th>Details / Comments</th></tr>
<tr><td>Project Approval 05_0136</td><td>7 June 2007</td><td>31 December 2030</td><td>Granted by the (then) Minister for Planning and last modified on 04 December 2013.</td></tr>
<tr><td>Mining Lease ML 1618*</td><td>15 May 2008</td><td>15 May 2029</td><td>Granted by the Minister for Primary Industries. Incorporates 2 755ha of surface area.</td></tr>
<tr><td>Mining Lease ML 1653*</td><td>21 January 2011</td><td>21 January 2032</td><td>Granted by the Minister for Primary Industries. Incorporates 0.25ha of surface area. Issued construction of ventilation shaft.</td></tr>
<tr><td>Environment Protection Licence No. 12856</td><td>9 July 2008
(licence version date
(1 October 2021)</td><td>Not applicable</td><td>Issued by the (then) Department of Environment and Climate Change (EPA).
EPL 11080 (for the Donaldson Coal Mine) was surrendered during the reporting period, with EPL 12856 updated with consolidated conditions applicable to both the Donaldson Coal Mine and Abel Underground Coal Mine.</td></tr>
<tr><td>Water Supply Works Approval 20WA218986</td><td>01/07/2016</td><td>30/06/2029</td><td rowspan="2">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.</td></tr>
<tr><td>Water Access Licence (WAL) 41525</td><td>01/07/2016</td><td>Continuing</td></tr>
<tr><td colspan="4">* See Figure 2.1</td></tr>
</table>

It is noted that this Annual Review has been prepared to fulfil the annual reporting requirements of Project Approval 05_0136, ML 1618, ML 1653, 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.

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 and has a current expiry date of 22 July 2022.

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.

4.3 NEXT REPORTING PERIOD

The activities proposed for 2022 will principally involve continued monitoring and, if required, maintenance activities. The following provides a summary of the planned activities.

Exploration

The Company plans to drill two exploration holes within EL 5497 / EL5498 and EL5337 to collect additional geological and geotechnical information for mine planning purposes. In the event that drilling is undertaken, the appropriate approvals will be sought and the drilling reported as part of the next Annual Review and within the annual exploration report.

Mining

No mining is currently planned to be undertaken during the 2022 reporting period.

Rehabilitation

No specific rehabilitation activities are currently planned for the 2022 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 and reflected in the new

Rehabilitation Management Plan. Any rehabilitation works undertaken will relate to rehabilitation of any subsidence impacts or to ongoing maintenance, principally erosion and sediment control.

Mining Operations Plan / Rehabilitation Management Plan

A Rehabilitation Management Plan (RMP) and Forward Program will be prepared during the next reporting period in accordance with the Operational Rehabilitation Reforms and amendments to the *Mining Regulation 2016*. The RMP will replace the existing MOP.

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 will continue to be convened during the next reporting period. It is expected that meetings will be held six-monthly 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 2020 Annual Review was submitted to the Resources Regulator and the Department of Planning, Industry and Environment (DPIE) compliance unit on 30 March 2021. Feedback was received from the DPIE compliance unit dated 30 June 2021. No response was received from the Resources Regulator. Whilst the Annual Review was considered to generally satisfy the reporting requirements of Project Approval 05_0136, additional information was requested to be included in future Annual Reviews. This additional information and where this has been addressed in this Annual Review is summarised in **Table 5.1**.

Table 5.1
Actions from the Previous Annual Review

Action required from previous Annual Review	Requested by	Action taken by the Operator	Where discussed in Annual Review
Introduction – please include the project approval boundary, operational disturbance footprint, and location of long walls on the Locality Plan	DPIE Compliance Unit	Locality Plan has been updated to include project approval boundary, operational disturbance footprint, and location of longwalls (and shortwalls)	Section 2
Biodiversity – please include a comparison of monitoring results against the monitoring results of previous years (as required by Schedule 4 condition 4(b)(iii) of the approval	DPIE Compliance Unit	Read as Schedule 5 Condition 4(b)(iii). As no biodiversity monitoring was undertaken during 2020 or 2021 (as per the updated Flora and Fauna Management Plan) no comparison can be made against previous results. Notwithstanding, a summary of previous results has been included in Section 6.6.	Section 6.6
Community – please include a summary of community contributions made in the reporting period	DPIE Compliance Unit	No community contributions were made during the reporting. This is confirmed in Section 9. Any future contributions will be summarised in the respective Annual Review.	Section 9

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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**.

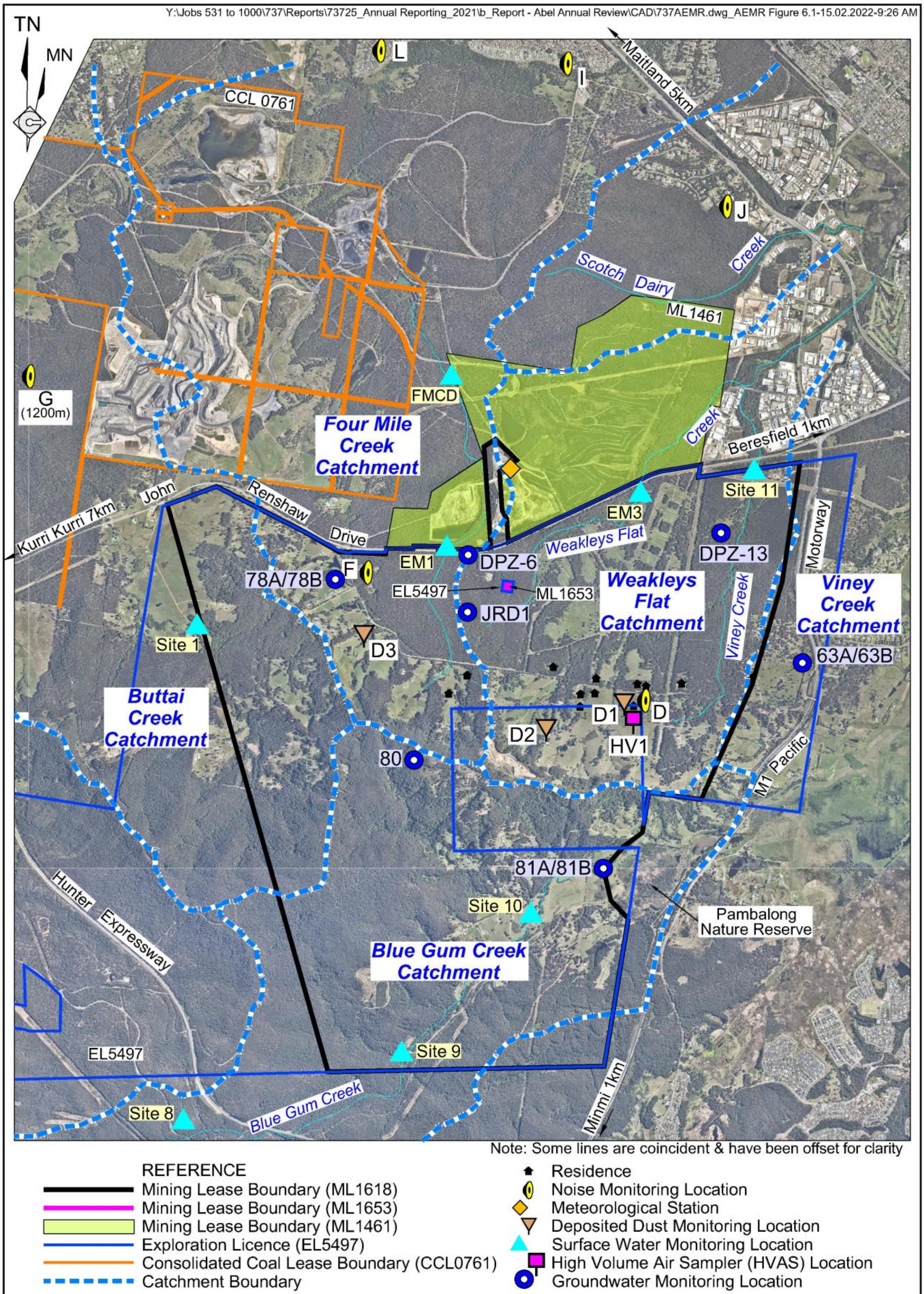


Figure 6.1
ENVIRONMENTAL MONITORING LOCATIONS

Table 6.2
Monthly Rainfall Records – 2007 to 2021

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**
Average	93.6	124.2	118.3	114.0	48.7	110.7	43.0	39.9	52.3	64.9	101.5	63.9	975.2
Note: Results relevant to this reporting period are in bold.													

Total rainfall during the 2021 calendar year was 971.6mm, representing an annual rainfall slightly below the average annual rainfall of 975.5mm. Approximately 24% of the total rainfall over the reporting period occurred in March (234.8mm), over half of which fell between 18 and 20 March. Rainfall in all but three months (March, October and November) were below the long-term annual average.

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) 2021. 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 – 2021

Location	Time	Noise Criteria	Attended Monitoring[1]		Noise generated by Abel Mine
			H1	H2	
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	NA	NA	Operations inaudible at all times
	Evening ($L_{A\,eq\,(15\,min)}$)	36	NA	NA	Operations inaudible at all times
	Night ($L_{A\,eq\,(15\,min)}$)	36	NA	NA	Operations inaudible at all times
	Night ($L_{A1(1min)}$)	45	NA	NA	Operations inaudible at all times
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	NA	NA	Operations inaudible at all times
	Evening ($L_{A\,eq\,(15\,min)}$)	40	NA	NA	Operations inaudible at all times
	Night ($L_{A\,eq\,(15\,min)}$)	40	NA	NA	Operations inaudible at all times
	Night ($L_{A1(1min)}$)	47	NA	NA	Operations inaudible at all times
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 (2021).					

Noise monitoring concluded that operations were inaudible 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. 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 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. Given the results of previous noise monitoring, the placement of the Abel Mine into care and maintenance, and the approval of the Noise Management Plan – Care and Maintenance (Version 5 – 3 June 2019), it is intended that noise monitoring will continue to occur at reduced six-monthly frequencies during the next reporting period as required by the Noise Management Plan. The suitability of bi-annual noise monitoring will be reviewed in the event that noise complaints were to be received.

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

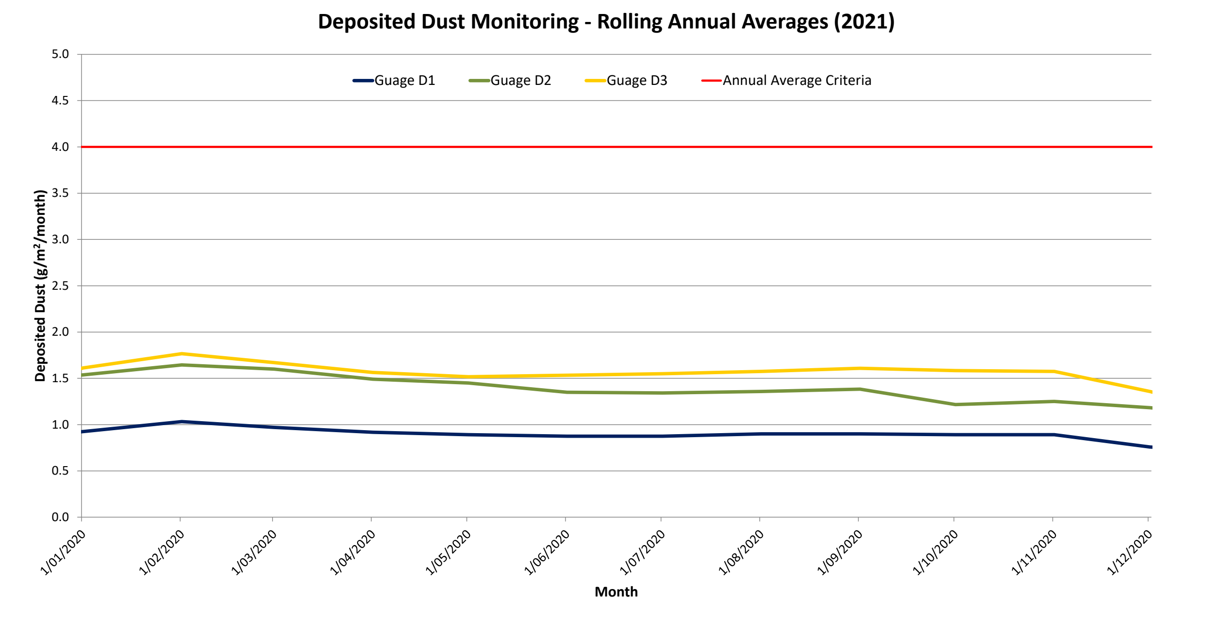
Monthly deposited dust monitoring was undertaken by the Company at a total of three locations surrounding and relevant to the Abel Mine. Total Suspended Particulates (TSP) and Particulate Matter <10µm (PM_{10}) monitoring was also undertaken at the existing High Volume Air Sampling (HVAS) station located approximately 2 300m southeast of the surface infrastructure area at Blackhill (located at Site D1). Monitoring locations are shown on **Figure 6.1** and results are summarised in **Table 6.4** and **Figures 6.2**, **6.3** and **6.4**.

Table 6.4
Deposited Dust Monitoring Results – 2021^

	Monthly Dust Deposition Rate (g/m^2/month)					
	D1		D2		D3	
Month	**Insoluble**	**Ash**	**Insoluble**	**Ash**	**Insoluble**	**Ash**
January	0.6	0.4	0.4	0.2	0.5	0.4
February	0.5	0.2	1.3	0.4	1.1	0.7
March	0.4	0.1	0.4	0.2	4.5*	2.2
April	0.6	0.3	0.5	0.2	3.2	1.3
May	0.2	0.2	4.4	3.4	0.8	0.6
June	0.2	0.1	0.8	0.6	0.6	0.5
July	0.4	0.2	0.7	0.4	0.6	0.3
August	0.5	0.3	0.6	0.4	0.6	0.4
September	0.5	0.3	1.2	0.5	0.8	0.5
October	0.6	0.3	0.6	0.4	0.7	0.4
November	0.7	0.3	1.4	0.6	0.5	0.2
December	1.0	0.3	0.8	0.2	1.3	0.6
Monthly Minimum	0.2	0.1	0.4	0.2	0.5	0.2
Monthly Maximum	1.0	0.4	4.4	3.4	3.2**	2.2
Average	***0.5***	***0.3***	***1.1***	***0.6***	***1.0****	***0.7***

^ Historical data included in **Appendix 2** * Contaminated sample not considered further ** Excluding contaminated sample

Source: Donaldson Coal Pty Ltd.



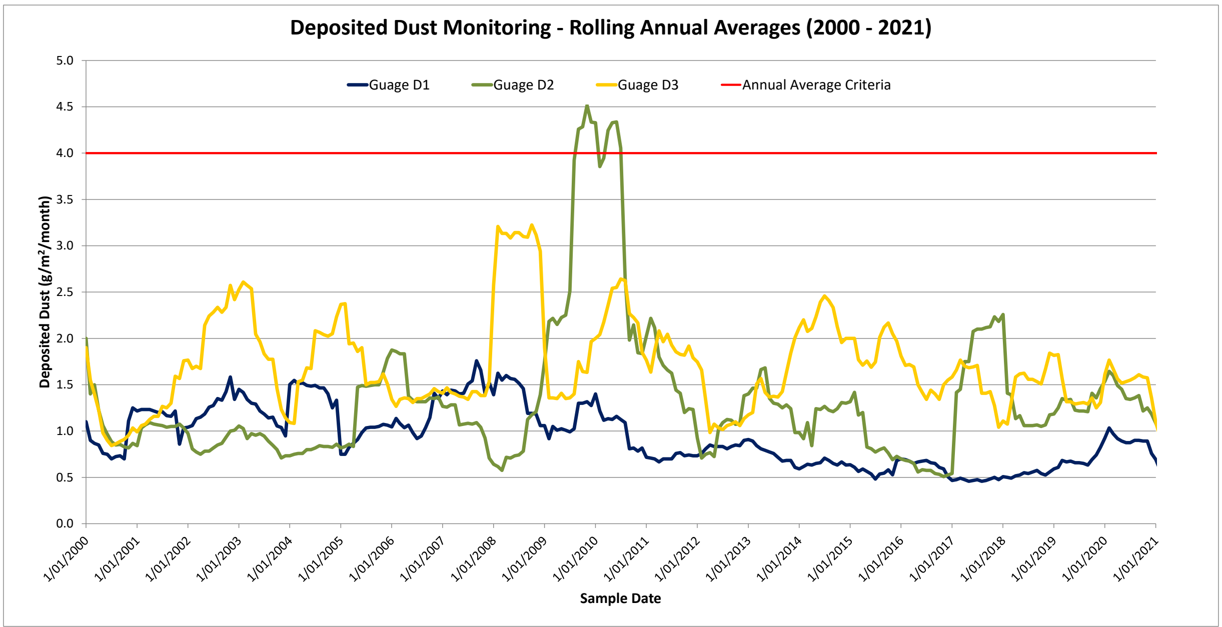
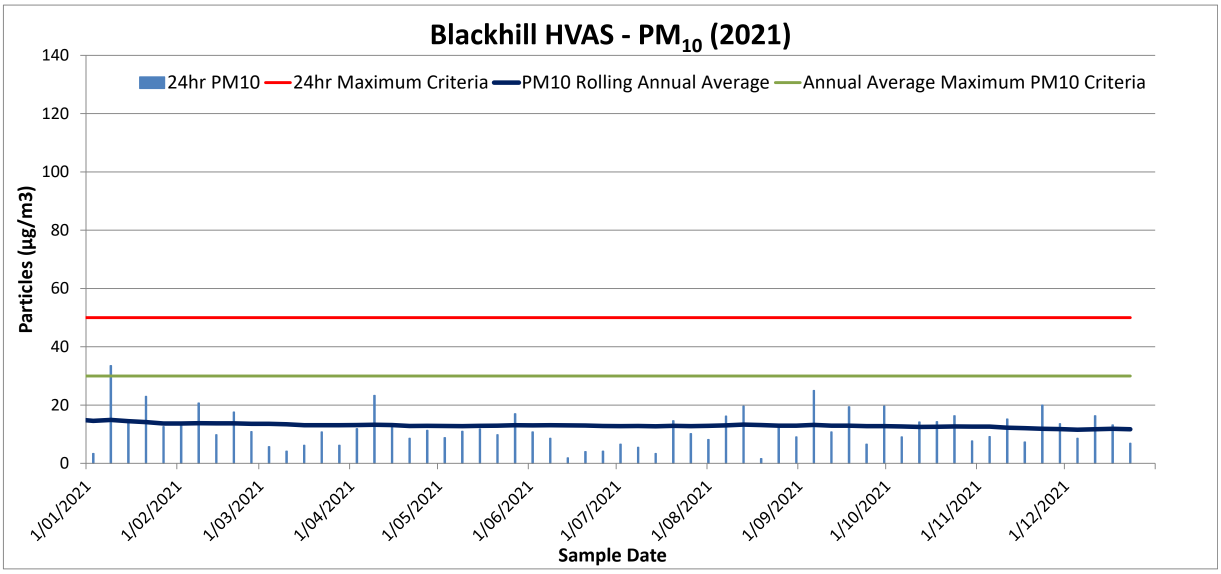


Figure 6.2 Deposited Dust Monitoring Results



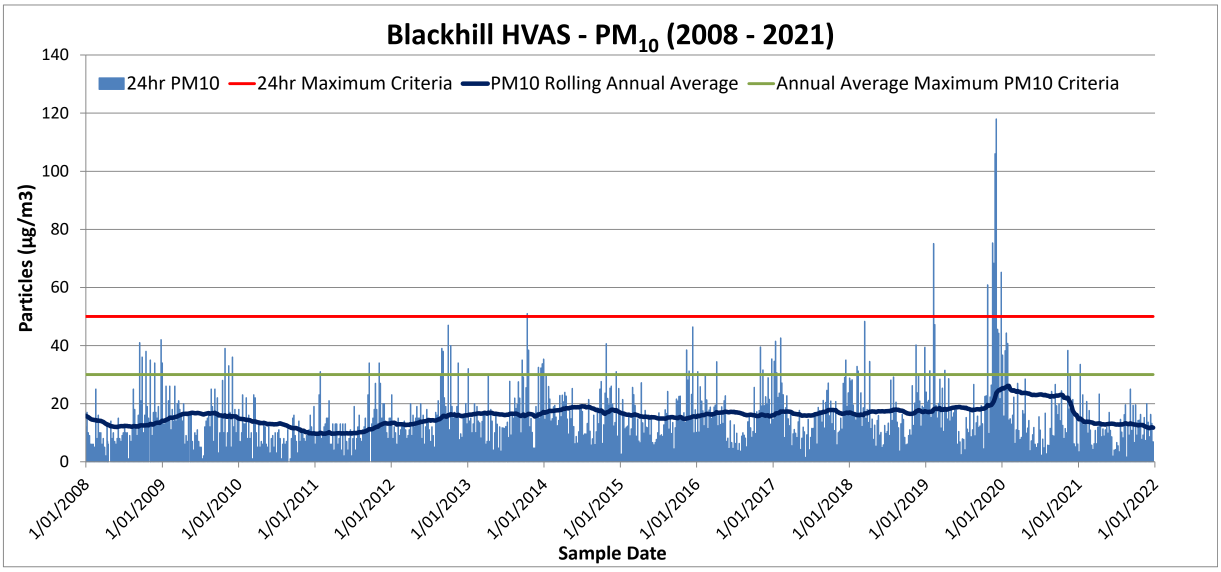
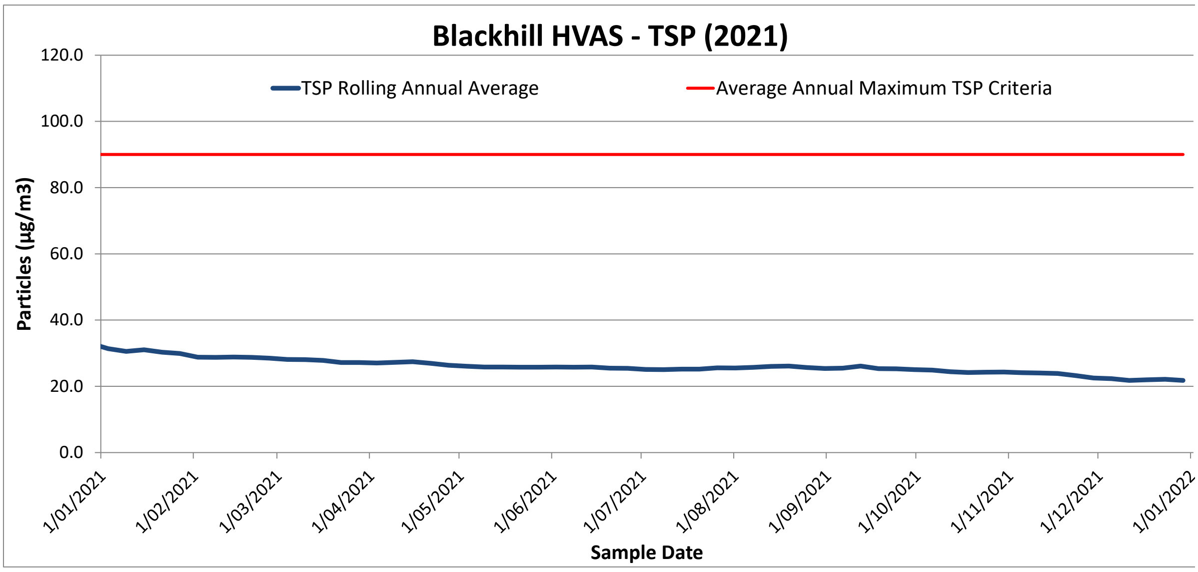


Figure 6.3 PM_{10} Monitoring Results



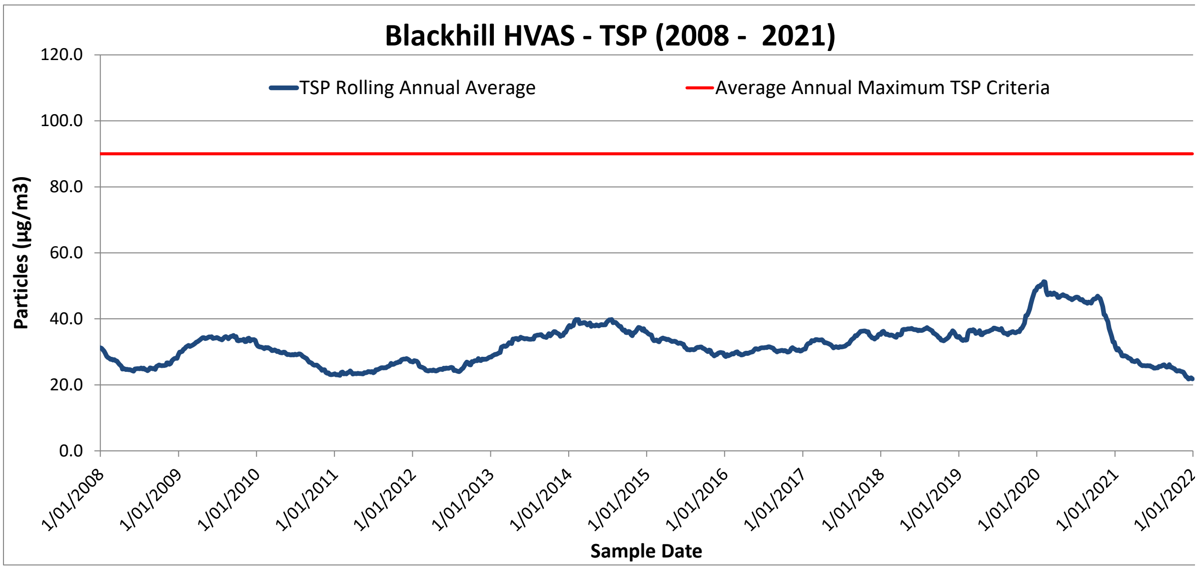


Figure 6.4 TSP Monitoring Results

Deposited Dust

The highest uncontaminated monthly dust deposition measurement was 4.4g/m^2/month recorded during May 2021 at D2 with the annual average monthly deposition rates ranging between 0.5g/m^2/month and 1.1g/m^2/month. These values are significantly below the cumulative criteria of 4g/m^2/month and the incremental criteria of an increase of 2g/m^2/month, indicating good air quality with respect to dust deposition.

Since commencement of the Abel operations, the rolling annual average deposited dust levels have remained low although spikes are evident due to local events, particularly at sites D2 and D3. However, when accounting for such events, no specific trends are evident and deposited dust levels remain significantly below the annual average criteria.

Suspended Particulates – PM_{10} and TSP

The suspended particulate monitoring results indicate that the 50µg/m^3 24-hour criteria for PM_{10} as specified in Schedule 3 Condition 9 of PA 05_0136 was not exceeded during the reporting period. The highest 24-hour average PM_{10} concentration during the reporting period, measured on 15 January 2021, was 33.5µg/m^3.

The annual average PM_{10} concentration for Blackhill was 11.7µg/m^3 for the 12 months to 31 December 2021 whilst the annual average TSP concentration was 21.8µg/m^3, both below the annual average criteria of 30µg/m^3 and 90µg/m^3 respectively. Notwithstanding, these annual average values are consistent with the long term (from 6 January 2008) PM_{10} and TSP averages of 15.7µg/m^3 and 31.9µg/m^3 respectively (**Figures 6.3** and **6.4**).

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 and no TSP trends are currently apparent. Similarly, rolling annual average PM_{10} levels have remained relatively consistent since 2008 with the exception of elevated levels associated with the widespread regional bushfire events during 2019/2020.

Reportable Incidents

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

Further Improvements

No other improvements relating to air pollution are planned or considered necessary. During the next reporting period, existing depositional dust gauges and the HVAS will be decommissioned to reflect revised monitoring requirements in accordance with the approved 2019 Air Quality and Greenhouse Gas Management Plan and consolidated EPL 12856.

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.

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.

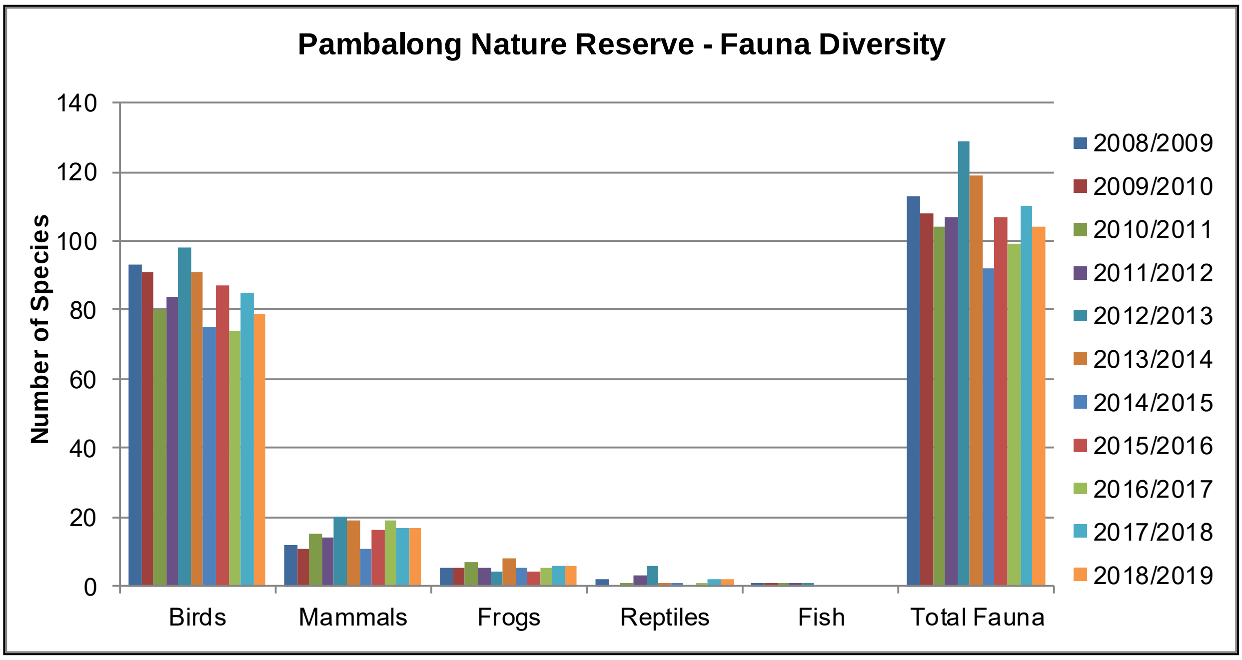
A summary of the species diversity recorded over all monitoring periods is provided in **Figure 6.5**. Since commencement of survey in 2008 the area of transition between dry and moist forest at Transect 1 expanded, with the width of the moist forest increasing. Along both Transect 1 and Transect 2, 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.

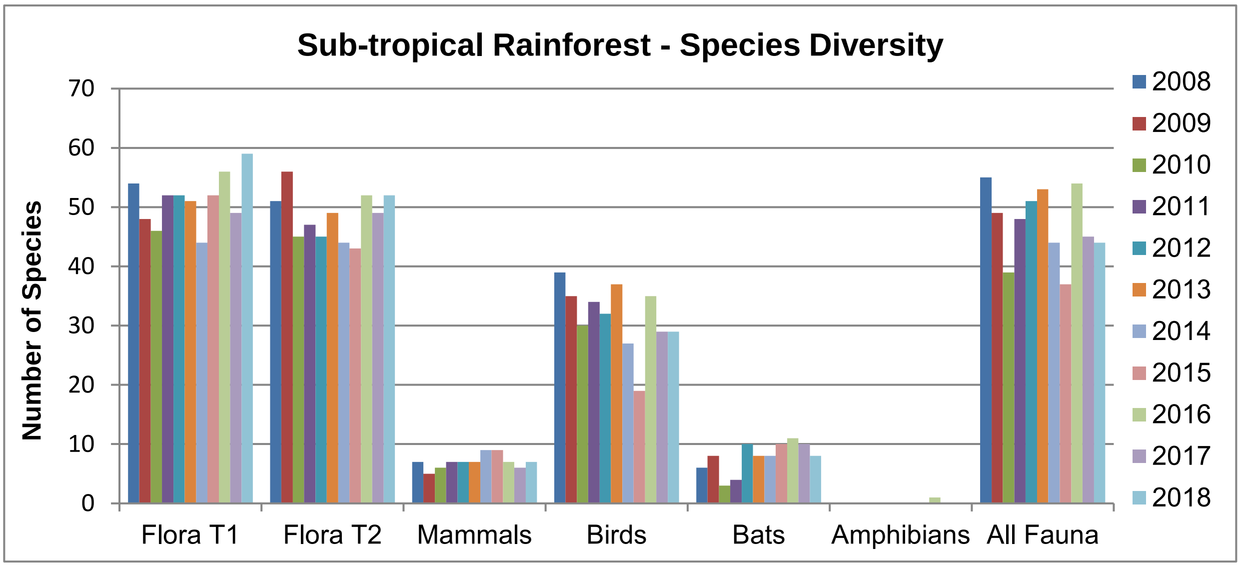
Along both Transect 1 and Transect 2 there was also a decline in Foliage Projection Cover (FPC) since the 2008 baseline survey. Whilst severe storms occurred around Newcastle in 2015, which has likely reduced canopy cover, reduced levels of ground, shrub and midstorey cover since the baseline survey 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.





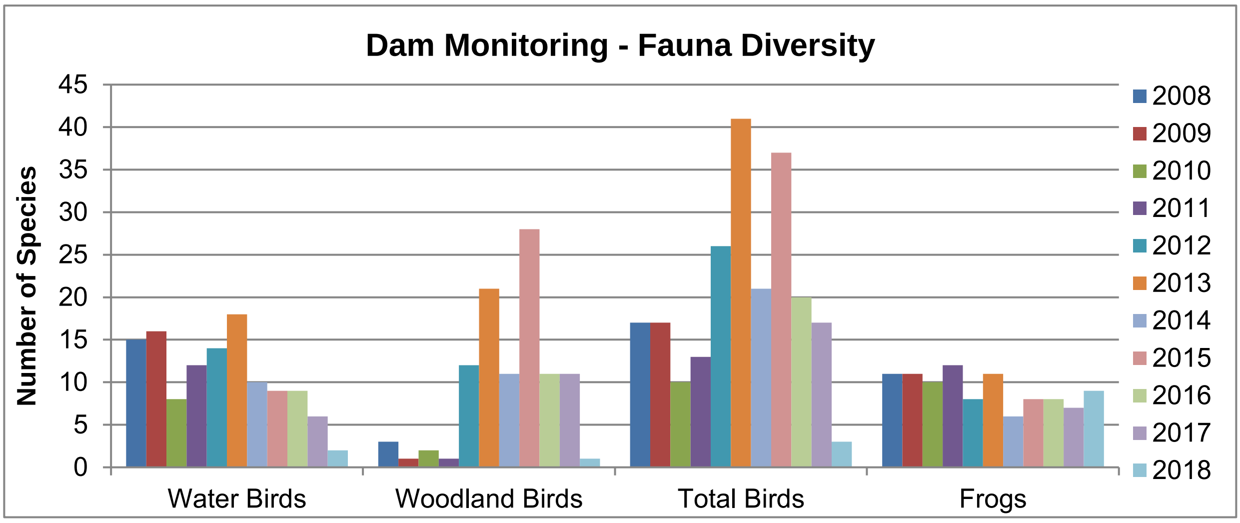


Figure 6.5 Selected Ecological Monitoring Results

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.

Reportable Incidents

No reportable incidents were recorded during the reporting period.

Further Improvements

In accordance with the Flora and Fauna Management Plan, monitoring of dams, sub-tropical rainforest and the Pambalong Nature Reserve will now 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.

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	4.1
	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

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), DPIE and Heritage NSW. Given that no mining was undertaken during the 2021 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.
- All subsidence impacts on the Hunter Water Corporation Waterline, Ausgrid Powerlines and TransGrid Transmission Towers were 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

Table 2: Subsidence Impact Performance Measures

Performance Measure		Status
Water Resources		
• Hexham Swamp; • Blue Gum Creek and Alluvium; and • Long Gully.	• Negligible environmental consequences, including: - *negligible* reduction in the quantity of water entering the swamp or the creeks (ie baseflow or environmental flows); - *negligible* reduction in the quality of water entering the swamp or the creeks; and - *negligible* reduction in creek bed or bank stability. • No connective cracking between the surface and the mine.	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).
• All other watercourses in the mining area.	• No greater environmental consequences than predicted in the EA and EA (MOD 3).	Subsidence monitoring has not recorded any impacts upon other watercourses.
Land		
• 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).	Mining has not yet occurred under any major cliff areas. Subsidence monitoring has not recorded any rock falls or other impacts.
• Minor cliffs • Rock face features; and • 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.	No mining related impacts upon Pambalong Nature Reserve have been recorded.
Biodiversity		
• Threatened species; and • Endangered ecological communities (including unspecified Lowland Rainforest EEC).	• Negligible environmental consequences.	No mining related impacts have been recorded to date (see Section 6.6).
Heritage Sites		
• Aboriginal heritage sites.	• No greater subsidence impacts or environmental consequences than predicted in the EA and EA (MOD 3).	No impacts upon Aboriginal or historical heritage have been recorded to date.
• Historic heritage.	• No greater subsidence impacts or environmental consequences than predicted in the EA and EA (MOD 3).	
Mine workings		
• 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.	Subsidence control zones and second workings have been implemented in accordance with the approved Subsidence Management Plans.
• 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 increased from 34.24% in 2020 to 69.87% in 2021, largely due to the recycling of effluent and a more than 50% reduction in mixed solid waste. As is expected, the total volume of wastes has also continued to remain relatively low since the mine entered care and maintenance.

Table 6.7
Approximate Waste Volumes 2016 to 2021

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

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.

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 224ML for the current water year 01 July 2020 to 30 June 2021, well within the 500ML allocation. 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 251.3ML 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 428ML was transferred from the Big Kahuna Dam to the Bloomfield CHPP.

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 9[1]: 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 values at Site 1, Site 8, Site 10, and Site 11 and the upper trigger value at Site 1, Site 10, Site 11, Site EM1 and Site EM3 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).

Relatively lower pH values were recorded during March for Sites 1, 8 and 10 (upstream) and Site 11 (downstream), coinciding with very high recorded rainfall over the same period. Average pH levels for all sites during the reporting period was consistent with to the long-term average.

No long term trends in pH are apparent (**Figure 7.2**) and, given that no operational activities occurred at either the Abel Mine or the Donaldson Open Cut Mine, it is not considered that the mine contributed to any anomalous pH values recorded during the reporting period.

Electrical Conductivity

The electrical conductivity (EC) ranged between 125.5µS/cm and 3078.0µS/cm at all monitoring sites during the reporting period. Lower trigger values were exceeded at Sites 1 and 10 (upstream) and Sites 11, EM1 and EM3 (downstream) during the reporting period. Upper trigger values for EC were exceeded at Site 10 (upstream) and Sites 11 and EM1 (downstream). The average EC levels during the reporting period was generally consistent with the long-term average for all sites excluding Site 11. For Site 11, the average EC during the reporting period was 1512µS/cm compared with the long-term average of 875µS/cm. The highest EC recorded at Site 11 (3078.0µS/cm) is also the highest EC recorded for this site (see **Figure 7.2**).

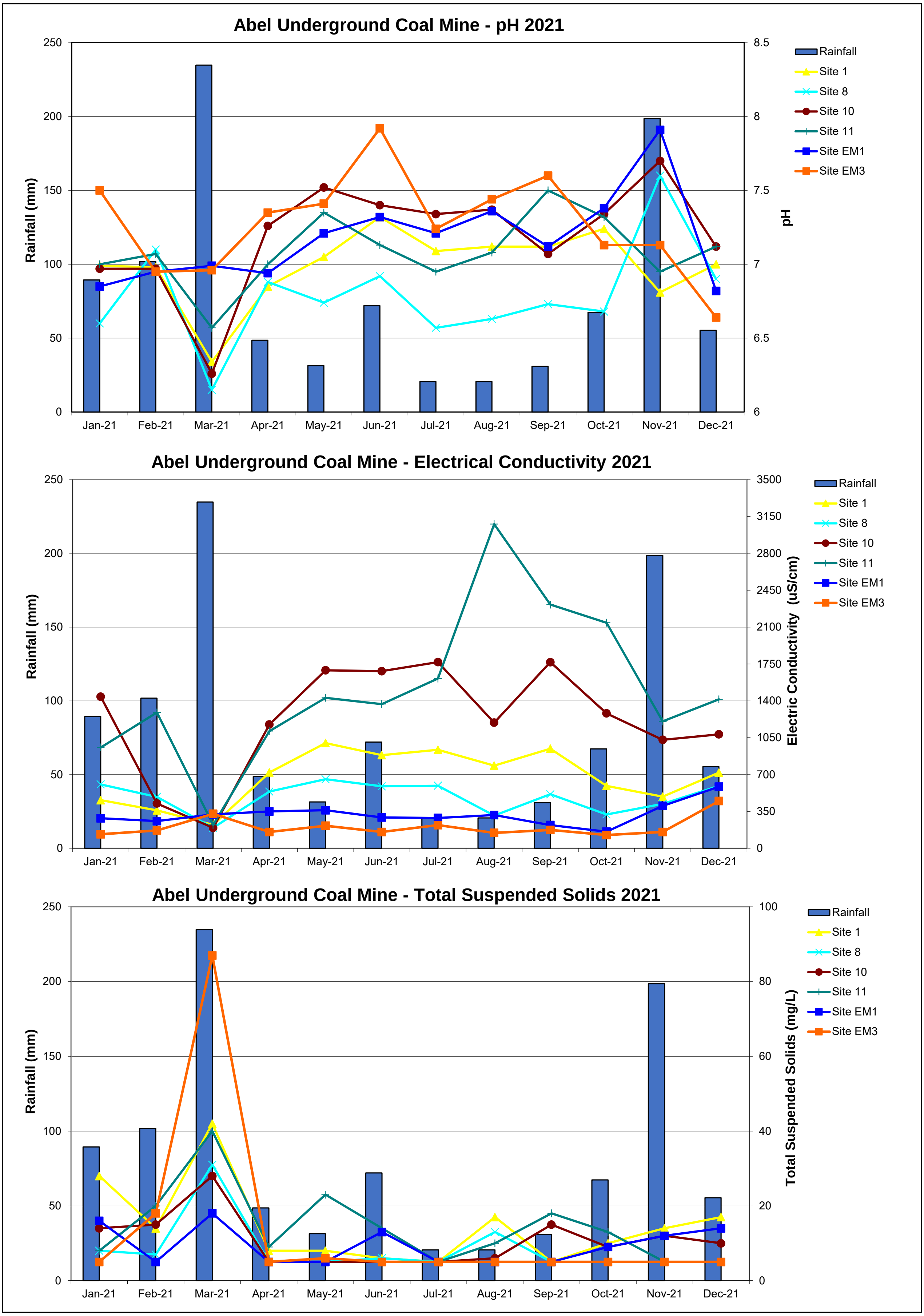


Figure 7.1 Surface Water Quality Monitoring Results – 2021

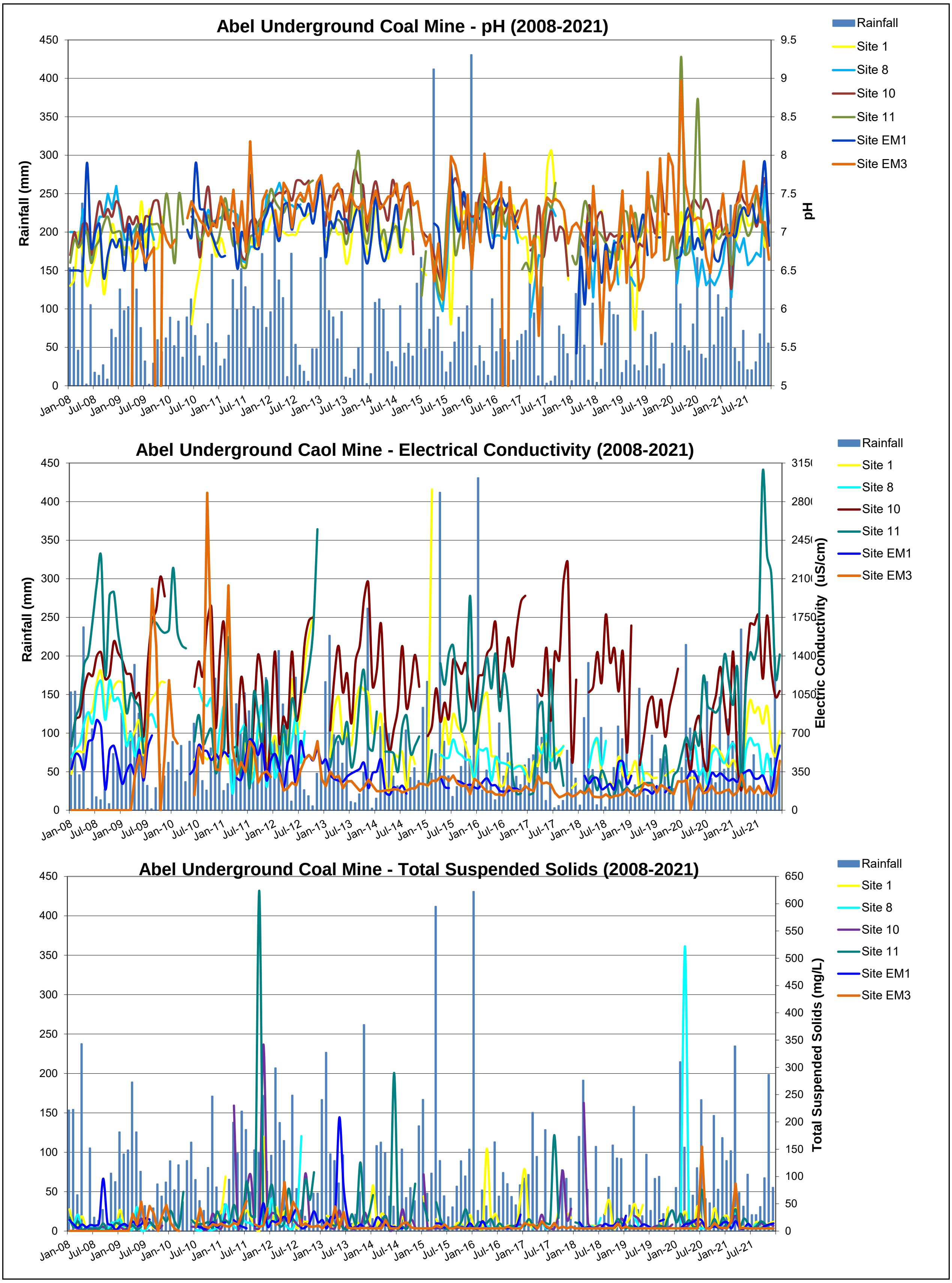


Figure 7.2 Surface Water Quality Monitoring Results – 2008 to 2021

Table 7.1
Summary of Surface Water Quality Monitoring Results – 2021

Sample Site	Triggers	2021												*Mean 2021*	*Long-term Mean*
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Rainfall (mm)															
-	-	89.4	101.8	234.8	48.6	31.4	72.0	20.6	20.6	31.0	67.4	198.6	55.4	-	-
Flow#															
1^	-	No Flow	No Flow	Fast	Still	Still	Still	Trickle	Still	Still	Still	Slow	Still	-	-
8^	-	No Flow	Low Flow	Fast	Still	Trickle	Trickle	Still	Trickle	Still	Still	Trickle	Still	-	-
10^	-	No Flow	Low Flow	Fast	Slow	Trickle	Trickle	Still	Slow	Trickle	Trickle	Trickle	Still	-	-
11*	-	No Flow	No Flow	Fast	Still	Trickle	Trickle	Still	Trickle	Still	Trickle	Slow	Still	-	-
EM1*	-	Still	Trickle	Slow	Still	Still	Still	Still	Still	Still	Still	Steady	Trickle	-	-
EM3*	-	Still	Steady	Slow	Trickle	Trickle	Trickle	Trickle	Trickle	Trickle	Trickle	Trickle	Trickle	-	-
pH															
1^	*6.6 - 7.7*	6.99	6.98	6.34	6.85	7.05	7.32	7.09	7.12	7.12	7.24	6.81	7.00	6.99	6.9
8^	*6.6 - 7.3*	6.6	7.1	6.15	6.88	6.74	6.92	6.57	6.63	6.73	6.68	7.6	6.9	6.79	6.9
10^	*7.0 - 7.5*	6.97	6.97	6.26	7.26	7.52	7.4	7.34	7.37	7.07	7.34	7.7	7.12	7.19	7.2
11*	*6.8 - 7.1*	7.00	7.07	6.57	7.00	7.35	7.13	6.95	7.08	7.5	7.32	6.95	7.12	7.09	7.1
EM1*	*6.5 - 7.1*	6.85	6.95	6.99	6.94	7.21	7.32	7.21	7.36	7.12	7.38	7.91	6.82	7.17	7.0
EM3*	*6.6 - 7.2*	7.50	6.95	6.96	7.35	7.41	7.92	7.24	7.44	7.6	7.13	7.13	6.64	7.27	7.2
Electrical Conductivity (mS/cm)															
1^	498 - 1 060	457	360	223.4	720.1	999	884.8	934.8	785.5	945.6	593	490	718.3	676	621
8^	395 - 746	607	488	194.3	538.8	656	588.5	594	311.3	512.8	321	422	592.4	486	569
10^	798 - 1 496	1439	426	194.8	1175	1690	1682	1768	1193	1767	1281	1030	1082	1227	1165
11*	920 - 1 704	957	1289	222.7	1113	1429	1369	1612	3078	2314	2141	1205	1414	1512	875
EM1*	235 - 580	285	258.1	321.8	350	361.5	292.8	288.3	315.3	220.9	158.3	403	585	320	343
EM3*	235 - 1 116	133	169.9	327.4	155.1	214.4	154.7	220.2	146.9	173.8	125.5	154.7	449	202	317
Total Suspended Solids (mg/L)															
1^	28	28	14	42	8	8	6	5	17	5	10	14	17	14.5	20.7
8^	16	8	7	31	5	5	6	5	13	5	5	5	5	8.3	16
10^	24	14	15	28	5	5	5	5	6	15	9	12	10	10.8	19.3
11*	18	8	20	40	9	23	14	5	10	18	13	5	5	14.2	14.2
EM1*	34	16	5	18	5	5	13	5	5	5	9	12	14	9.3	14.7
EM3*	30	5	18	87	5	6	5	5	5	5	5	5	5	13.0	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 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.

Based on the monitoring data, lower ECs tend to correlate with periods of high rainfall and higher ECs during low rainfall conditions. No significant difference is apparent between upstream and downstream monitoring locations and, despite a short-term spike in EC at Site 11, no long-term trends in EC are apparent (**Figure 7.2**).

Total Suspended Solids

The relevant upper total suspended solids (TSS) trigger values were exceeded at all sites, excluding EM1, during March 2021 (correlating with significant rainfall) and at Site 11 during February (20mg/L) and May 2021 (23mg/L). Given that the additional exceedances at Site 11 were marginal and did not persist across multiple sampling rounds, it is considered that short-term, localised conditions rather contributed to these levels.

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.

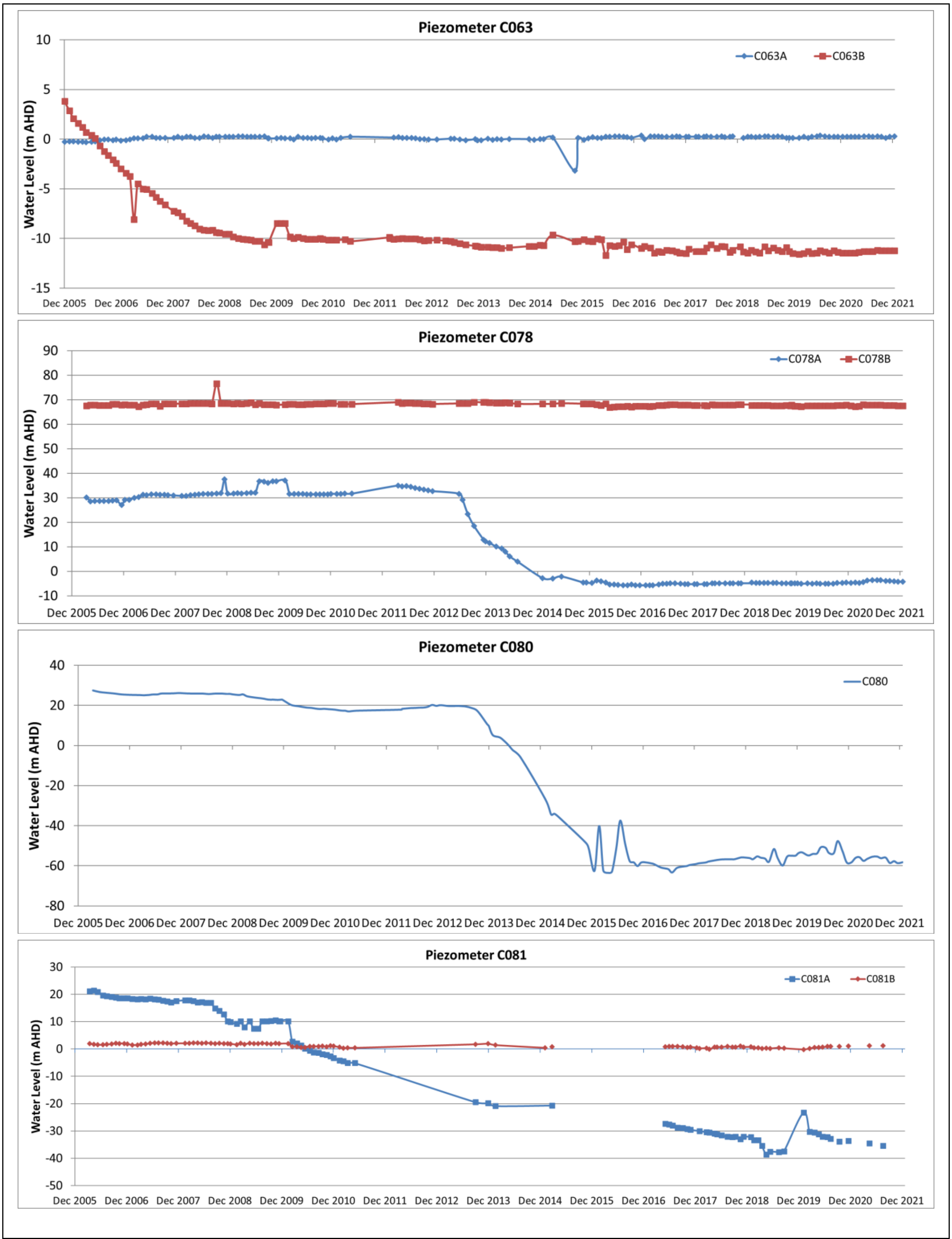


Figure 7.3 Groundwater Level Results – All Data

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 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 2020/2021 water year, groundwater inflows are estimated at 224ML. 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	2021
pH		
DPZ – 6	5.44 – 7.58 (6.6)	6.03 - 7.30 (6.64)
DPZ – 13*	No Access	No Access
JRD2	5.23 – 8.06 (7.0)	5.23 - 7.20 (6.67)
Electrical Conductivity		
DPZ – 6	120 - 4960 (2708)	138.7 - 2602 (1937)
DPZ – 13*	No Access	No Access
JRD2	146 - 2660 (1552)	490.7 - 2546 (1764)
( ) = Average	# see **Figure 6.1**	*DPZ – 13 inaccessible during 2021
Source: Donaldson Coal Pty Ltd		

These bores record pH values ranging from acidic to near neutral (5.23-7.30) and EC values ranging between 139µS/cm and 2 602µS/cm. Substantial variations in pH throughout the reporting period in a similar manner as recorded in previous reporting periods with a relatively steady range recorded since 2016 (see **Figure 7.5**).

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.

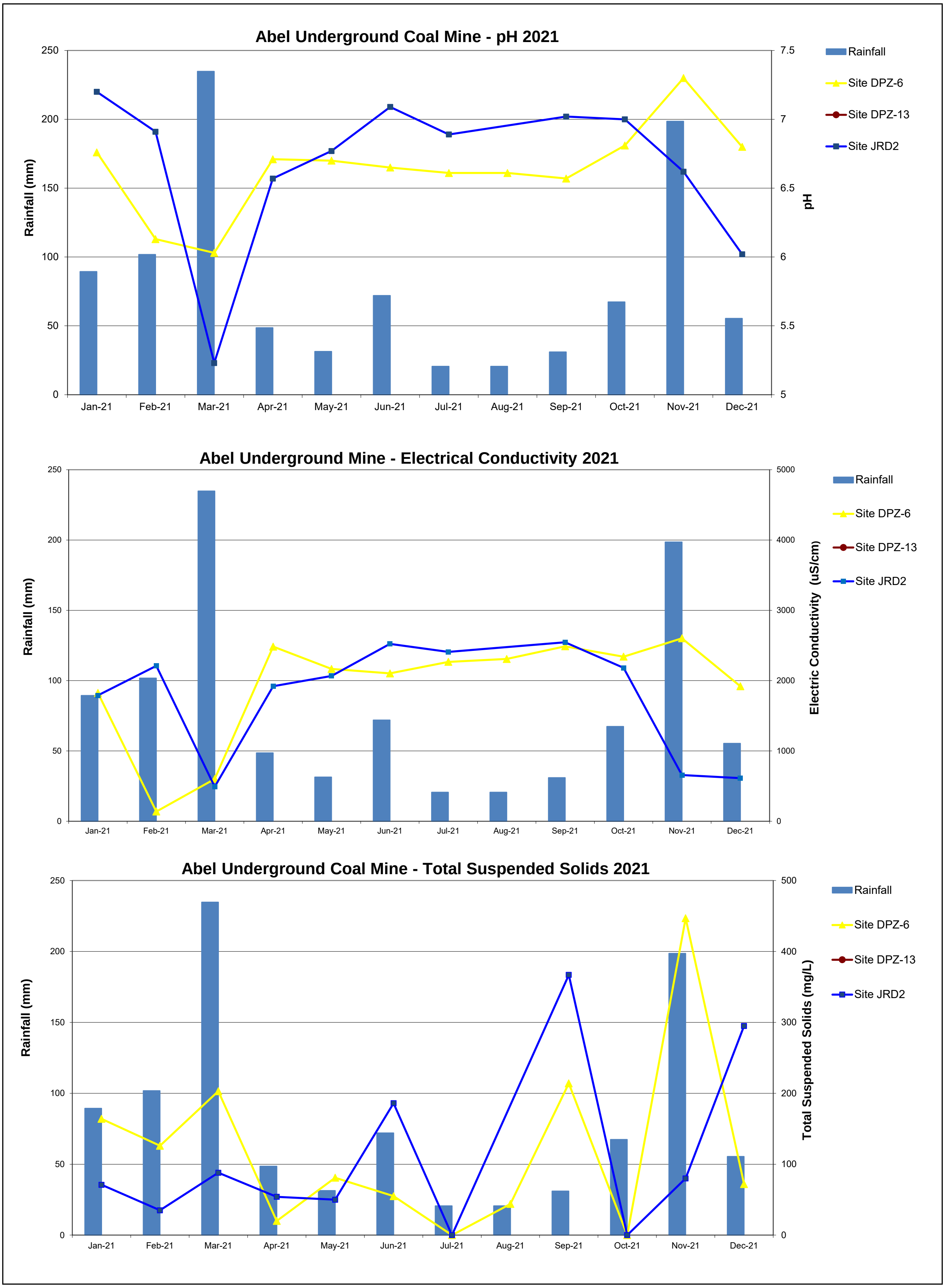
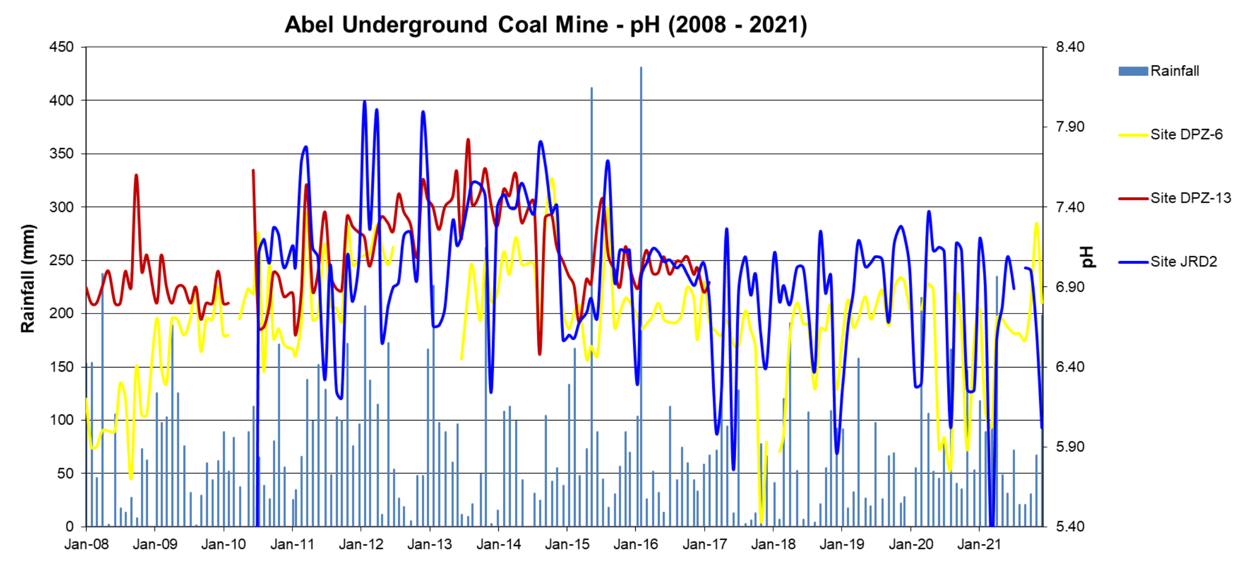


Figure 7.4 Groundwater Quality Monitoring Results – 2021



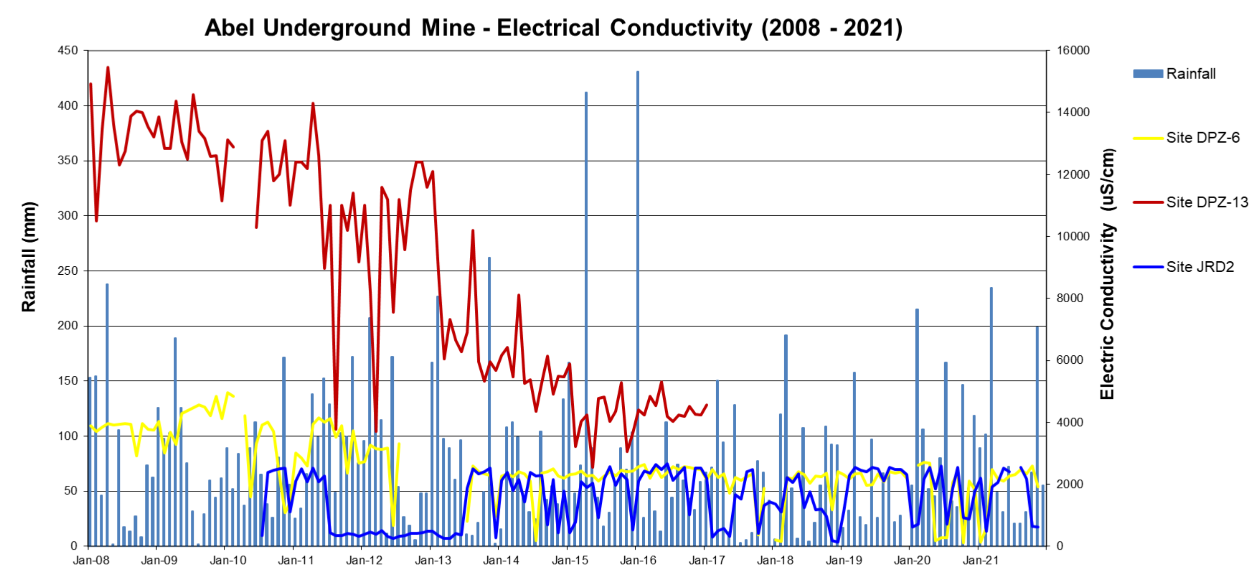


Figure 7.5 Groundwater Quality Monitoring Results – 2008 – 2021

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 10 (ha)**	**Year 11 (ha)**	**Year 12 (ha)**
Total mine footprint	13.15[1]	13.15[1]	13.15[1]
Total active disturbance	13.15[2]	13.15[2]	13.15[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 2021 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 Mining Operations Plan.

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

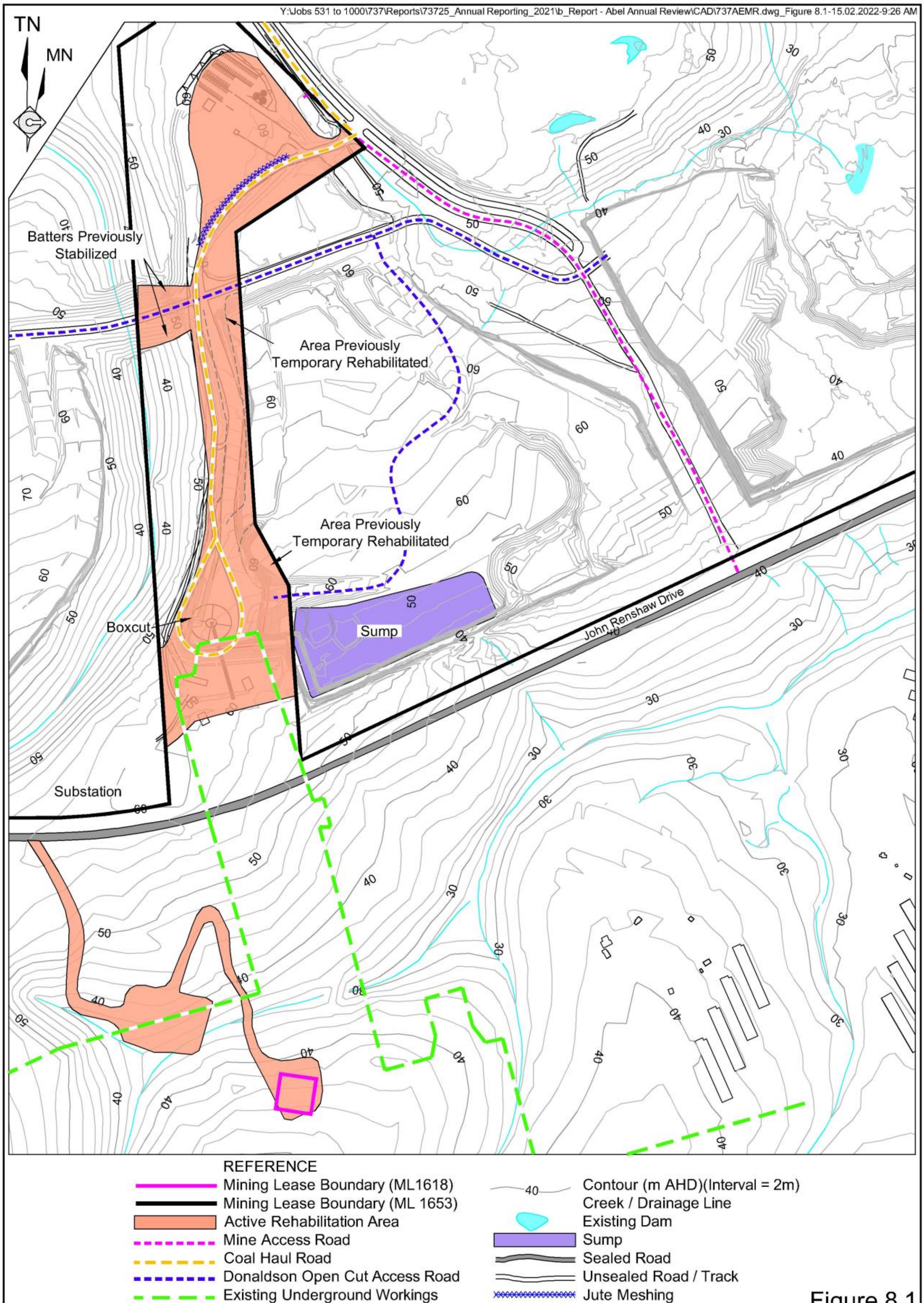


Figure 8.1
REHABILITATION ACTIVITIES
(1 January 2021 - 31 December 2021)

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 Mining Operations Plan 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* (appended to the Mining Operations Plan), 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 to be prepared during the 2022 reporting period in accordance with the Operational Rehabilitation Reforms and amendments to the *Mining Regulation 2016* will incorporate the above. The RMP will replace the existing MOP.

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. Any surface cracks that appear 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 2021 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, DPIE. It is noted that Cessnock and Maitland City Councils have been invited to meetings but have elected not to attend.

The committee held one meeting during the reporting period (15 March 2021). The regular September meeting did not occur due to the Covid-19 pandemic. 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 no additional community contributions were made.

10. INDEPENDENT AUDIT

The last independent environmental audit of the mine was undertaken in December 2018, in accordance with *Schedule 5 Condition 5* of PA 05_0136 for the period 20 March 2015 to 20 December 2018. The independent audit report was finalised in February 2019 and confirmed that the areas inspected were generally satisfactory and that mining has occurred generally in accordance with the approved mine plan. The audit identified a total of six (6) non-compliances against PA 05_0136 for the audit period, of which all have been subsequently rectified. No non-compliances were recorded against ML1683.

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 was due to occur during December 2021. In consideration of pandemic-related delays, approval for the independent environment audit to be delayed until Quarter 1 of 2022 was granted by the Department of Planning, Industry and Environment.

Table 10.1
Independent Audit Action Response Plan Status

Ref	Description	Donaldson Response	Timeline	Status Update
Section 4	Annual groundwater reporting in the Abel Mine Annual Review should include graphical presentations of water level data to indicate trends. These should continue to be included in Annual Review's during care and maintenance phase for bores approved in the revised WMP	The Abel Annual Review will continue to provide graphical representation of relevant groundwater bores within the relevant section of the document.	Annually	Graphical summaries were presented in the 2018 Annual Review and are presented in Section 7.3 of this Annual Review.
PA 05_0136 Compliance Recommendations				
Various	Work with relevant regulators to resolve where possible all of the non-compliances.	Accept recommendation and continue to work with regulators to resolve non-compliances.	As and when required	Compliance status update provided in Sections 1 and 11 of this Annual Review.
Sch 3 Cond 1	Blue Gum Creek and Long Gully – Water Quality Recommend for future Trigger Level EC exceedances, assessment of metals (Fe, Al and Mn) are used to assess whether change in EC is mining induced. Trigger values for metals should also be included for Site 10 in Table 3.7 of the WMP. Further consideration of this trigger level in the revised WMP should be undertaken in consultation with a relevant water specialist and relevant regulators in consideration of distance to active mining. Pambalong Nature Reserve – Groundwater Levels Recommend monthly monitoring at Piezometer C081B or in accordance with approved WMP. Further consideration of this trigger level in the revised WMP should be undertaken in consultation with a relevant groundwater specialist and relevant regulators in consideration of distance to active mining. Recommend the following updates to the WMP: • Revision of Piezometer Monitoring Sites for Pambalong Nature Reserve to ensure the piezometer relevant to the feature; and • Clarify Trigger Level 1 and 2 for Groundwater levels for the Pambalong Nature Reserve.	The Water Management Plan will be reviewed and updated in 2019. This update will include a review of trigger actions that determine if a change in water quality is mining induced. Abel Coal Mine will update the Water Management Plan in 2019 and review comments provided by the audit team. A water specialist will, where relevant, incorporate comments into the updated management plan.	Completed	The Water Management Plan was reviewed and updated during the 2019 reporting period with DPIE approval received 04 June 2019.

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

Ref	Description	Donaldson Response	Timeline	Status Update
PA 05_0136 Compliance Recommendations (Cont'd)				
Sch 4 Cond 10b)	Recommend dust gauges re-sited (if not being removed from program).	A dust gauge audit will be conducted to identify any non-complying dust gauges with corrective actions put in place to ensure compliance. An update to the Air Quality Management Plan will propose the removal of Dust Gauges.	Completed	The Air Quality Management Plan was reviewed and updated with DPIE approval received 04 June 2019. The updated Plan provides for the cessation of deposited dust monitoring during care and maintenance, thereby removing the need to undertake an audit of the gauges. A variation to EPL 12856 was also finalised 1 October 2021 enabling cessation of deposited dust monitoring.
Sch 4 Cond 23	Coal Transport records are consistently made publicly available on website when production recommences.	All coal transport records are up to date to the end of 2018 on the Donaldson Coal Website. This will occur on an annual basis at the start of the new year.	Annually	The 2021 coal transport report is available on the Donaldson Coal website. Further coal transport reports will be uploaded following recommencement of mining.
Sch 4 Cond 24c)	Audit be undertaken to confirm compliance at lighting components which will operate in next period (e.g. CHPP and rail loadout).	On recommencement of mining, including use of the Bloomfield CHPP and Rail Loadout, Abel will recommission currently disused lights for use at night time. At this point, Abel will conduct an audit against AS4282.	When mining recommences	Not yet applicable – mining has not yet recommenced.
PA 05_0136 MOD3 Continual Improvement Recommendations				
Sch 2 Cond 4	Follow up with WaterNSW to resolve Certificate of Title for WAL 41525 being incorrectly labelled to a water source.	WaterNSW will be contacted again in 2021 to follow up on the Abel Certificate of Title for WAL 41525.	Completed	Water NSW have issued the updated / corrected WAL certificate.
Sch 2 Cond 9	Include a statement in the relevant Annual Review that discusses transportation of product coal produced on the Bloomfield site via the Bloomfield Rail Loop, and Rail Spur and the Main Northern Railway.	Accept recommendation and incorporate statement into the 2018/19 Annual Review.	Annually	Commentary included in Section 2.1 of this Annual Review.
Sch 2 Cond 11	Include a statement in the Annual Review that discusses alterations and additions to building and structures.	Accept recommendation and incorporate statement into the 2018/19 Annual Review.	Annually	Statement included in Section 8.1 of this Annual Review.

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

Ref	Description	Donaldson Response	Timeline	Status Update
PA 05_0136 MOD3 Continual Improvement Recommendations (Cont'd)				
Sch 3 Cond 1	• "Minor Cliff" definition be clarified on review of EP/management plans.	• Minor Cliff's will be defined in the next update to the Subsidence Monitoring Program required under the Extraction Plan.	When mining recommences	Not yet applicable – mining has not yet recommenced.
	• Whilst mining, AEMR include PA 05_0136 Table 2 and a tabulated summary of impacts and conclusions.	• The 2018/19 Abel Annual Review and future Annual reviews will include a tabulated summary of impacts and conclusions as outlined in Table 2.	Annually	Tabulated summary included in Section 6.8 of this Annual Review.
	• Labelling of Water Quality Monitoring Sites 9 and 10 in AEMR are consistent with that shown in the WMP.	• Water quality labels of sites 9 and 10 will be reviewed and addressed in the 2018/19 Annual Review.	Completed	The labelling on Figure 6.1 of the 2018 Annual Review (and subsequent Annual Reviews) has been updated.
	• If mining recommences, a clear definition of GDEs in the Hexham Swamp be documented (impacts and monitoring).	• When mining recommences the Water Management Plan (WMP) will require an update. If mining recommences, a definition will be included in the WMP of Groundwater Dependent Ecosystems.	When mining recommences	Not yet applicable – mining has not yet recommenced.
Sch 3 Cond 4p)	Future TARPs include Trigger Levels for Groundwater Drawdown, especially at bores relevant to Pambalong Nature Reserve (excluded from Area 4 EP).	The next update to the Extraction Plan will review the trigger levels for TARPs relating to the Pambalong Nature Reserve.	When mining recommences	Not yet applicable – mining has not yet recommenced.
Sch 3 Cond 6	No written evidence was provided that first working in South Mains were designed to DRG's satisfaction. Recommend a response is sought for any future first workings in accordance with this condition prior to works being undertaken.	On the recommencement of mining, Abel Mine will seek a written response from the relevant authority confirming that first workings are designed to the satisfaction of the DRE	When mining recommences	Not yet applicable – mining has not yet recommenced.
Sch 3 Cond 11	When revising Service Boreholes Management Plan, include mitigation and management measures for visual impacts and compensation for noise, air and visual impacts.	Accept recommendation and incorporate mitigation and management measures into the next update of the Service Boreholes Management Plan.	When mining recommences	Not yet applicable – mining has not yet recommenced.
Sch 4 Cond 1	Remove Location K from PA 05_0136 Table 4 and any other strategy, plan or program.	There is no proposed modification to PA 05_0136 where Location K will be removed. This recommendation will be considered with any future modification.	Noted	No modification currently planned.
Sch 4 Cond 3	Include statement in AEMR that reports on Cumulative Noise Criteria.	Accept recommendation and incorporate into the 2018/19 Annual Review.	Annually	Statement included in Section 6.3 of this Annual Review.

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

Page 4 of 6

Ref	Description	Donaldson Response	Timeline	Status Update
PA 05_0136 MOD3 Continual Improvement Recommendations (Cont'd)				
Sch 4 Cond 5c)	Clarify noise mitigation process in NMP under meteorological conditions to which noise limits do not apply.	Accept recommendation and incorporate into the 2019 update of the Noise Management Plan.	Completed	The Noise Management Plan was reviewed and updated during the 2019 reporting period with DPIE approval received 04 June 2019.
Sch 4 Cond 11	Energy efficiency opportunities for the Abel Underground Mine to be identified, assessed and reported through a series of five year assessment cycles in accordance with the Energy Efficiency Opportunities Act 2006 (EEO Act, 2006).	Energy Efficiencies will be identified in the updated 2019 Air Quality Management Plan. Compliance with the Energy Efficiency Opportunities Act 2006 will be managed by Yancoal Corporate who are the 'controlling corporation' as defined by the EEO Act 2006.	Completed	The Air Quality Management Plan was reviewed and updated during the 2019 reporting period with DPIE approval received 04 June 2019. It is noted that the EEO Act 2006 was repealed in 2014.
Sch 4 Cond 16	Recommend clearly labelling column on water transfer amounts on site spreadsheet e.g. "Transfer from Big Kahuna to Lake Kennerson (ML)" and including pumped volumes in Annual Review.	Accept recommendations and update site water spreadsheet and incorporate into 2018/19 Abel Annual Review.	Completed Annually	The spread sheet has been updated as recommended. The volume transferred during this reporting period is reported in Section 7.2 of this Annual Review.
Sch 4 Cond 25b)	Recommend that refresher training provided to any personnel on site to ensure that waste management and waste bins handled correctly (see Plates 7, 8, 10, 14, 15 and 18).	A tool box talk will be provided to all operational personnel onsite in March 2019 to outline the correct handling of waste onsite.	Completed	A waste management presentation was presented to all operational personnel in March 2019.
Sch 4 Cond 25c)	Investigate redundant tank (see Plate 19) and respond accordingly. Confirm source of which pipe below operating sewage system to confirm it is benign.	A review of the future requirements for the redundant tank will be undertaken and actions reported in the 2019/20 Annual Review. The contractor that services the sewerage treatment plant (STP) at Abel has been approached to determine the source of the pipe below the STP.	Completed	Site personnel have inspected and do not believe the pipe is connected to the sewage system. Advice was received from the wastewater treatment contractor confirming that the pipe is not associated with the STP but is rather a stormwater pipe draining from the car park. No further actions required.
Sch 4 Cond 26a)	Bush Fire Response Procedure Section be added to site induction presentation at next review.	The Abel Site Familiarisation Induction currently covers the Emergency Muster Area and what to do in the event of an emergency. It also covers fire equipment onsite.	Noted	No further action required.

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

Ref	Description	Donaldson Response	Timeline	Status Update
PA 05_0136 MOD3 Continual Improvement Recommendations (Cont'd)				
Sch 4 Cond 29e)	Complete mine closure plan at least 5 years prior to closure or consent expiry date.	Accept recommendation and complete Mine Closure Plan 5 years prior to closure.	Noted	Currently no further action. Mine is currently in care and maintenance. Consent does not expire until 2030.
Sch 6 Cond 1f)	Recommend adding links to EMS attached documents or including as appendix to EMS.	Accept recommendation and on next update of the EMS, provide a link to the 'Abel Management Plans' page on the Donaldson Coal website.	Next update of the EMS	The Environmental Management Strategy (dated August 2018) has yet to be updated but will be reviewed during the next reporting period.
Sch 6 Cond 2	Condition list made into a table and included in each revised management plan during care and maintenance and demonstrate where each is addressed.	Accept comments and incorporate into future updates of Management Plans.	Completed	The review and update of various management plans was completed and the plans approved 4 June 2019. The updated plans include a summary of relevant requirements and where each is addressed in the plan.
SOCs	Recommended that at next project approval modification (if mining recommences), a full review of the SOCs are undertaken and any commitments which are duplicative of development consent conditions are sought to be removed with a relevant justification.	Accept comment and action in the next modification of Abel Coal.	When mining recommences	Not yet applicable – mining has not yet recommenced.
Management Plans	Most plans required update for care and maintenance status. Detail in table A and B should be considered during this review. The plans would all benefit from clarification of what responsibilities are Bloomfield's (CHPP and rail loadout) and which are care and maintenance activities and as such the responsibility of Abel Mine. Some of the changes will be inconsistent with the SOCs which include significant detail which is more suited to inclusion in the management plans. An appendix should include evidence of consultation with relevant regulators for each plan. Address recommended changes to each plan as listed in Table A of Appendix D. The RMP should include confirmation of where topsoil is stored and confirmation that adequate volumes exist to achieve the nominated final land use.	Abel Coal Mine will update relevant management plans in 2019 and review comments provided by the audit team and where relevant, incorporate comments into the updated management plans. Updated plans will be specific for Care and Maintenance and include a clarification of the responsibility boundaries between Abel and Bloomfield. A summary of management plan status was included in the Abel 2019/20 Annual Review.	Completed	The review and update of various management plans was completed during the 2019 reporting period, with agency comments addressed and final approval sought from DPIE 4 June 2019.

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

Ref	Description	Donaldson Response	Timeline	Status Update
EPL12856				
A1	Recommend that consideration be given to a variation to reduce the 'coal works' scale as mine in care and maintenance status. This assumes that CHPP and rail loadout facilitates are included in Bloomfield's EPL.	Abel will review this recommendation and determine the benefits of a license variation. A variation will be applied for if it is determined there is a benefit in reducing the scale of coal works on the sites license.	Completed	EPL 12856 was updated 21 October 2021. The scale for "Mining for Coal" was reduced to the lowest scale. It is noted that the scale of coal works is already at the lowest scale provided for in the POEO Regulation 2021.
P1	Recommend updating this condition when management plans updated. Consideration should be given to seek reduction or removal of depositional dust gauges from program.	A variation to the locations of monitoring sites was submitted to the EPA in 2018. The variation is currently being assessed by the EPA. Further review of locations within site management plans may trigger another variation if required.	Completed	Condition has been updated as of 21 October 2021 to remove depositional dust gauges.
L2	Recommend updating noise monitoring locations and meteorological condition limit wording to make consistent with those shown in PA 05_0136 whilst operational.	A review of the noise monitoring locations and meteorological condition limit wording will be conducted with the update to the Noise Management Plan.	Completed	The Noise Management has been updated and removes location K from the active monitoring locations. Whilst noise limits are specified within EPL 12856 for additional locations it does not specify that noise must be monitored at every (or any) location. Therefore, there is no inconsistency with the updated Noise Management Plan. Notwithstanding, noise monitoring was requested to be removed from the EPL; however, noise monitoring was not completely removed in the revised EPL.
O4	Seek removal/amendment to condition O4.2 as no sprays are utilised by the septic system.	There is no plan to remove condition O4.2 from the EPL. Abel Coal may utilise sprays in future adjustments to the Sewerage Treatment Plant.	Noted	No further action required.
U1.3-1.5	Recommend requesting U1 removed at next variation as it has been completed	Accept recommendation and incorporate into the next EPL variation.	Completed	Condition U1 has been removed from EPL 12856.
ML1618				
11	Date of when mine entered Care and Maintenance is reported in the Annual Mining Lease Group Exploration report as being 02 May 2016, this date is not consistent with other reports e.g. the 2017 AEMR states mine entered care and maintenance on 28 April 2016. Recommend updated in next report.	Accept and incorporate into the next Annual Mining Lease Group Exploration report or Annual Review dependent on a review of the agreed date	Completed	The official date the Abel Mine entered care and maintenance has been confirmed as 2 May 2016. This is reflected in the 2018 and subsequent Annual Reviews.

11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

During the reporting period there were no:

- reportable incidents[2] or exceedances relating to Abel Underground Mine operations; or
- official cautions, warning letters, penalty notices or prosecution proceedings.

One administrative non-compliance was recorded for the reporting period. PA 05_0136 Schedule 2 Condition 11 requires that all new buildings and structures, and any alterations or additions are constructed in accordance with the relevant requirements of the BCA. Whilst Construction Certificates have been received for buildings within the surface infrastructure area, the Occupation Certificates have not yet been received. The certifying body inspected once and requested changes prior to issuing the Occupation Certificate. The requested changes have been made and the certifying body requested to reinspect. However, the certifying body has not yet issued the final certificate. This will continue to be followed up.

[2] It is noted that a reportable incident occurred at the Bloomfield Colliery relating to discharge from a sediment basin associated with the CHPP. The Bloomfield Group reported the incident in March 2021 as per the Bloomfield EPL 396.

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:

- preparation of the Rehabilitation Management Plan in accordance with the Resources Regulator's Operational Rehabilitation Reform;
- undertaking of the independent environmental audit; and
- review and update of the Water Management Plan.

Appendices

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Appendix 1

Noise Monitoring Reports

1. Bi-Annual Noise Monitoring, Half-year Ending July 2021
2. Bi-Annual Noise Monitoring, Half-year Ending December 2021

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DONALDSON AND ABEL COAL MINES

Bi-Annual Noise Monitoring
Half-year Ending July 2021

Prepared for:

Donaldson Coal Pty Ltd
PO Box 675
Green Hills 2320

SLR Ref: 630.01053-R01
Version No: -v1.0
December 2021

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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
Q82 630.01053-R01-v1.0	10 December 2021	Martin Davenport	Kieran Murphy	Martin Davenport

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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 July 2021 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* *Saturday*	*7 am to 6 pm* *8 am to 1 pm*
Mining operations, including mining, haulage of waste to dumps and coal processing	*Monday to Friday* *Saturday, Sunday*	*24 hours per day* *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 LAeq(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*
	LAeq(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*
	LAeq(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 – 2004 *Electroacoustics—Sound level meters – Specifications*, AS IEC 61672.2-2004, AS IEC 61672.3-2004 and carried current NATA or manufacturer calibration certificates. Certificates for acoustic instrumentation used during the July 2021 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.

It is noted that availability and deployment of noise logging equipment was delayed due to COVID-19 and as such noise monitoring was conducted as soon as practicable in July 2021.

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 July 2021 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 1 July 2021 to Tuesday 13 July 2021 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 commenced on Thursday 1 July 2021 and finished during the night-time period on Friday 2 July 2021. 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	01/07/2021 14:43 14°C 0.9 m/s WNW	77	66	52	39	54	Birdsong 45-63 Road traffic 40-77 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	01/07/2021 18:24 13°C 0.1 m/s SW	76	63	48	43	52	Road traffic 40-76 Insects 42-47 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	1/07/2021 22:26 12°C 0.6 m/s WNW	54	49	46	42	44	Insects 41-51 Road traffic 35-54 **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	1/7/2021 17:47 13°C 0.2 m/s W	81	69	56	48	58	Road traffic 48-81 Insects 36-42 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	1/7/2021 18:03 13°C 0.2 m/s WSW	78	64	55	48	55	Insects 36-43 Road traffic 48-78 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	1/7/2021 22:48 12°C 1.0 m/s WNW	73	59	50	42	49	Road traffic 44-73 Insects 41-43 **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	1/7/2021 16:07 14°C 0.5 m/s SSW	62	51	49	44	47	Road traffic 43-58 Insects 28-30 Birdsong 42-62 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	1/7/2021 19:38 13°C 0.8 m/s S	58	49	47	39	44	Road traffic 45-51 Insects 30-33 Aeroplane 49 Other industry 28-44 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	1/7/2021 23:54 12°C 1.2 m/s NNW	52	45	39	31	36	Road traffic 32-47 Insects 30-52 Other industry 26-30 **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	1/7/2021 16:55 13°C 0.7 m/s S	69	59	45	36	46	Road traffic 34-69 Birdsong 47-53 Insects 33-38 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	1/7/2021 21:08 13°C 1.2 m/s NW	53	43	40	37	39	Traffic 35-53 Insects 37-40 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	2/7/2021 00:44 12°C 0.8 m/s WNW	51	41	38	33	36	Traffic 25-51 Insects 33-48 **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	1/07/2021 17:18 13°C 1.0 m/s S	70	59	45	39	46	Road traffic 38-65 Resident 45-50 Birdsong 46-70 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	1/7/2021 21:41 12°C 0.3 m/s W	59	42	41	39	40	Road traffic 37-59 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	1/7/2021 22:00 12°C 0.3 m/s SSW	66	45	42	36	40	Road traffic 40-57 Exhaust click 66 **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	1/07/2021 16:34 13°C 0.7 m/s SSW	74	67	50	37	53	Road traffic 40-74 Residents AC 37 Birdsong 42-59 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	1/7/2021 20:08 13°C 1.2 m/s WNW	65	60	43	34	45	Road traffic 35-65- Residential noise 40-52 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	02/7/2021 00:22 12°C 0.5 m/s W	49	35	30	26	29	Road traffic 30-49 Residential noise 25-30 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution 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 and stockpile area were inaudible during all 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 '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	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	Inaudible	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 Bloomfield $L_{A1(1minute)}$ 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 1 July 2021 and Tuesday 13 July 2021 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 20666	1/7/2021 to 13/7/2021
F – Black Hill Road, Black Hill	ARL 316 16-203-528	1/7/2021 to 13/7/2021
G – Buchanan Road, Buchanan	ARL NGARA 8781DD	1/7/2021 to 13/7/2021
I – Magnetic Drive, Ashtonfield	ARL EL316 16-203-521	1/7/2021 to 13/7/2021
L – 65 Tipperary Dr, Ashtonfield	ARL NGARA 878202	1/7/2021 to 13/7/2021
J – Parish Drive, Thornton[1]	SVAN 957 27523	1/7/2021 to 13/7/2021

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 Black Hill School, Black Hill	Day	68	55	34	57
	Evening	57	45	38	50
	Night	48	44	37	48
F Lot 684 Black Hill Road, Black Hill	Day	72	57	45	59
	Evening	61	55	42	55
	Night	58	52	39	53
G 156 Buchanan Road, Buchanan	Day	51	49	40	47
	Evening	50	47	36	45
	Night	48	43	30	42
I 49 Magnetic Drive, Ashtonfield	Day	67	55	37	58
	Evening	56	46	38	49
	Night	47	40	34	45
L 65 Tipperary Dr, Ashtonfield	Day	61	51	37	51
	Evening	56	40	30	46
	Night	40	34	27	41
J 220 Parish Drive, Thornton	Day	52	47	38	46
	Evening	48	45	37	44
	Night	46	42	32	42

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

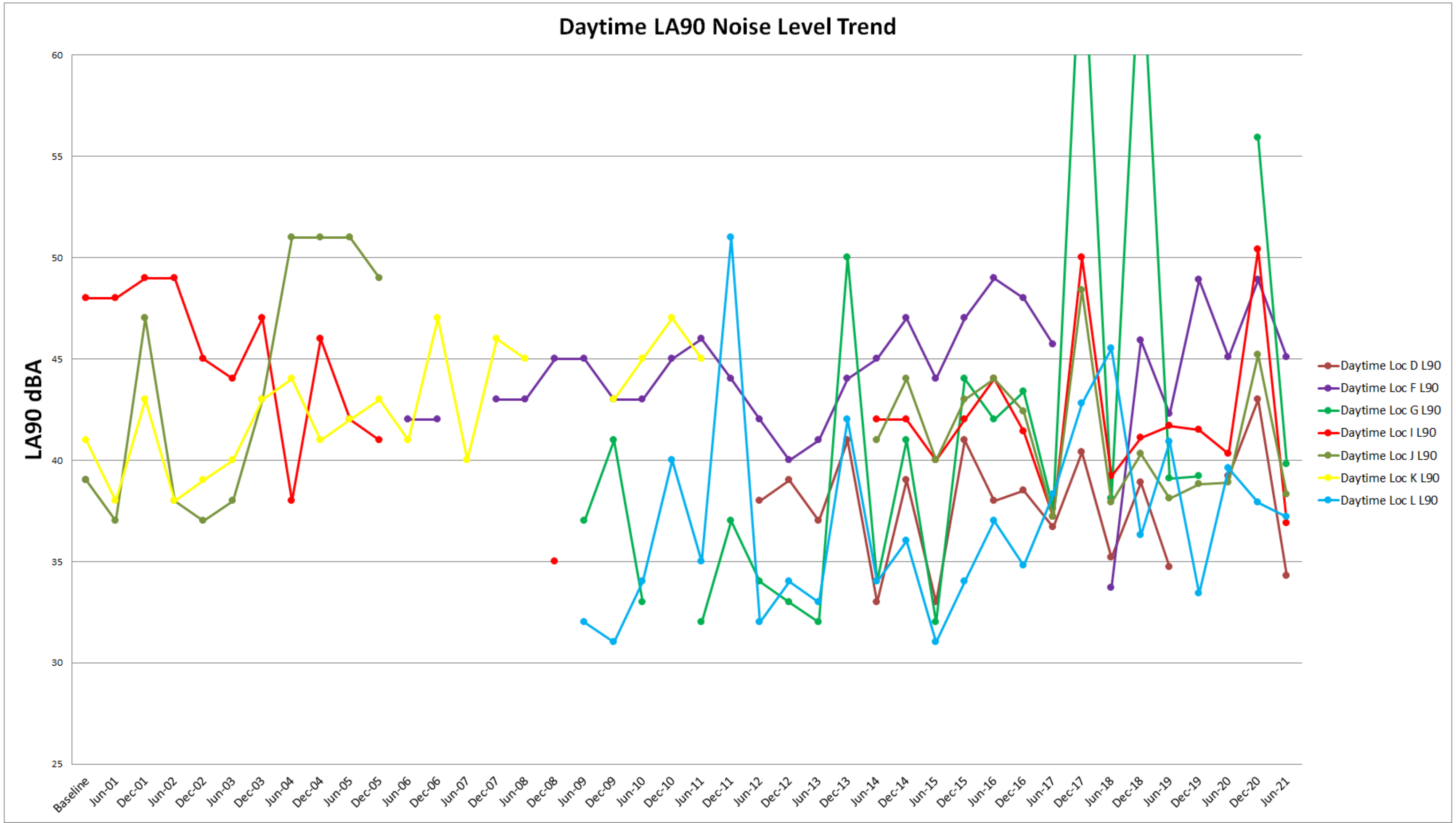


Figure 2 Long Term Evening LA90 Noise Levels

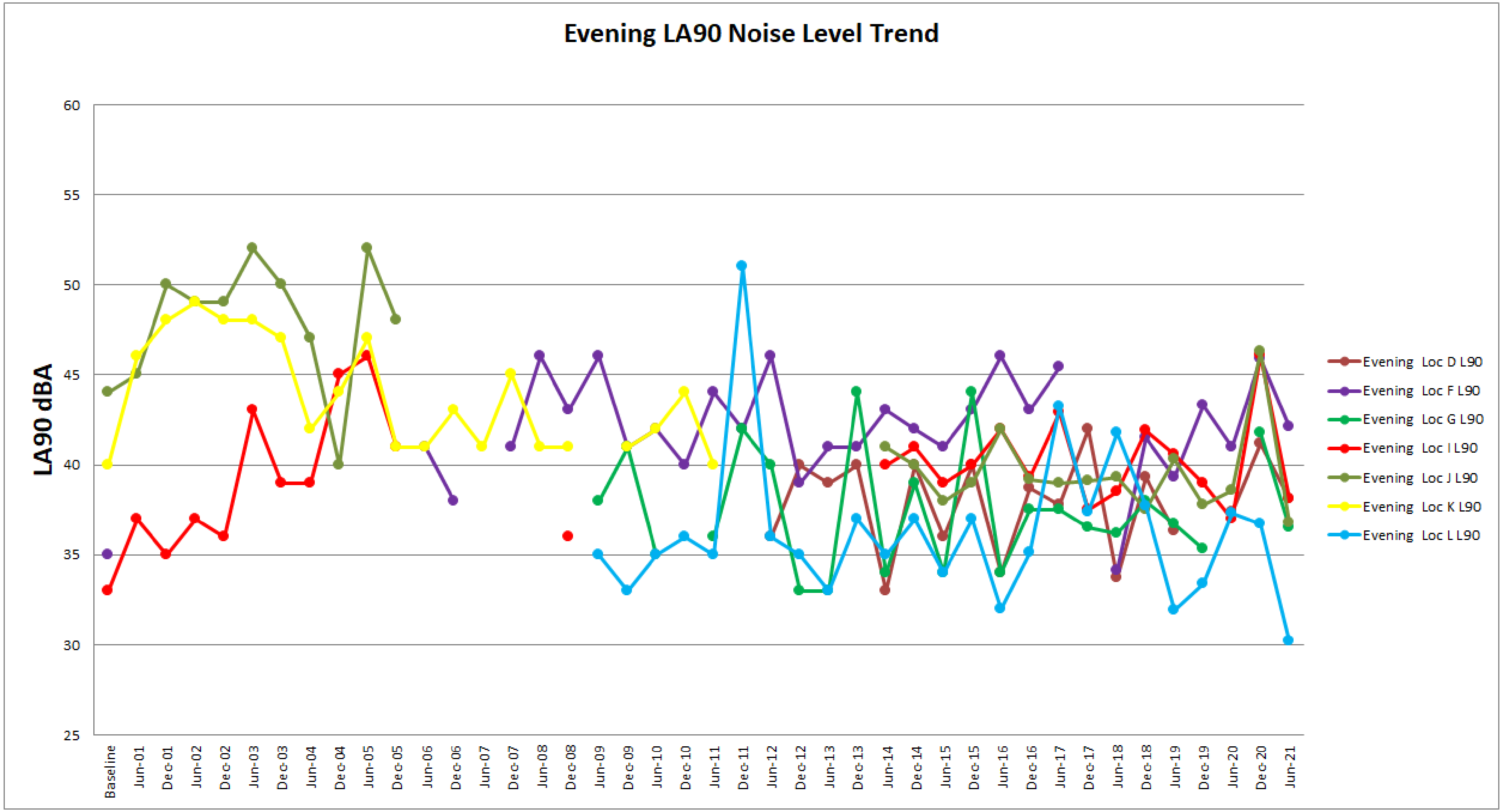
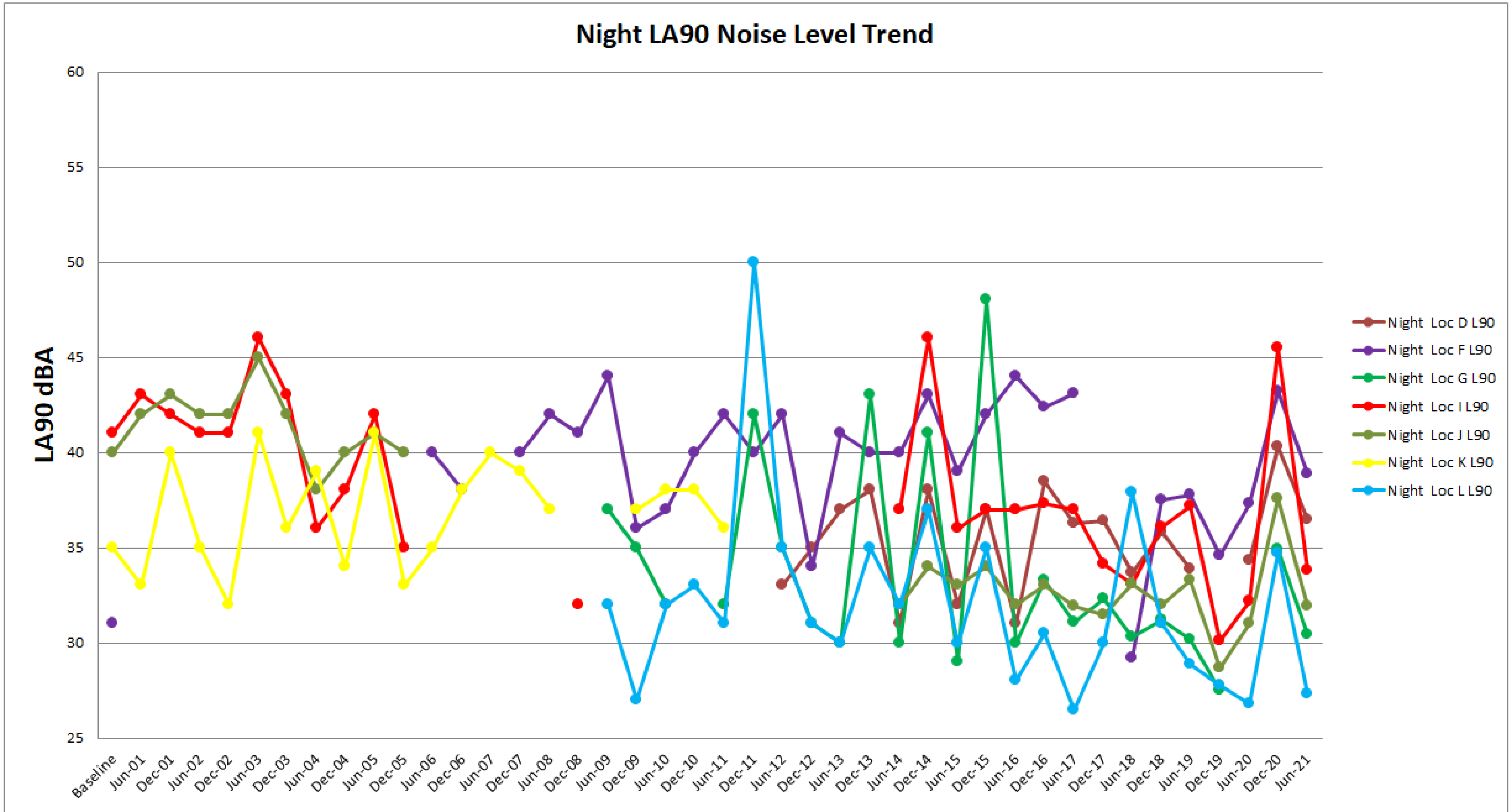


Figure 3 Long Term Night-time LA90 Noise Levels



5.2.1.1 Baseline

The summary of results in **Table 12** shows the ambient 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	**July 2021**	
D Black Hill School, Black Hill	Day	N/A[2]	34	N/A[2]
	Evening	N/A[2]	38	N/A[2]
	Night	N/A[2]	37	N/A[2]
F Lot 684 Black Hill Road, Black Hill	Day	39	45	6
	Evening	35	42	7
	Night	31	39	8
G 156 Buchanan Road, Buchanan	Day	N/A[2]	40	N/A[2]
	Evening	N/A[2]	37	N/A[2]
	Night	N/A[2]	30	N/A[2]
I 49 Magnetic Drive, Ashtonfield	Day	48	37	-11
	Evening	33	38	5
	Night	41	34	-7
L 65 Tipperary Drive, Ashtonfield	Day	N/A[2]	37	N/A[2]
	Evening	N/A[2]	30	N/A[2]
	Night	N/A[2]	27	N/A[2]
J 220 Parish Drive, Thornton	Day	39	38	-1
	Evening	44	37	-7
	Night	40	32	-8

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 LA10 noise levels recorded for the current monitoring period compared to those measured during the previous monitoring period.

Table 13 LA90 Results Comparison – Previous Half-year

Monitoring Location	Period[1]	Long term Night-time LA10 Noise Levels		Difference dB[2]
		December 2020	**July 2021**	
D Black Hill School, Black Hill	Day	43	34	-9
	Evening	41	38	-3
	Night	40	37	-4
F Lot 684 Black Hill Road, Black Hill	Day	49	45	-4
	Evening	46	42	-4
	Night	43	39	-4
G 156 Buchanan Road, Buchanan	Day	56	40	-16
	Evening	42	37	-5
	Night	35	30	-5
I 49 Magnetic Drive, Ashtonfield	Day	50	37	-14
	Evening	46	38	-8
	Night	46	34	-12
L 65 Tipperary Drive, Ashtonfield	Day	38	37	-1
	Evening	37	30	-7
	Night	35	27	-7
J 220 Parish Drive, Thornton	Day	45	38	-7
	Evening	46	37	-10
	Night	38	32	-6

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.

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 2019	**December 2020**	
D Black Hill School, Black Hill	Day	39	34	-5
	Evening	37	38	1
	Night	34	37	2
F Lot 684 Black Hill Road, Black Hill	Day	45	45	-
	Evening	41	42	1
	Night	37	39	2
G 156 Buchanan Road, Buchanan	Day	0	40	40
	Evening	0	37	37
	Night	0	30	30
I 49 Magnetic Drive, Ashtonfield	Day	40	37	-3
	Evening	37	38	1
	Night	32	34	2
L 65 Tipperary Drive, Ashtonfield	Day	40	37	-2
	Evening	37	30	-7
	Night	27	27	1
J 220 Parish Drive, Thornton	Day	39	38	-1
	Evening	39	37	-2
	Night	31	32	1

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.

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

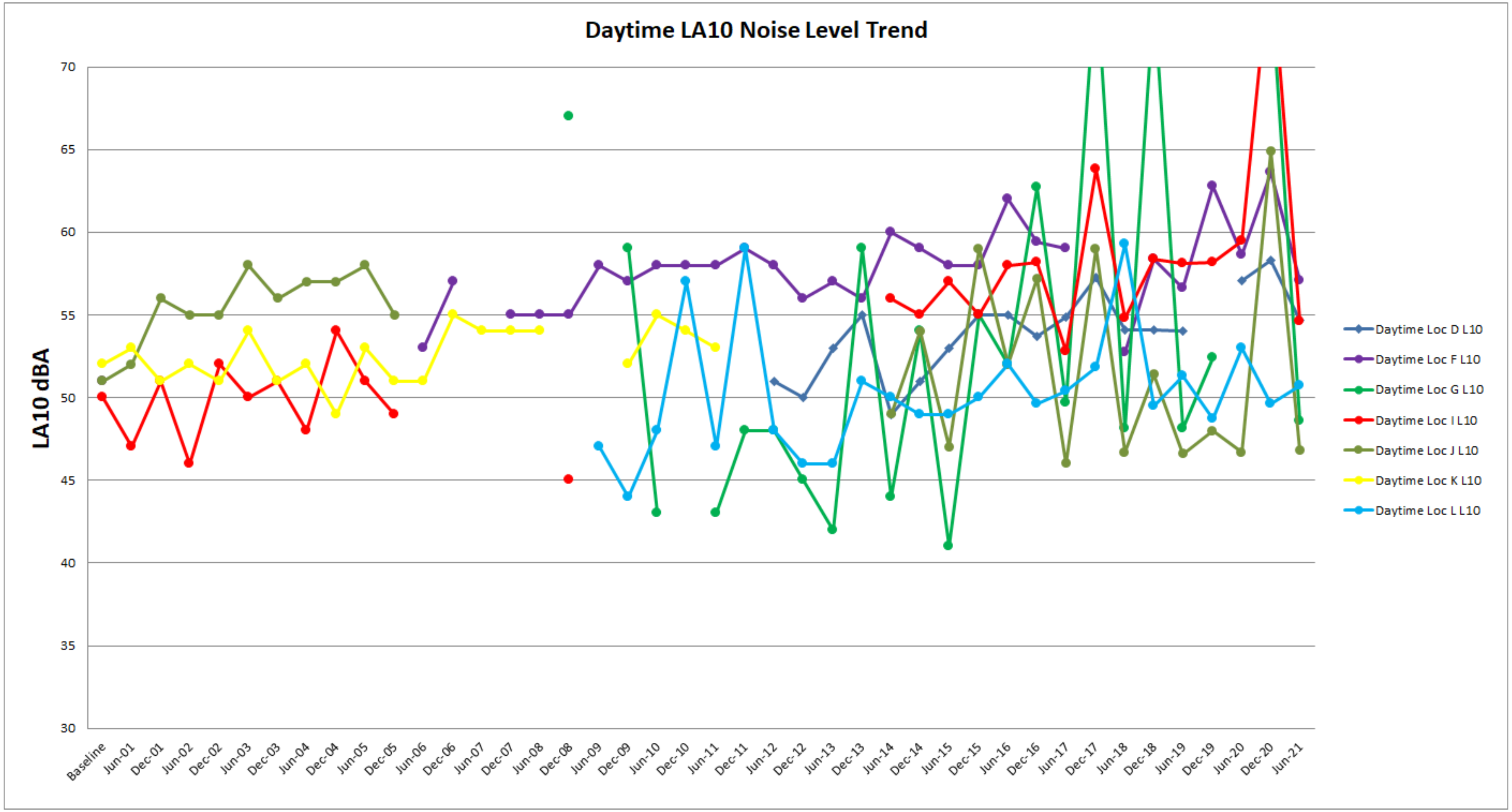


Figure 5 Long term Evening L_{A10} Noise Levels

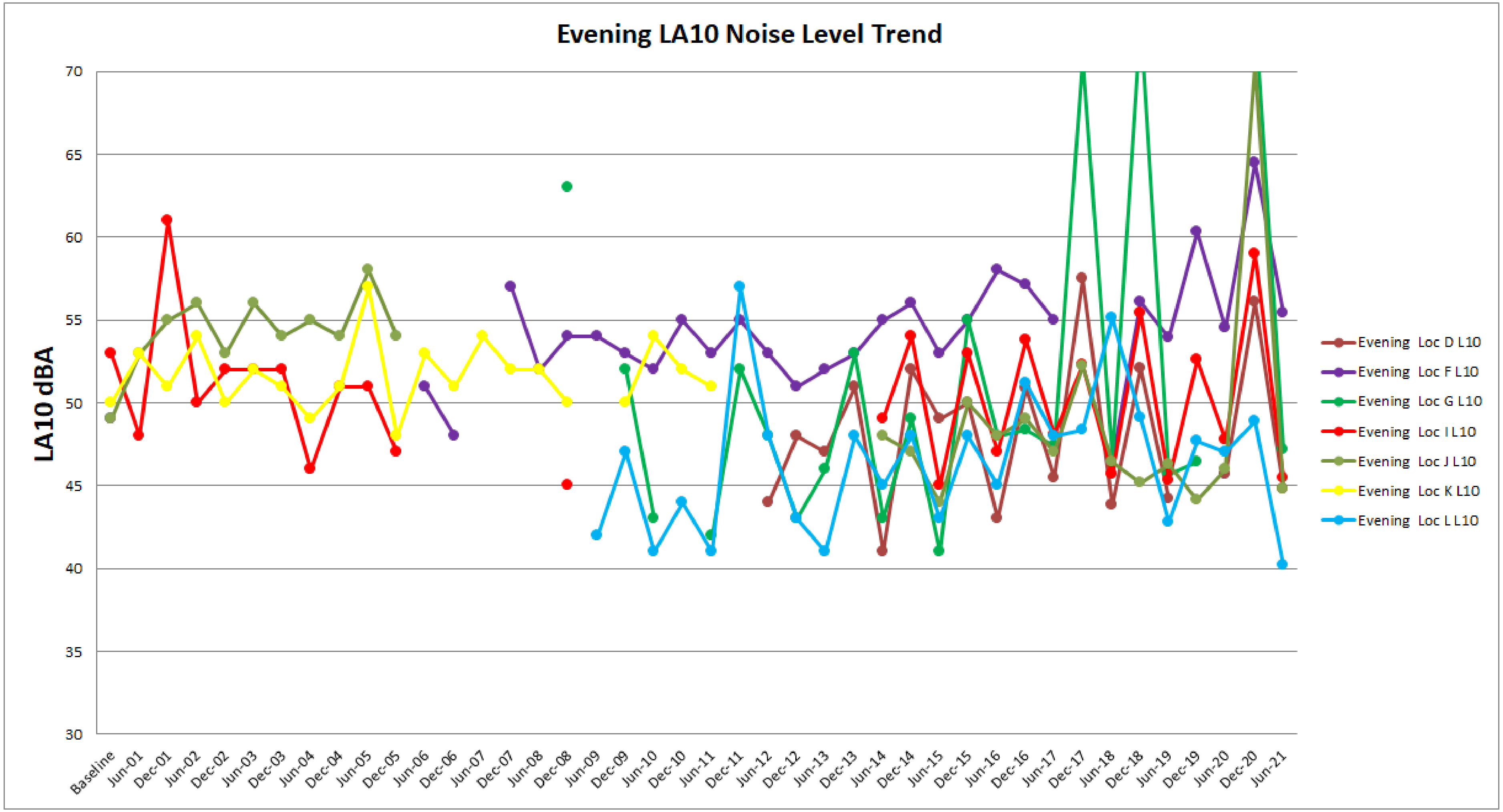
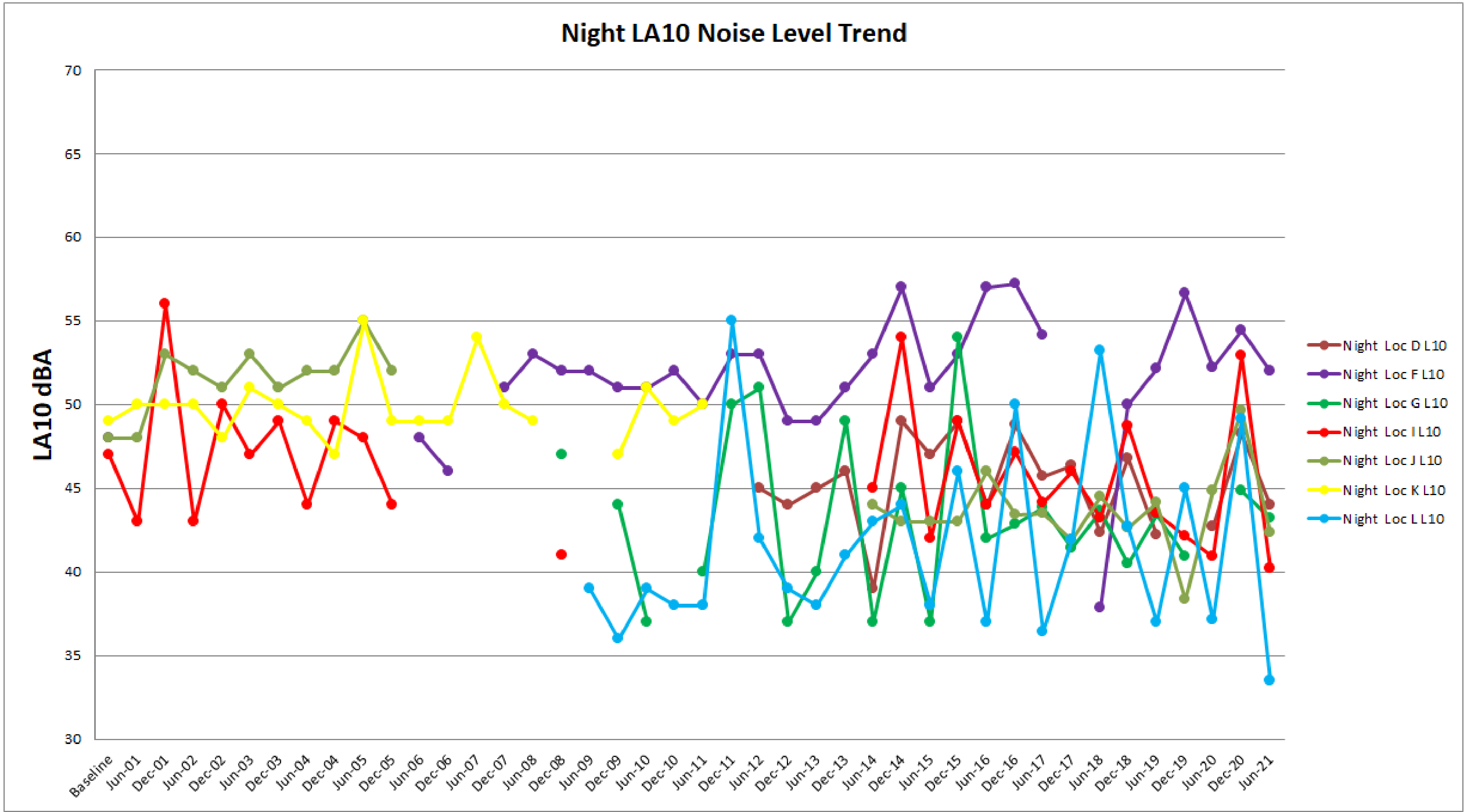


Figure 6 Long term Night LA10 Noise Levels



5.2.2.1 Baseline

Table 15 presents the ambient LA10 noise levels recorded for the current monitoring period compared to the levels recorded during the baseline monitoring period.

Table 15 LA10 Results Comparison – Baseline

Monitoring Location	Period[1]	Long term Night-time LA10 Noise Levels		Difference dB[3]
		Baseline	**July 2021**	
D Black Hill School, Black Hill	Day	N/A[2]	55	N/A
	Evening	N/A[2]	45	N/A
	Night	N/A[2]	44	N/A
F Lot 684 Black Hill Road, Black Hill	Day	51	57	6
	Evening	49	55	6
	Night	48	52	4
G 156 Buchanan Road, Buchanan	Day	N/A[2]	49	N/A
	Evening	N/A[2]	47	N/A
	Night	N/A[2]	43	N/A
I 49 Magnetic Drive, Ashtonfield	Day	50	55	5
	Evening	53	46	-8
	Night	47	40	-7
L 65 Tipperary Drive, Ashtonfield	Day	N/A[2]	51	N/A
	Evening	N/A[2]	40	N/A
	Night	N/A[2]	34	N/A
J 220 Parish Drive, Thornton	Day	51	47	-4
	Evening	49	45	-4
	Night	48	42	-6

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 LA10 noise levels recorded for the current monitoring period compared to those measured during the previous monitoring period.

Table 16 LA10 Results Comparison – Previous Half-year

Monitoring Location	Period[1]	Long term Night-time LA10 Noise Levels		Difference dB[2]
		December 2020	**July 2021**	
D Black Hill School, Black Hill	Day	58	55	-4
	Evening	56	45	-11
	Night	48	44	-4
F Lot 684 Black Hill Road, Black Hill	Day	64	57	-7
	Evening	65	55	-9
	Night	54	52	-2
G 156 Buchanan Road, Buchanan	Day	75	49	-27
	Evening	74	47	-26
	Night	45	43	-2
I 49 Magnetic Drive, Ashtonfield	Day	77	55	-22
	Evening	59	46	-14
	Night	53	40	-13
L 65 Tipperary Drive, Ashtonfield	Day	50	51	1
	Evening	49	40	-9
	Night	49	34	-16
J 220 Parish Drive, Thornton	Day	65	47	-18
	Evening	71	45	-26
	Night	50	42	-7

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.

5.2.2.3 Coinciding Period Last Year

Table 17 presents the ambient LA10 noise levels recorded for the current monitoring period compared to those measured during the coinciding monitoring period last year.

Table 17 LA10 Result Comparison – Coinciding Period Last Year

Monitoring Location	Period[1]	Long term Night-time LA10 Noise Levels		Difference dB[2]
		June 2020	**July 2021**	
D Black Hill School, Black Hill	Day	57	55	-2
	Evening	46	45	-1
	Night	43	44	1
F Lot 684 Black Hill Road, Black Hill	Day	59	57	-2
	Evening	55	55	1
	Night	52	52	0
G 156 Buchanan Road, Buchanan	Day	0	49	49
	Evening	0	47	47
	Night	0	43	43
I 49 Magnetic Drive, Ashtonfield	Day	60	55	-5
	Evening	48	46	-2
	Night	41	40	-1
L 65 Tipperary Dr, Ashtonfield	Day	53	51	-2
	Evening	47	40	-7
	Night	37	34	-4
J 220 Parish Drive, Thornton	Day	47	47	0
	Evening	46	45	-1
	Night	45	42	-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.

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 July 2021 half at six focus locations surrounding the mine.

Abel portal operations were not observed to be audible at any locations during the monitoring period with CHPP operations audible at Location L during the daytime attended noise survey. Contributed noise levels from Abel Mine did not exceed noise emission goals and compliance with the Abel Mine *Project Approval* was indicated at all locations.

A comparison of ambient L_{A10} and L_{A90} noise levels recorded during the current monitoring period (July 2021), the baseline monitoring period, the last monitoring period (December 2020), and the coinciding monitoring period from last year (June 2020) 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

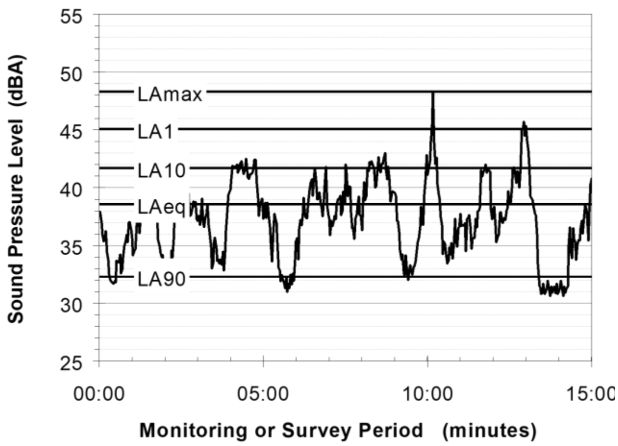
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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

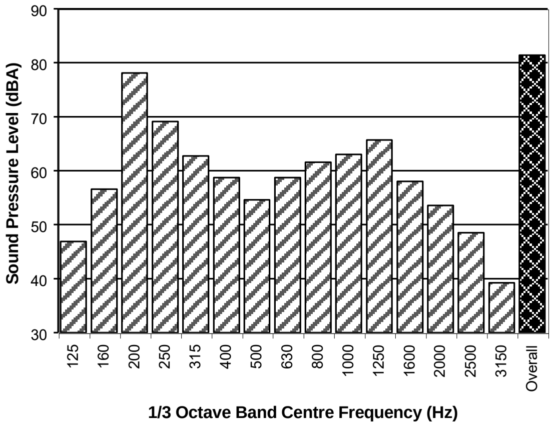
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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

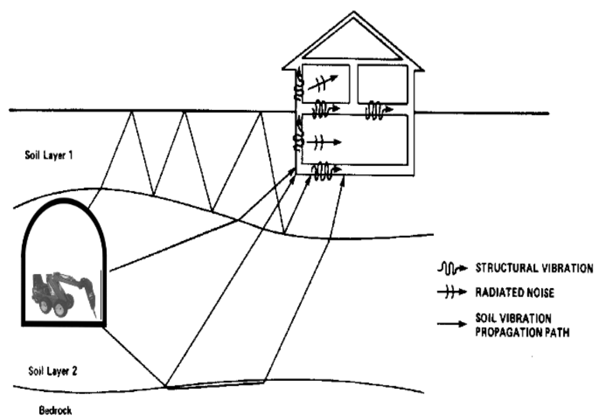
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience 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).

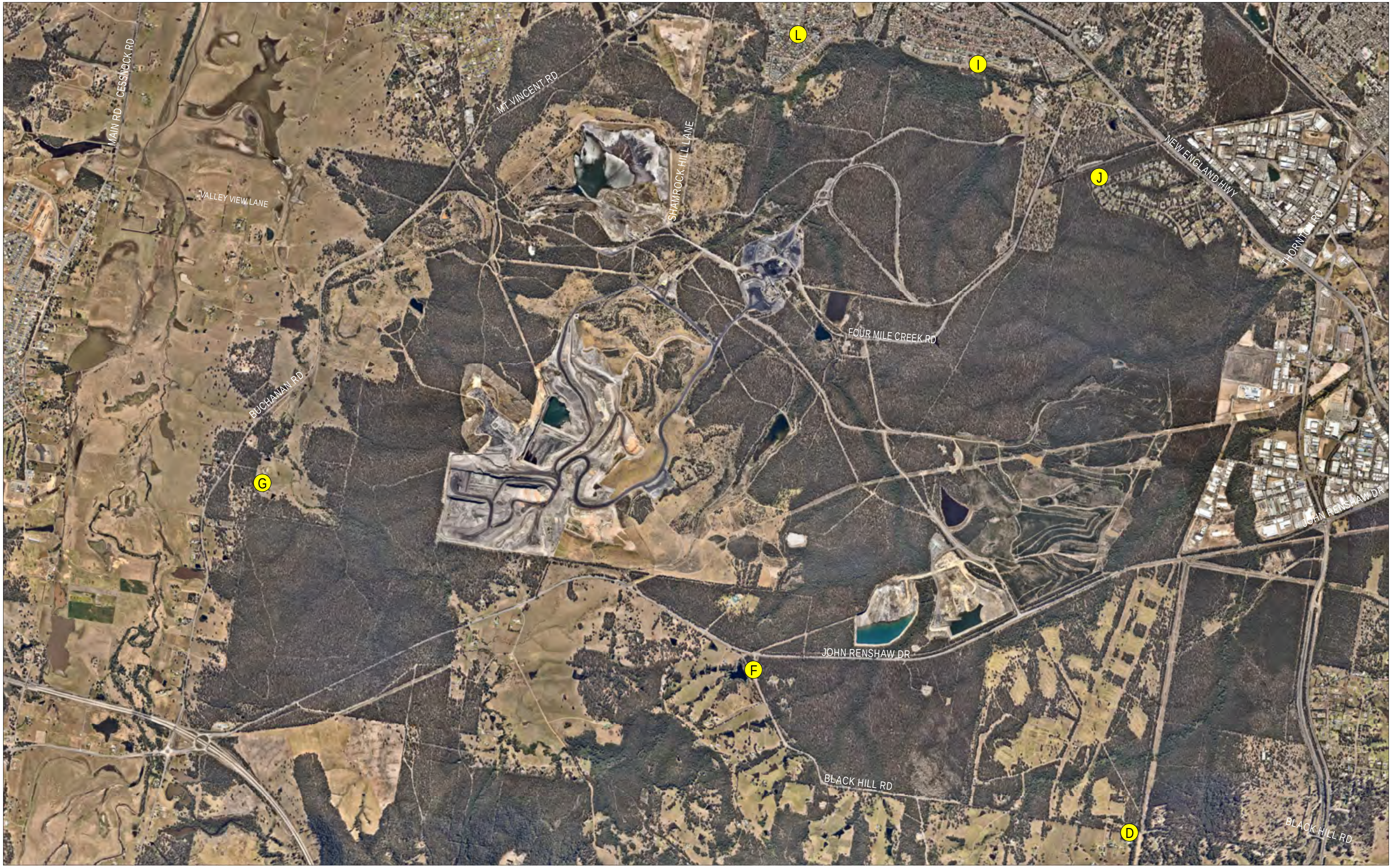
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



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

SLR

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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

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

Sound Level Meter

IEC 61672-3.2013

Calibration Certificate

Calibration Number C21186

Client Details	SLR Consulting Pty Ltd Level 11, 176 Wellington Parade East Melbourne VIC 3002
Equipment Tested/ Model Number :	ARL Ngara
Instrument Serial Number :	8781DD
Microphone Serial Number :	322476
Pre-amplifier Serial Number :	28502

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	22.5°C	**Ambient Temperature :**	22.7°C
Relative Humidity :	51.7%	**Relative Humidity :**	52.2%
Barometric Pressure :	101.3kPa	**Barometric Pressure :**	101.2kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	Max Moore
Calibration Date :	1 Apr 2021	**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.

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.

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Sound Level Meter
IEC 61672-3.2013
Calibration Test Report

Calibration Number C21186

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

Equipment Tested/ Model Number : ARL Ngara
Instrument Serial Number : 8781DD
Microphone Serial Number : 322476
Pre-amplifier Serial Number : 28502

Pre-Test Atmospheric Conditions		**Post-Test Atmospheric Conditions**	
Ambient Temperature :	22.5°C	**Ambient Temperature :**	22.7°C
Relative Humidity :	51.7%	**Relative Humidity :**	52.2%
Barometric Pressure :	101.3kPa	**Barometric Pressure :**	101.2kPa

---

Calibration Technician : Lucky Jaiswal
Secondary Check: Max Moore
Calibration Date : 1 Apr 2021
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	93.97	94.05	94.03	94.00
C	93.92	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)

18.70	18.90	19.00	19.00	19.00
18.80	18.80	18.80	18.90	18.90

Acoustic Noise Floor : 18.9 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)

16.80	16.70	16.80	16.80	17.00
16.90	16.50	16.90	17.00	16.80

Random Readings dB(C)

19.20	19.20	19.20	19.10	19.30
19.30	19.40	19.20	19.10	19.20

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 :	16.8	19.2	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	88.6	88.6	88.6	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	88.57	-5.38	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	91.41	-2.56	-3.0	+1.5 / -2.5	0.44	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	74.8	75.0	N/A	0.10
250	74.9	75.0	N/A	0.10
500	74.9	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	72.2	72.1	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	74.80	-0.20	±1.0	P	0.37
250	74.90	-0.10	±1.0	P	0.37
500	74.90	-0.10	±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	73.80	-1.20	+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	73.70	-1.30	+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
70.9	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	119.0	0.0	±0.8	P	0.1
120.0	120.0	0.0	±0.8	P	0.1

Overload indication at 121.0dB.

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	34.1	0.1	±0.8	P	0.1
30.0	30.2	0.2	±0.8	P	0.1
29.0	29.2	0.2	±0.8	P	0.1
28.0	28.2	0.2	±0.8	P	0.1
27.0	27.3	0.3	±0.8	P	0.1
26.0	26.4	0.4	±0.8	P	0.1
25.0	25.6	0.6	±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	120.1	0.0	±1.5	P	0.1
Negative	120.0				

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 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 **Secondary Check:** Max Moore
Calibration Date : 1 Apr 2021 **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.

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Sound Level Meter
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Calibration Test Report

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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
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Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
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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*
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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.

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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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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
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C20480

Client Details SLR Consulting Pty Ltd
5/21 Parap Road
Darwin NT 0820

Equipment Tested/ Model Number : ARL EL-316
Instrument Serial Number : 16-203-528
Microphone Serial Number : 305010
Pre-amplifier Serial Number : 26964

Atmospheric Conditions
Ambient Temperature : 21.6°C
Relative Humidity : 34.8%
Barometric Pressure : 101.88kPa

Calibration Technician : Jeff Yu
Calibration Date : 26 Aug 2020
Secondary Check: Max Moore
Report Issue Date : 1 Sep 2020

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.

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.
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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 Test Report

Calibration Number C20480

Client Details SLR Consulting Pty Ltd
5/21 Parap Road
Darwin NT 0820

Equipment Tested/ Model Number : ARL EL-316
Instrument Serial Number : 16-203-528
Microphone Serial Number : 305010
Pre-amplifier Serial Number : 26964

Atmospheric Conditions
Ambient Temperature : 21.6°C
Relative Humidity : 34.8%
Barometric Pressure : 101.88kPa

Calibration Technician : Jeff Yu
Calibration Date : 26 Aug 2020
Secondary Check: Max Moore
Report Issue Date : 1 Sep 2020

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.

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 - 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 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	94.1
Linear	N/A

Table 2 – Post-Adjustment Absolute sensitivity test results

Frequency Weighting	Sound Pressure Level (dB)
A	94.2
C	94.0
Linear	N/A

The measurement uncertainty for the above tests, derived at the 95% confidence level is 0.11dB.

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	55.0	91.2	N/A	0.1
63.1	68.1	93.3	N/A	0.1
125.9	78.1	94.0	N/A	0.1
251.3	85.2	94.0	N/A	0.1
502.5	90.5	94.0	N/A	0.1
1005.1	94.2	94.0	N/A	0.1
1978.8	95.8	94.1	N/A	0.1
3957.5	95.9	93.9	N/A	0.1
7915.1	93.6	91.6	N/A	0.1
12664.1	89.5	87.2	N/A	0.2
15830.2	86.6	84.5	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	N/A	N/A	N/A	0.1
251.2	114.8	0.2	Y	0.1
501.2	114.8	0.2	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	110.1	110.2	110.3
100.0	99.9	99.8	99.9
90.0	90.0	89.9	90.0
80.0	80.0	80.1	80.1
70.0	69.8	69.8	69.8
60.0	59.9	59.9	59.9
50.0	49.9	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	99.0	99.1	99.1
98.0	98.0	98.0	98.0
97.0	97.0	96.9	97.0
96.0	95.9	95.9	95.9
95.0	95.0	95.0	95.0
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	88.9	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	26.4	77.4	N/A	0.1
12.6	30.4	81.3	N/A	0.1
15.9	36.4	84.6	N/A	0.1
20.0	43.0	87.2	N/A	0.1
25.1	49.0	89.3	N/A	0.1
31.6	54.4	90.8	N/A	0.1
39.8	59.4	91.9	N/A	0.1
50.1	63.7	92.7	N/A	0.1
63.1	67.8	93.2	N/A	0.1
79.4	71.6	93.5	N/A	0.1
100.0	75.0	93.7	N/A	0.1
125.9	77.9	93.8	N/A	0.1
158.5	80.6	93.9	N/A	0.1
199.5	82.9	93.9	N/A	0.1
251.2	85.1	93.9	N/A	0.1
316.2	87.0	93.9	N/A	0.1
398.1	88.8	94.0	N/A	0.1
501.2	90.3	94.0	N/A	0.1
631.0	91.9	94.0	N/A	0.1
794.3	93.0	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	93.9	N/A	0.1
1995.0	95.3	93.9	N/A	0.1
2512.0	95.5	93.7	N/A	0.1
3162.0	95.5	93.5	N/A	0.1
3981.0	95.3	93.2	N/A	0.1
5012.0	94.9	92.7	N/A	0.1
6310.0	94.3	92.1	N/A	0.1
7943.0	93.3	91.1	N/A	0.1
10000.0	91.9	89.8	N/A	0.1
12590.0	90.1	88.0	N/A	0.1
15850.0	88.1	85.8	N/A	0.1
19950.0	85.7	82.9	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	108.1	N
CF3 Negative	108.1	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)
50 - 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	24.7	N
C	23.9	N
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	105.2	N/A
96.0	95.0	N/A
86.0	85.1	N/A
76.0	75.0	N/A
66.0	64.9	N/A
56.0	55.0	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	86.0	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	108.1	108.1	N/A	N/A	N/A	N/A
98.0	98.0	98.0	N/A	N/A	N/A	N/A
88.0	87.9	87.9	N/A	N/A	N/A	N/A
78.0	78.0	78.0	N/A	N/A	N/A	N/A
68.0	67.9	67.9	N/A	N/A	N/A	N/A
58.0	57.6	57.6	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	107.8	N/A	N/A
98.0	97.7	N/A	N/A
88.0	87.7	N/A	N/A
78.0	77.8	N/A	N/A
68.0	67.7	N/A	N/A
58.0	57.6	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	70.1	0.1
"1/100"	20.0	70.0	0.1
"1/1000"	30.0	69.8	0.1
"1/10000"	40.0	69.8	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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Sound Level Meter
AS 1259.1:1990 - AS 1259.2:1990
Calibration Certificate

Calibration Number C20410

Client Details SLR Consulting Australia Pty Ltd
5/21 Parap Road
Darwin NT 0820

Equipment Tested/ Model Number : ARL EL-316
Instrument Serial Number : 16-203-531
Microphone Serial Number : 322709
Pre-amplifier Serial Number : 26968

Atmospheric Conditions
Ambient Temperature : 24.6°C
Relative Humidity : 42.1%
Barometric Pressure : 101.1kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 30 Jul 2020
Secondary Check: Max Moore
Report Issue Date : 4 Aug 2020

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	*±0.14dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.16dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.22dB*	*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.

NATA
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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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Ph: +61 2 9484 0800
ABN: 65 160 399 119
www.acousticresearch.com.au

Service Report

Report Number:	20096
Date:	4/08/2020
Equipment:	ARL EL-316 SN: 16-203-531
Client Name:	SLR Consulting Australia Pty Ltd (Darwin)
Contact Name:	Gemma Sheridan (SLR)

Accesories:

UC-53A SN:322262, NH-17 SN:26968, post mic, windshield, pvc pipe and case.

1. Information from customer:

IIC reseting.

2. Condition of the instrument:

Faulty.

3. Corrective action required:

Replaced crystal and capacitors on DAP board.
Found microphone is faulty(fails acoustic frequency sweep).
Replaced UC-53A microphone.
Old UC-53A microphone SN: 322262.
New UC-53A microphone SN: 322709.
Logger adjusted to suit new microphone.

4. Tests conducted to ensure fault rectification

Ngara links and displays status correctly.
Test logging returned expected results.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: **SLM 25532 & FILT 5408**

Equipment Description: Sound Level Meter

Manufacturer: B & K

Model No: 2270 **Serial No:** 2679354

Microphone Type: 4189 **Serial No:** 2695417

Preamplifier Type: ZC0032 **Serial No:** 12254

Filter Type: 1/3 Octave **Serial No:** 2679354

Comments: All tests passed for class 1.
(See over for details)

Owner: SLR Consulting Australia Pty Ltd
Level 2, 2 Lincoln Street
Lane Cove, NSW 2066

Ambient Pressure: 998 hPa ±1.5 hPa

Temperature: 23 °C ±2° C **Relative Humidity:** 26% ±5%

Date of Calibration: 09/09/2019 **Issue Date:** 09/09/2019

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

CHECKED BY: ..IKB.. **AUTHORISED SIGNATURE:** ....
Jack Kielt

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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WORLD RECOGNISED ACCREDITATION

ACU-VIB
ELECTRONICS

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Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
Tel: (02) 96808133 Fax: (02)96808233
Mobile: 0413 809806
web site: www.acu-vib.com.au

Accredited Lab. No. 9262
Acoustic and Vibration
Measurements

CERTIFICATE NO.: **SLM 25532 & FILT 5408**

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	Entered
Electrical Noise	11.2	Entered
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	NA
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.
A full technical report is available if required.

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

Date of Calibration: 09/09/2019 **Issue Date:** 09/09/2019

Checked by: MKB

Accredited for compliance with ISO/IEC 17025 - Calibration
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Accredited Lab. No. 9262
Acoustic and Vibration Measurements

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web site: www.acu-vib.com.au

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: 25534

EQUIPMENT TESTED: 1/2" Microphone
Manufacturer: B & K
Type No: 4197 **Serial No:** 3077697 (Part 2)
Owner: SLR Consulting Australia Pty Ltd
Level 2, 2 Lincoln Street
Lane Cove, NSW 2066
Tests Performed: Acoustic Microphone Frequency Response with Inverse A Weighting

CONDITION OF TEST:

Ambient Pressure: 997 hPa ±1.5 hPa **Relative Humidity:** 24 % ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 09/09/2019 **Issue Date** 09/09/2019
Acu-Vib Test Procedure: AVP05 (Microphone Acoustic Frequency Response)

CHECKED BY: VKB **AUTHORISED SIGNATURE:** ....
Jack Kielt

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.
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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Web site: www.acu-vib.com.au

Acoustic Tests, Microphone response

Job No: 13678 Test No: 255334

Microphone type: B&K 4197 Serial No,: 3077697 (Part 2)

Preamplifier type: 2683 Serial No. : 2792513

SLM body (if appropriate): SVAN 912 AE Serial No: 4396

Ambient Temperature: 23C ±2° C, Relative Humidity: 997 RH ±5% RH,

Ambient Pressure: 24 hPa ±1.5 hPa

Frequency Hz	Deviation re 1 kHz	Type 2 Tol.	Type 1 Tol.	U95 dB	P/F
31.5 Hz	0.11dB	± 3.0 dB	± 1.5 dB dB	0.12	P
63 Hz	-0.01dB	± 2.0 dB	± 1.5 dB dB	0.10	P
125 Hz	-0.08dB	± 1.5 dB	± 1.0 dB dB	0.09	P
250 Hz	-0.15dB	± 1.5 dB	± 1.0 dB dB	0.09	P
500 Hz	-0.14dB	± 1.5 dB	± 1.0 dB dB	0.09	P
1 kHz Ref	0.00dB	± 1.5 dB	± 1.0 dB dB	0.09	P
2 kHz	0.05dB	± 2.0 dB	± 1.0 dB dB	0.07	P
4 kHz	-0.25dB	± 3.0 dB	± 1.0 dB dB	0.13	P
8 kHz	-0.21dB	± 5.0 dB	+1.5;-3.0 dB	0.13	P
12.5 kHz	-0.10dB	+ 5.0; - ∞ dB	+3.0;-6.0 dB	0.19	P
16 kHz	0.61dB	+ 5.0; - ∞ dB	+ 3.0; - ∞ dB	0.30	P

Tolerances from AS1259-1990 part 1, (IEC 60651).

Notes:

Signed (Testing Officer) __________ Date:09/09/2019

Checked by: VKB Date:09/09/2019

Acoustic test WS 1 results

Certificate Of Calibration

Certificate No: 25533

Equipment Tested: 1/2" Microphone
Manufacturer: B & K
Type No: 4197 **Serial No:** 3077697 (Part 1)
Owner: SLR Consulting Australia Pty Ltd
Level 2, 2 Lincoln Street
Lane Cove, NSW 2066
Tests Performed: Acoustic Microphone Frequency Response with Inverse A Weighting

Condition Of Test:

Ambient Pressure: 997 hPa ±1.5 hPa **Relative Humidity:** 24 % ±5%
Temperature: 23 °C ±2° C
Date of Calibration: 09/09/2019 **Issue Date** 09/09/2019
Acu-Vib Test Procedure: AVP05 (Microphone Acoustic Frequency Response)

Checked by: JKB **Authorised Signature:** ....
Jack Kielt

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.
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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Mobile: 0413 809806
Web site: www.acu-vib.com.au

Acoustic Tests, Microphone response

Job No: 13678 Test No: 25533

Microphone type: B&K 4197 Serial No,: 3077697 (Part 1)

Preamplifier type: 2683 Serial No. : 2792513

SLM body (if appropriate): SVAN 912 AE Serial No: 4396

Ambient Temperature: 23C ±2° C, Relative Humidity: 997 RH ±5% RH,

Ambient Pressure: 24 hPa ±1.5 hPa

Frequency Hz	Deviation re 1 kHz	Type 2 Tol.	Type 1 Tol.	U95 dB	P/F
31.5 Hz	0.11dB	± 3.0 dB	± 1.5 dB dB	0.12	P
63 Hz	-0.11dB	± 2.0 dB	± 1.5 dB dB	0.10	P
125 Hz	-0.18dB	± 1.5 dB	± 1.0 dB dB	0.09	P
250 Hz	-0.25dB	± 1.5 dB	± 1.0 dB dB	0.09	P
500 Hz	-0.24dB	± 1.5 dB	± 1.0 dB dB	0.09	P
1 kHz Ref	0.00dB	± 1.5 dB	± 1.0 dB dB	0.09	P
2 kHz	0.05dB	± 2.0 dB	± 1.0 dB dB	0.07	P
4 kHz	-0.25dB	± 3.0 dB	± 1.0 dB dB	0.13	P
8 kHz	-0.31dB	± 5.0 dB	+1.5;-3.0 dB	0.13	P
12.5 kHz	-0.20dB	+ 5.0; - ∞ dB	+3.0;-6.0 dB	0.19	P
16 kHz	0.51dB	+ 5.0; - ∞ dB	+ 3.0; - ∞ dB	0.30	P

Tolerances from AS1259-1990 part 1, (IEC 60651).

Notes:

Signed (Testing Officer) ________________ Date:09/09/2019

Checked by: JKB ________________ Date:09/09/2019

Acoustic test WS 1 results

CERTIFICATE OF CALIBRATION

CERTIFICATE NO.: SLM 27099 & FILT 5849

Equipment Description:	Sound & Vibration Analyser		
Manufacturer:	Svantek		
Model No:	Svan-957	**Serial No:**	27523
Microphone Type:	7052E	**Serial No:**	50326
Preamplifier Type:	SV12L	**Serial No:**	25996
Filter Type:	1/3 Octave	**Serial No:**	27523
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:	1010 hPa ±1.5 hPa		
Temperature:	23 °C ±2° C	**Relative Humidity:**	43% ±5%
Date of Calibration:	16/06/2020	**Issue Date:**	16/06/2020
Acu-Vib Test Procedure:	AVP10 (SLM) & AVP06 (Filters)		

CHECKED BY: ...JK... **AUTHORISED SIGNATURE:** ....
Jack Kielt

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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web site: www.acu-vib.com.au

CERTIFICATE NO.: SLM 27099 & FILT 5849

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: 16/06/2020 **Issue Date:** 16/06/2020

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.

NVMS SOLUTIONS

Certificate of Calibration – Sound Level Meter

Report Reference:	SLM/19/08/011	**Date of calibration:**	16/08/2019

Client: SLR Consulting Australia Pty. Ltd.
Address: 503 Murray Street, Perth WA 6000

Sound Level Meter:	Svantek SVAN 957	**Microphone**:	ACO 7052E
Meter Serial No:	20666	**Microphone Serial No**:	54741
Meter Class:	1	**Preamplifier:**	Svantek SV 12L
Hardware Version:	6.16.3	**Preamplifier Serial No:**	10690
Software Version:	6.16.3	**Filters**:	Integral Octave & 1/3 Octave Band
Channel/s tested:	N/A		

Procedures from IEC 61672-3:2006 were used to perform periodic tests.

Clause 9	Indication at the calibration check frequency	**Complied**
Clause 10	Self-generated noise	**Checked**
Clause 11	Acoustical tests of frequency weighting	**Complied**
Clause 12	Electrical tests of frequency weightings	**Complied**
Clause 13	Frequency and time weighting at 1kHz	**Complied**
Clause 14	Level linearity on the reference level range	**Complied**
Clause 15	Level linearity including level range control	**N/A**
Clause 16	Toneburst response	**Complied**
Clause 17	Peak C sound level	**Complied**
Clause 18	Overload indication	**Complied**

Where the instrument includes an Octave Band or 1/3 Octave Band Filter Set, performance characteristics were checked against the requirements of the following clauses of AS/NZS4476:1997:

Clause 4.4, 5.3	Relative Attenuation	**Complied**

Primary test equipment:

Bruel & Kjaer type 4226 multifunction calibrator S/N 1899898
Agilent Technologies HP33120A Waveform generator S/N US36006913
Agilent Technologies HP8903E Distortion Analyser S/N 2818A00472

Environmental conditions – start of tes 22.3 deg C, 101.9 kPa, 43.1 %RH
Environmental conditions – end of test: 22.5 deg C, 101.7 kPa, 45.6 %RH

The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 [AS IEC 61672.1-2004], the sound level meter submitted for testing conforms to the Class 1 requirements of IEC 61672-1:2002 [AS IEC 61672.1-2004].

The calibration procedures followed are in accordance with the terms of the NATA accreditation of this laboratory.

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Calibration.
Measurement results are traceable to SI and IEC 61672.3. Reference equipment has been calibrated by the National Measurement Institute or NATA accredited laboratories.
Accreditation No. 12604

Authorised Signatory

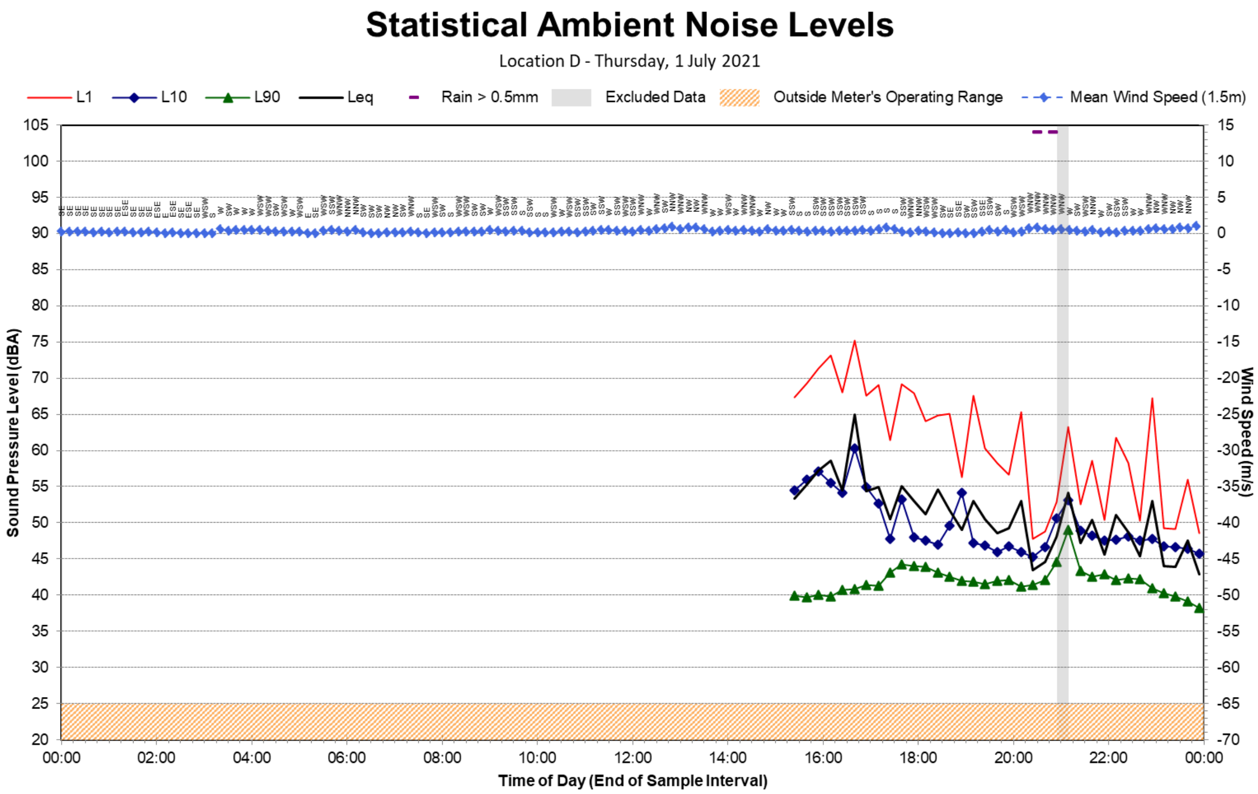
16/8/19
Date of Issue

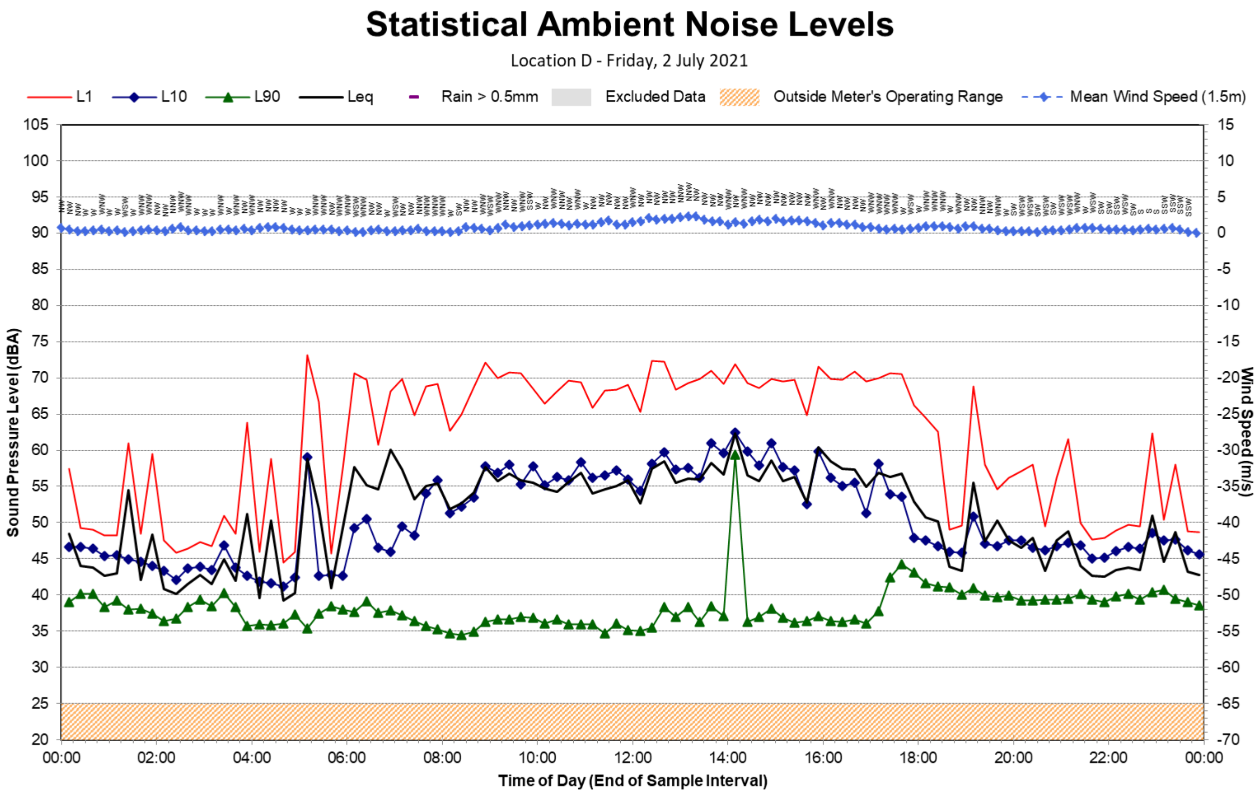
Noise & Vibration Measurement Systems Pty Ltd
433 Vincent Street West, West Leederville, WA 6007, Australia
PO Box 514, Wembley, WA 6913

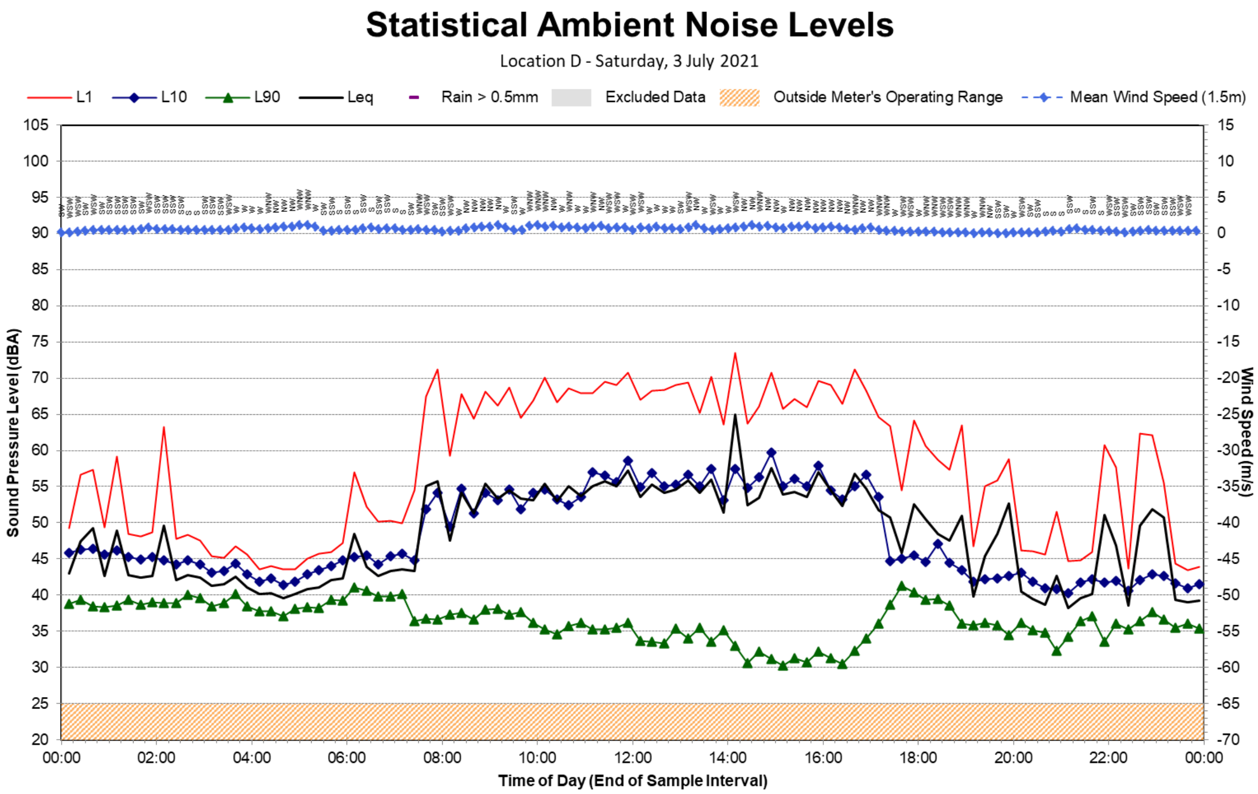
Phone: (08) 9380 6933
Fax: (08) 9388 2631
e-mail: sales@nvms.com.au

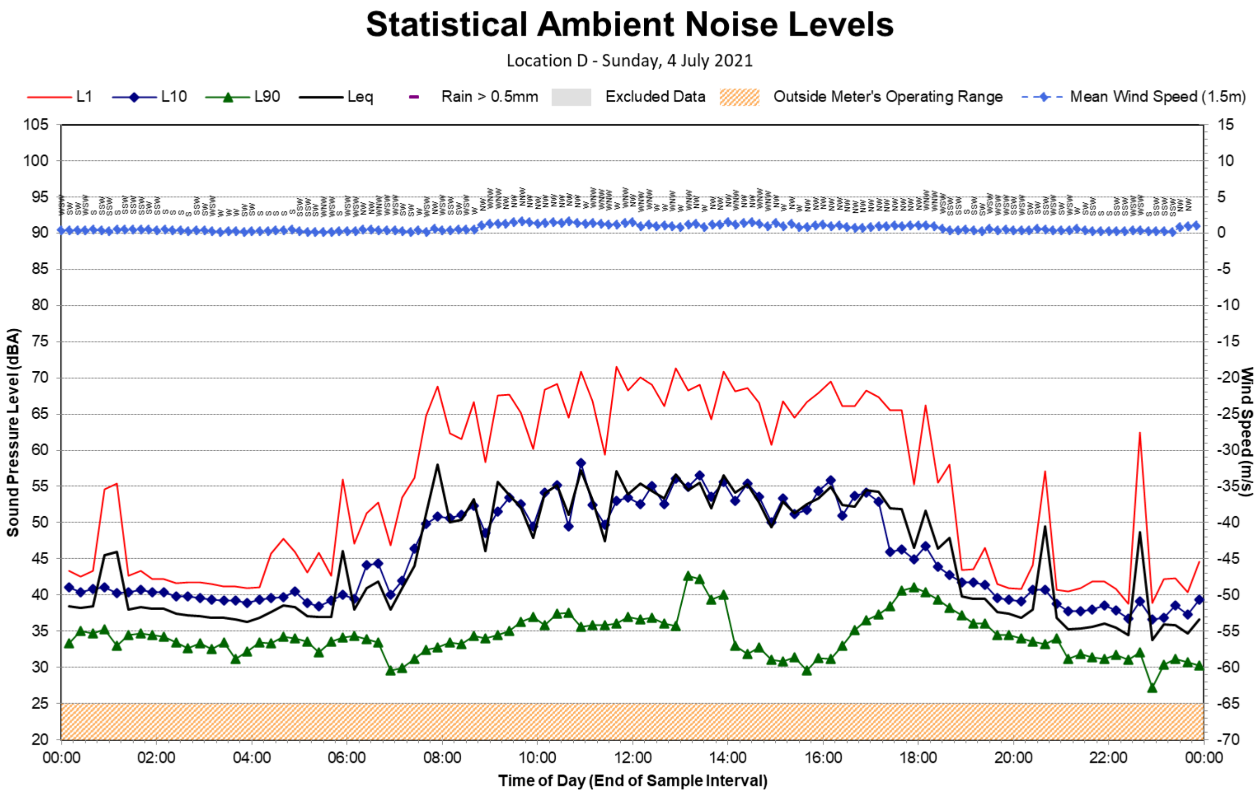
APPENDIX D

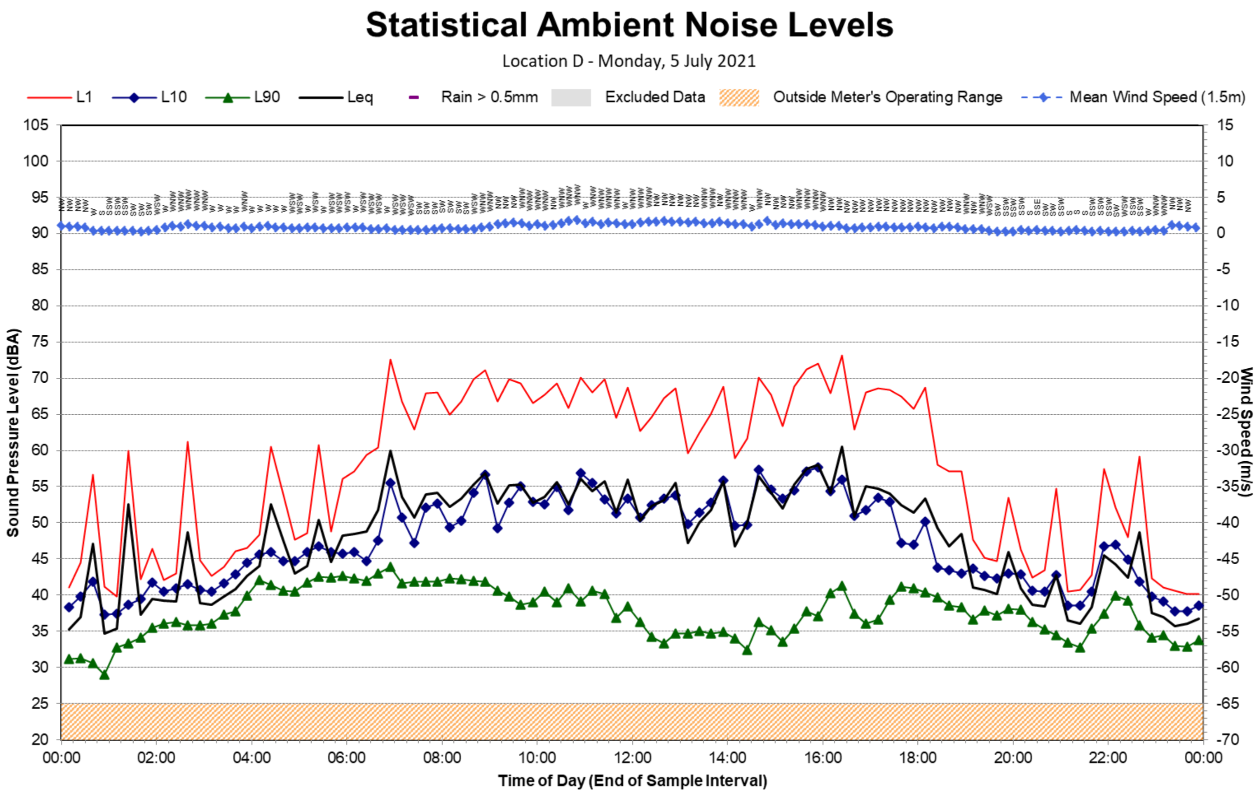
Statistical Ambient Noise Levels

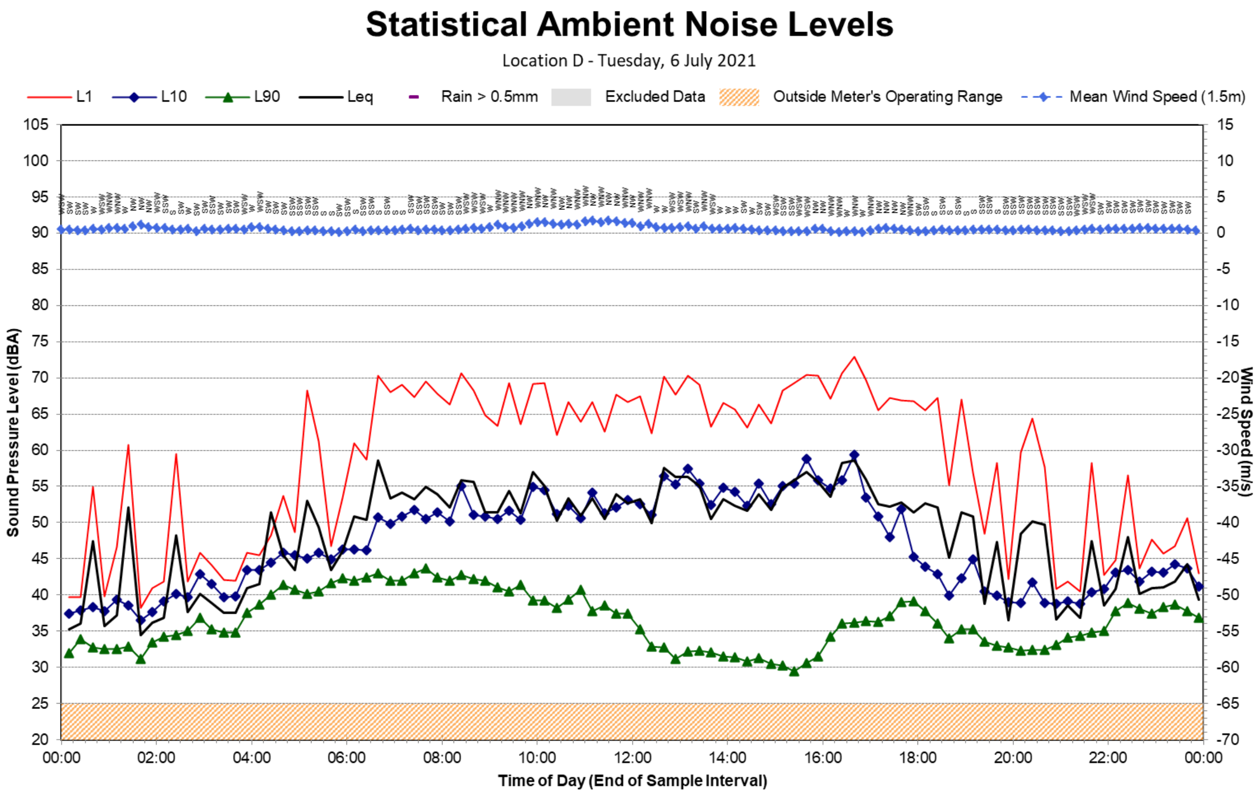

Statistical Ambient Noise Levels
Location D - Thursday, 1 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

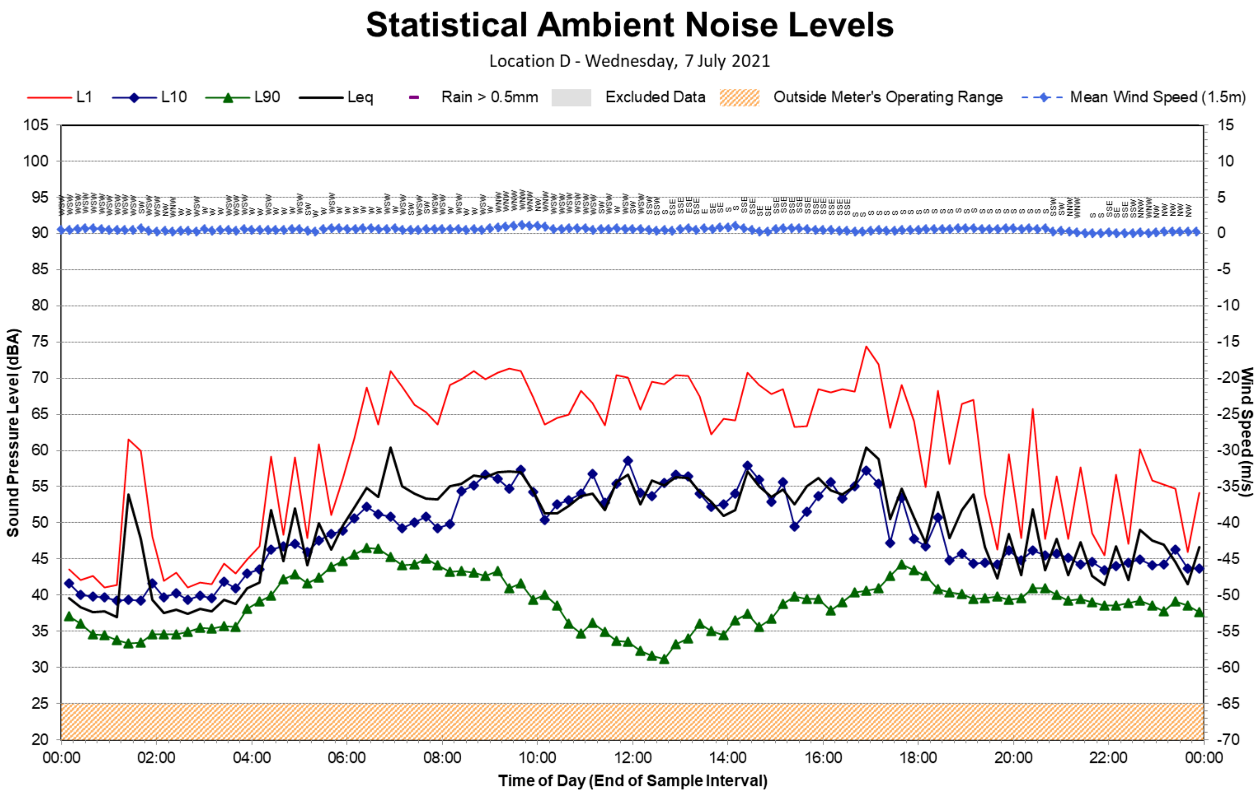

Statistical Ambient Noise Levels
Location D - Friday, 2 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

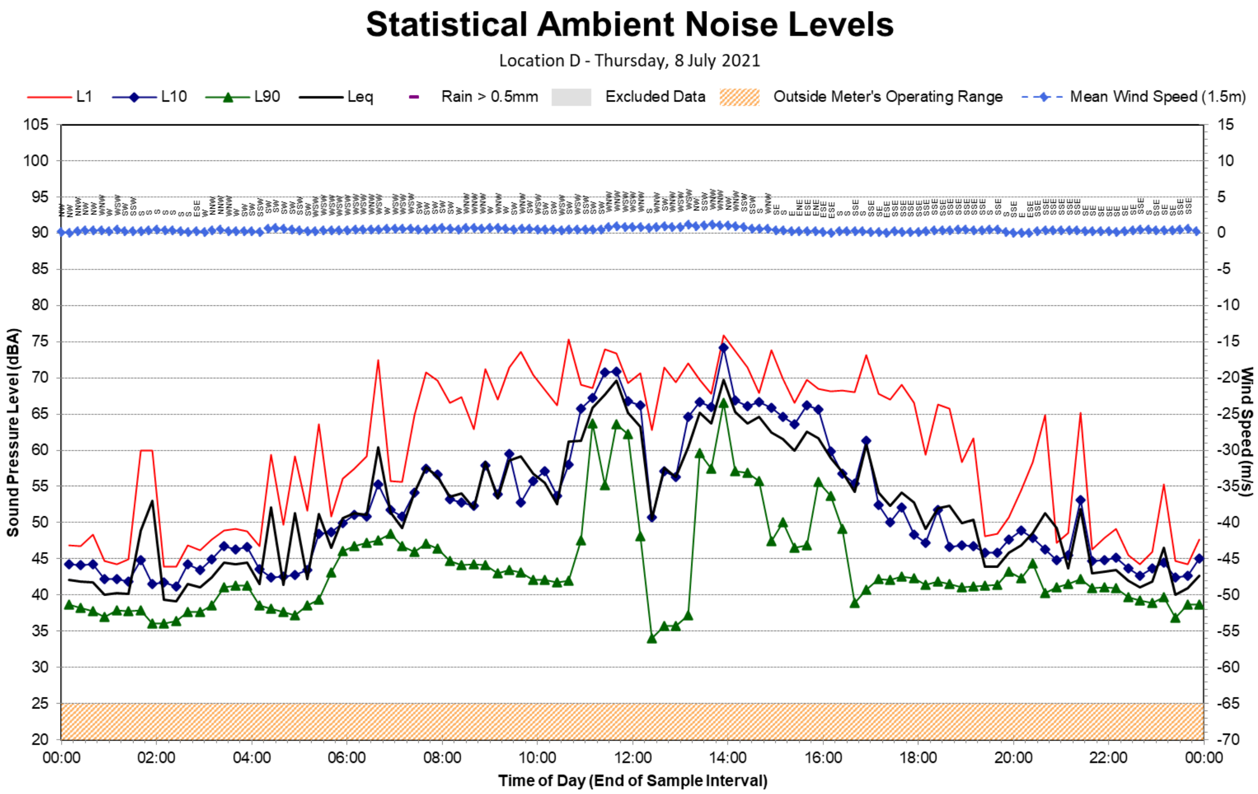

Statistical Ambient Noise Levels
Location D - Saturday, 3 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

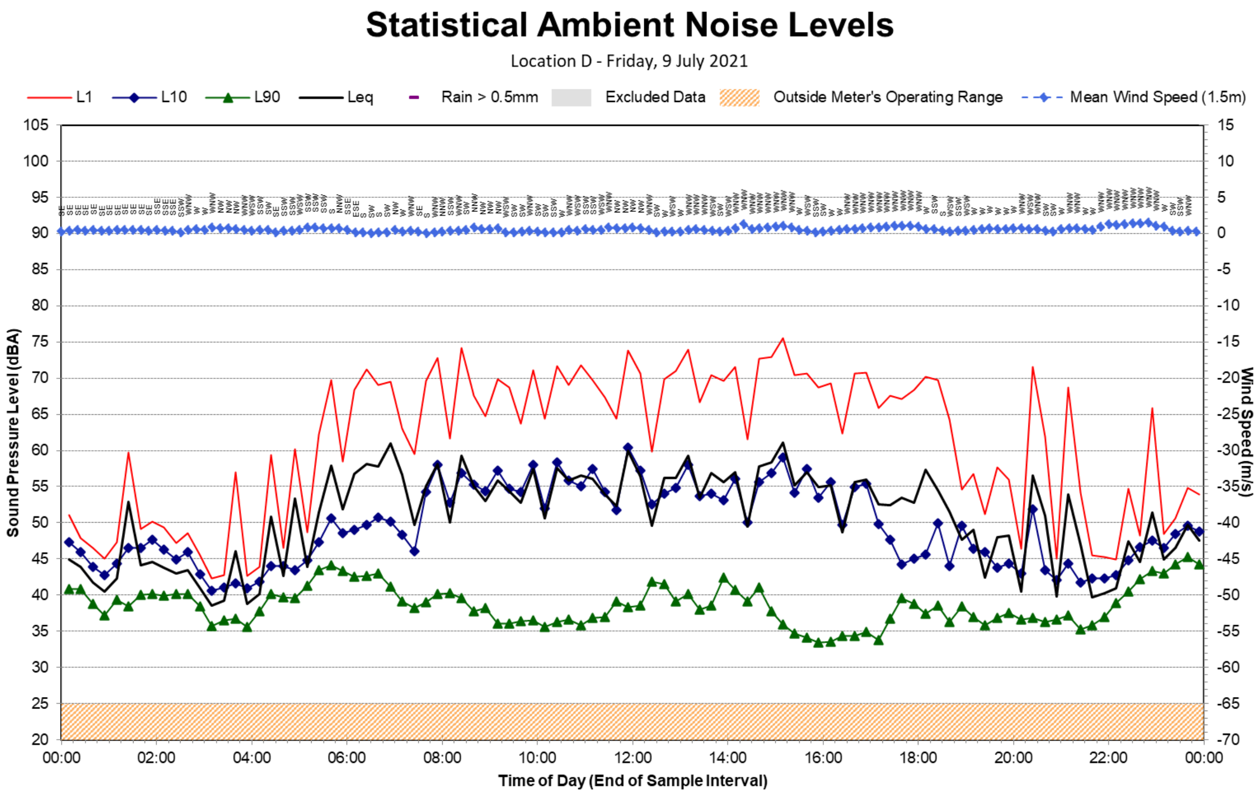

Statistical Ambient Noise Levels
Location D - Sunday, 4 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Monday, 5 July 2021
L1
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)

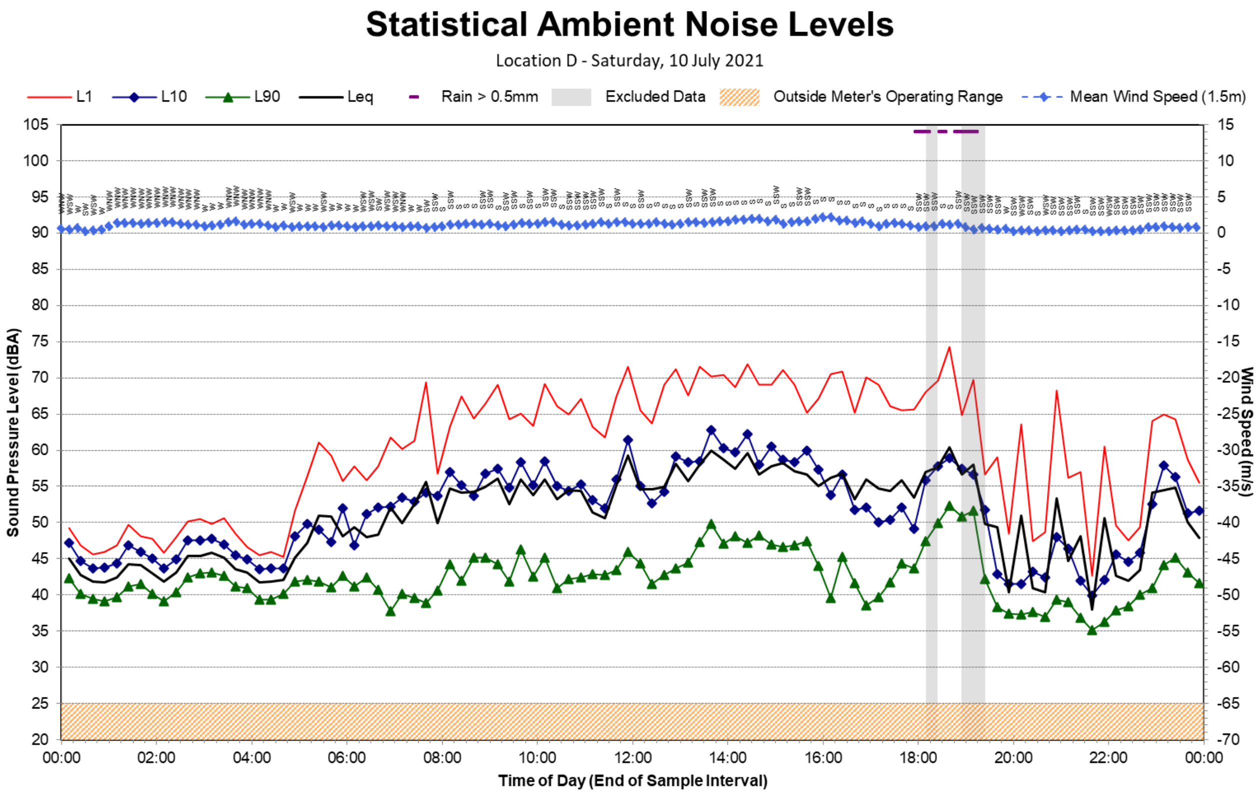

Statistical Ambient Noise Levels
Location D - Tuesday, 6 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Wednesday, 7 July 2021
L1
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)

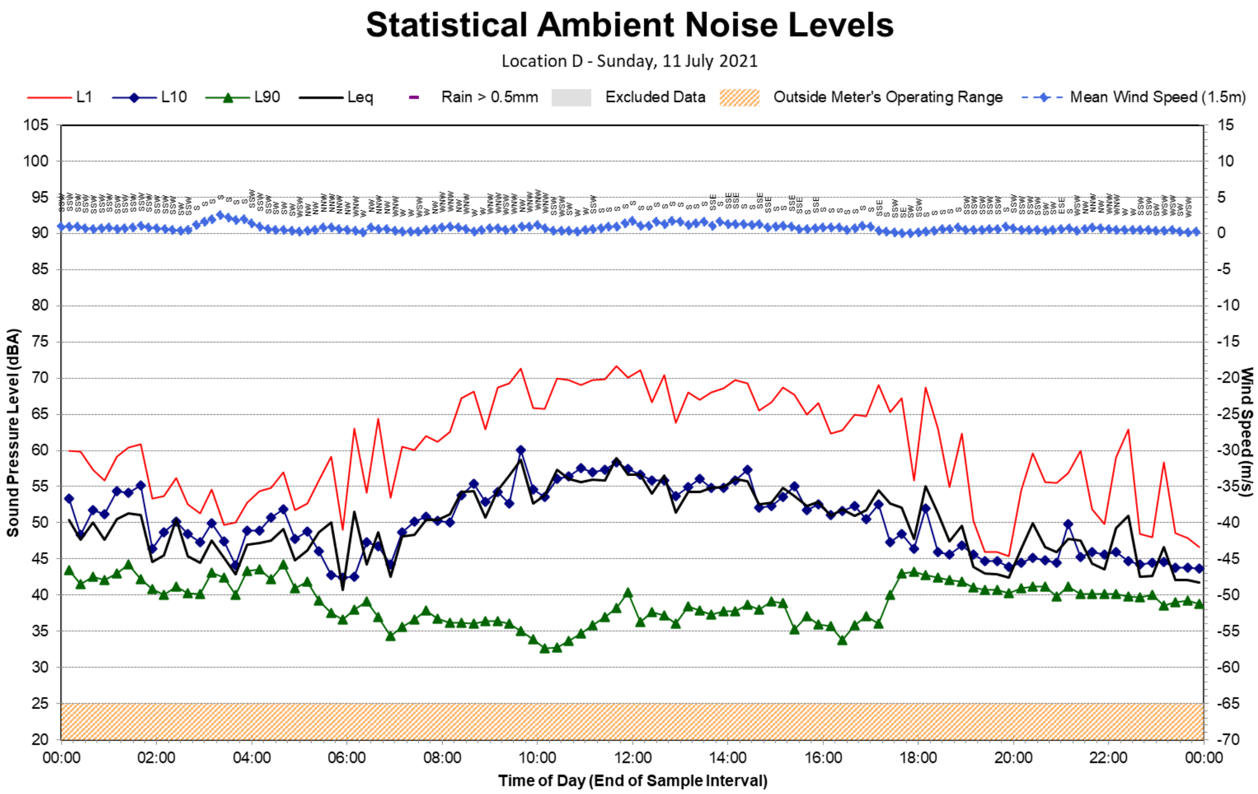

Statistical Ambient Noise Levels
Location D - Thursday, 8 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

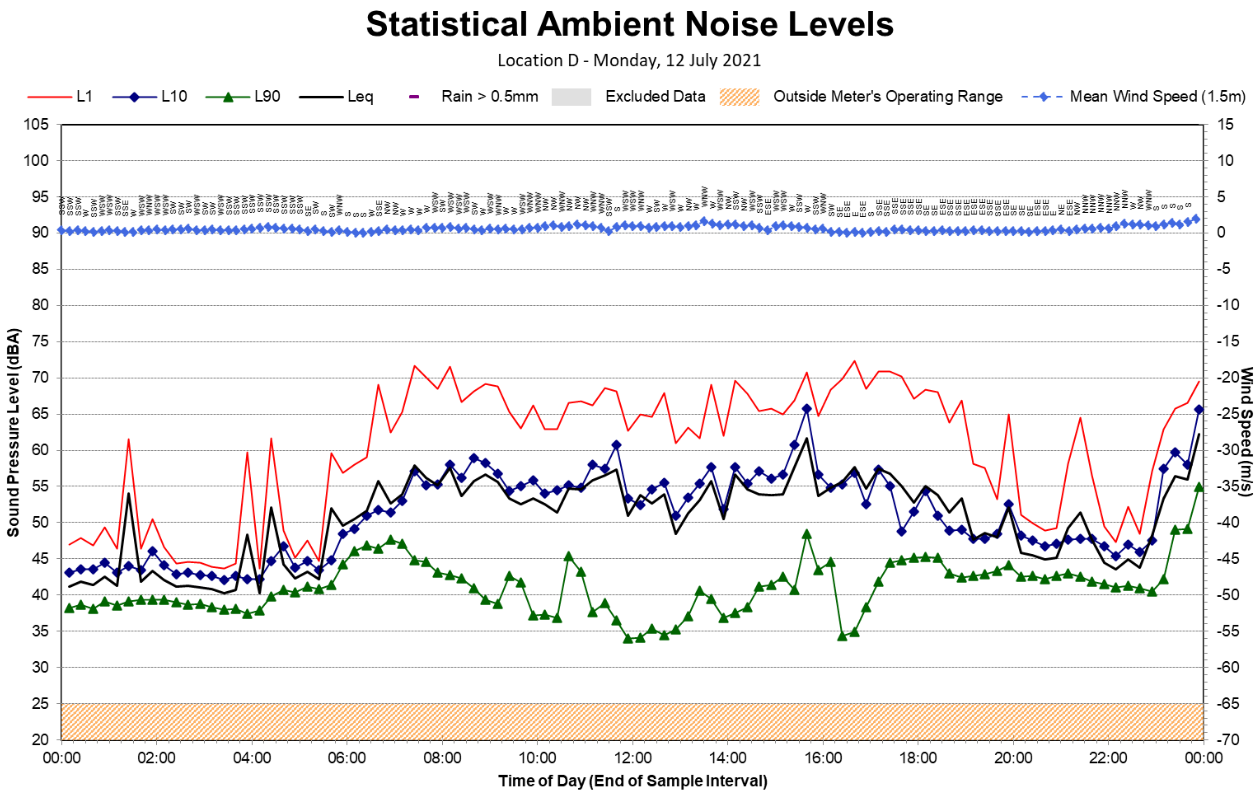


Statistical Ambient Noise Levels
Location D - Friday, 9 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



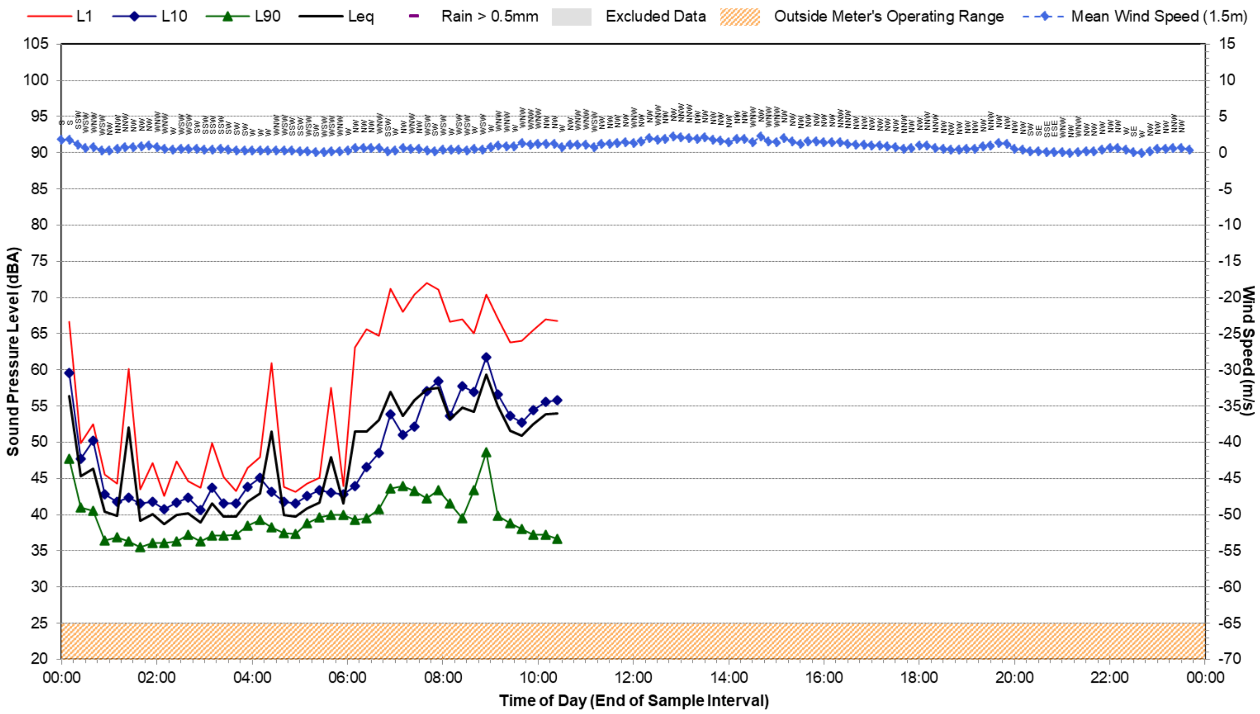
Statistical Ambient Noise Levels
Location D - Saturday, 10 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location D - Sunday, 11 July 2021
L1
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, 12 July 2021
L1
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)

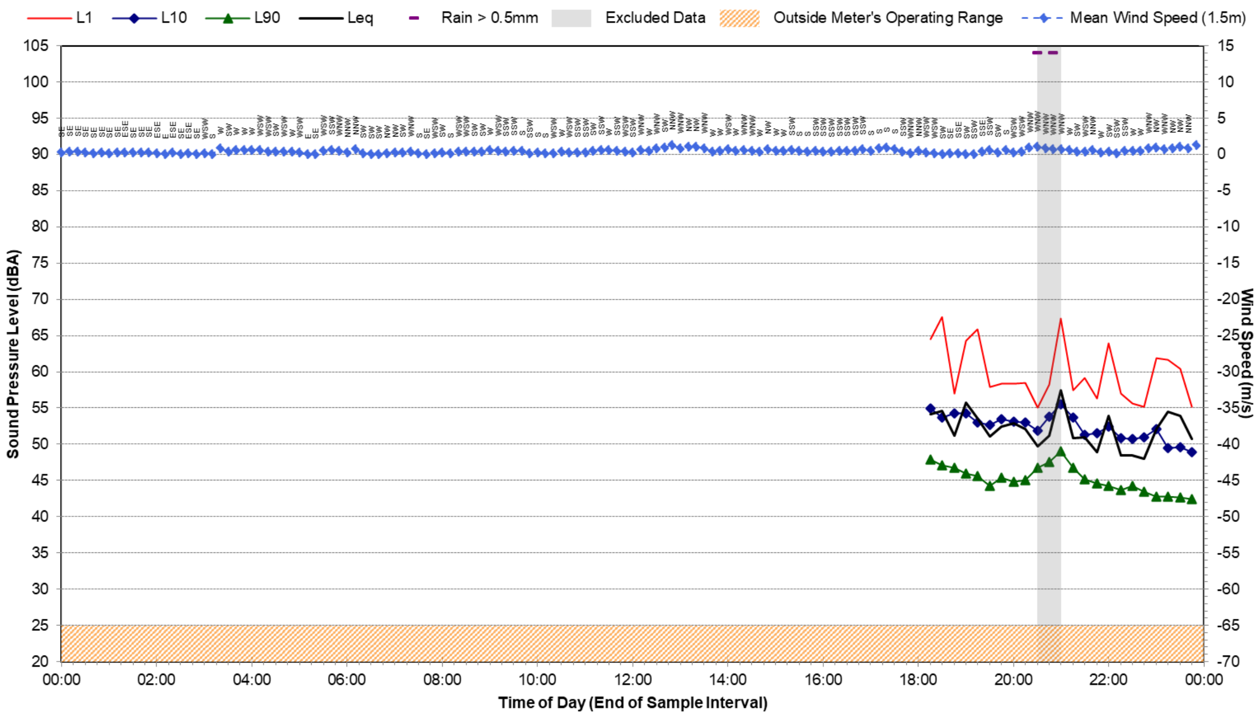
Statistical Ambient Noise Levels

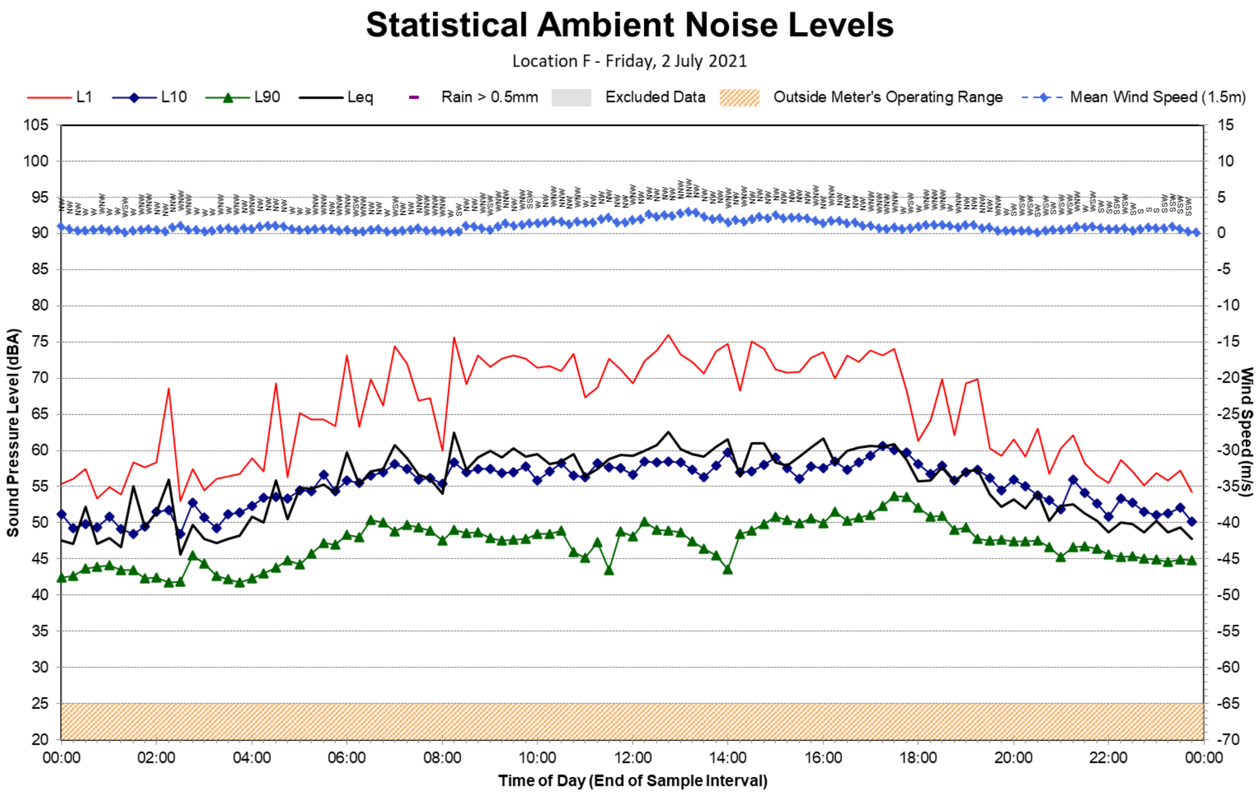
Location D - Tuesday, 13 July 2021

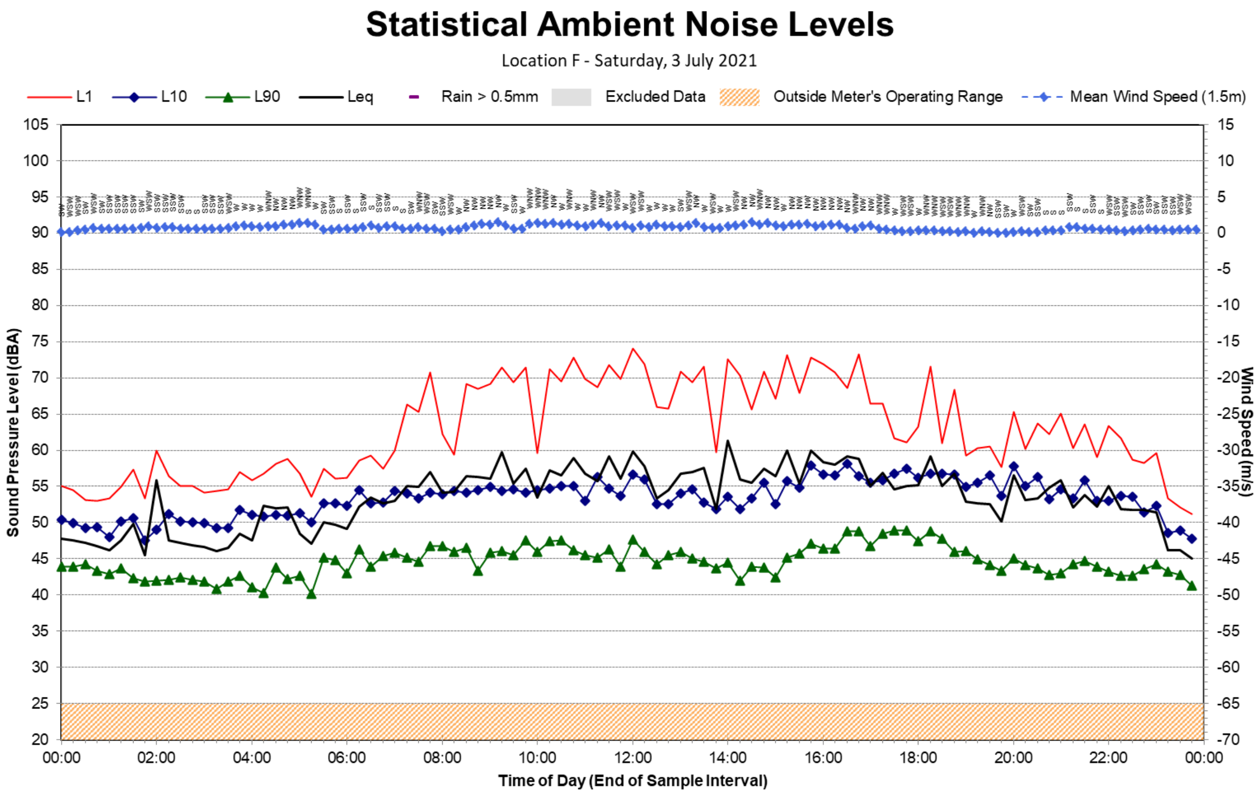


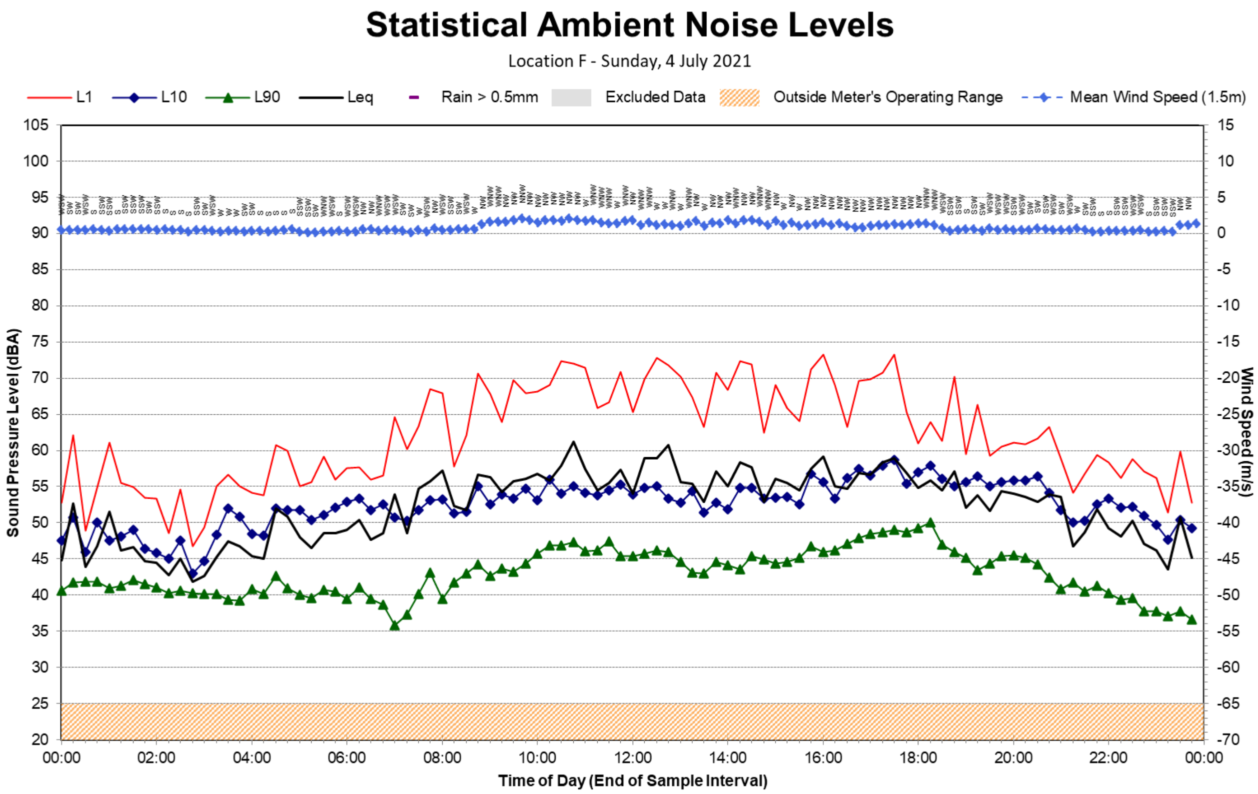
Statistical Ambient Noise Levels

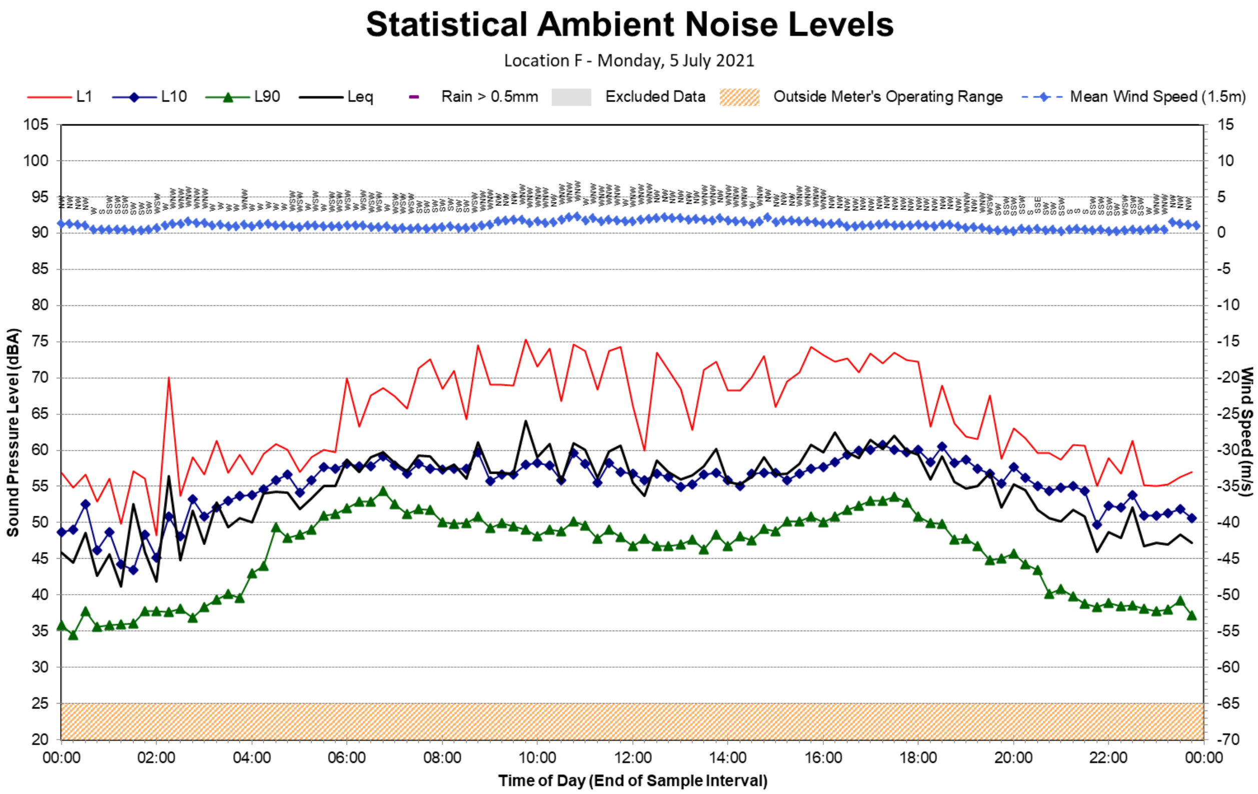
Location F - Thursday, 1 July 2021




Statistical Ambient Noise Levels
Location F - Friday, 2 July 2021
L1
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)

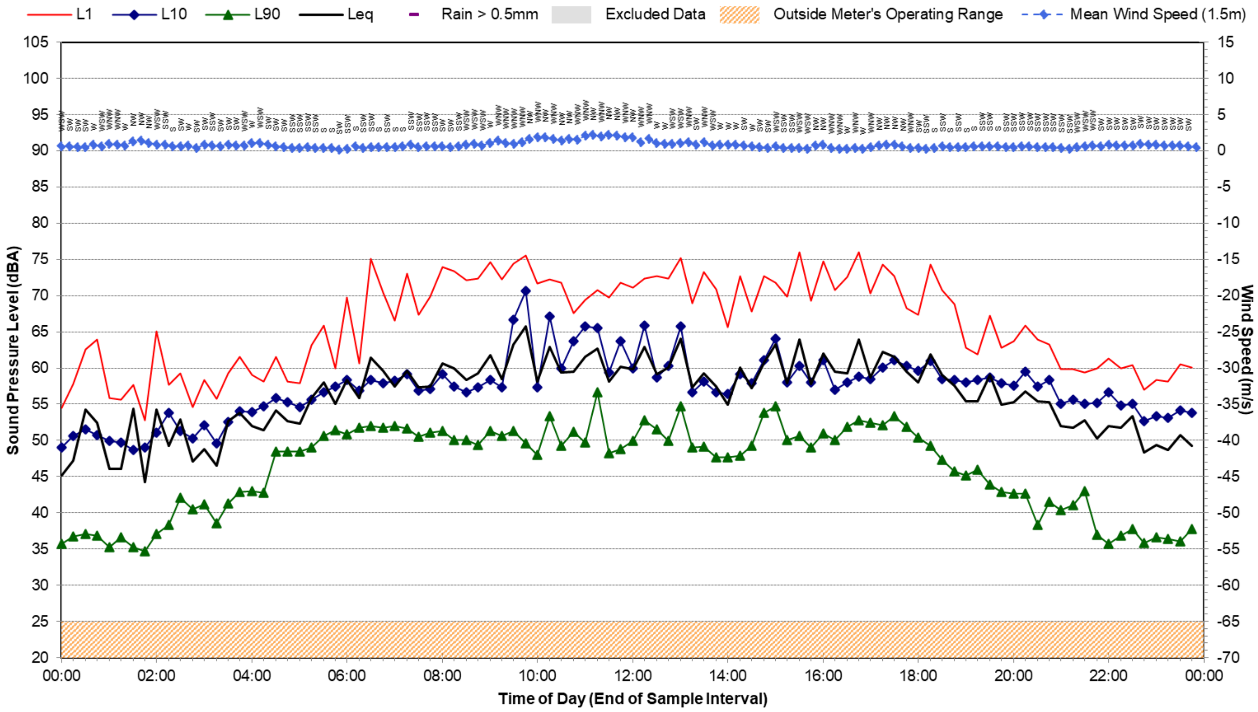

Statistical Ambient Noise Levels
Location F - Saturday, 3 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Sunday, 4 July 2021
L1
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, 5 July 2021
L1
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)

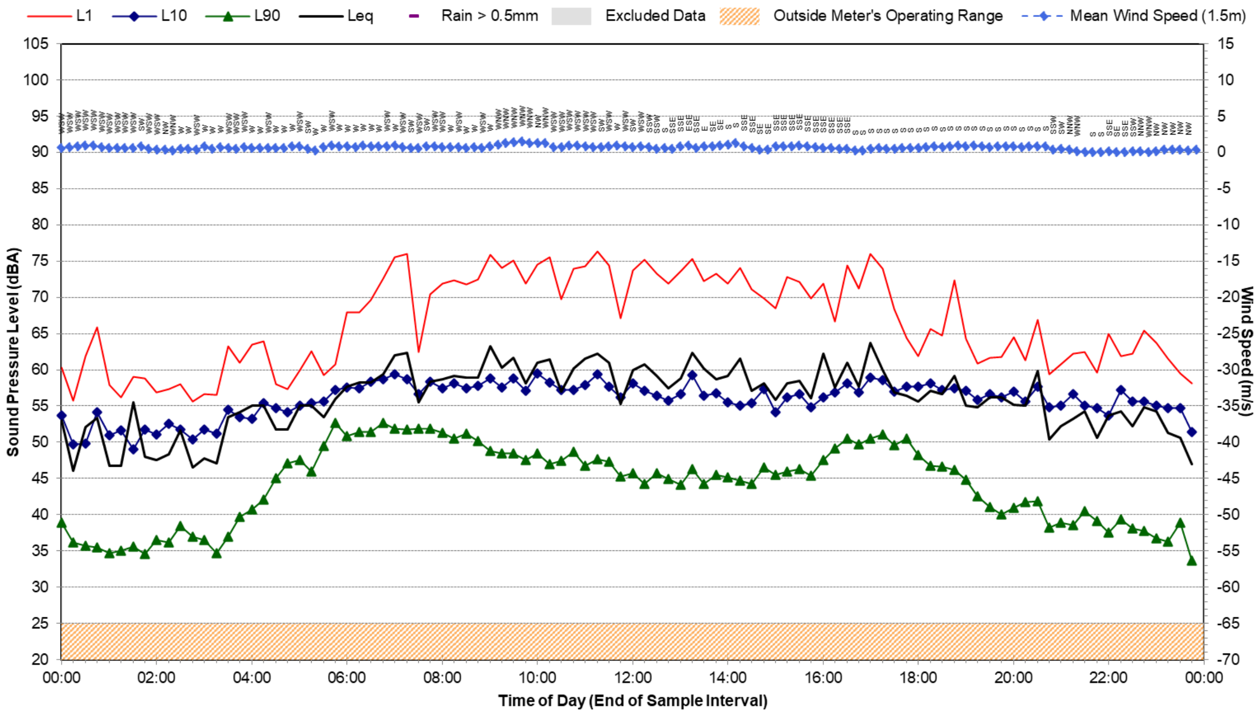
Statistical Ambient Noise Levels

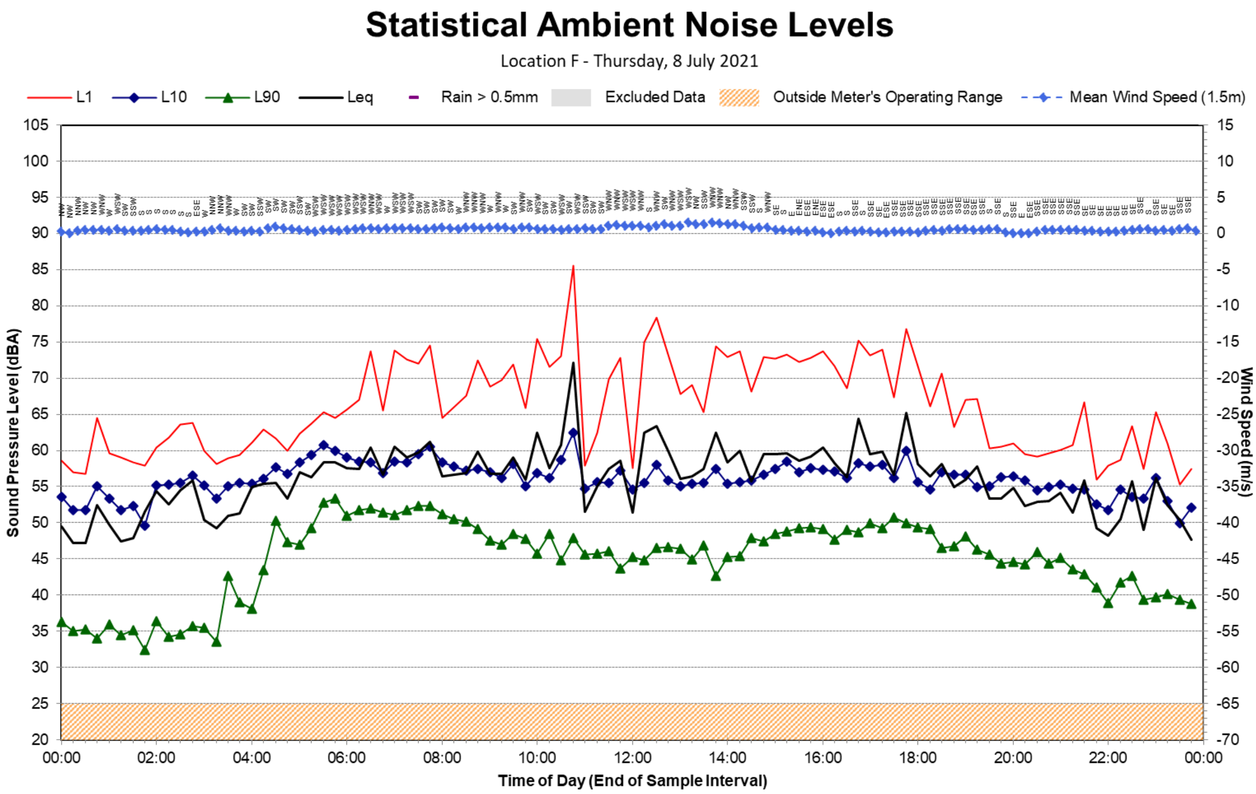
Location F - Tuesday, 6 July 2021

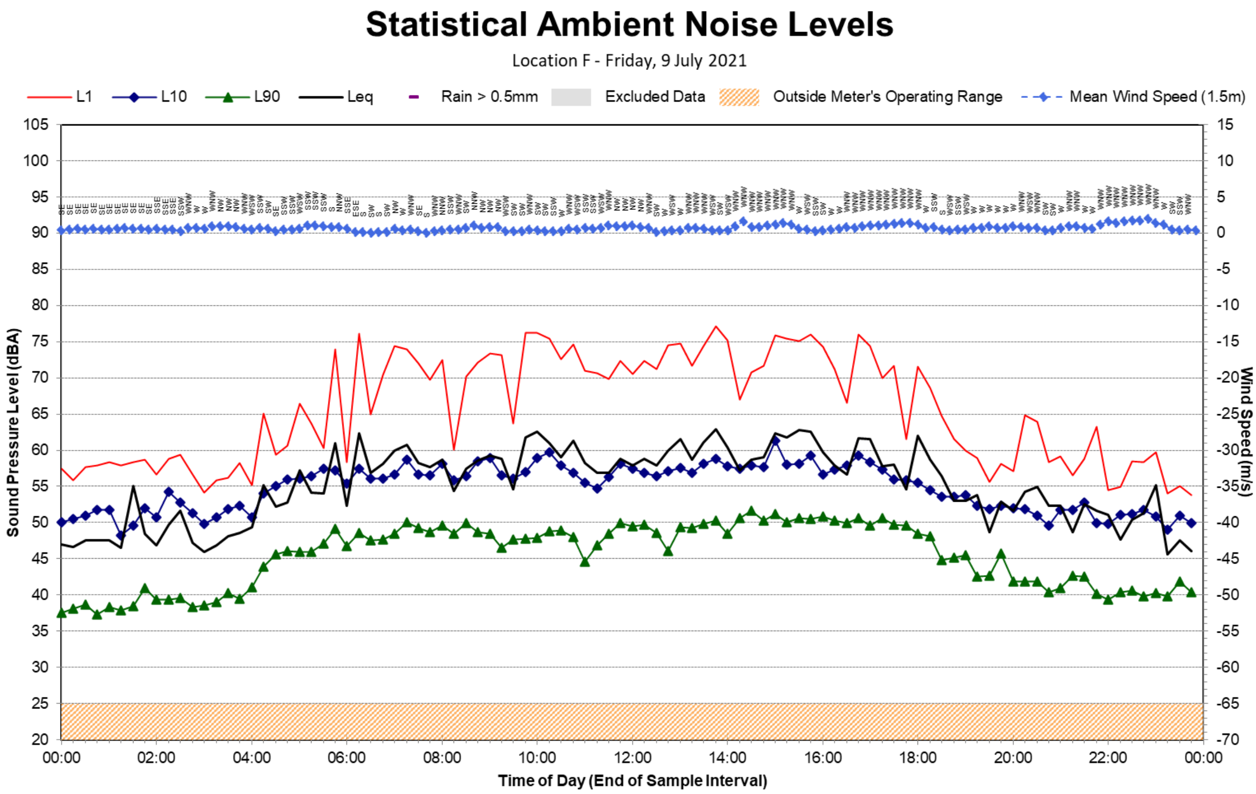


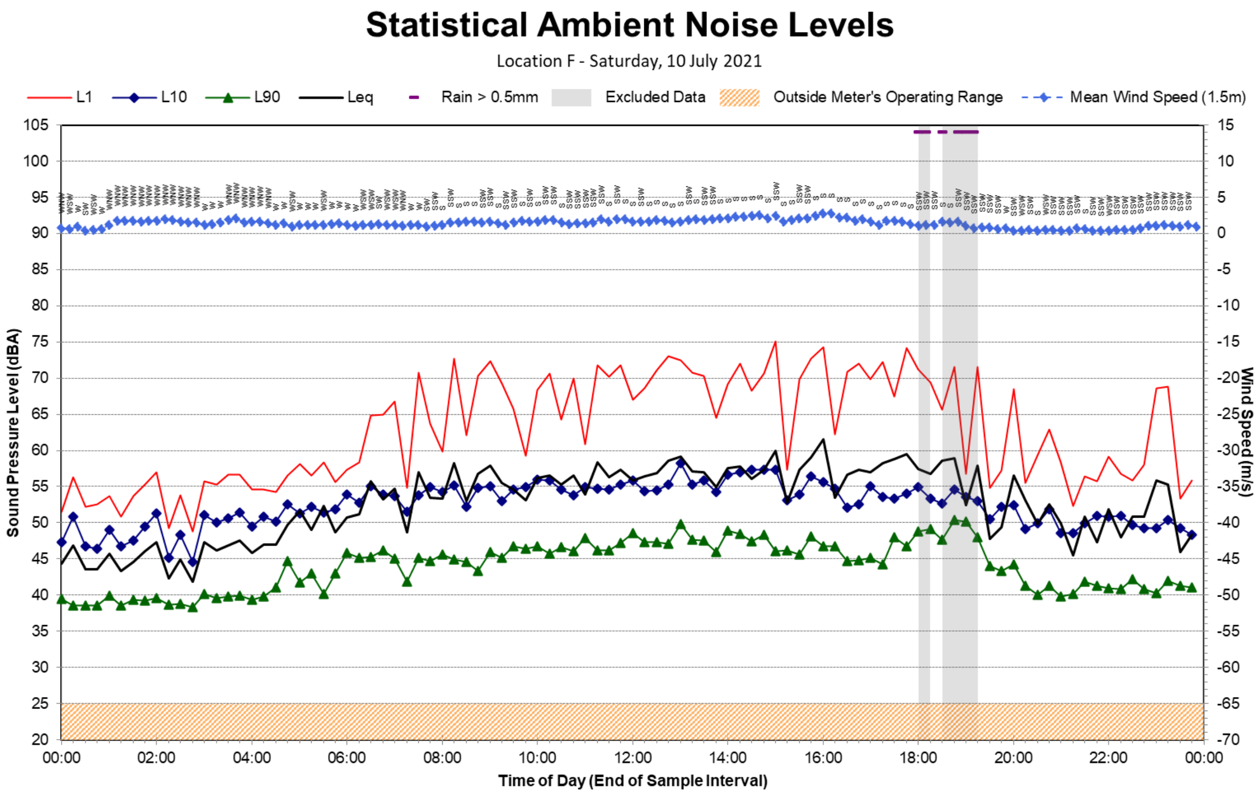
Statistical Ambient Noise Levels

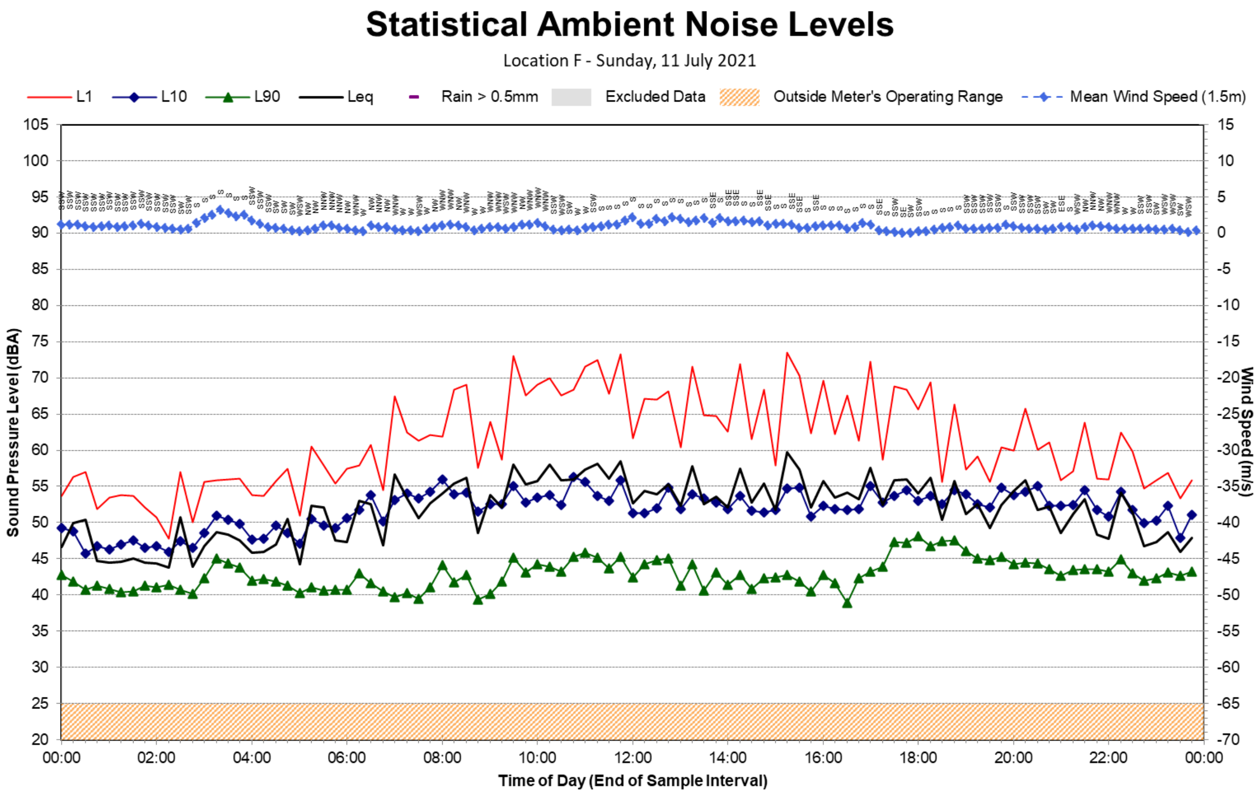
Location F - Wednesday, 7 July 2021

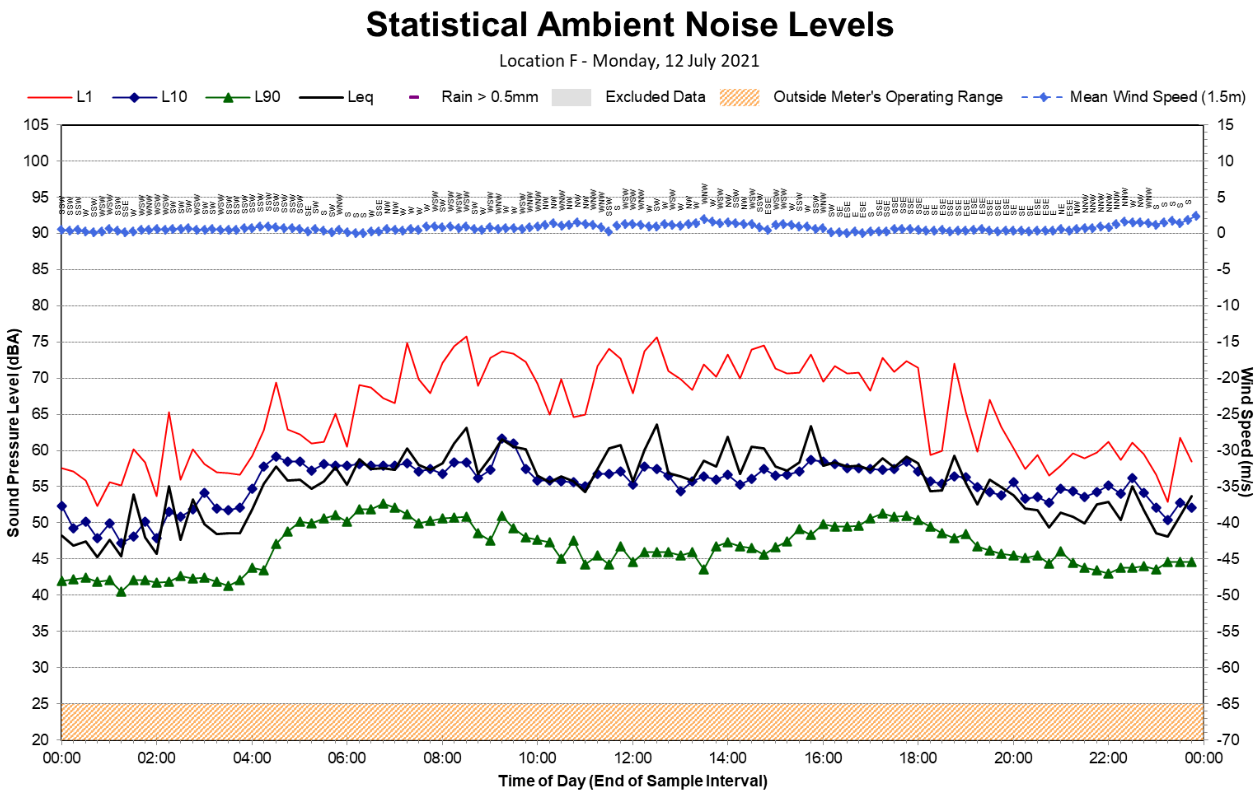


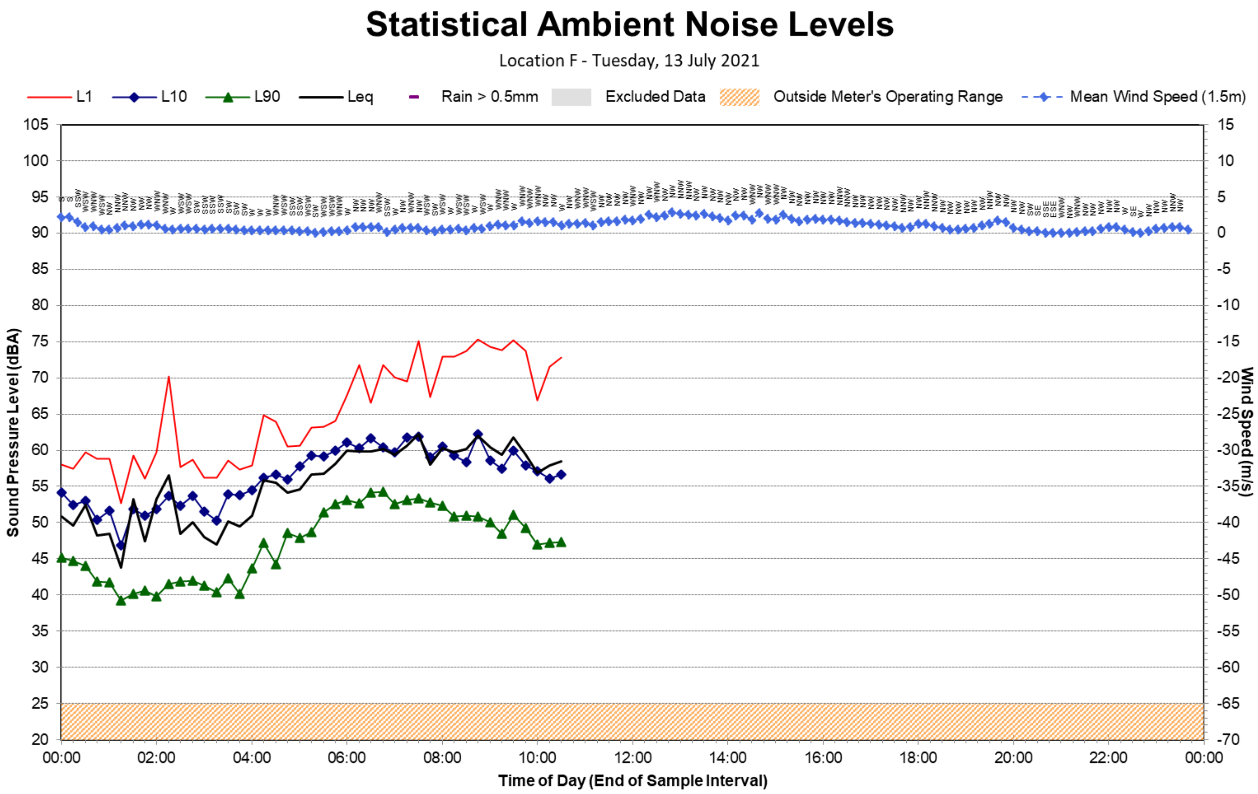

Statistical Ambient Noise Levels
Location F - Thursday, 8 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Friday, 9 July 2021
L1
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 - Saturday, 10 July 2021
L1
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

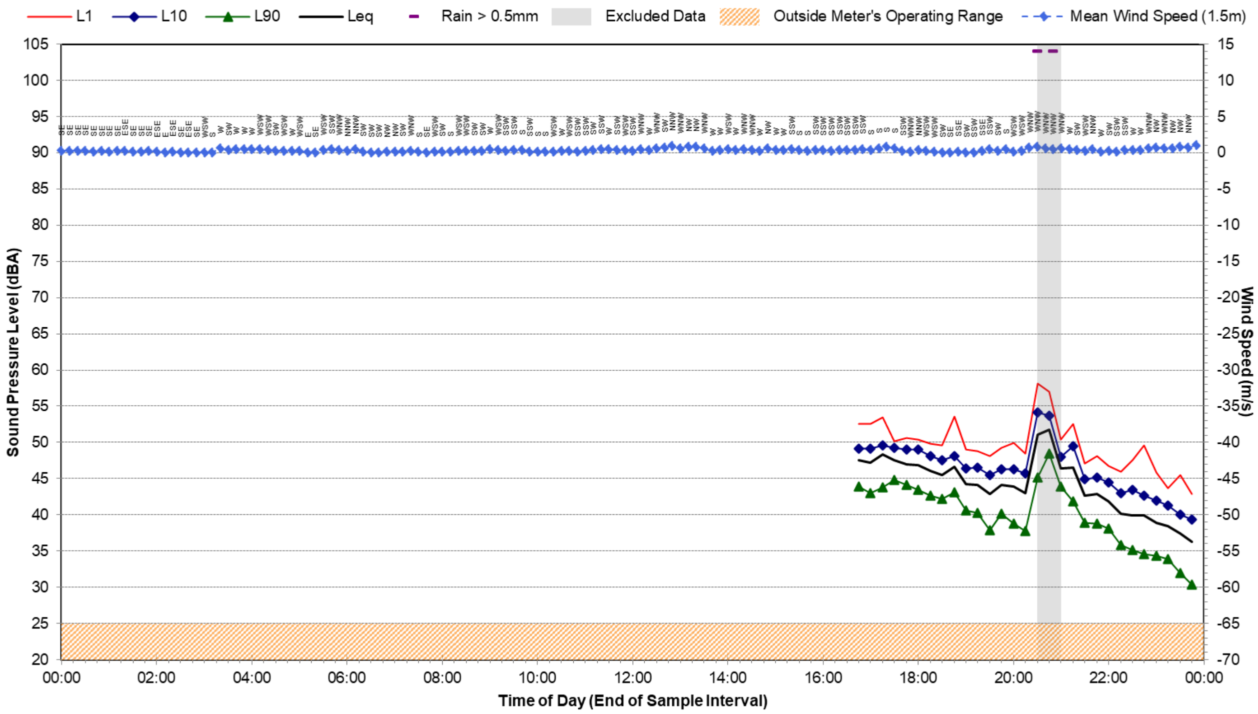

Statistical Ambient Noise Levels
Location F - Sunday, 11 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


Statistical Ambient Noise Levels
Location F - Monday, 12 July 2021
L1
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, 13 July 2021
L1
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)

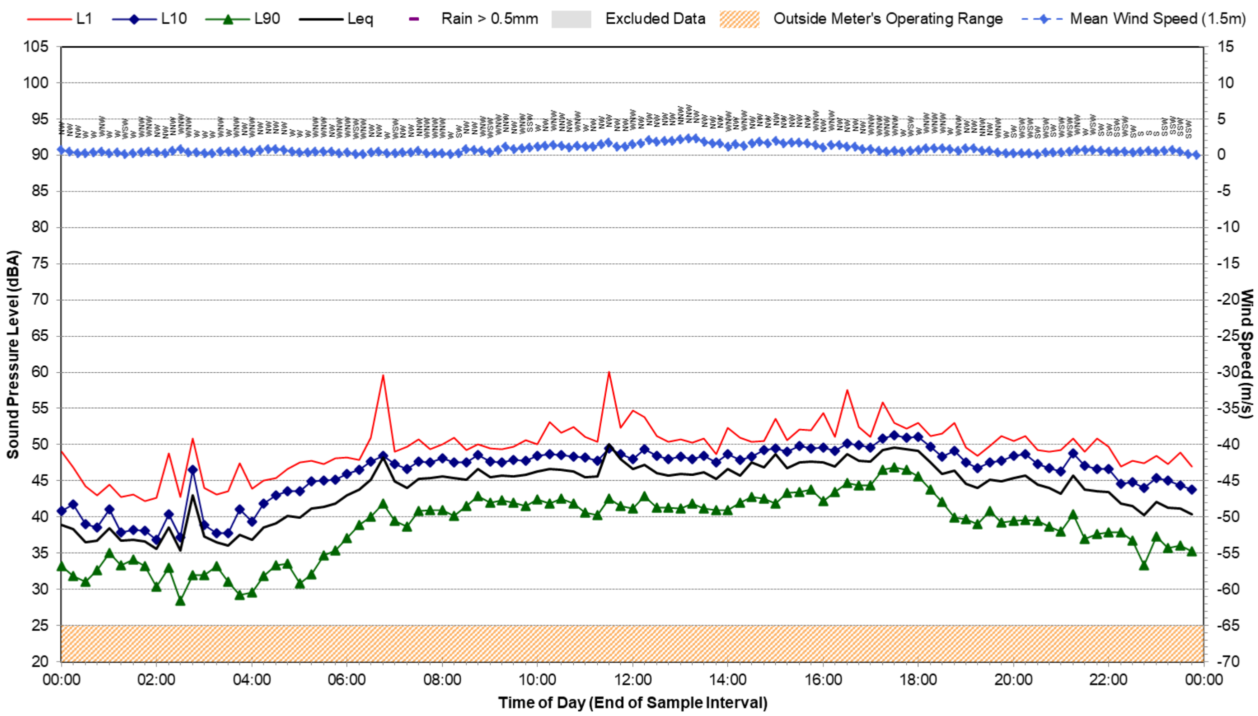
Statistical Ambient Noise Levels

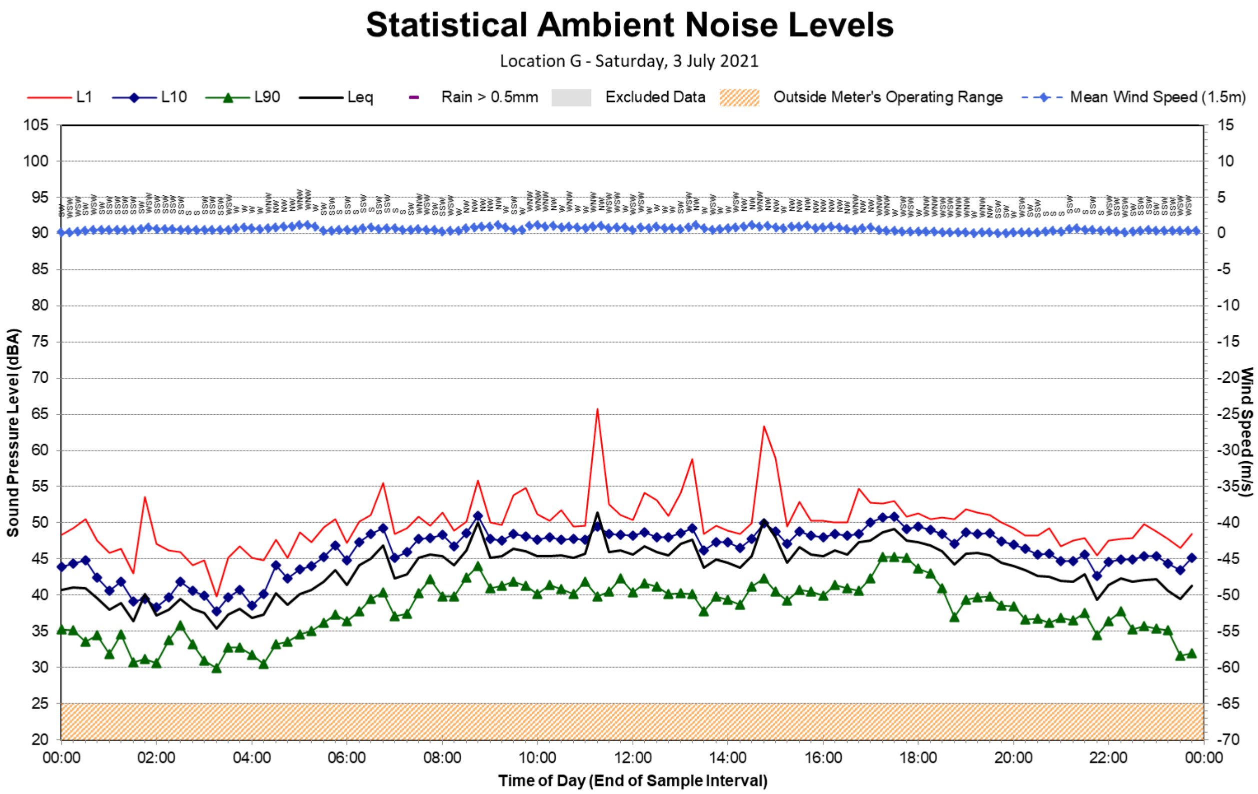
Location G - Thursday, 1 July 2021

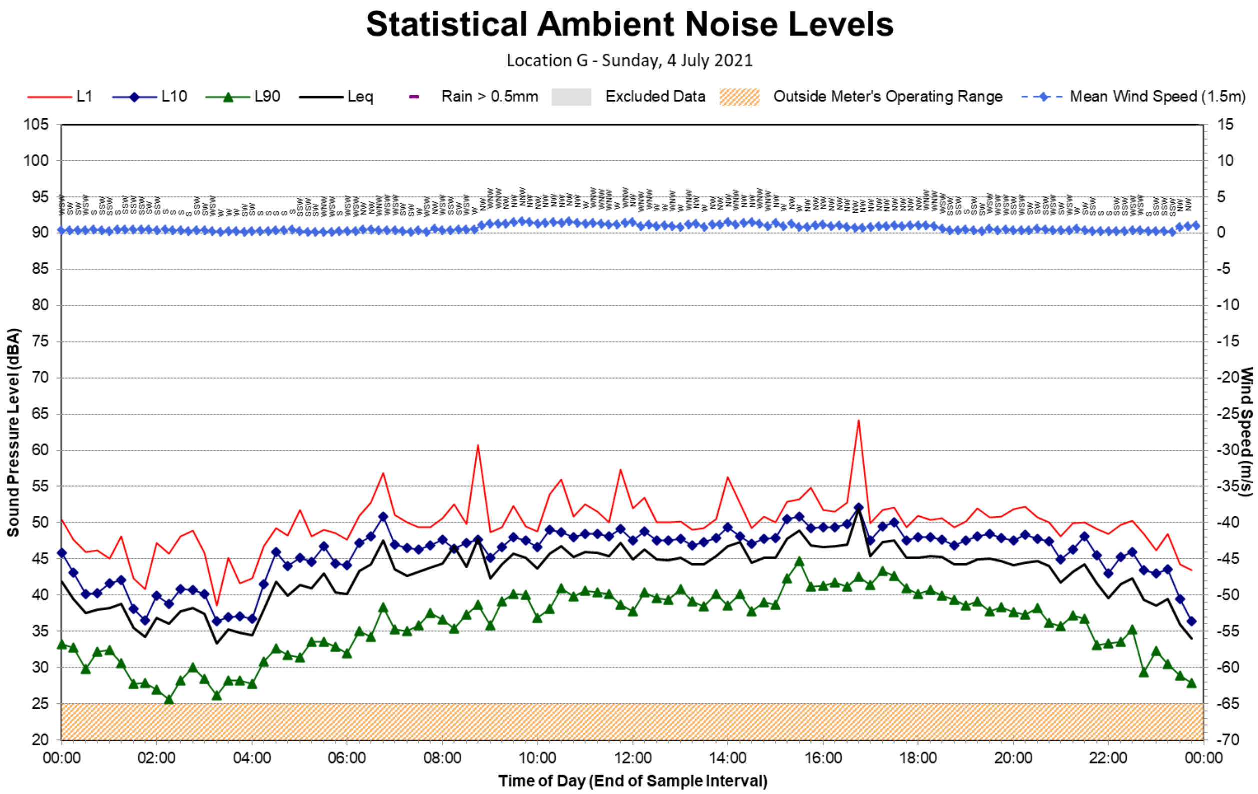


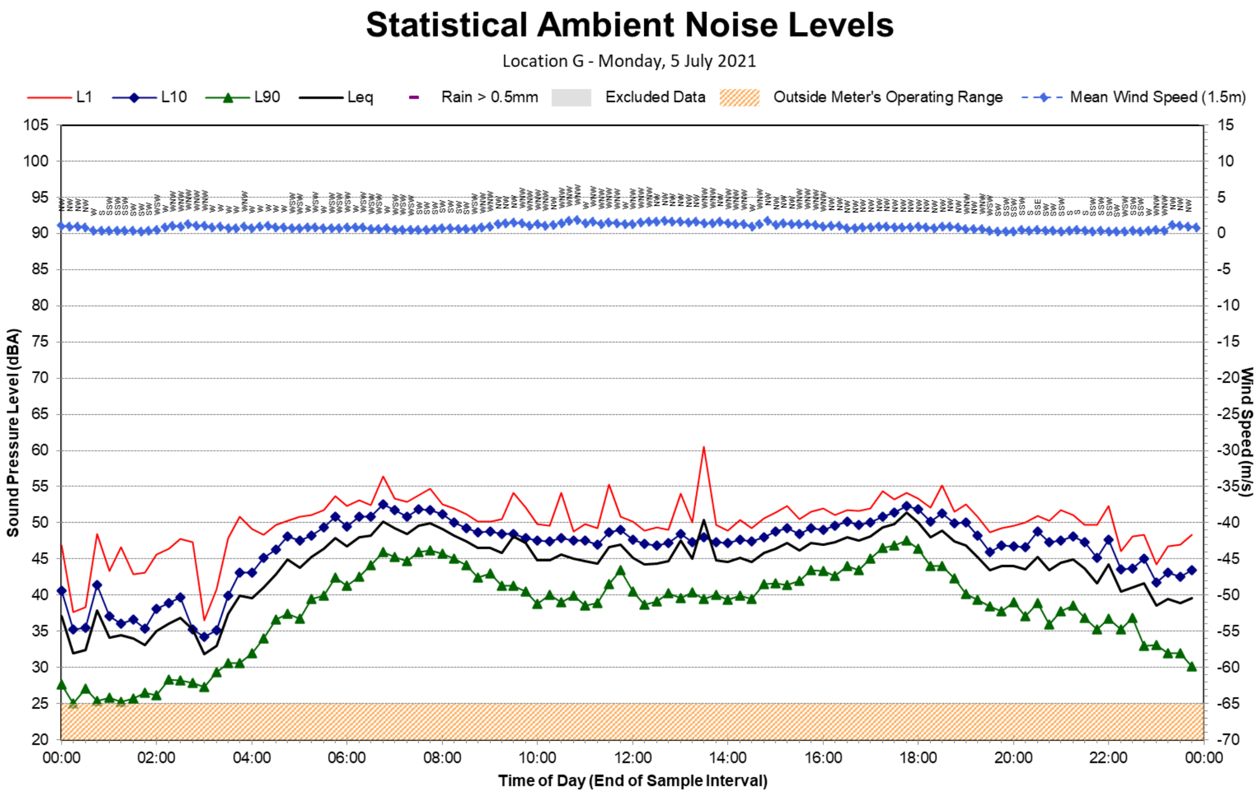
Statistical Ambient Noise Levels

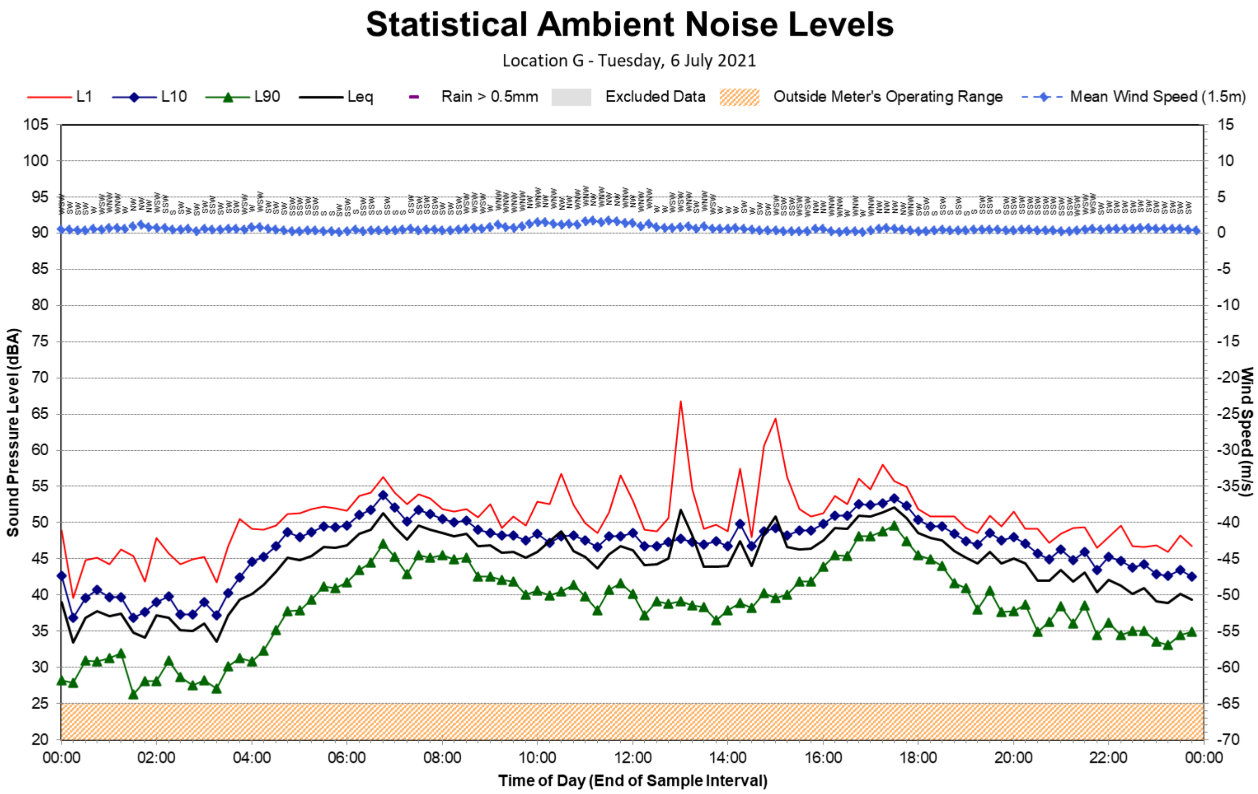
Location G - Friday, 2 July 2021

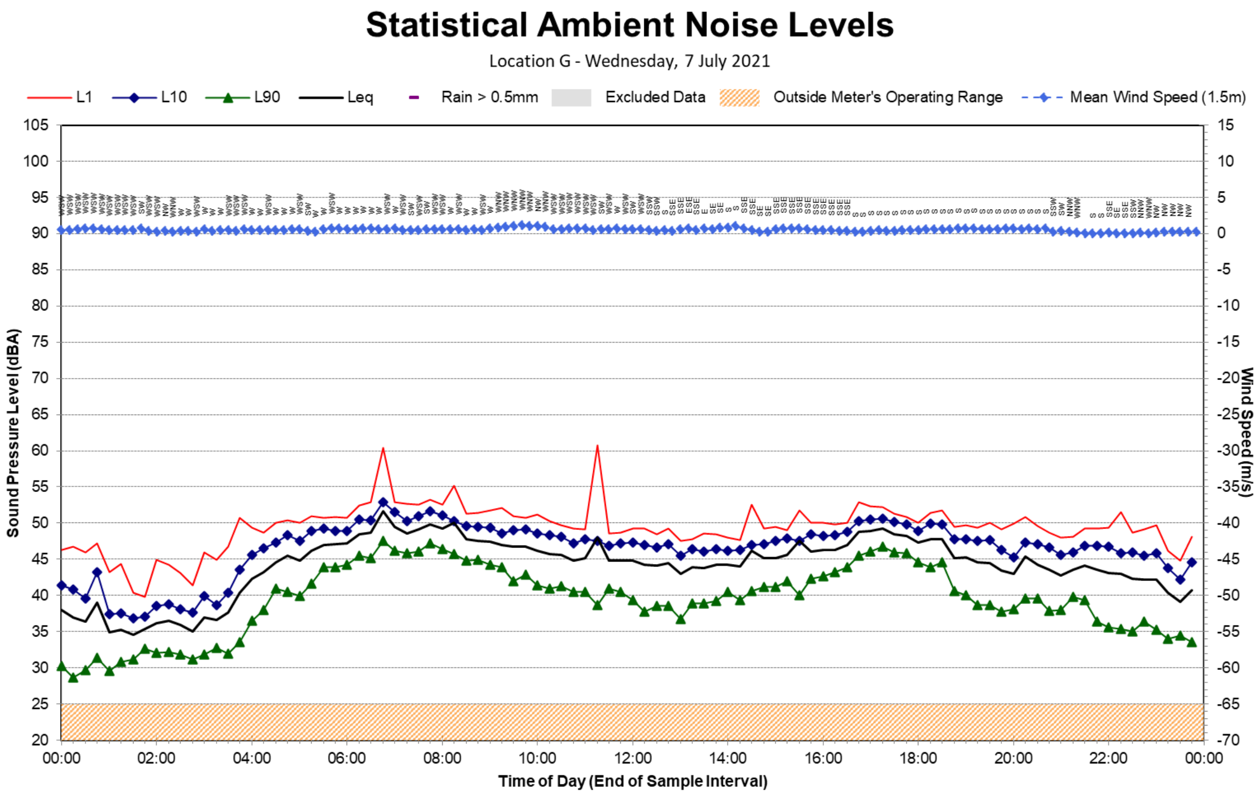



Statistical Ambient Noise Levels
Location G - Saturday, 3 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

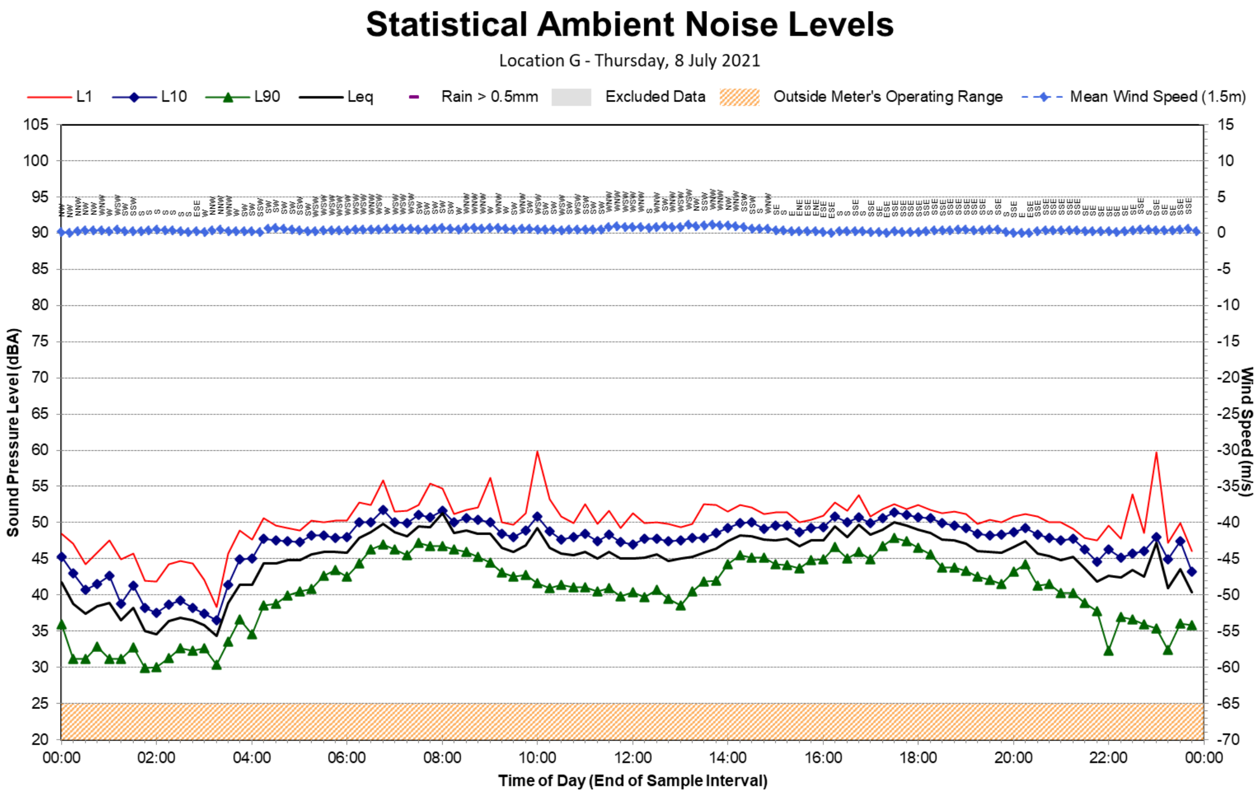

Statistical Ambient Noise Levels
Location G - Sunday, 4 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Monday, 5 July 2021
L1
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)

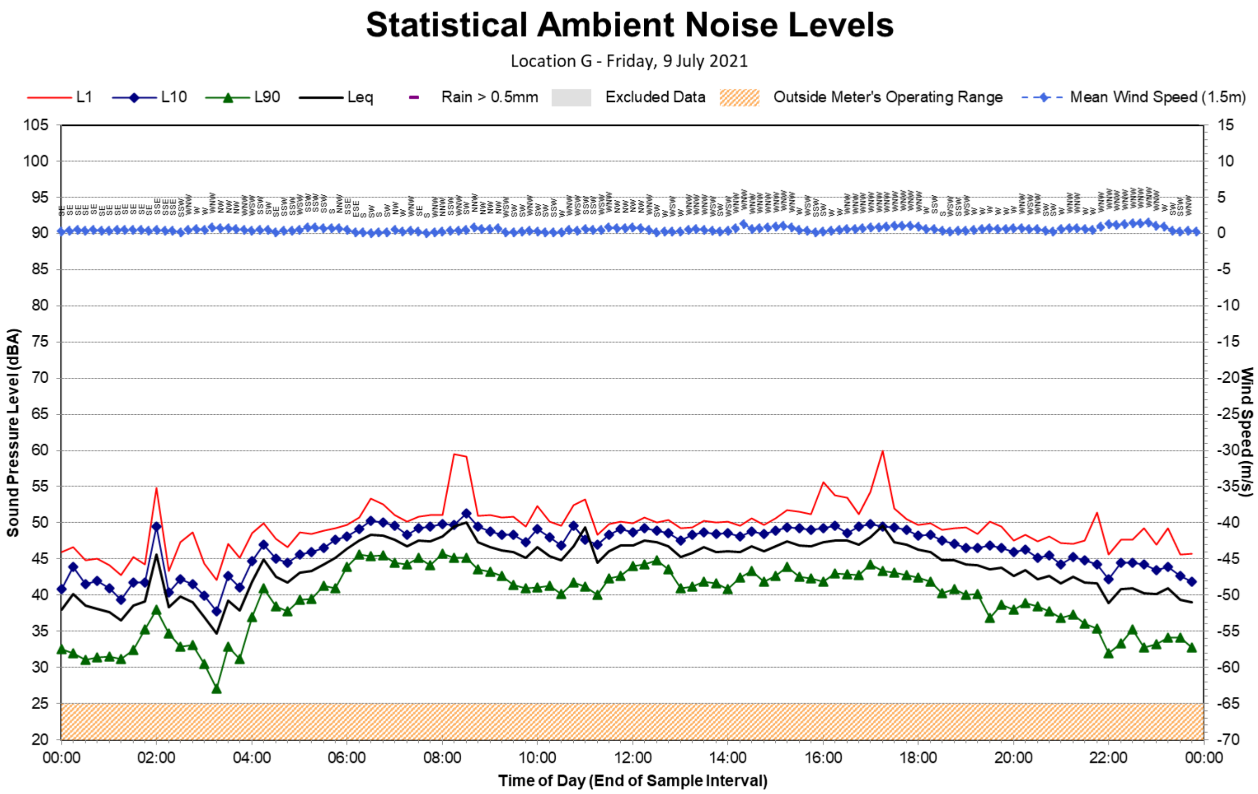

Statistical Ambient Noise Levels
Location G - Tuesday, 6 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

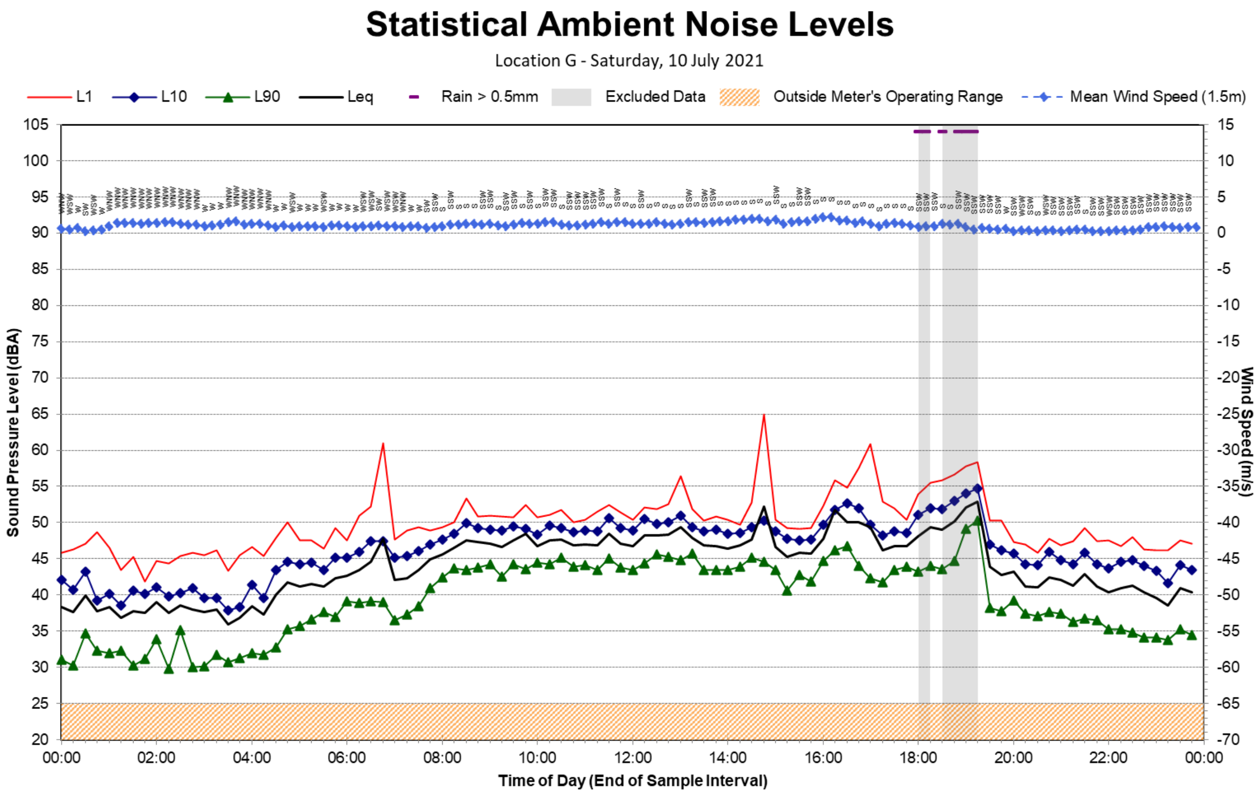


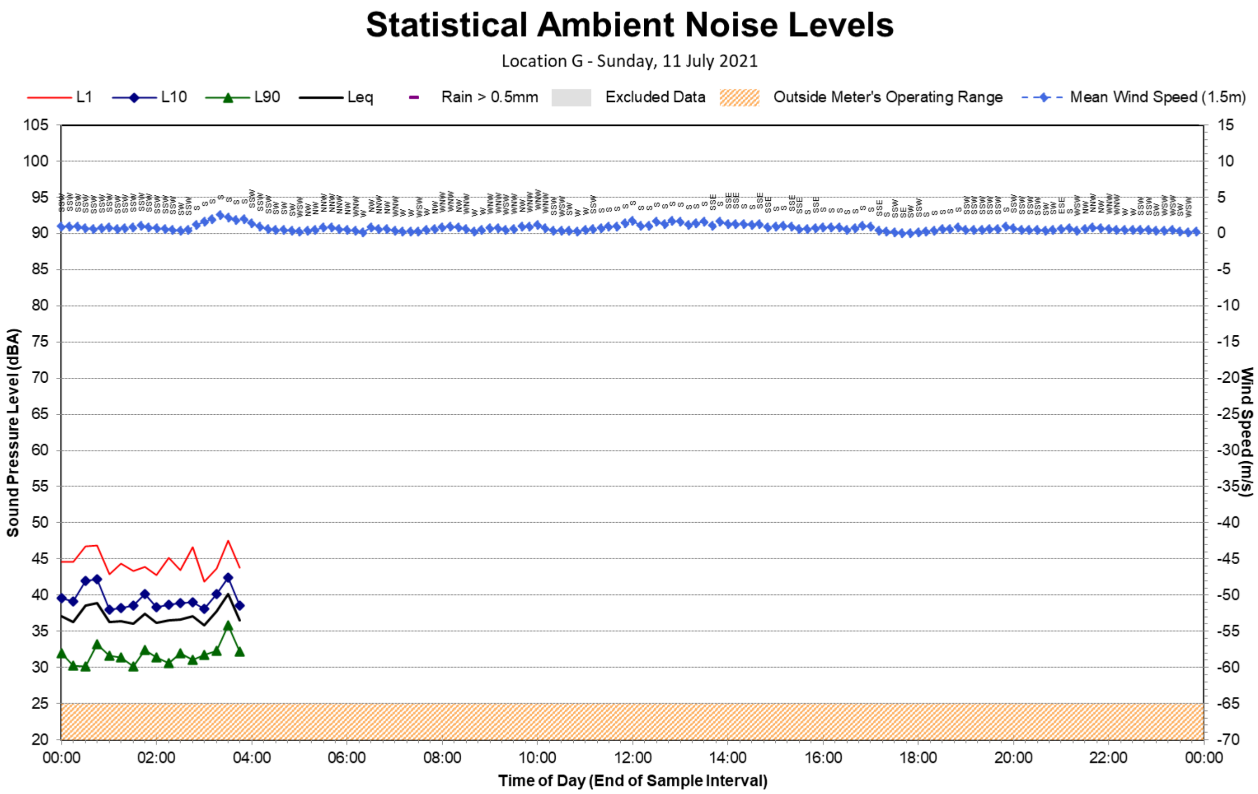
Statistical Ambient Noise Levels
Location G - Wednesday, 7 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

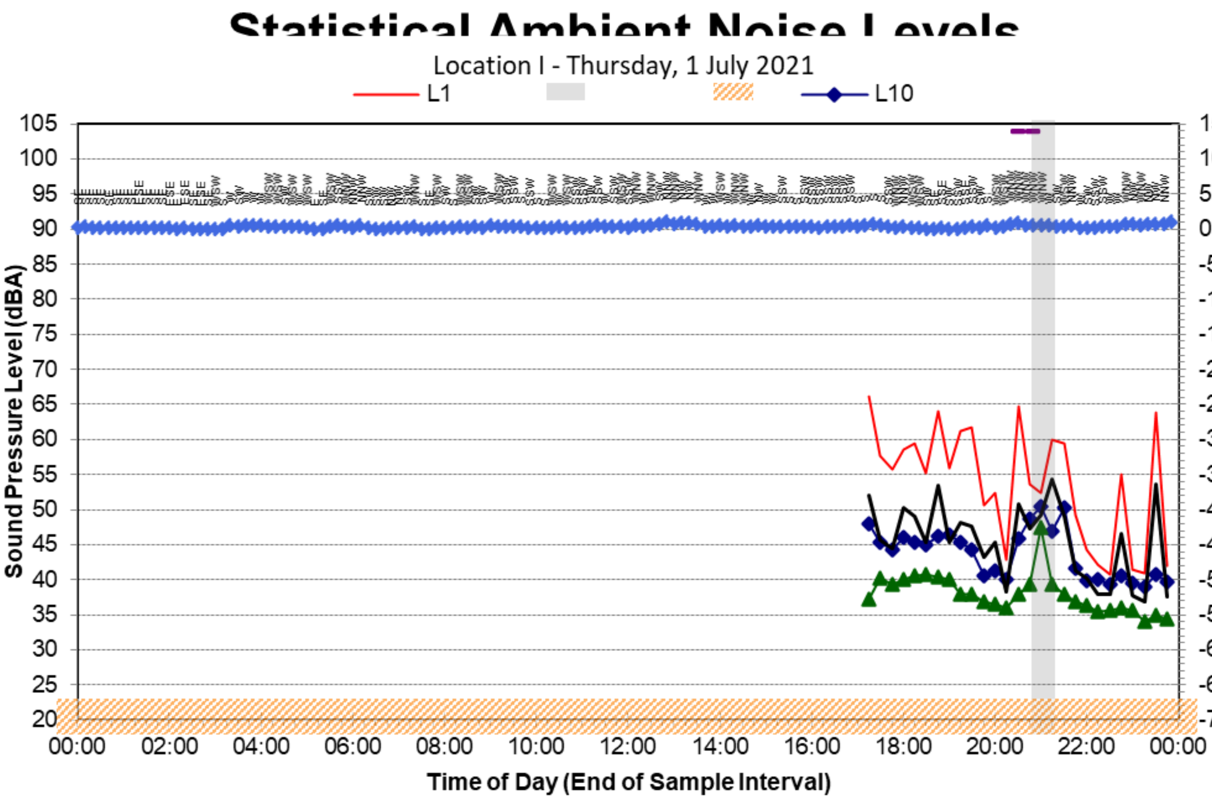


Statistical Ambient Noise Levels
Location G - Thursday, 8 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Friday, 9 July 2021
L1
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)

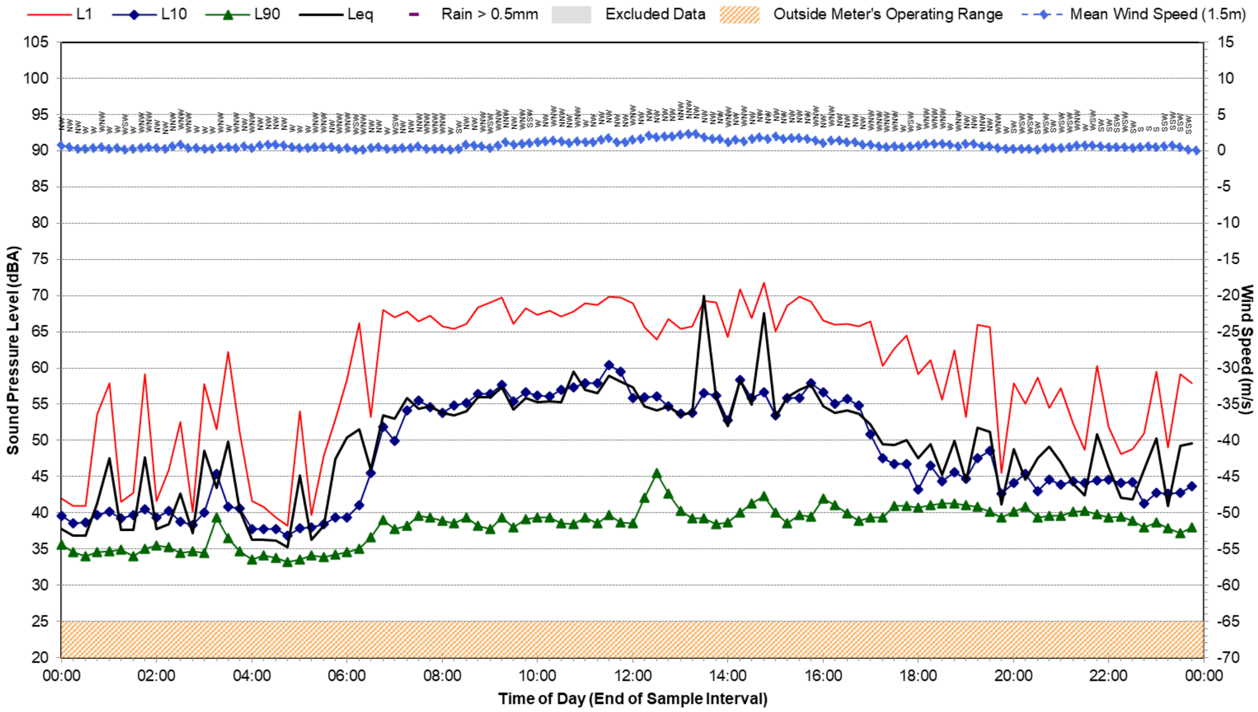

Statistical Ambient Noise Levels
Location G - Saturday, 10 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Sunday, 11 July 2021
L1
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, 1 July 2021
L1
L10
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

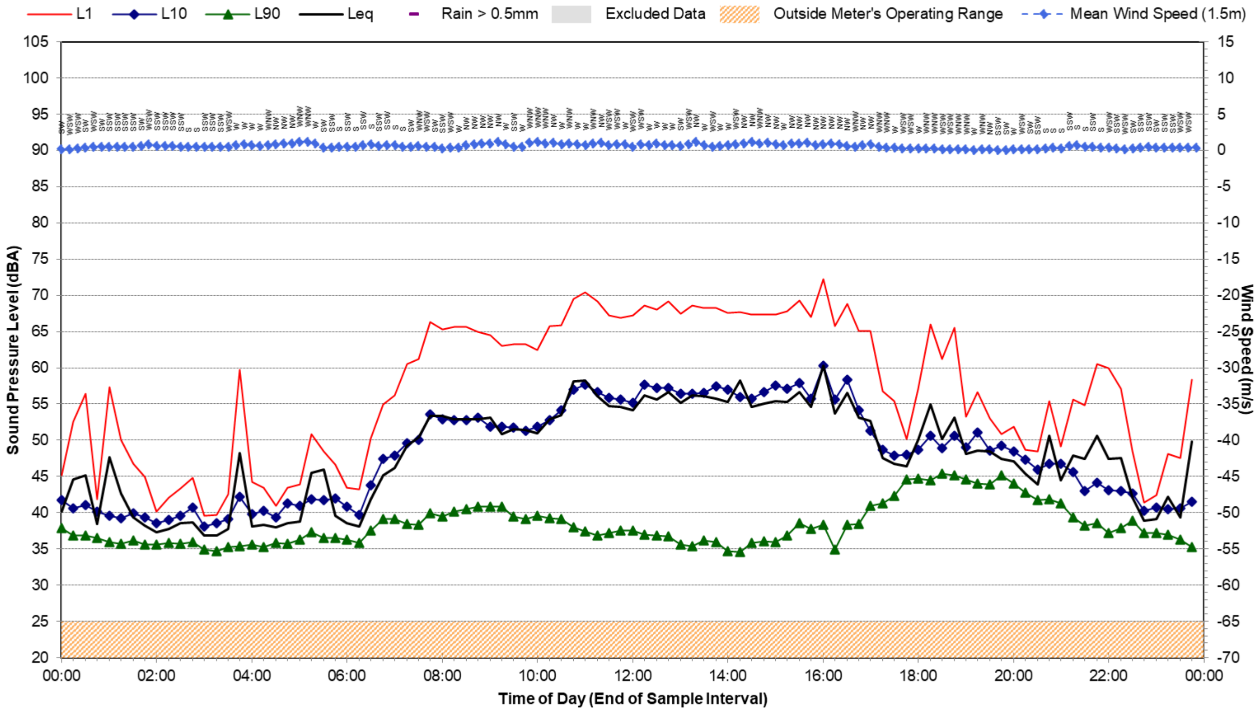
Statistical Ambient Noise Levels

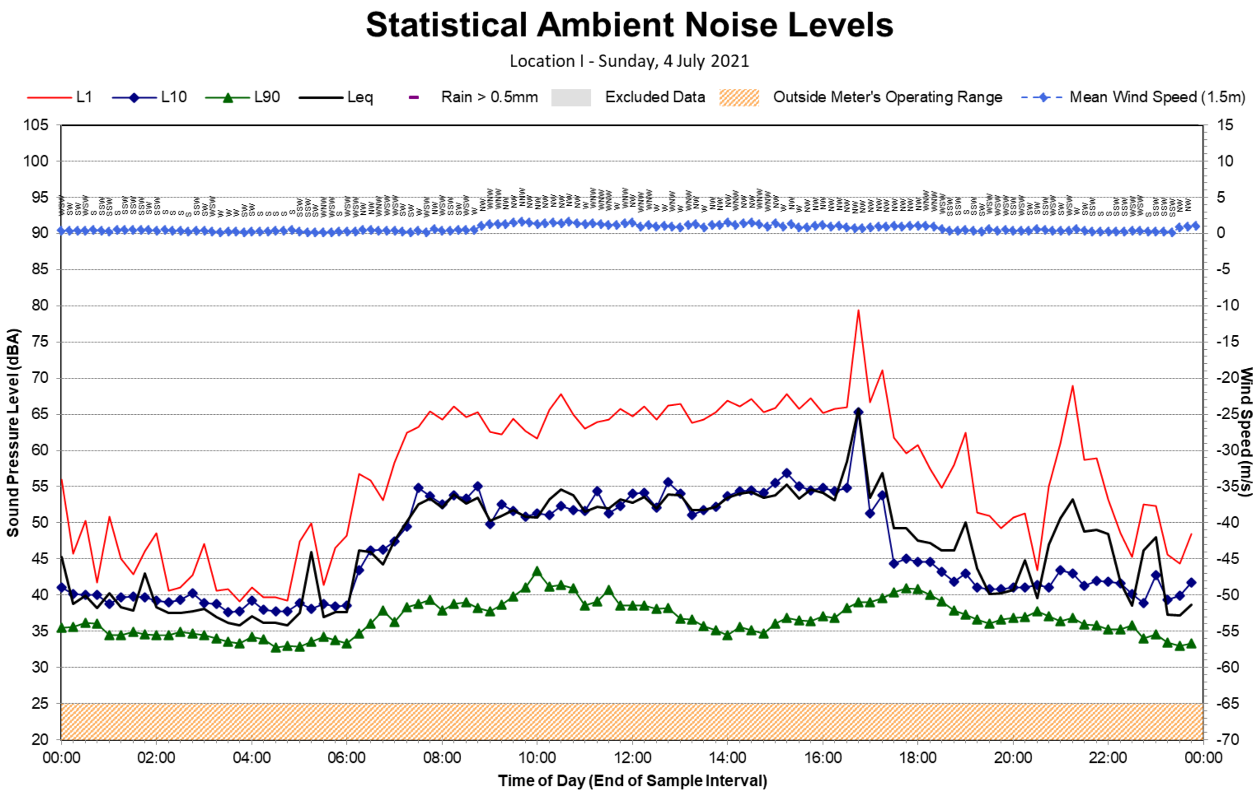
Location I - Friday, 2 July 2021



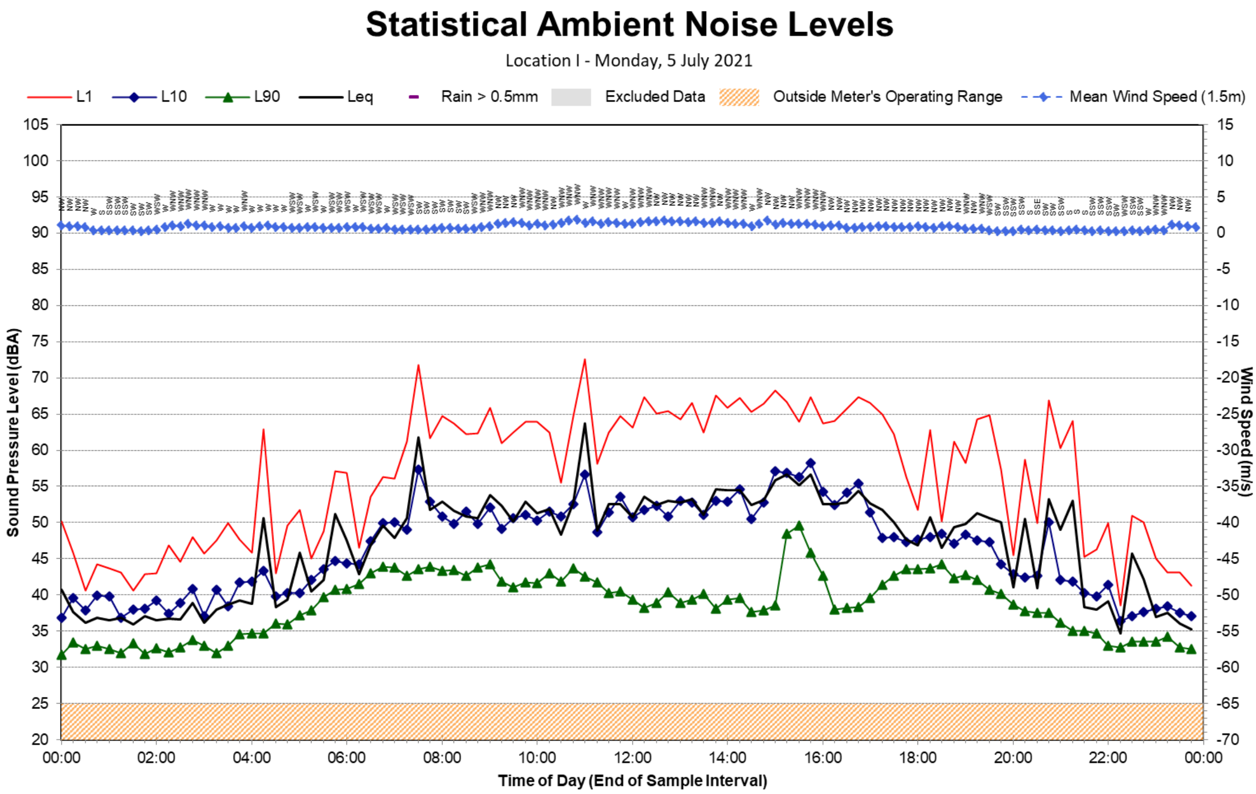
Statistical Ambient Noise Levels

Location I - Saturday, 3 July 2021

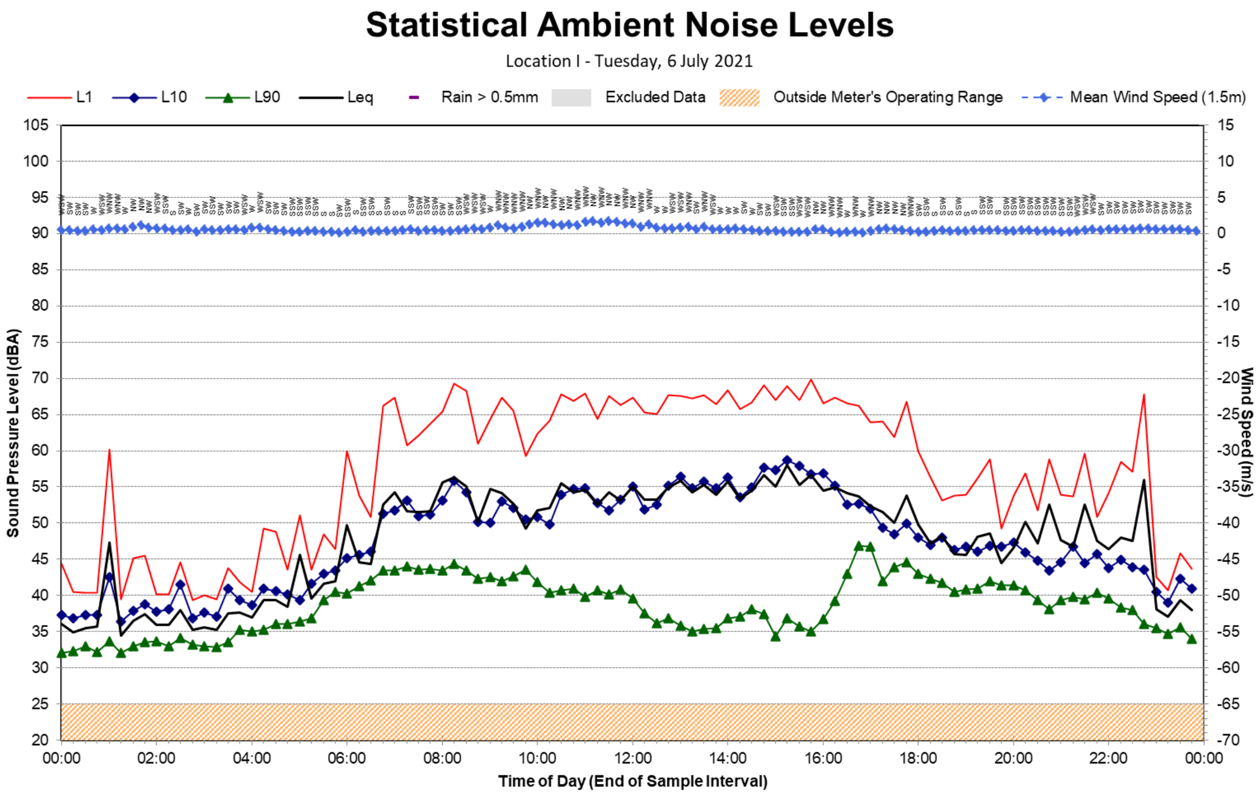


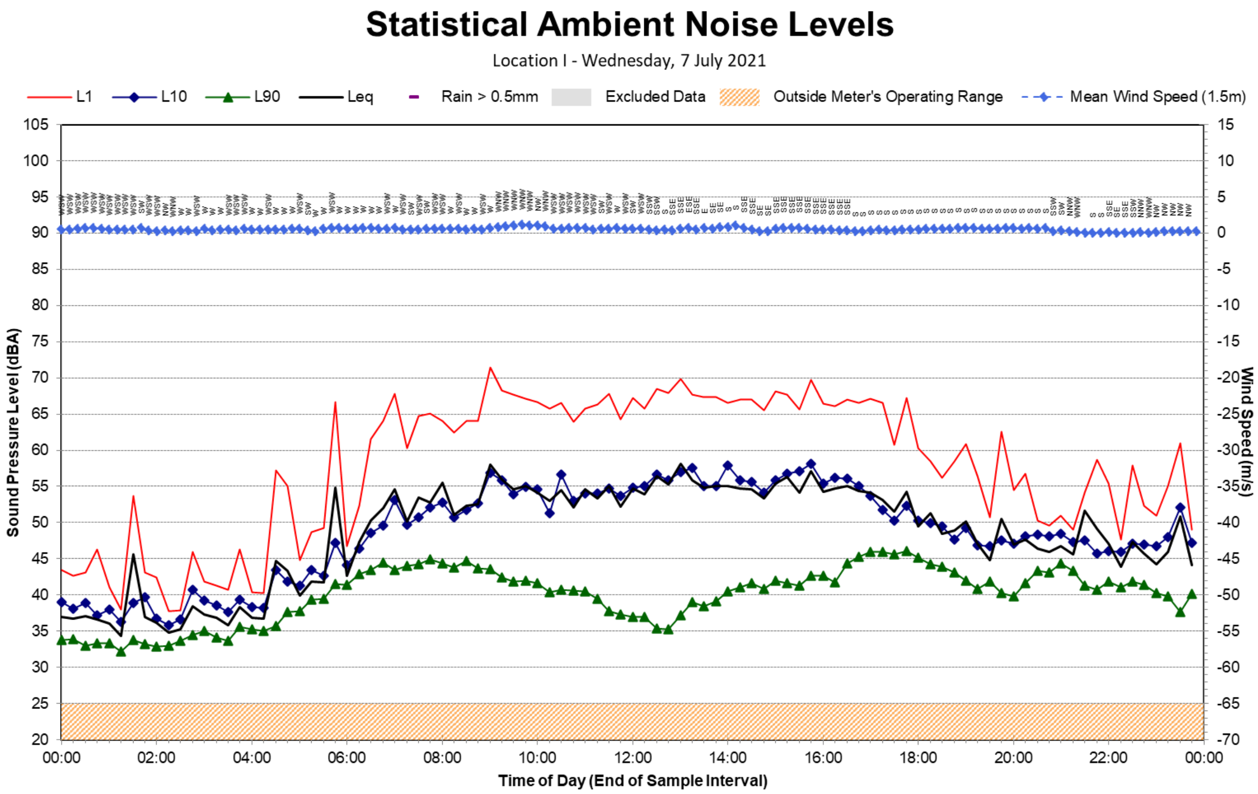


Statistical Ambient Noise Levels
Location I - Sunday, 4 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



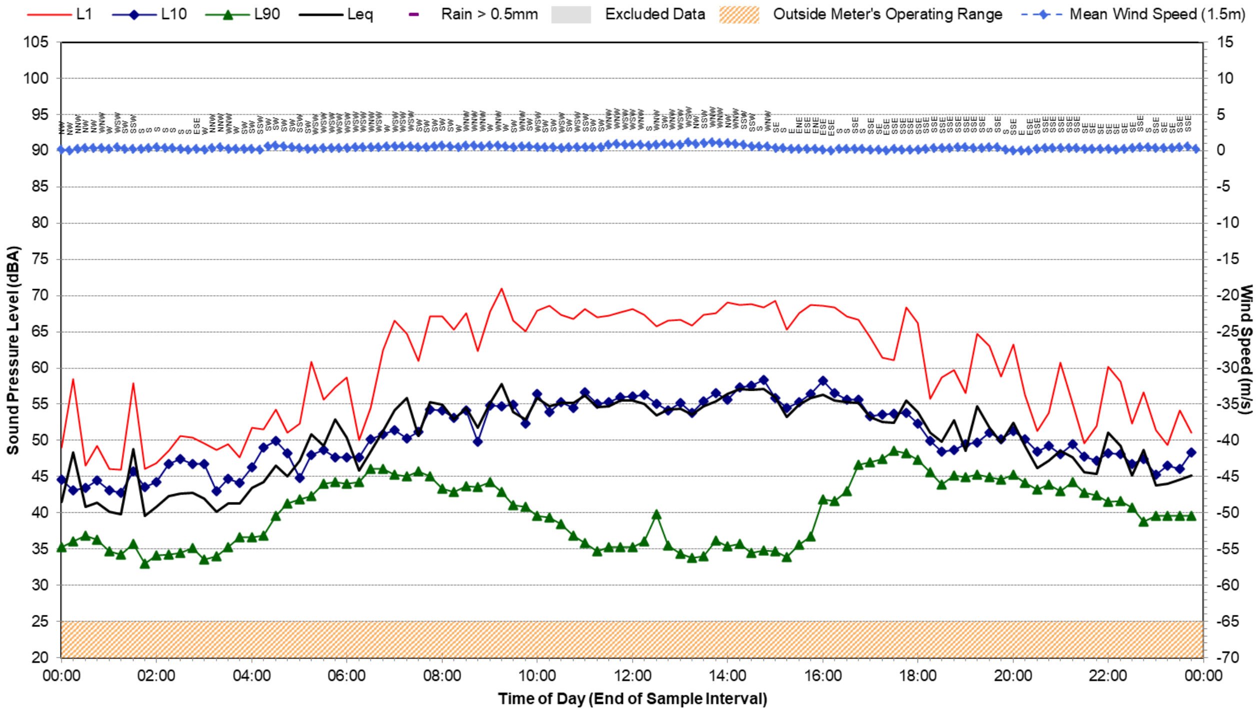
Statistical Ambient Noise Levels
Location I - Monday, 5 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Tuesday, 6 July 2021
L1
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 - Wednesday, 7 July 2021
L1
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)

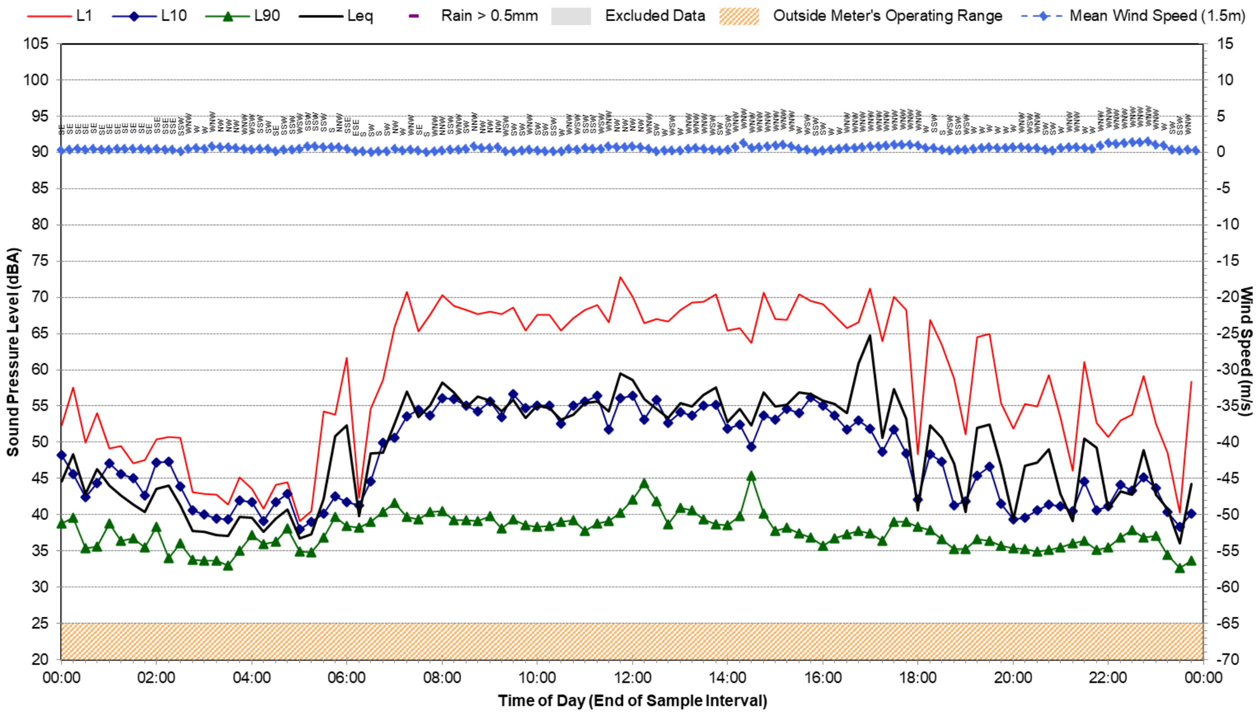
Statistical Ambient Noise Levels

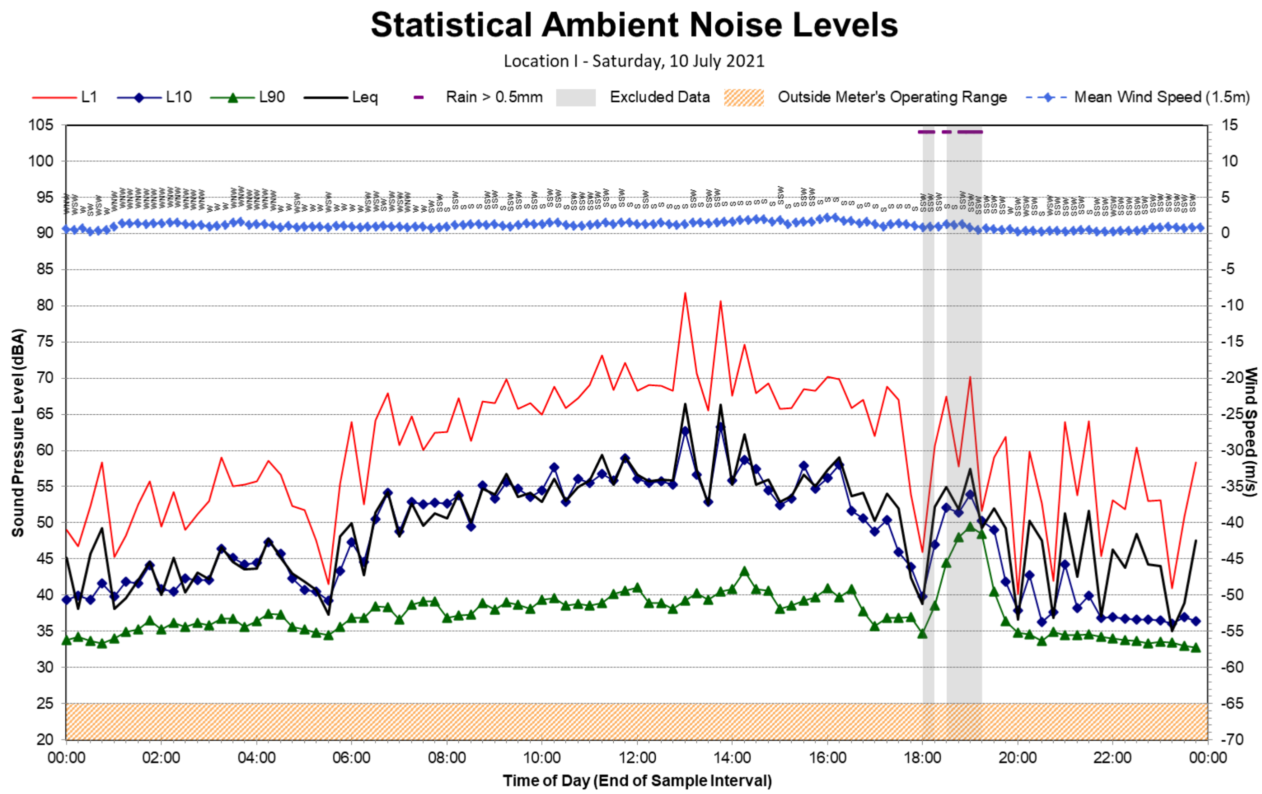
Location I - Thursday, 8 July 2021



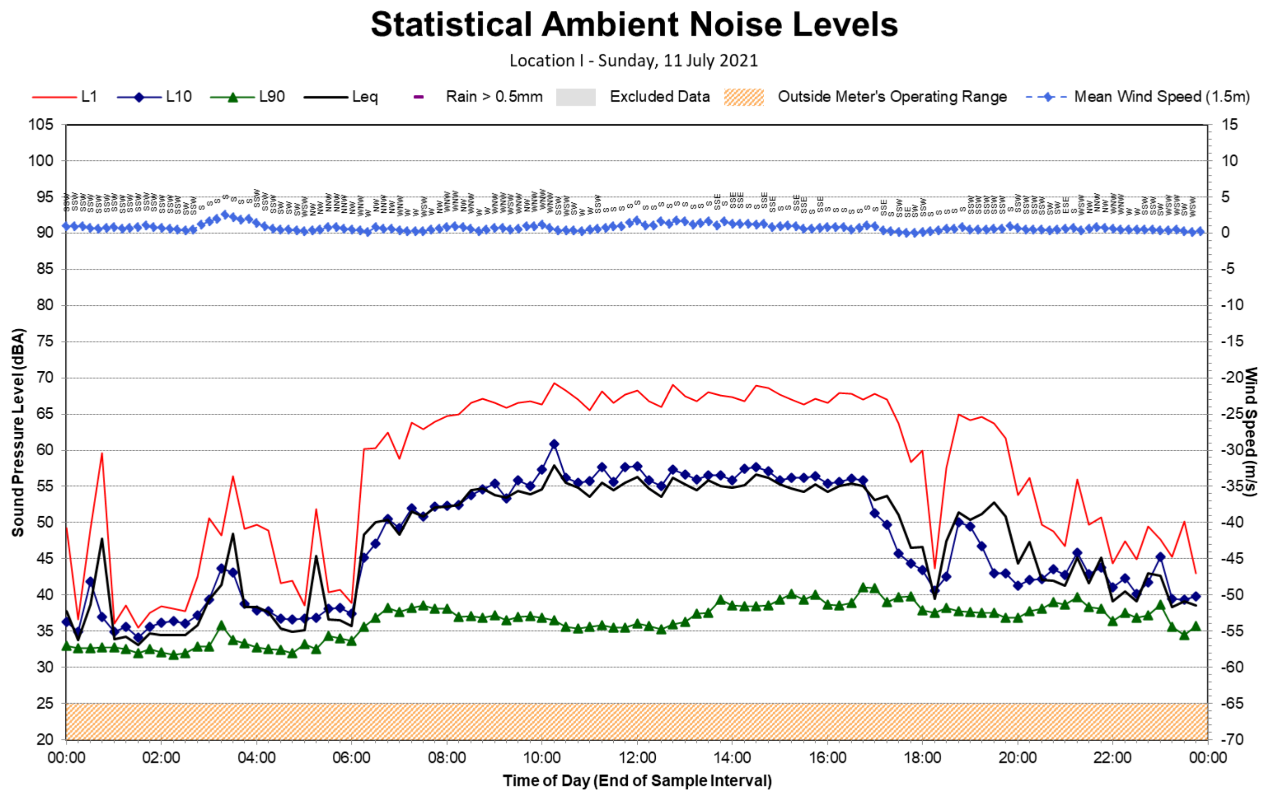
Statistical Ambient Noise Levels

Location I - Friday, 9 July 2021

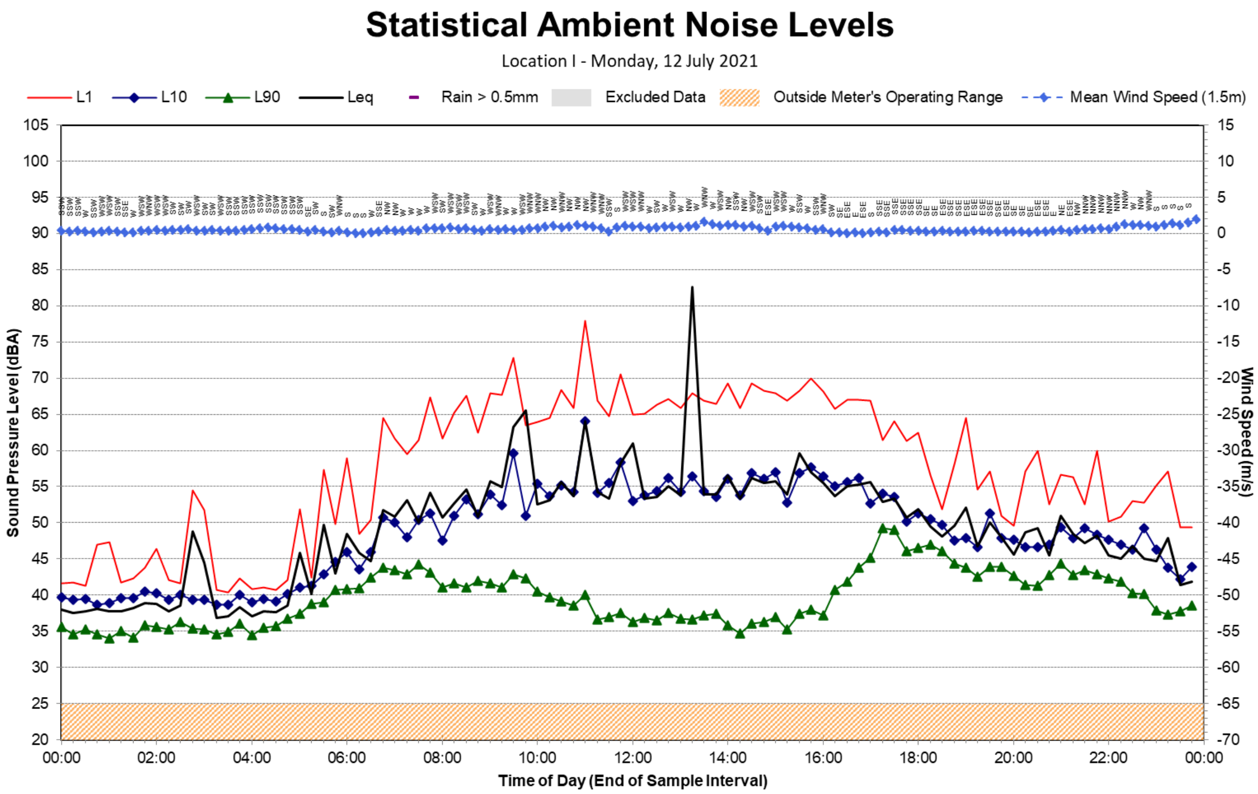




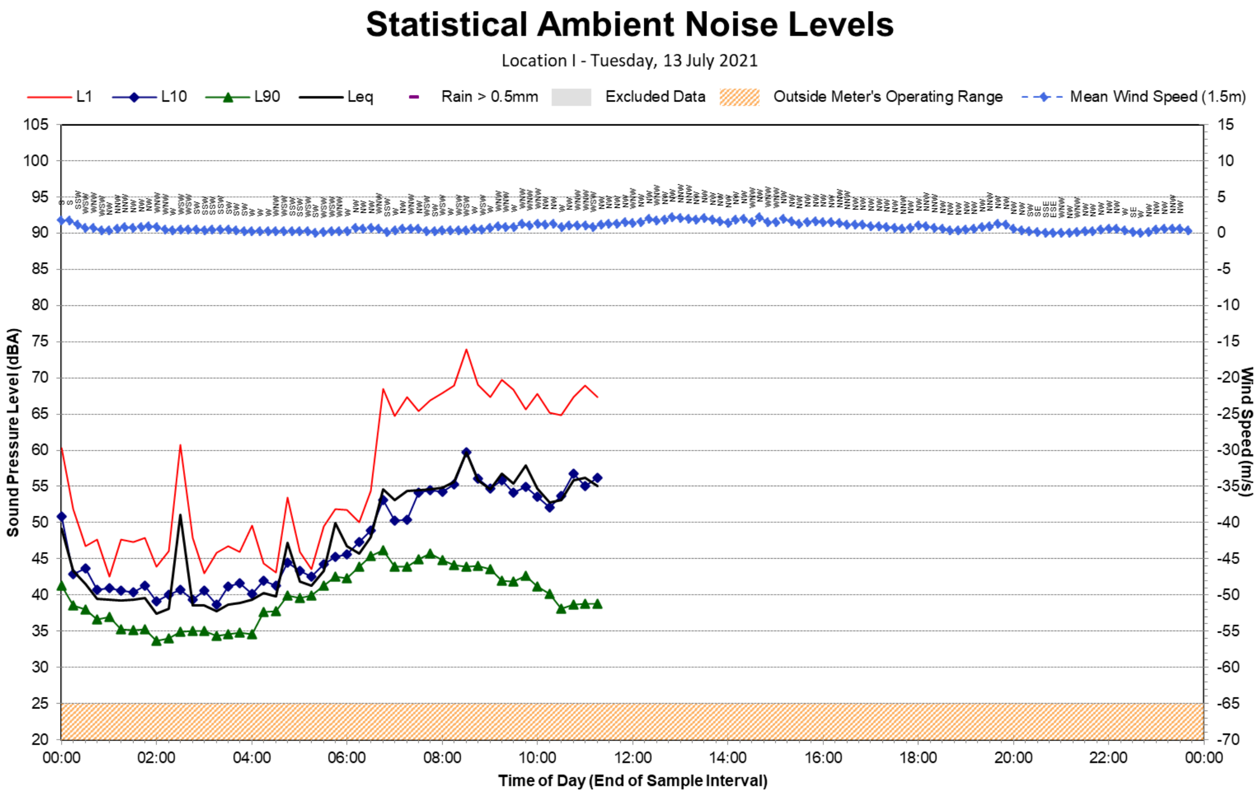
Statistical Ambient Noise Levels
Location I - Saturday, 10 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



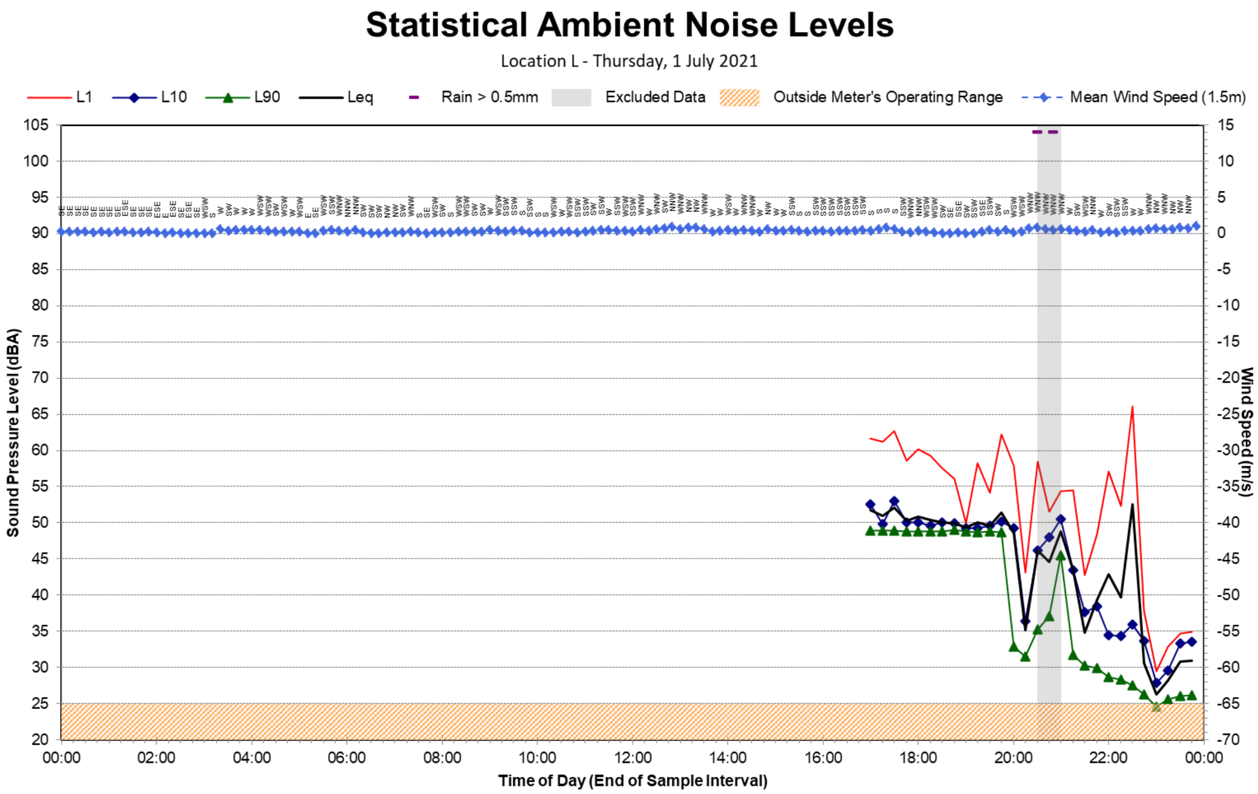
Statistical Ambient Noise Levels
Location I - Sunday, 11 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



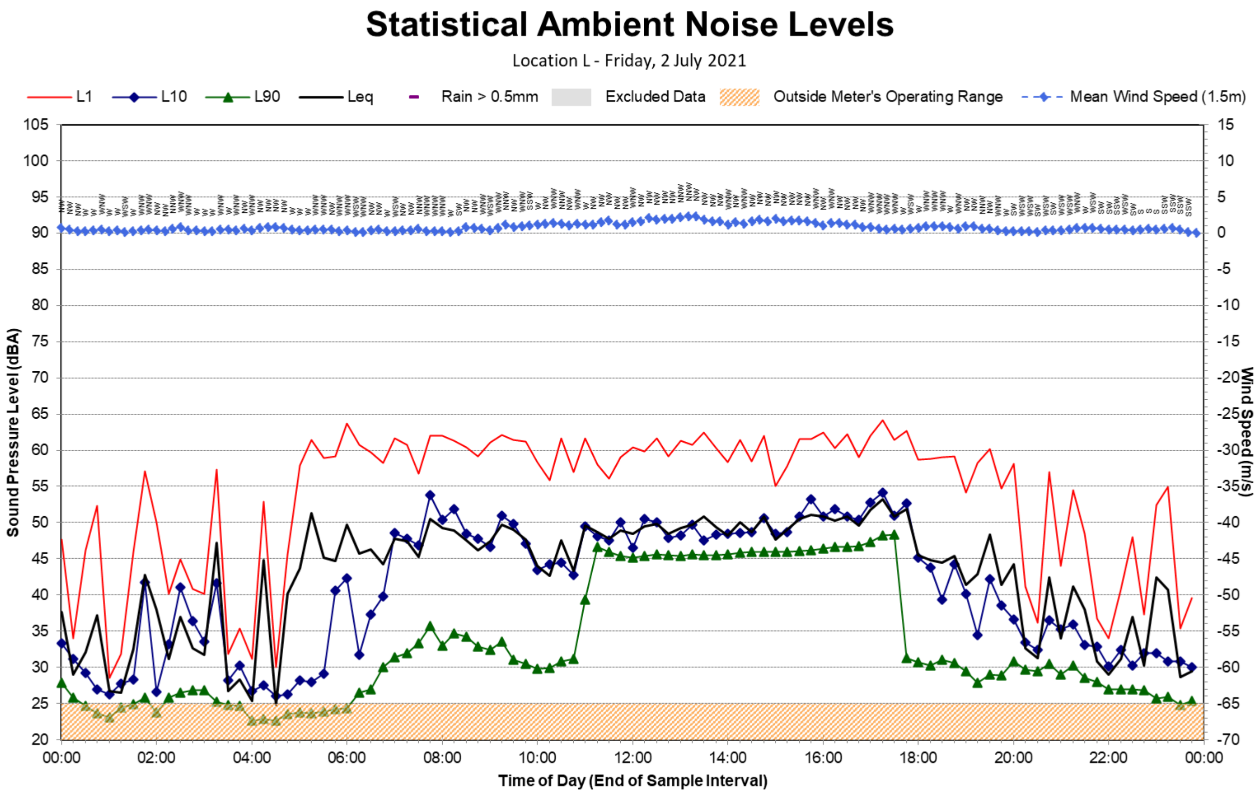
Statistical Ambient Noise Levels
Location I - Monday, 12 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



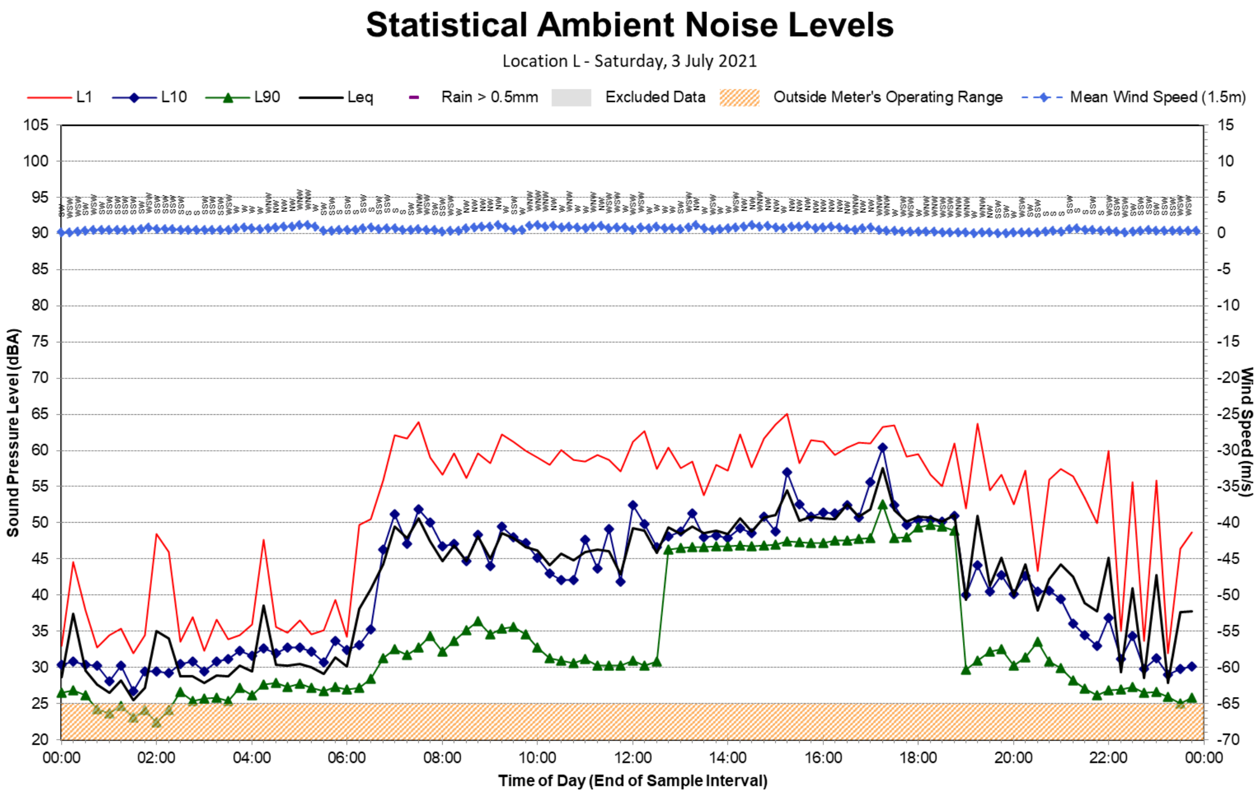
Statistical Ambient Noise Levels
Location I - Tuesday, 13 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

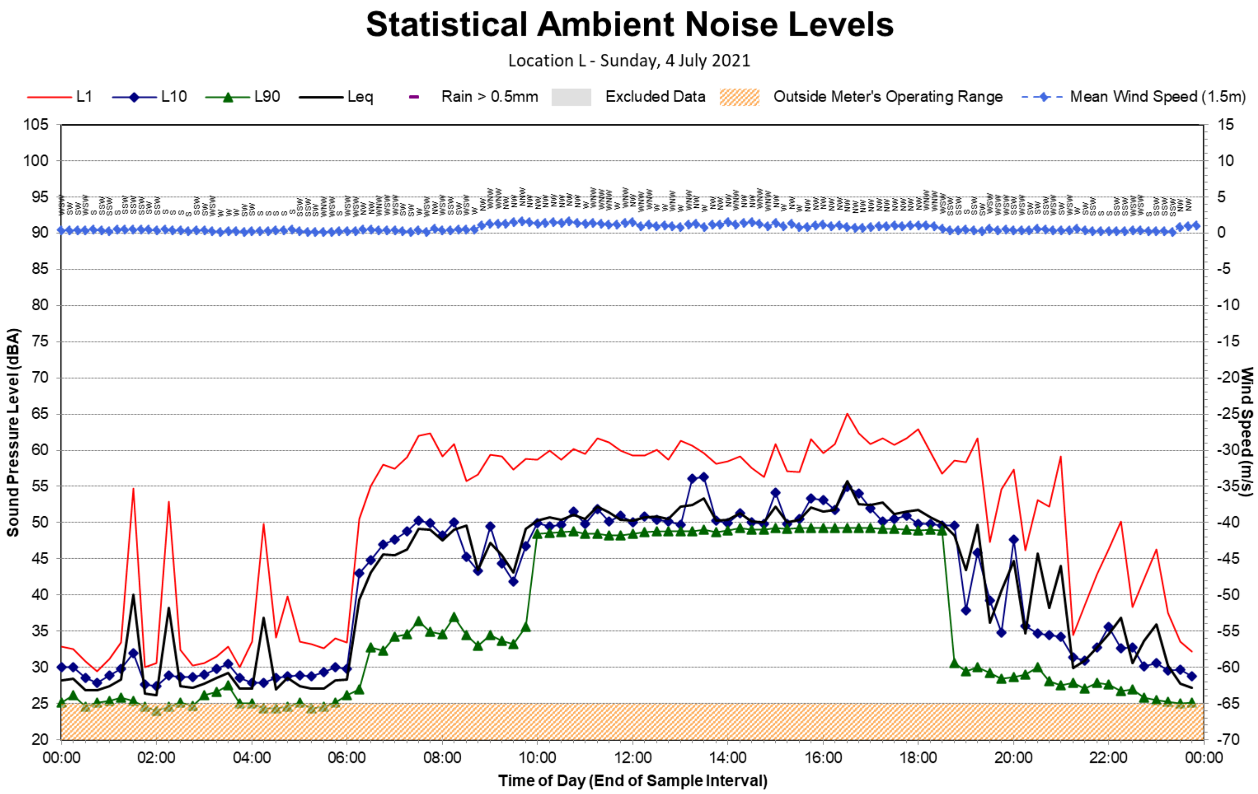


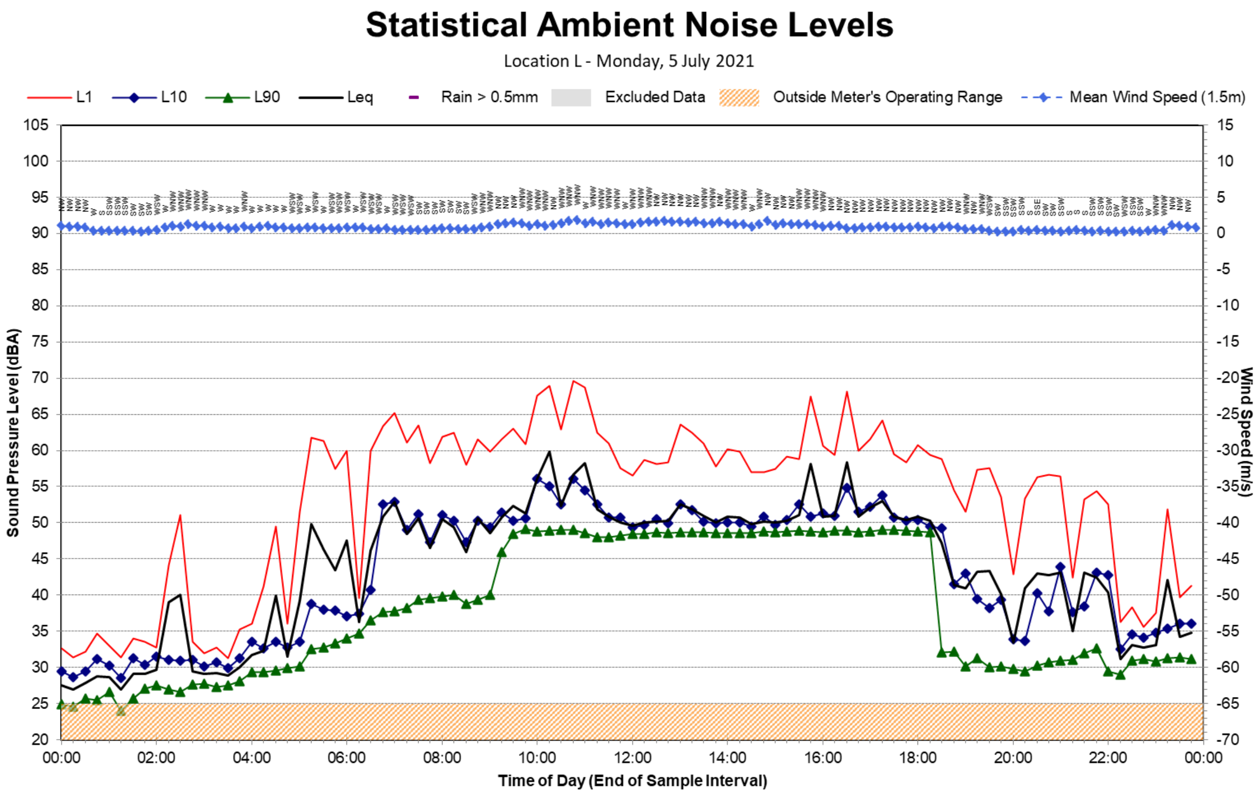
Statistical Ambient Noise Levels
Location L - Thursday, 1 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

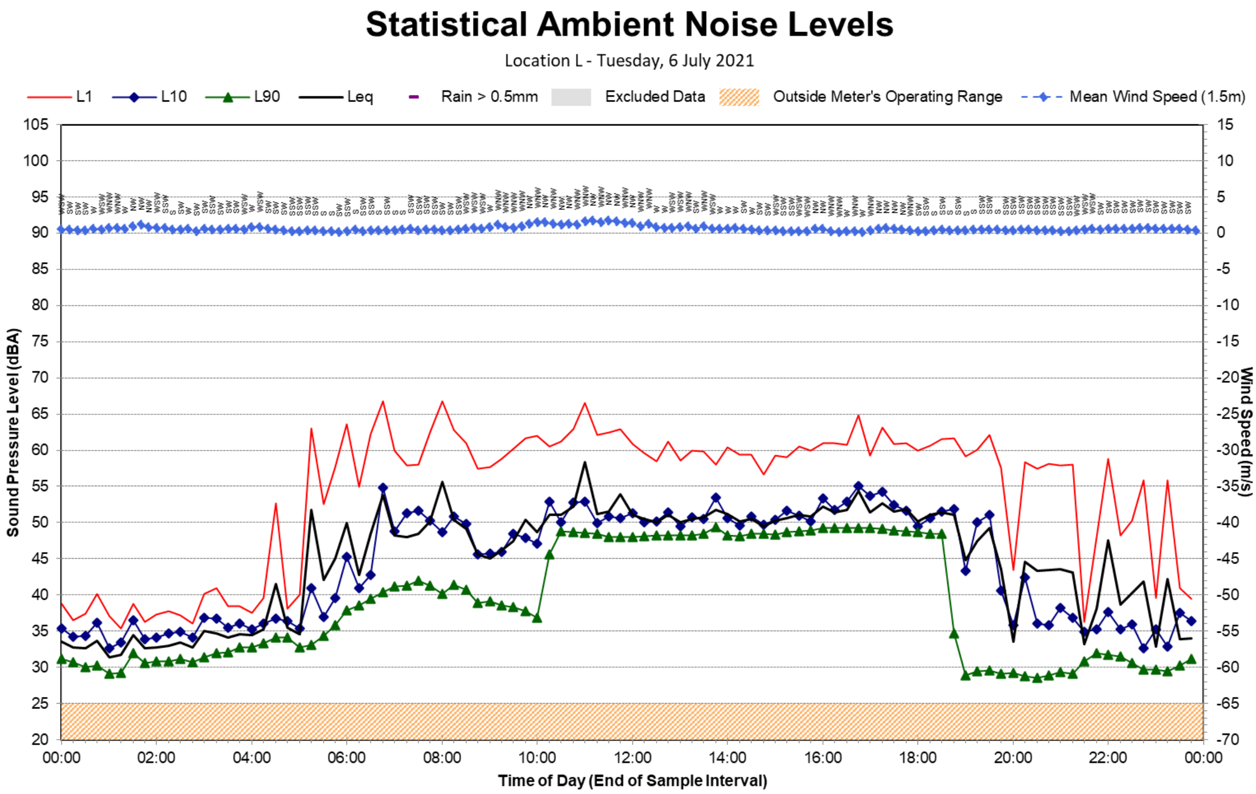


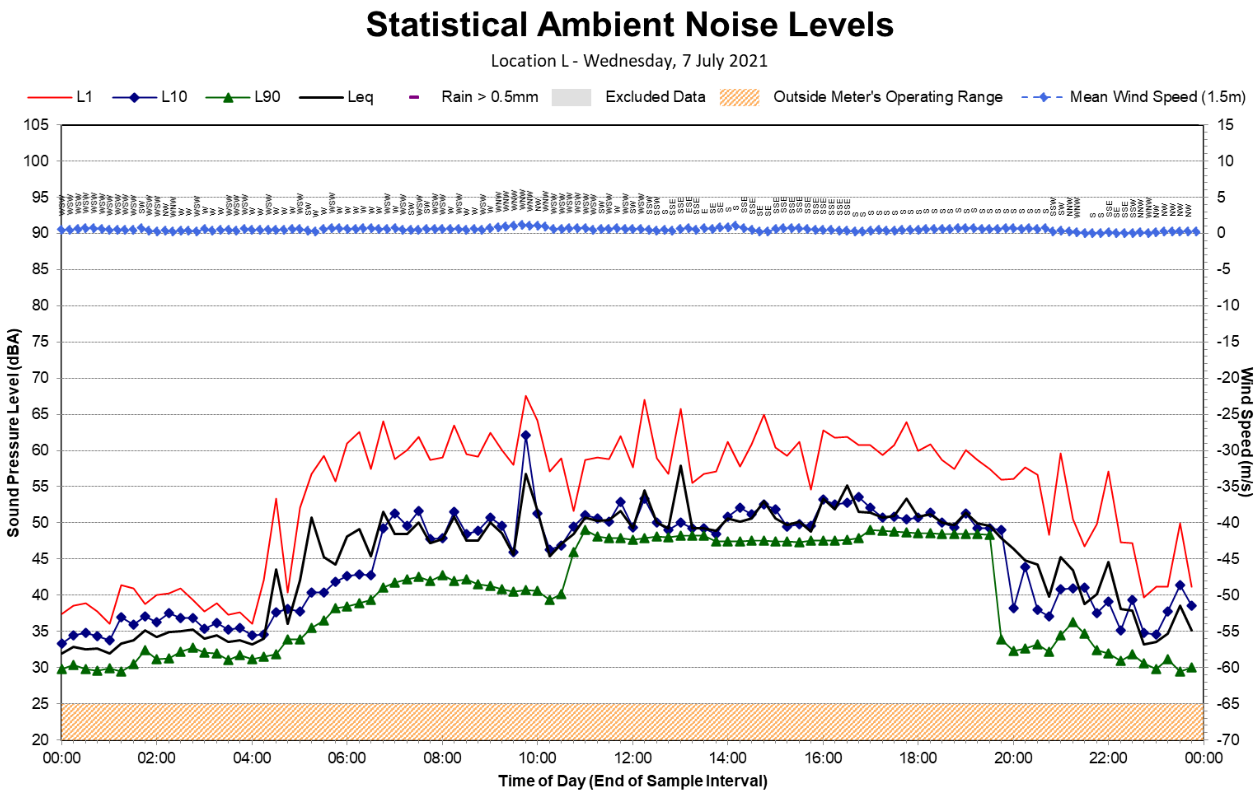
Statistical Ambient Noise Levels
Location L - Friday, 2 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Saturday, 3 July 2021
L1
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)

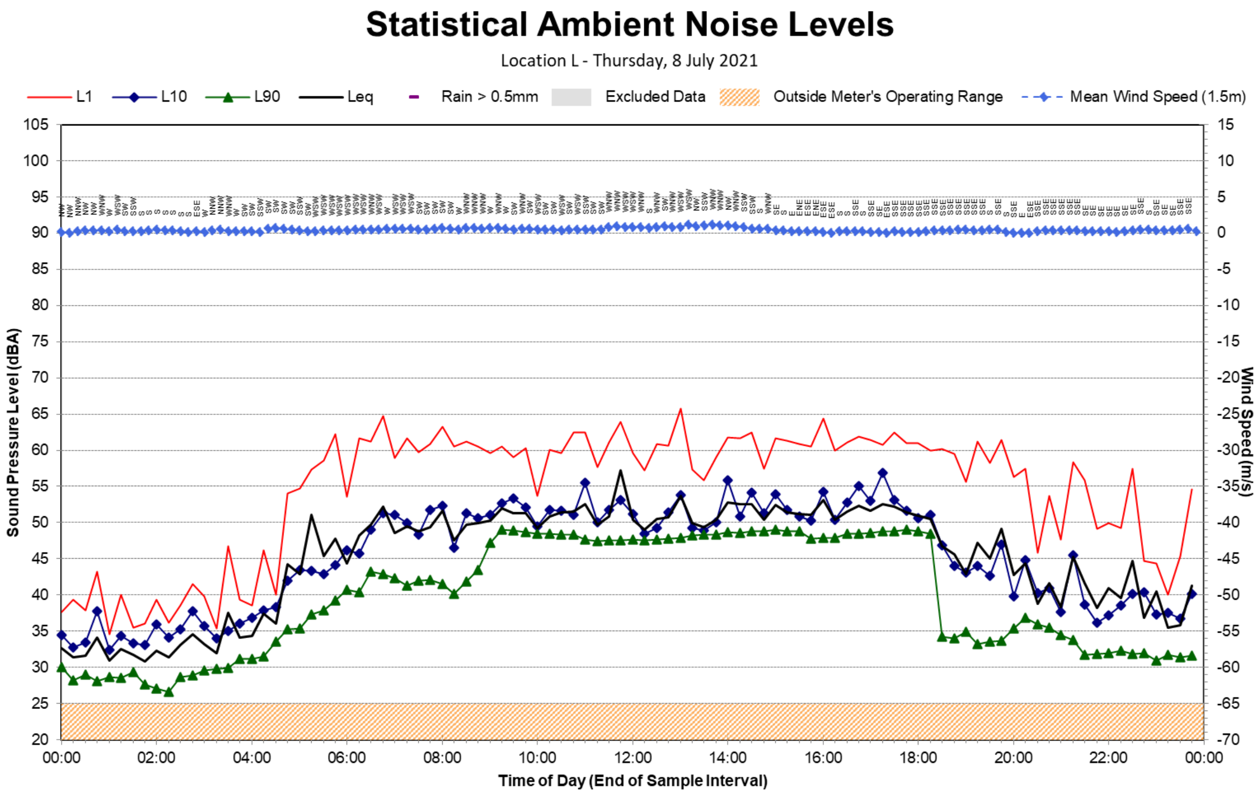

Statistical Ambient Noise Levels
Location L - Sunday, 4 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Monday, 5 July 2021
L1
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, 6 July 2021
L1
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)



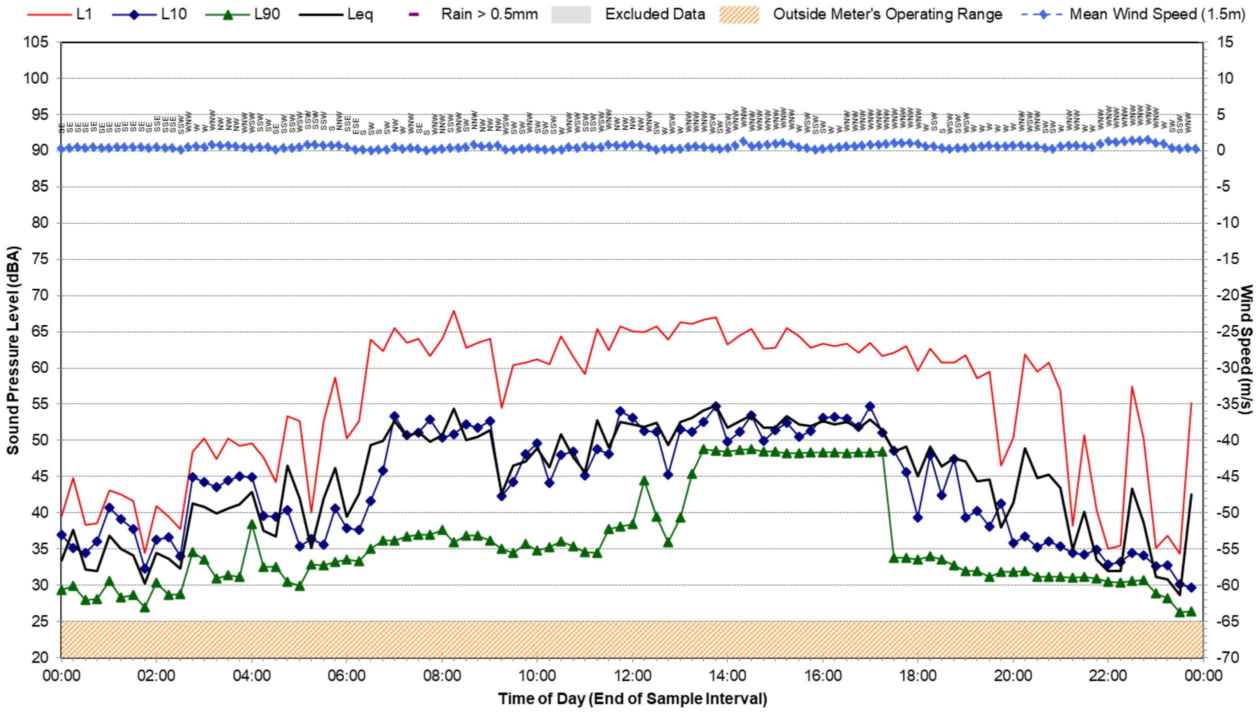
Statistical Ambient Noise Levels
Location L - Wednesday, 7 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
Location L - Thursday, 8 July 2021
L1
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)

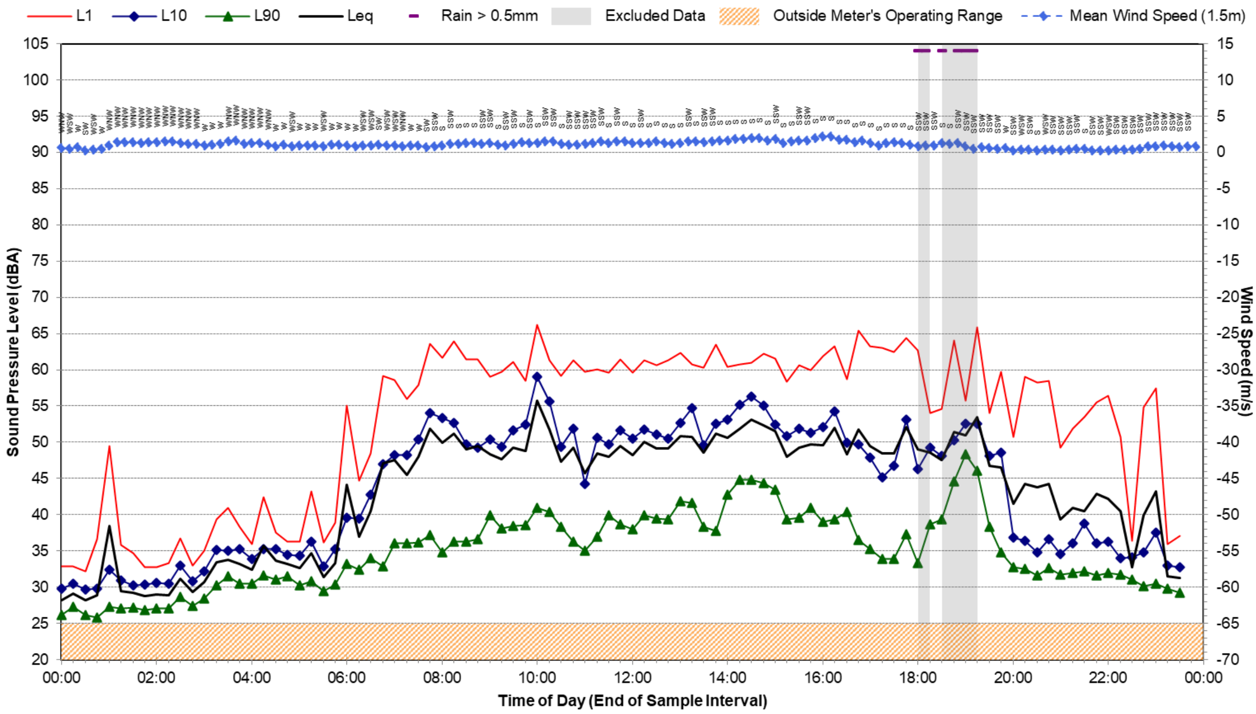
Statistical Ambient Noise Levels

Location L - Friday, 9 July 2021



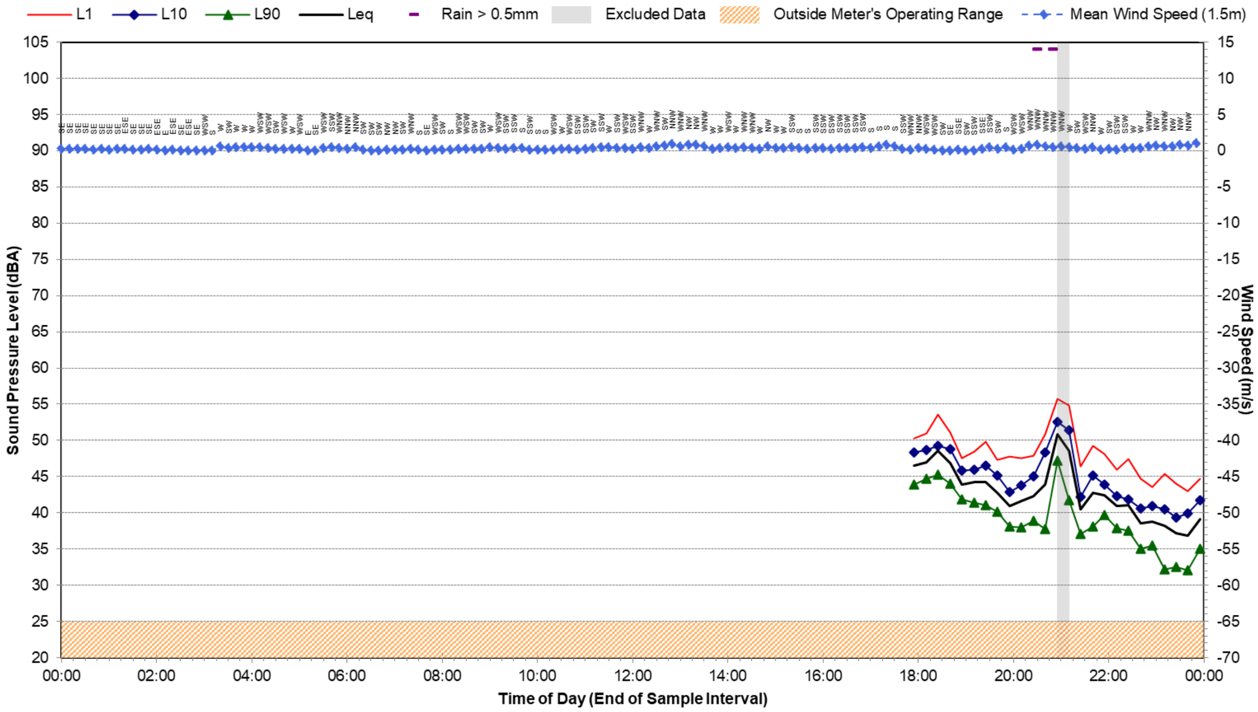
Statistical Ambient Noise Levels

Location L - Saturday, 10 July 2021



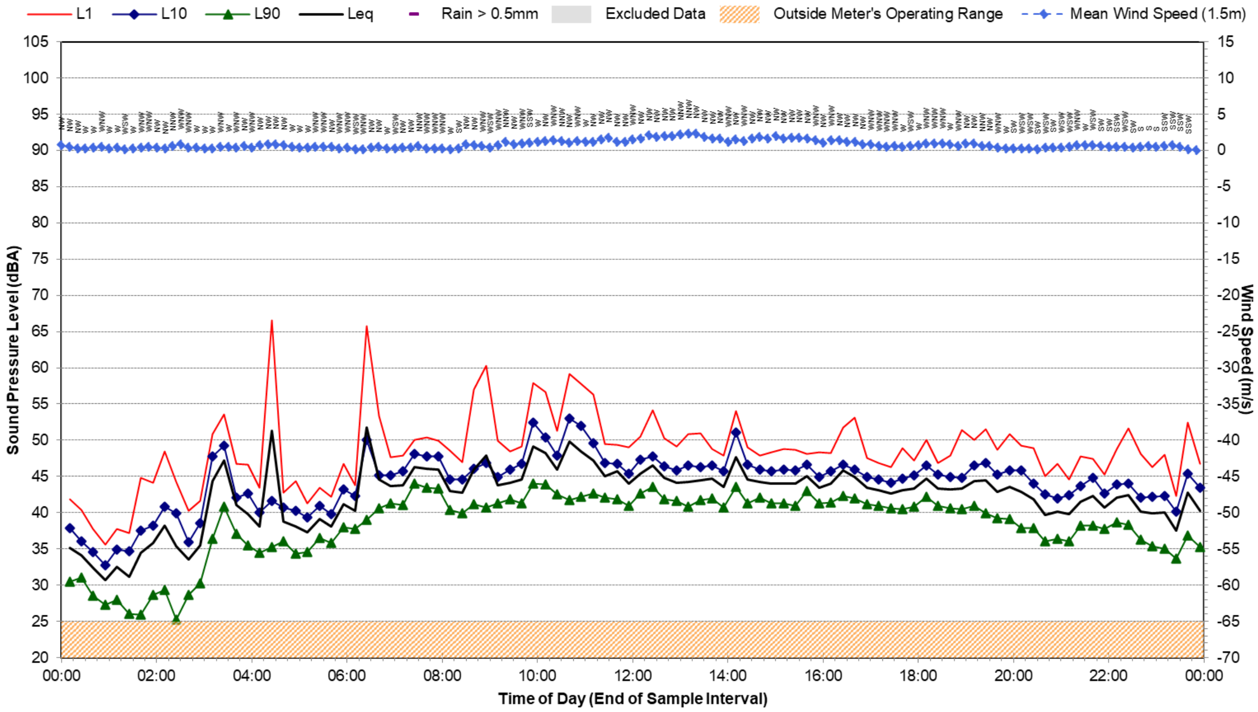
Statistical Ambient Noise Levels

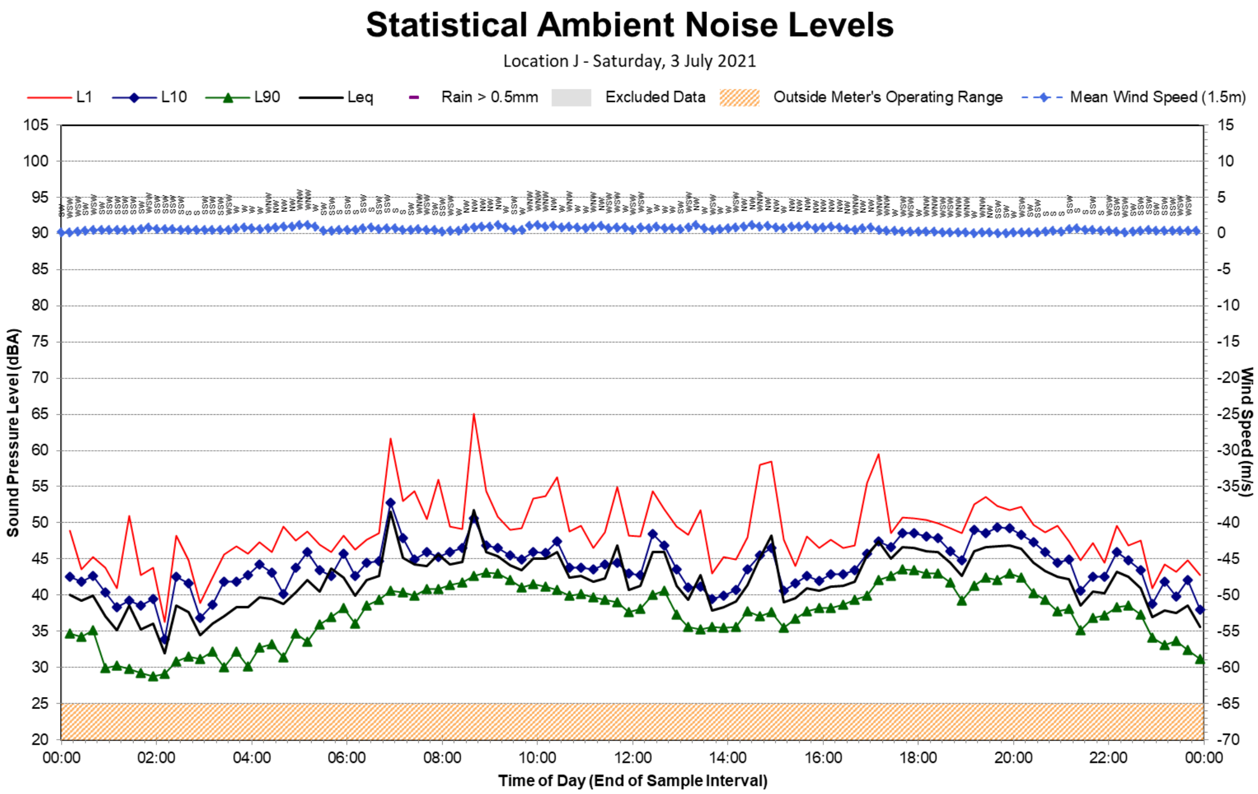
Location J - Thursday, 1 July 2021

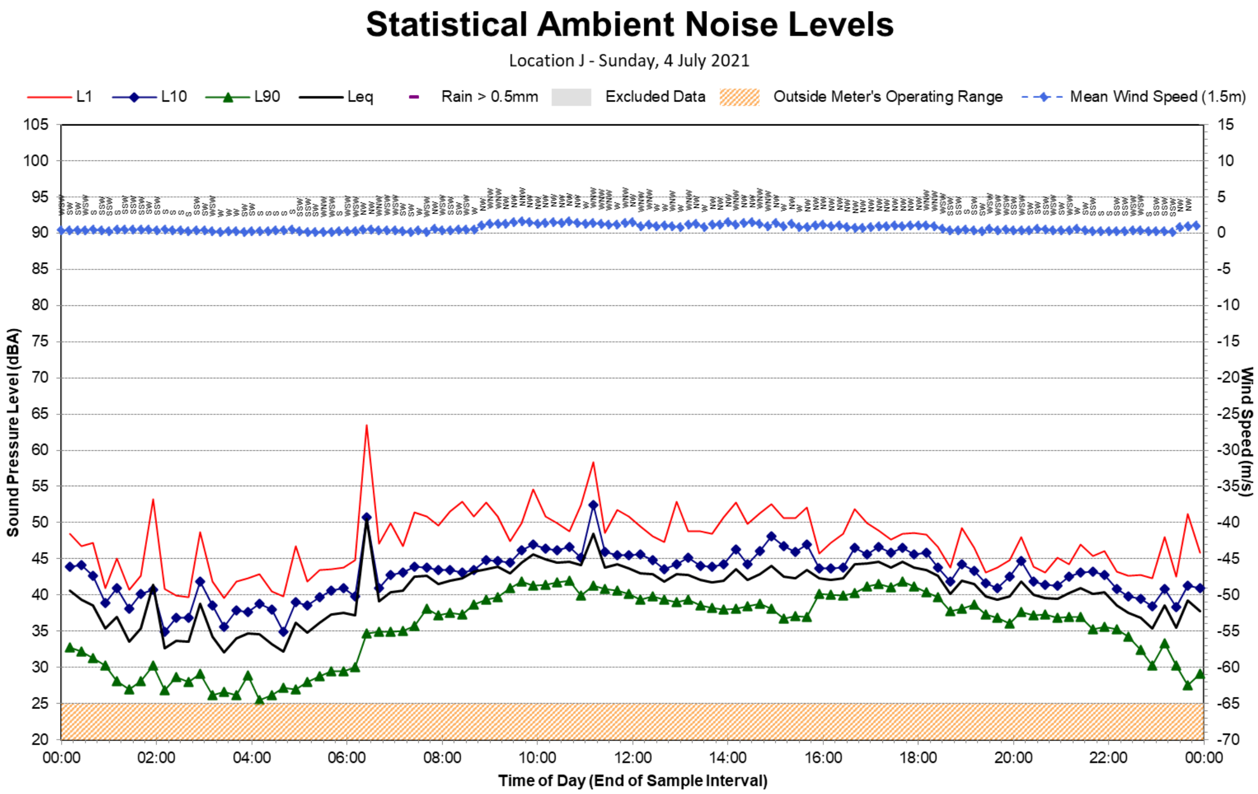


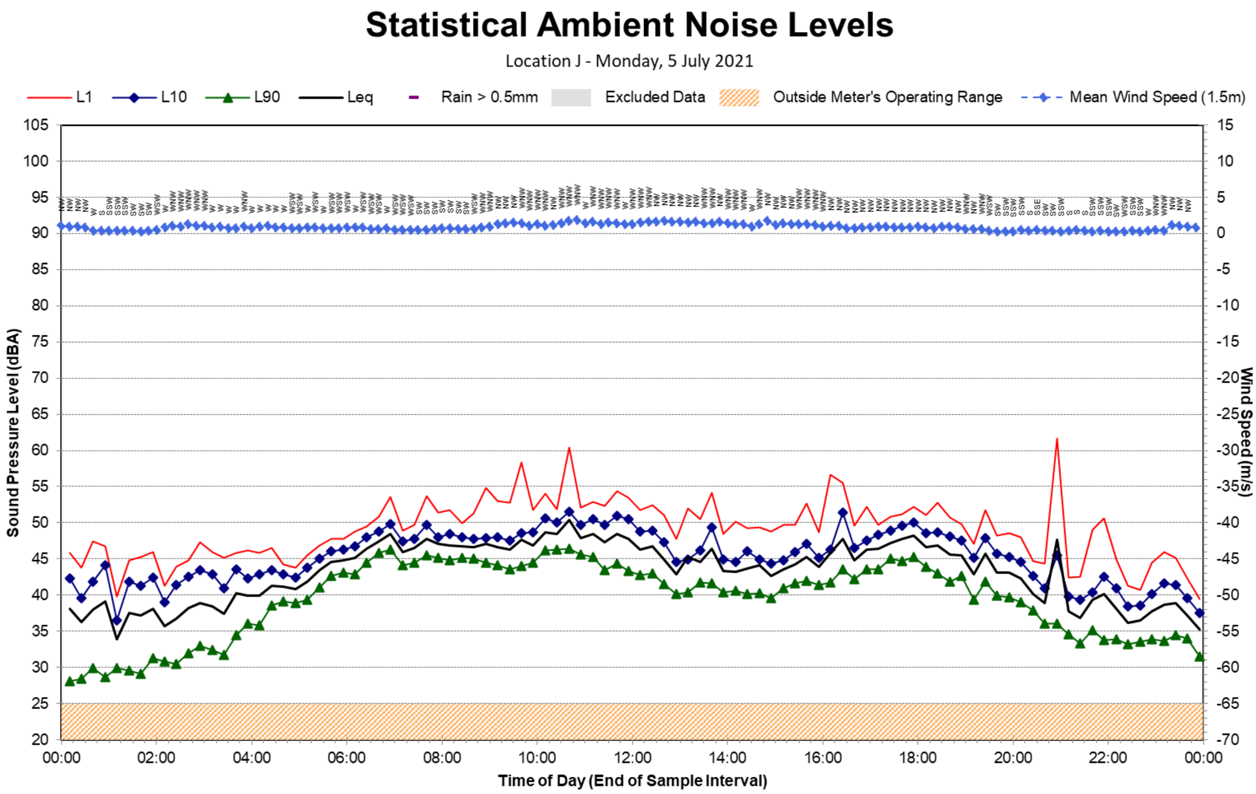
Statistical Ambient Noise Levels

Location J - Friday, 2 July 2021

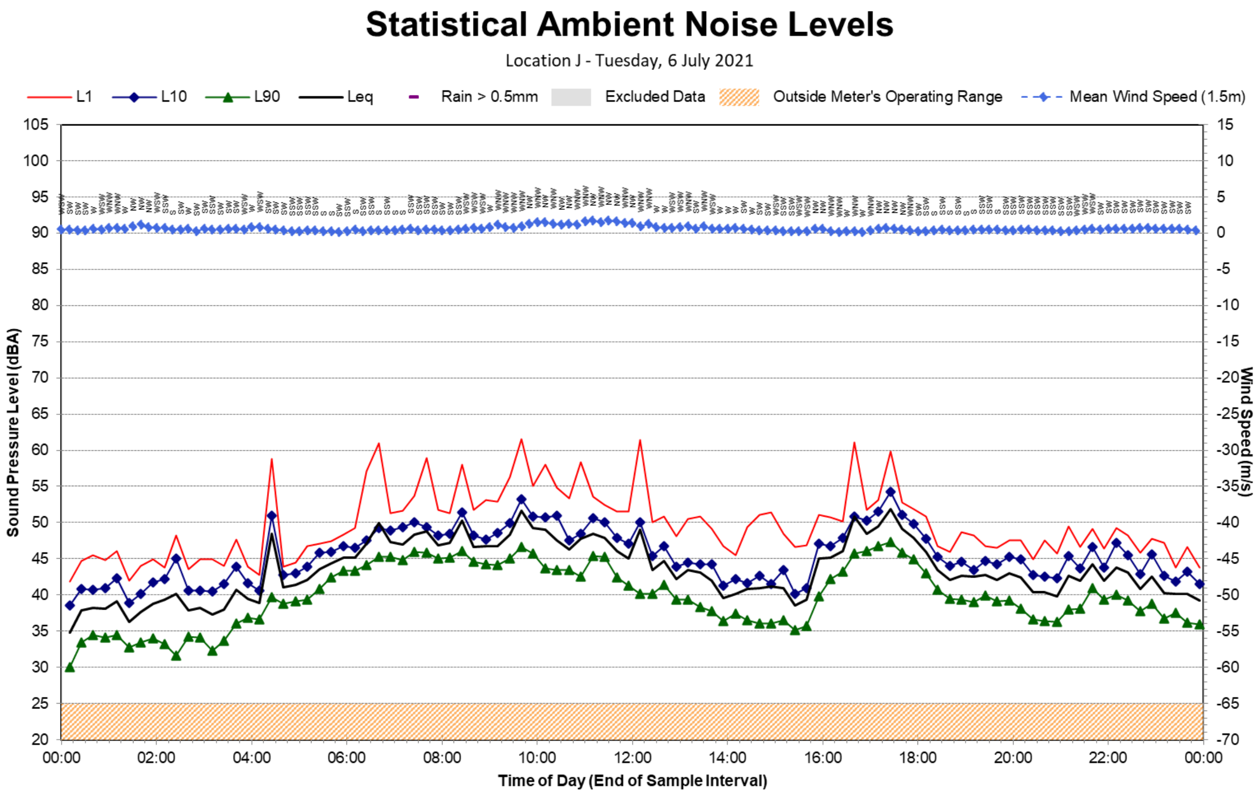



Statistical Ambient Noise Levels
Location J - Saturday, 3 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Sunday, 4 July 2021
L1
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)



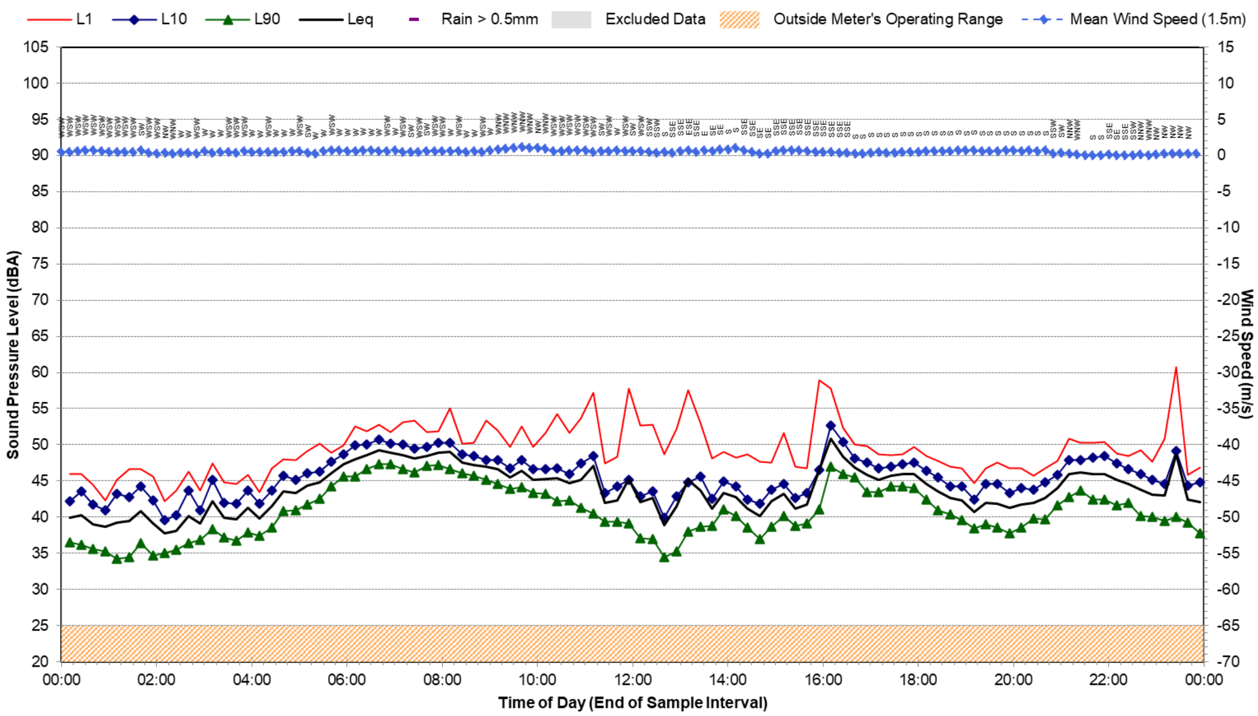
Statistical Ambient Noise Levels
Location J - Monday, 5 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
Location J - Tuesday, 6 July 2021
L1
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)

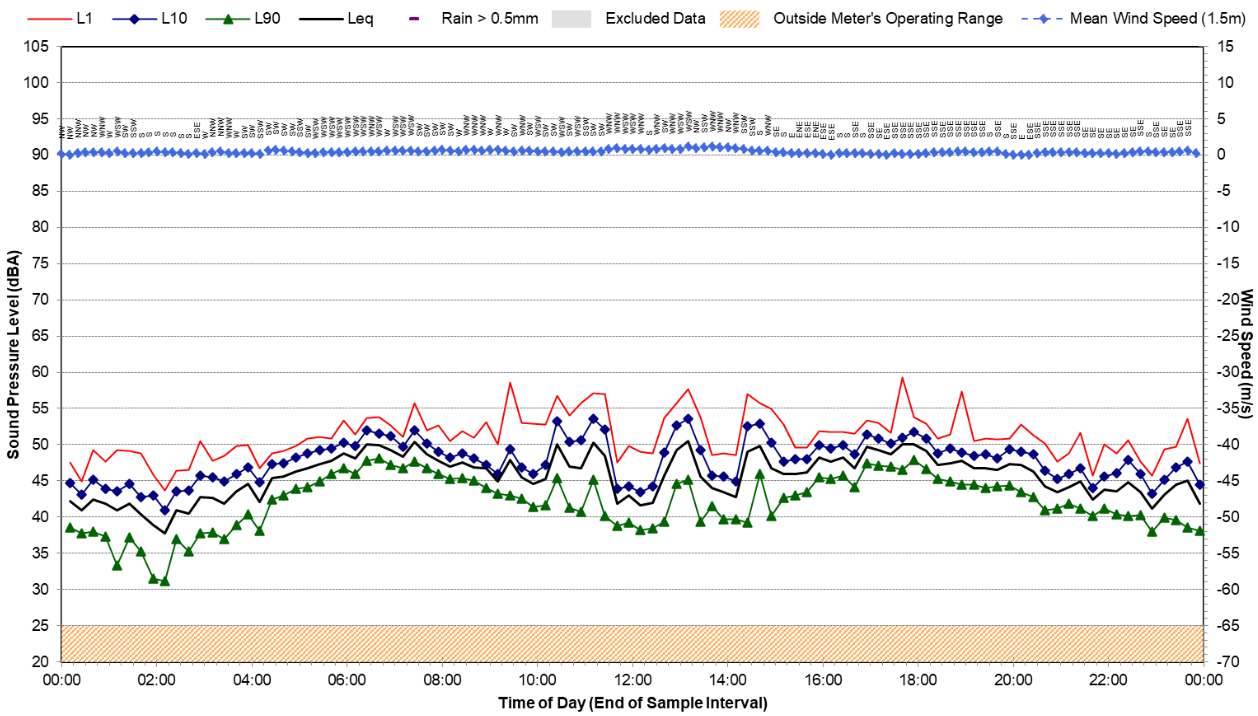
Statistical Ambient Noise Levels

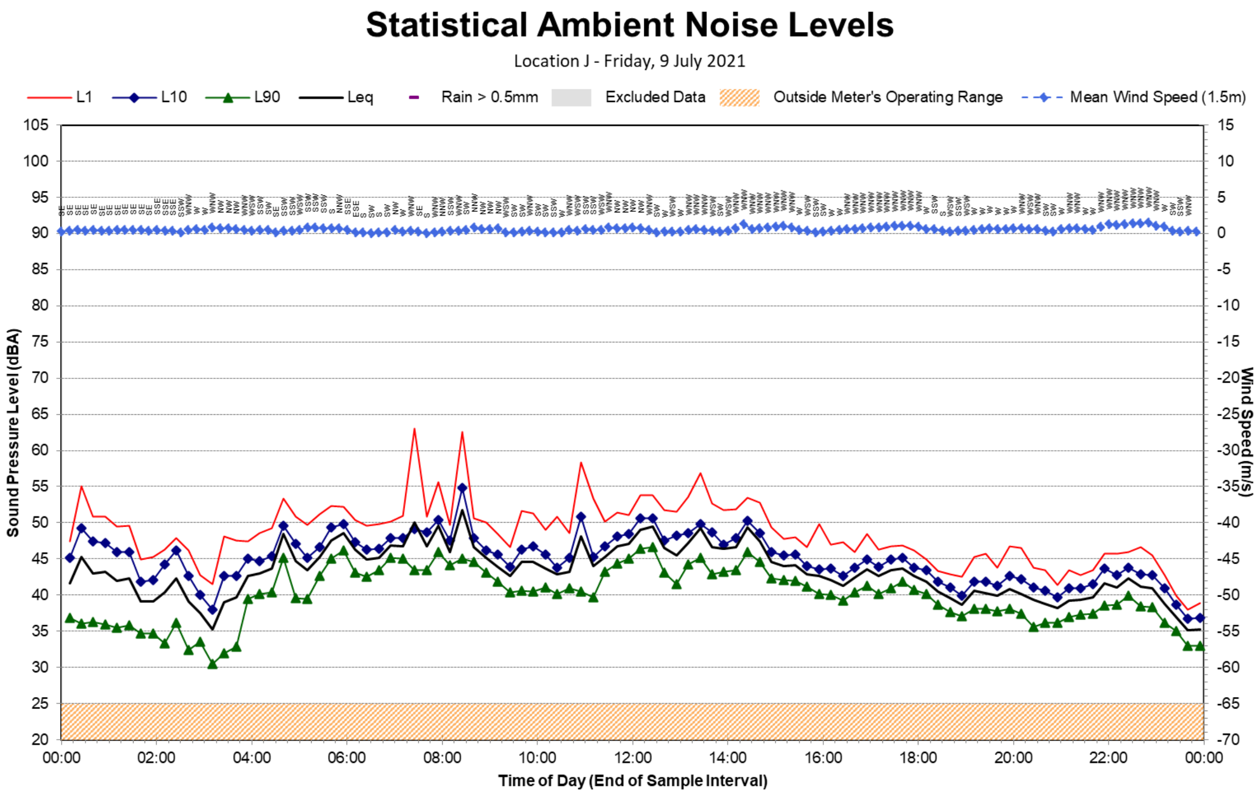
Location J - Wednesday, 7 July 2021

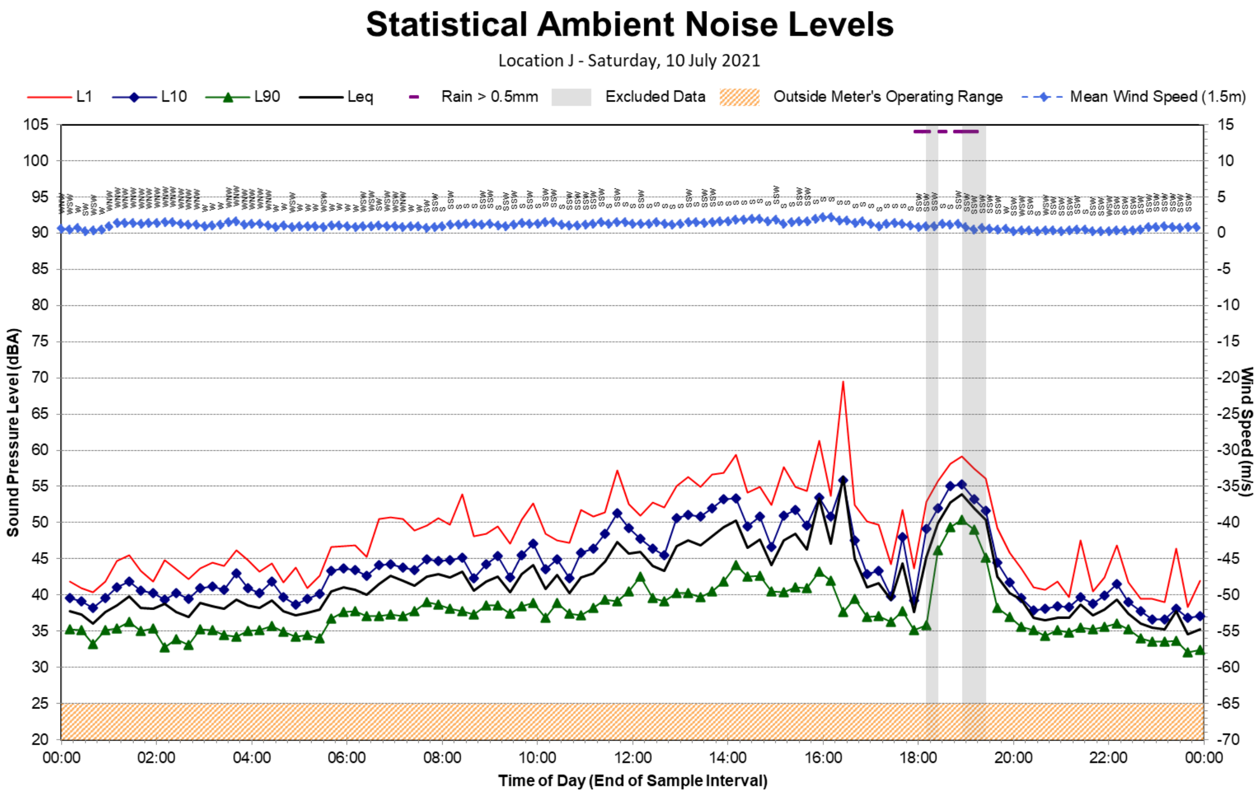


Statistical Ambient Noise Levels

Location J - Thursday, 8 July 2021

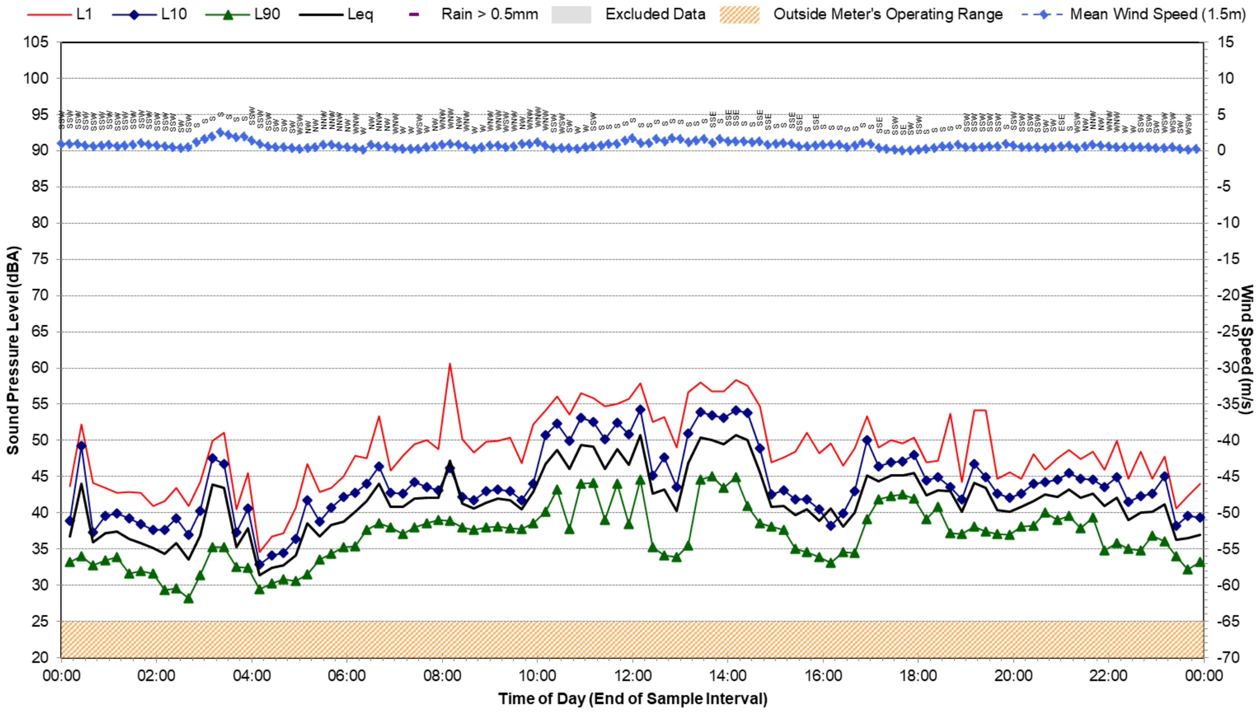



Statistical Ambient Noise Levels
Location J - Friday, 9 July 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location J - Saturday, 10 July 2021
L1
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)

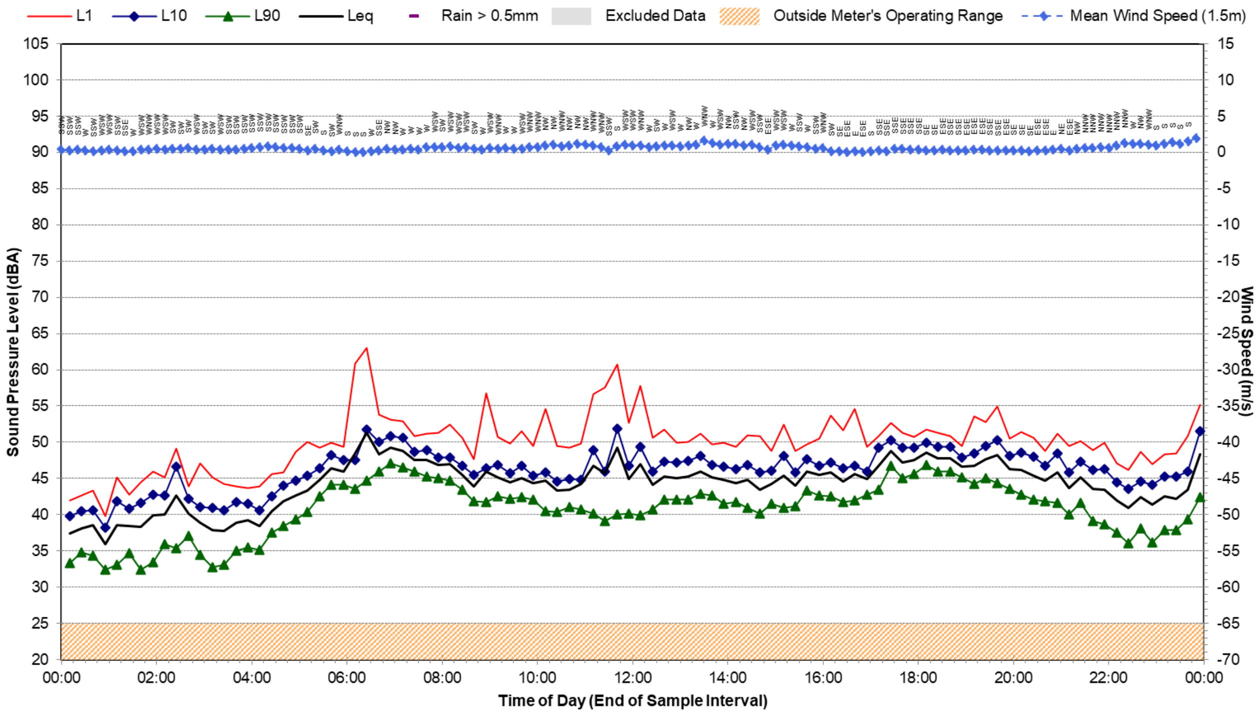
Statistical Ambient Noise Levels

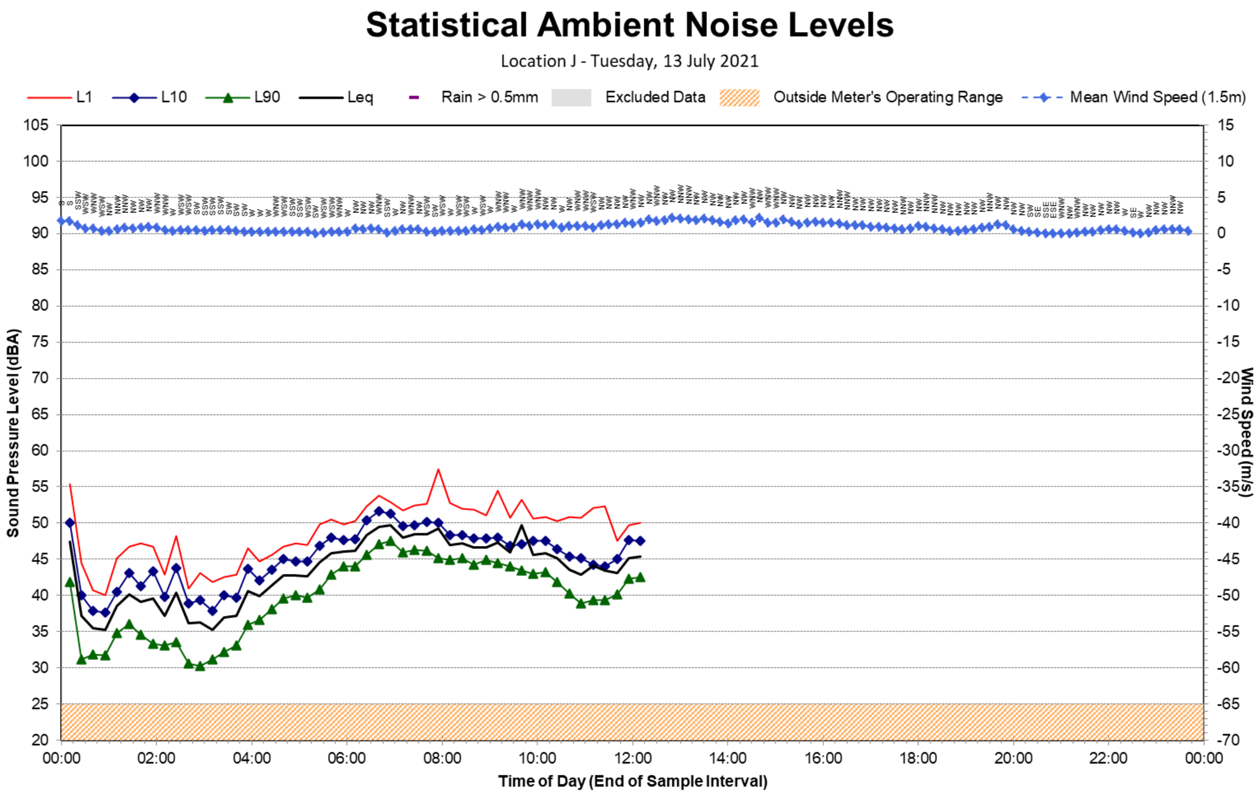
Location J - Sunday, 11 July 2021



Statistical Ambient Noise Levels

Location J - Monday, 12 July 2021




Statistical Ambient Noise Levels
Location J - Tuesday, 13 July 2021
L1
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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DONALDSON AND ABEL COAL MINES

Bi-Annual Noise Monitoring
Half-year Ending December 2021

Prepared for:

Donaldson Coal Pty Ltd
PO Box 675
Green Hills 2320

SLR Ref: 630.01053-R01
Version No: -v1.0
February 2022

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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	25 February 2022	Martin Davenport	Shannon Harvey	Martin Davenport

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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 2021 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* *Saturday*	*7 am to 6 pm* *8 am to 1 pm*
Mining operations, including mining, haulage of waste to dumps and coal processing	*Monday to Friday* *Saturday, Sunday*	*24 hours per day* *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	
		$L_{Aeq(15minute)}$	$L_{Aeq(15minute)}$	$L_{Aeq(15minute)}$	$L_{A1(1minute)}$
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
		LAeq(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*
	LAeq(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*
	LAeq(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 – 2004 *Electroacoustics—Sound level meters – Specifications*, AS IEC 61672.2-2004, AS IEC 61672.3-2004 and carried current NATA or manufacturer calibration certificates. Certificates for acoustic instrumentation used during the December 2021 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 2021 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 Monday 13 December 2021 to Thursday 30 December 2021 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 during the evening period on Monday 13 December 2021, the night period during Monday 13 December 2021 and Tuesday 14 December 2021, and the daytime period on Thursday 23 December 2021. 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	23/12/2021 12:20 21°C 0.7 m/s S	75	68	56	41	55	Birdsong 45-63 Road traffic 40-75 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	13/12/2021 19:02 20°C 1.3 m/s SE	73	58	48	38	49	Road traffic 39-73 Birdsong 42-61 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	13/12/2021 22:31 16°C 0.7 m/s S	58	50	49	46	47	Insects 44-53 Road traffic 40-47 Birdsong 58 **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	23/12/2021 12:42 22°C 0.5 m/s SE	70	63	54	43	52	Road traffic 43-70 Birdsong 40-48 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	13/12/2021 19:21 19°C 1.1 m/s SE	71	61	53	41	51	Insects 38-44 Road traffic 42-71 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	13/12/2021 22:51 16°C 1 m/s S	64	56	50	43	48	Road traffic 30-63 Insects 42-50 Bats 64 **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	23/12/2021 14:04 23°C 0.6 m/s SSE	62	56	51	44	49	Road traffic 40-55 Insects 32-35 Birdsong 42-62 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	13/12/2021 20:25 16°C 0.6 m/s S	73	67	54	43	48	Road traffic 40-48 Insects 43-47 Birdsong 52-73 Other industry 33-44 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	14/12/2021 00:15 16°C 0.4 m/s SW	49	47	44	37	41	Road traffic 35-49 Insects 36-46 **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	23/12/2021 14:53 22°C 1 m/s ESE	75	63	48	37	51	Road traffic 36-75 Birdsong 41-57 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	13/12/2021 21:15 16°C 0.6 m/s SSE	59	49	46	42	44	Traffic 40-59 Insects 40-49 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	14/12/2021 01:06 16°C 0.4 m/s SSW	48	43	40	35	38	Traffic 30-36 Insects/Frogs 35-45 Dog barking 48 **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	23/12/2021 15:17 23°C 0.9 m/s SE	68	60	51	41	49	Road traffic 40-47 Insects 35-41 Birdsong 46-68 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	13/12/2021 21:45 16°C 0.2 m/s SSE	50	47	45	39	43	Insects 39-50 Road traffic 35-45 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	13/12/2021 22:02 16°C 0.7 m/s S	50	48	46	39	43	Insects 40-50 Road traffic 35-44 **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	23/12/2021 14:32 22°C 0.8 m/s S	73	65	50	35	51	Road traffic 40-73 Birdsong 46-60 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Evening	13/12/2021 20:53 17°C 0.6 m/s SSE	72	60	42	34	47	Road traffic 40-72 Residential noise 42-50 Insects 34-39 Other industry 25-32 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution Inaudible					
Night	14/12/2021 00:44 17°C 0.3 m/s SW	68	43	35	31	40	Road traffic 42-68 Insects 30-35 **Abel Mine Inaudible**
		Estimated Abel Mine Noise Contribution 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 and stockpile area were inaudible during all 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 '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	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	Inaudible	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 Bloomfield $L_{A1(1minute)}$ 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 Monday 13 December 2021 to Thursday 30 December 2021 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	ARL 316 16-306-044	23/12/2021 to 30/12/2021
F – Black Hill Road, Black Hill	ARL 316 16-306-044	13/12/2021 to 23/12/2021
G – Buchanan Road, Buchanan	ARL 316 16-306-047	13/12/2021 to 23/12/2021
I – Magnetic Drive, Ashtonfield	ARL EL316 16-306-040	23/12/2021 to 30/12/2021
L – 65 Tipperary Dr, Ashtonfield	ARL 316 16-306-047	23/12/2021 to 30/12/2021
J – Parish Drive, Thornton	ARL 316 16-207-043	23/12/2021 to 30/12/2021

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 a technical logger error no data is available for Location J.

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 Black Hill School, Black Hill	Day	64	53	36	53
	Evening	59	48	37	53
	Night	51	48	35	47
F Lot 684 Black Hill Road, Black Hill	Day	74	56	43	61
	Evening	61	52	40	53
	Night	57	51	36	53
G 156 Buchanan Road, Buchanan	Day	56	48	39	49
	Evening	51	46	37	46
	Night	45	41	31	46
I 49 Magnetic Drive, Ashtonfield	Day	59	49	38	51
	Evening	58	48	38	61
	Night	52	48	40	49
L 65 Tipperary Dr, Ashtonfield	Day	58	46	32	48
	Evening	58	47	32	49
	Night	48	40	30	44

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

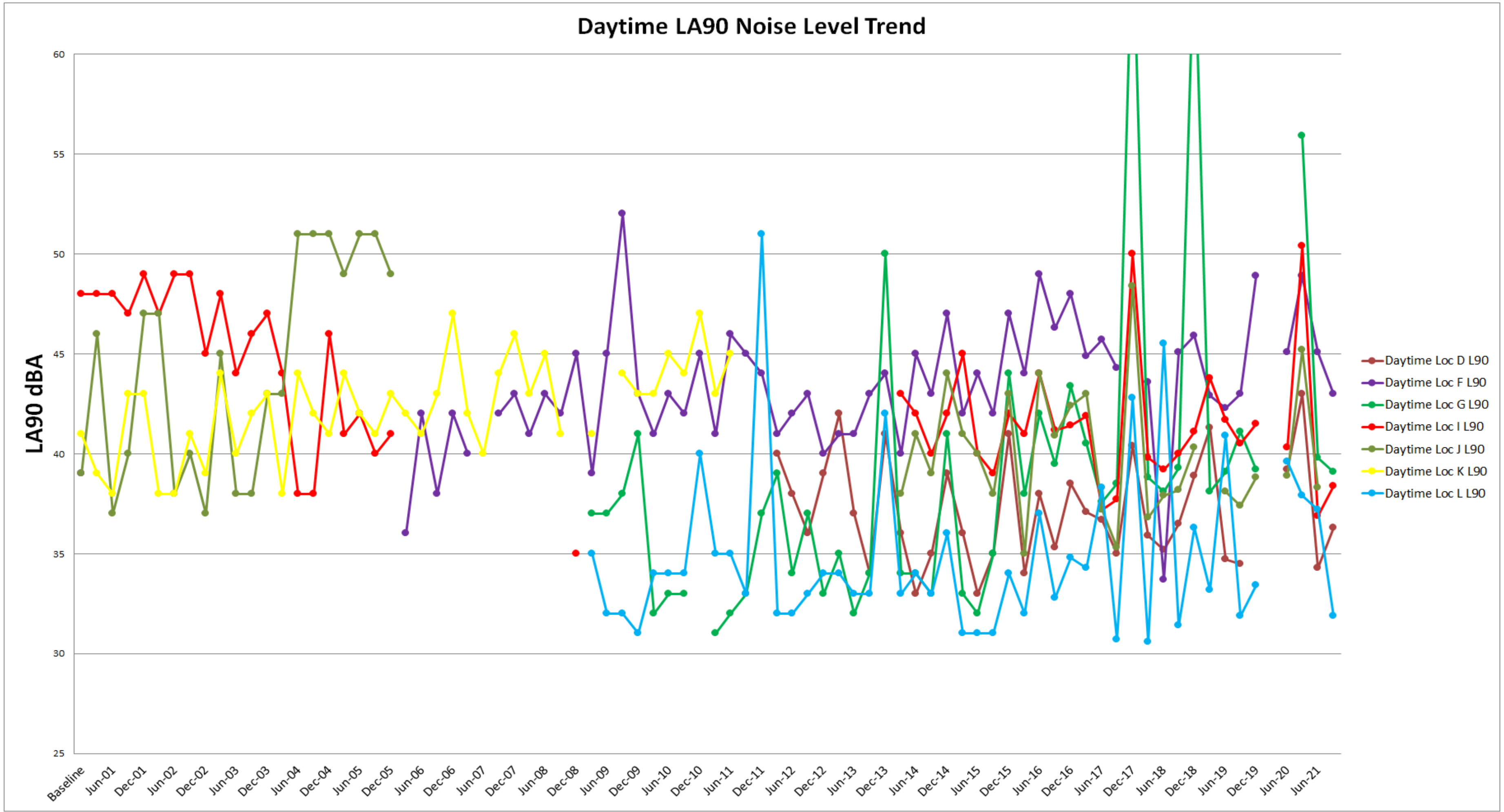


Figure 2 Long Term Evening LA90 Noise Levels

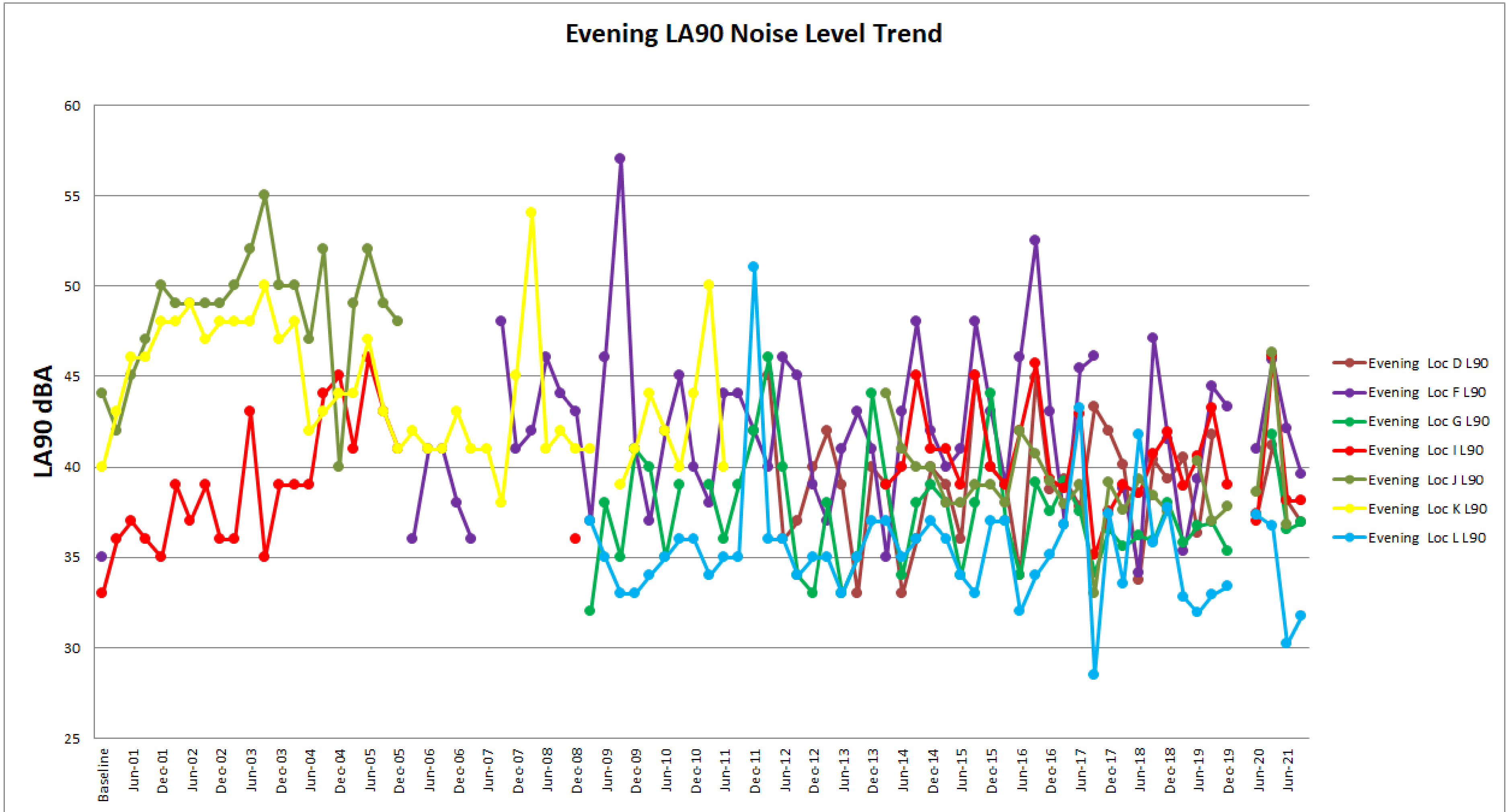
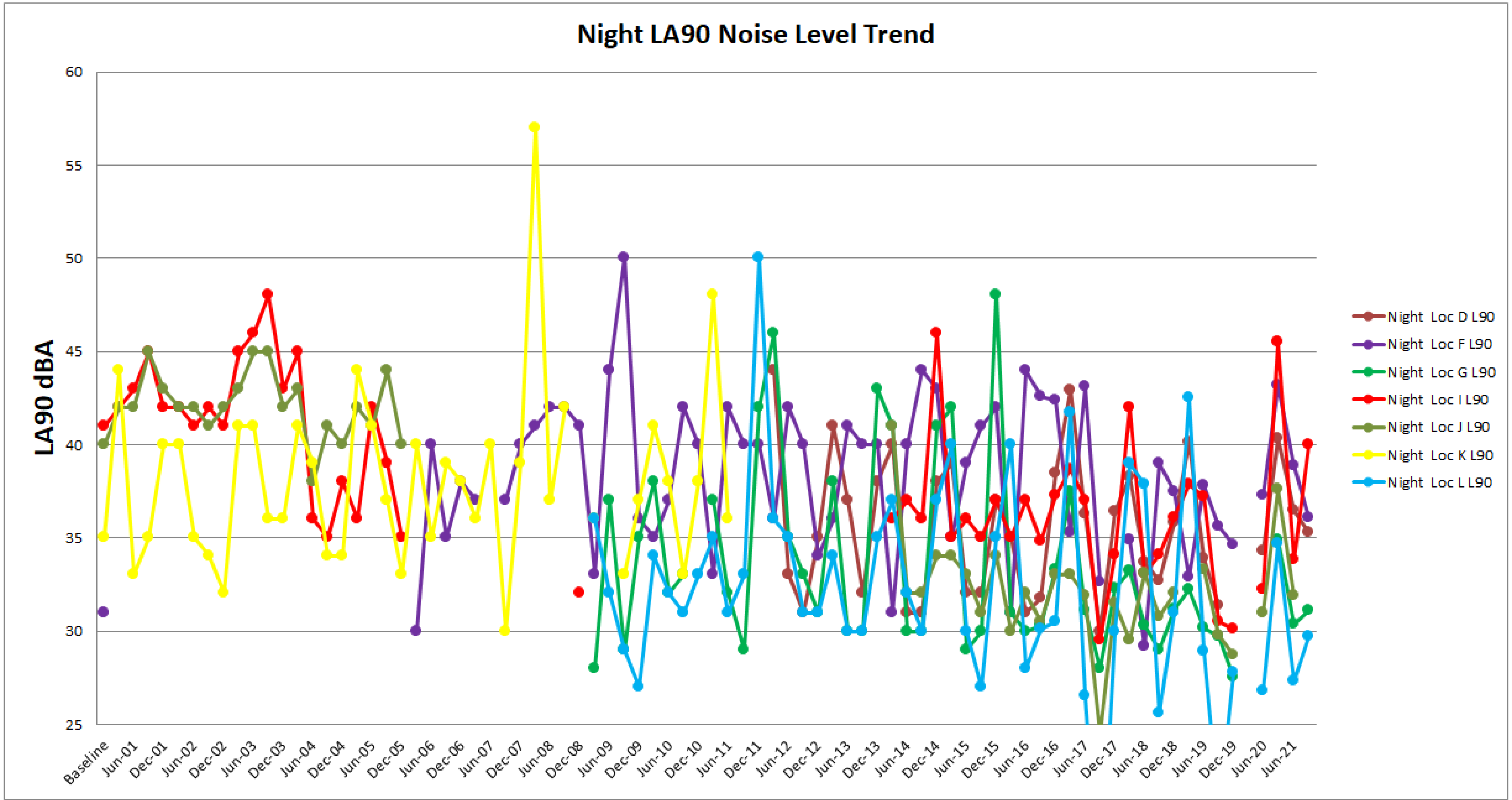


Figure 3 Long Term Night-time LA90 Noise Levels



5.2.1.1 Baseline

The summary of results in **Table 12** shows the ambient 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	**December 2021**	
D Black Hill School, Black Hill	Day	N/A[2]	36	N/A[2]
	Evening	N/A[2]	37	N/A[2]
	Night	N/A[2]	35	N/A[2]
F Lot 684 Black Hill Road, Black Hill	Day	39	43	4
	Evening	35	40	5
	Night	31	36	5
G 156 Buchanan Road, Buchanan	Day	N/A[2]	39	N/A[2]
	Evening	N/A[2]	37	N/A[2]
	Night	N/A[2]	31	N/A[2]
I 49 Magnetic Drive, Ashtonfield	Day	48	38	-10
	Evening	33	38	5
	Night	41	40	-1
L 65 Tipperary Drive, Ashtonfield	Day	N/A[2]	32	N/A[2]
	Evening	N/A[2]	32	N/A[2]
	Night	N/A[2]	30	N/A[2]
J 220 Parish Drive, Thornton	Day	39	-	-[4]
	Evening	44	-	-[4]
	Night	40	-	-[4]

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 for Location J for December 2021.

5.2.1.2 Previous Half-year

Table 13 presents the ambient L_{A10} 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]
		July 2021	**December 2021**	
D Black Hill School, Black Hill	Day	43	36	2
	Evening	41	37	-1
	Night	40	35	-1
F Lot 684 Black Hill Road, Black Hill	Day	49	43	-2
	Evening	46	40	-3
	Night	43	36	-3
G 156 Buchanan Road, Buchanan	Day	56	39	-1
	Evening	42	37	0
	Night	35	31	1
I 49 Magnetic Drive, Ashtonfield	Day	50	38	2
	Evening	46	38	0
	Night	46	40	6
L 65 Tipperary Drive, Ashtonfield	Day	38	32	-5
	Evening	37	32	2
	Night	35	30	2
J 220 Parish Drive, Thornton	Day	45	-	-[3]
	Evening	46	-	-[3]
	Night	38	-	-[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 for Location J for December 2021.

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 2020	**December 2021**	
D Black Hill School, Black Hill	Day	39	36	-7
	Evening	37	37	-4
	Night	34	35	-5
F Lot 684 Black Hill Road, Black Hill	Day	45	43	-6
	Evening	41	40	-6
	Night	37	36	-7
G 156 Buchanan Road, Buchanan	Day	0	39	-17
	Evening	0	37	-5
	Night	0	31	-4
I 49 Magnetic Drive, Ashtonfield	Day	40	38	-12
	Evening	37	38	-8
	Night	32	40	-6
L 65 Tipperary Drive, Ashtonfield	Day	40	32	-6
	Evening	37	32	-5
	Night	27	30	-5
J 220 Parish Drive, Thornton	Day	39	-	-[3]
	Evening	39	-	-[3]
	Night	31	-	-[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.

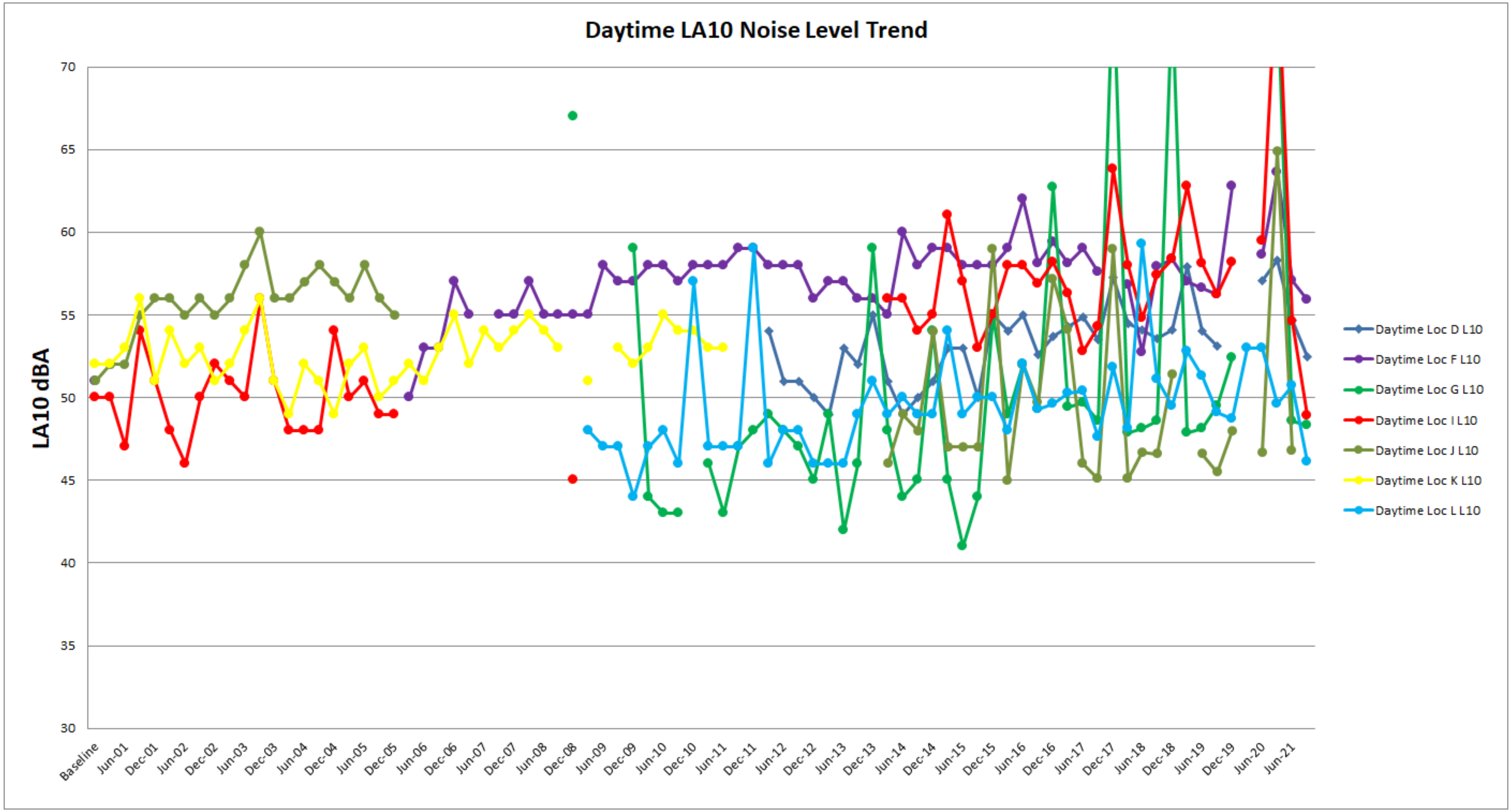
Note 2: Rounded to the nearest whole dB.

Note 3: No data for Location J for December 2021.

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 L_{A10} Noise Levels



SLR

Figure 5 Long term Evening L_{A10} Noise Levels

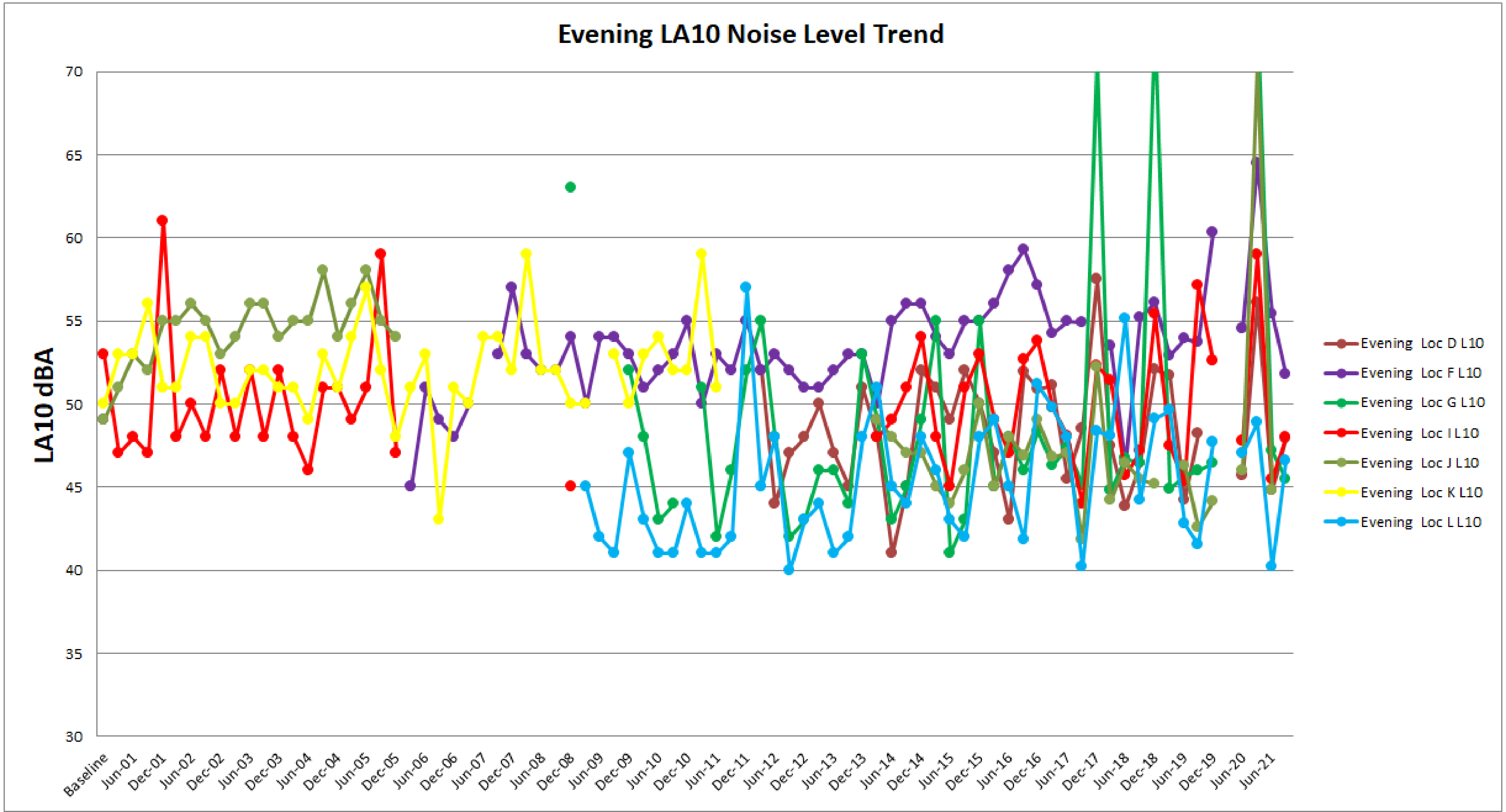
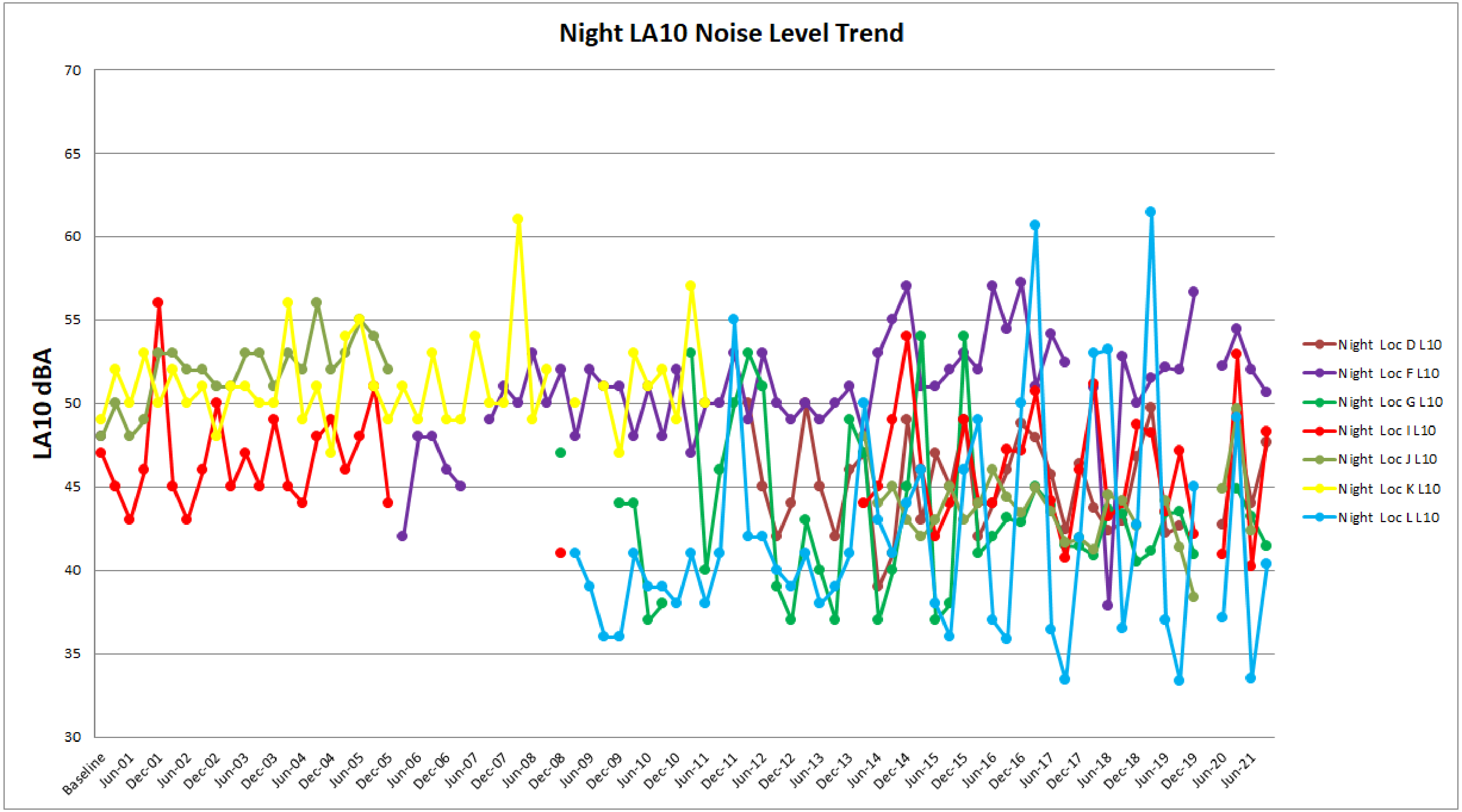


Figure 6 Long term Night LA10 Noise Levels



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	**December 2021**	
D Black Hill School, Black Hill	Day	N/A[2]	53	N/A
	Evening	N/A[2]	48	N/A
	Night	N/A[2]	48	N/A
F Lot 684 Black Hill Road, Black Hill	Day	51	56	5
	Evening	49	52	3
	Night	48	51	3
G 156 Buchanan Road, Buchanan	Day	N/A[2]	48	N/A
	Evening	N/A[2]	46	N/A
	Night	N/A[2]	41	N/A
I 49 Magnetic Drive, Ashtonfield	Day	50	49	-1
	Evening	53	48	-5
	Night	47	48	1
L 65 Tipperary Drive, Ashtonfield	Day	N/A[2]	46	N/A
	Evening	N/A[2]	47	N/A
	Night	N/A[2]	40	N/A
J 220 Parish Drive, Thornton	Day	51	-	-[4]
	Evening	49	-	-[4]
	Night	48	-	-[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 for Location J for December 2021.

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]
		July 2021	**December 2021**	
D Black Hill School, Black Hill	Day	55	53	-2
	Evening	45	48	3
	Night	44	48	4
F Lot 684 Black Hill Road, Black Hill	Day	57	56	-1
	Evening	55	52	-4
	Night	52	51	-1
G 156 Buchanan Road, Buchanan	Day	49	48	0
	Evening	47	46	-2
	Night	43	41	-2
I 49 Magnetic Drive, Ashtonfield	Day	55	49	-6
	Evening	46	48	3
	Night	40	48	8
L 65 Tipperary Drive, Ashtonfield	Day	51	46	-5
	Evening	40	47	6
	Night	34	40	7
J 220 Parish Drive, Thornton	Day	47	-	-[3]
	Evening	45	-	-[3]
	Night	42	-	-[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 for Location J for December 2021.

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 2020	July 2021	
D Black Hill School, Black Hill	Day	58	53	-6
	Evening	56	48	-8
	Night	48	48	-1
F Lot 684 Black Hill Road, Black Hill	Day	64	56	-8
	Evening	65	52	-13
	Night	54	51	-4
G 156 Buchanan Road, Buchanan	Day	75	48	-27
	Evening	74	46	-28
	Night	45	41	-3
I 49 Magnetic Drive, Ashtonfield	Day	77	49	-28
	Evening	59	48	-11
	Night	53	48	-5
L 65 Tipperary Dr, Ashtonfield	Day	50	46	-4
	Evening	49	47	-2
	Night	49	40	-9
J 220 Parish Drive, Thornton	Day	65	-	-[3]
	Evening	71	-	-[3]
	Night	50	-	-[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 for Location J for December 2021.

5.3 Rail Noise Monitoring

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 Decmeber 2021 half at six focus locations surrounding the mine.

Abel portal operations and Bloomfield CHPP operations were not observed to be audible at any locations during the monitoring period. As such contributed noise levels from Abel Mine did not exceed noise emission goals and compliance with the Abel Mine *Project Approval* was indicated at all locations.

A comparison of ambient L_{A10} and L_{A90} noise levels recorded during the current monitoring period (December 2021), the baseline monitoring period, the last monitoring period (July 2021), and the coinciding monitoring period from last year (December 2020) has been conducted.

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.

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

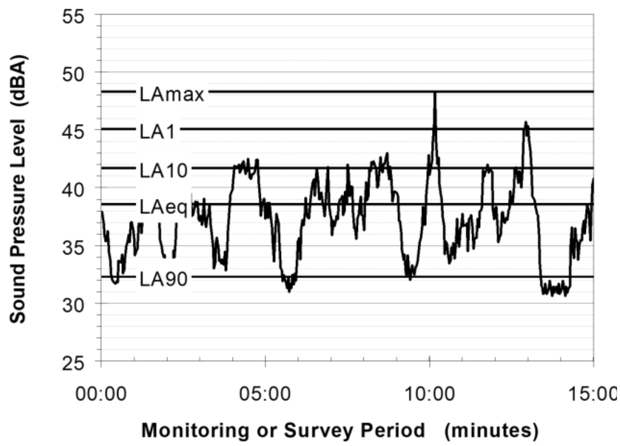
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

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

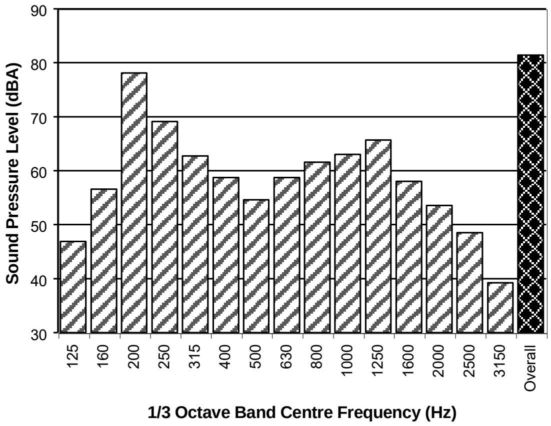
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

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

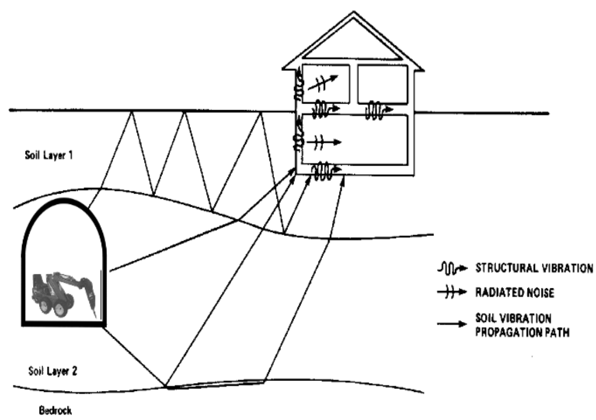
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience 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).

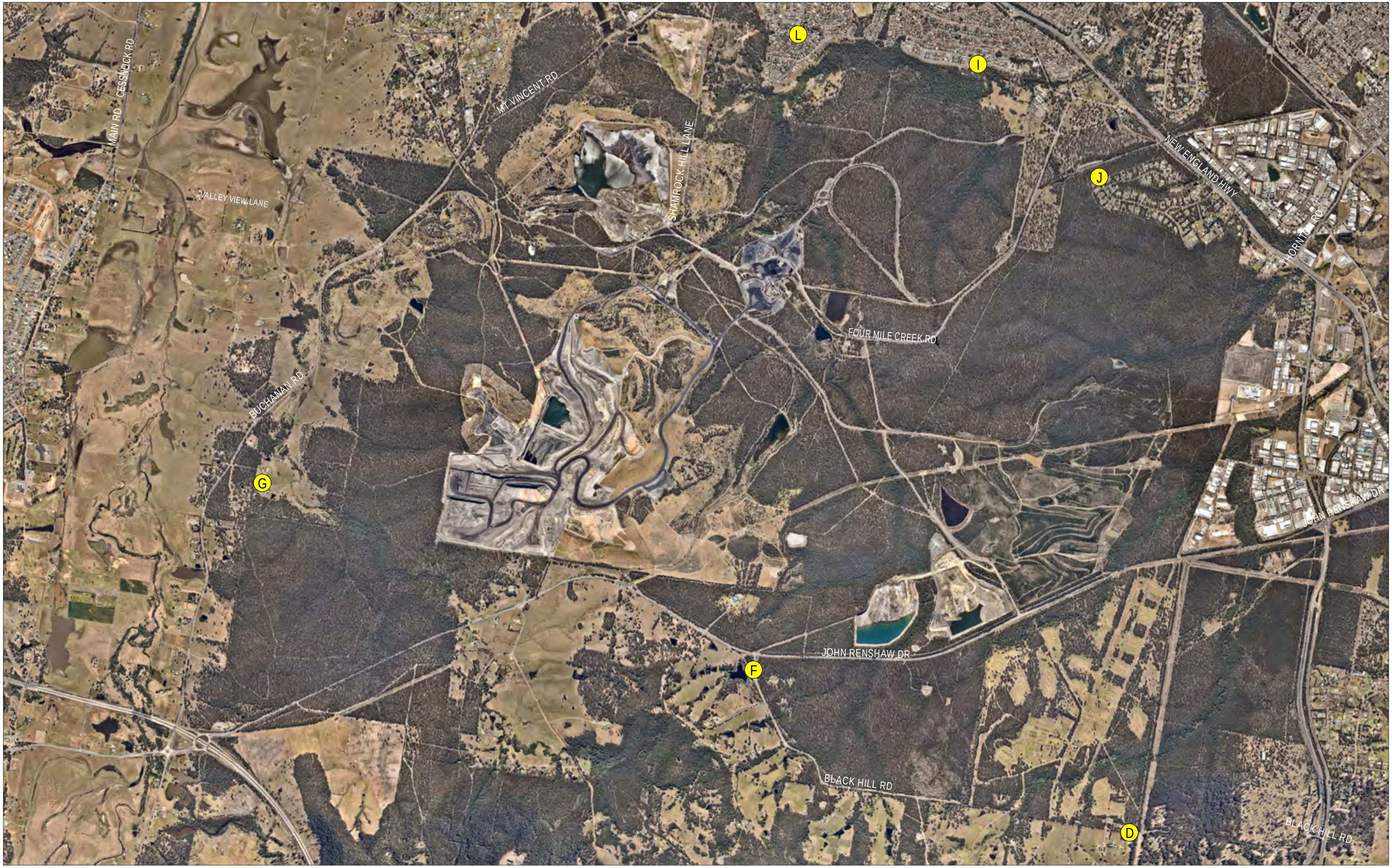
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



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



SLR

10 KINGS ROAD
NEW LAMBTON
NEW SOUTH WALES 2305
AUSTRALIA
T: 61 2 4037 3200
F: 61 2 4037 3201
www.slrconsulting.com

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: 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

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%.

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Lab No. 9262
Acoustic and Vibration Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

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	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.

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

Sound Level Meter

AS 1259.1:1990 - AS 1259.2:1990

Calibration Certificate

Calibration Number C21350

Client Details	SLR Consulting Australia Pty Ltd Unit 5, 21 Parap Road Parap NT 0820
Equipment Tested/ Model Number :	ARL EL-316
Instrument Serial Number :	16-207-043
Microphone Serial Number :	317100
Pre-amplifier Serial Number :	27866

Atmospheric Conditions

Ambient Temperature :	23.6°C
Relative Humidity :	43.6%
Barometric Pressure :	100.74kPa

Calibration Technician :	Jeff Yu	**Secondary Check:**	Max Moore
Calibration Date :	2 Jun 2021	**Report Issue Date :**	21 Jul 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.

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.

Acoustic Research Labs Pty Ltd
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North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter

AS 1259.1:1990 - AS 1259.2:1990

Calibration Certificate

Calibration Number C20409

Client Details SLR Consulting Australia Pty Ltd
5/21 Parap Road
Darwin NT 0820

Equipment Tested/ Model Number : ARL EL-316
Instrument Serial Number : 16-306-040
Microphone Serial Number : 322287
Pre-amplifier Serial Number : 28089

Atmospheric Conditions
Ambient Temperature : 22.7°C
Relative Humidity : 40.8%
Barometric Pressure : 100.8kPa

Calibration Technician : Lucky Jaiswal **Secondary Check:** Max Moore
Calibration Date : 20 Jul 2020 **Report Issue Date :** 4 Aug 2020

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	*±0.14dB*	*Temperature*	*±0.2°C*
12.5kHz	*±0.16dB*	*Relative Humidity*	*±2.4%*
16kHz	*±0.22dB*	*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.

NATA
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Acoustic Research Labs Pty Ltd
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North Rocks NSW AUSTRALIA 2151
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www.acousticresearch.com.au

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

Calibration Number C21135

Client Details SLR Consulting Australia Pty Ltd
5/21 Parap Road
Darwin NT 0820

Equipment Tested/ Model Number : ARL EL-316
Instrument Serial Number : 16-306-044
Microphone Serial Number : 312214
Pre-amplifier Serial Number : 27454

Atmospheric Conditions
Ambient Temperature : 23.2°C
Relative Humidity : 57.7%
Barometric Pressure : 101.01kPa

Calibration Technician : Lucky Jaiswal
Calibration Date : 11 Mar 2021
Secondary Check: Max Moore
Report Issue Date : 16 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.

NATA
WORLD RECOGNISED ACCREDITATION

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

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Acoustic Research Labs Pty Ltd
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Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

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

Calibration Number C21351

Client Details	SLR Consulting Australia Pty Ltd Unit 5, 21 Parap Rd Darwin NT 0820
Equipment Tested/ Model Number :	ARL EL-316
Instrument Serial Number :	16-306-047
Microphone Serial Number :	322778
Pre-amplifier Serial Number :	28143

Atmospheric Conditions

Ambient Temperature :	22.7°C
Relative Humidity :	36.6%
Barometric Pressure :	100.5kPa

Calibration Technician :	Lucky Jaiswal	**Secondary Check:**	Max Moore
Calibration Date :	19 Jul 2021	**Report Issue Date :**	21 Jul 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.

NATA
WORLD RECOGNISED ACCREDITATION

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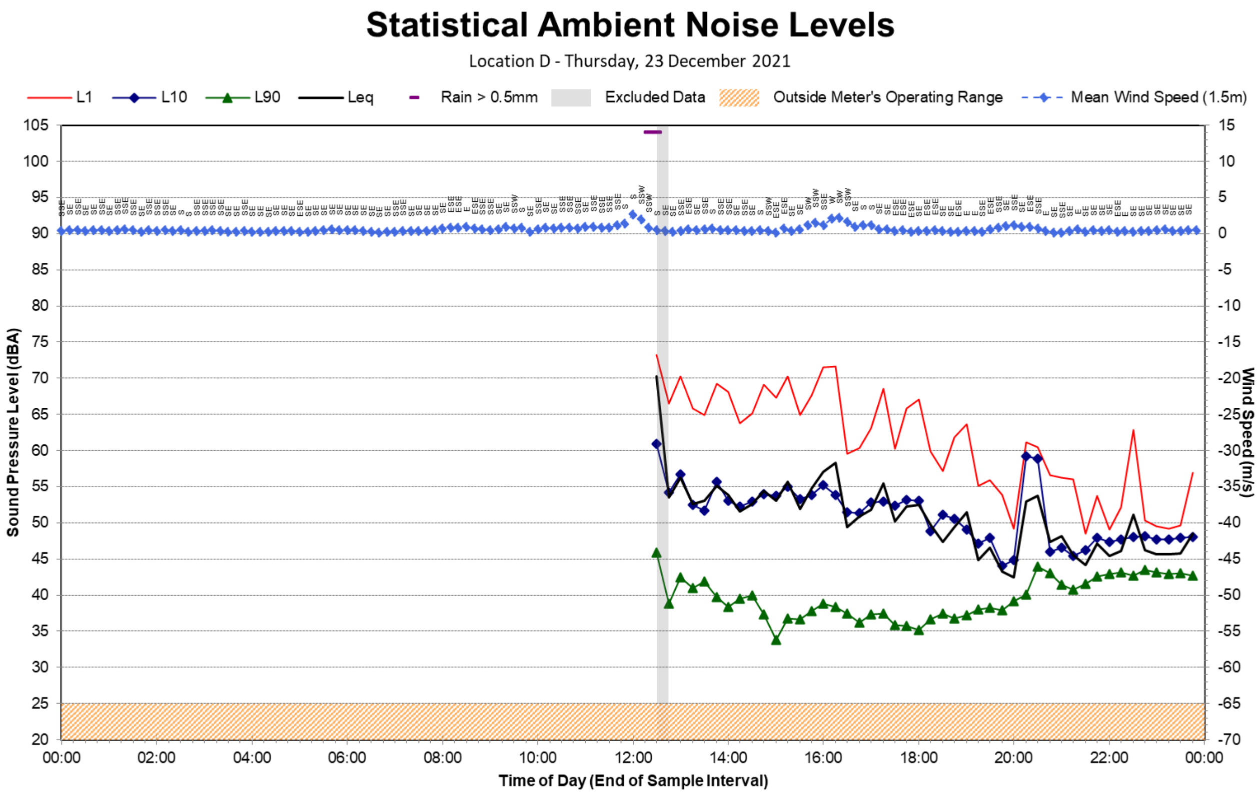
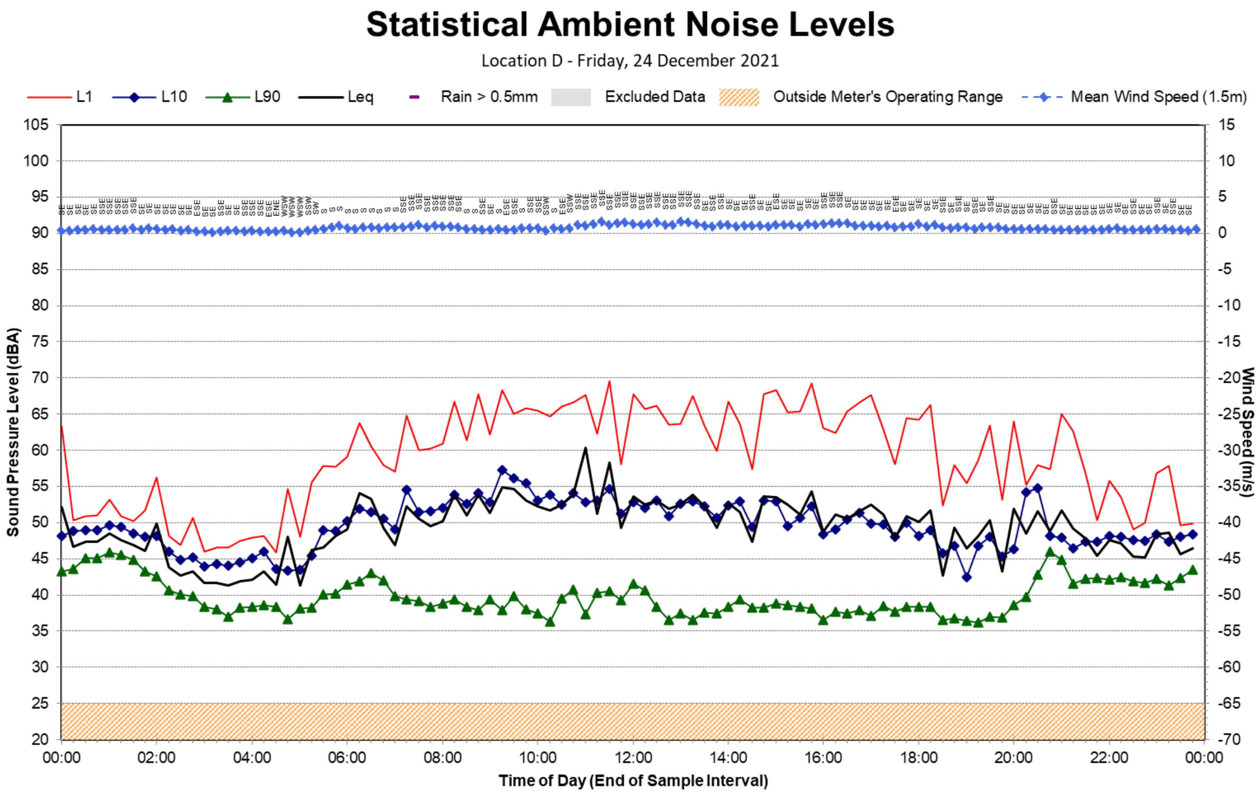
APPENDIX D

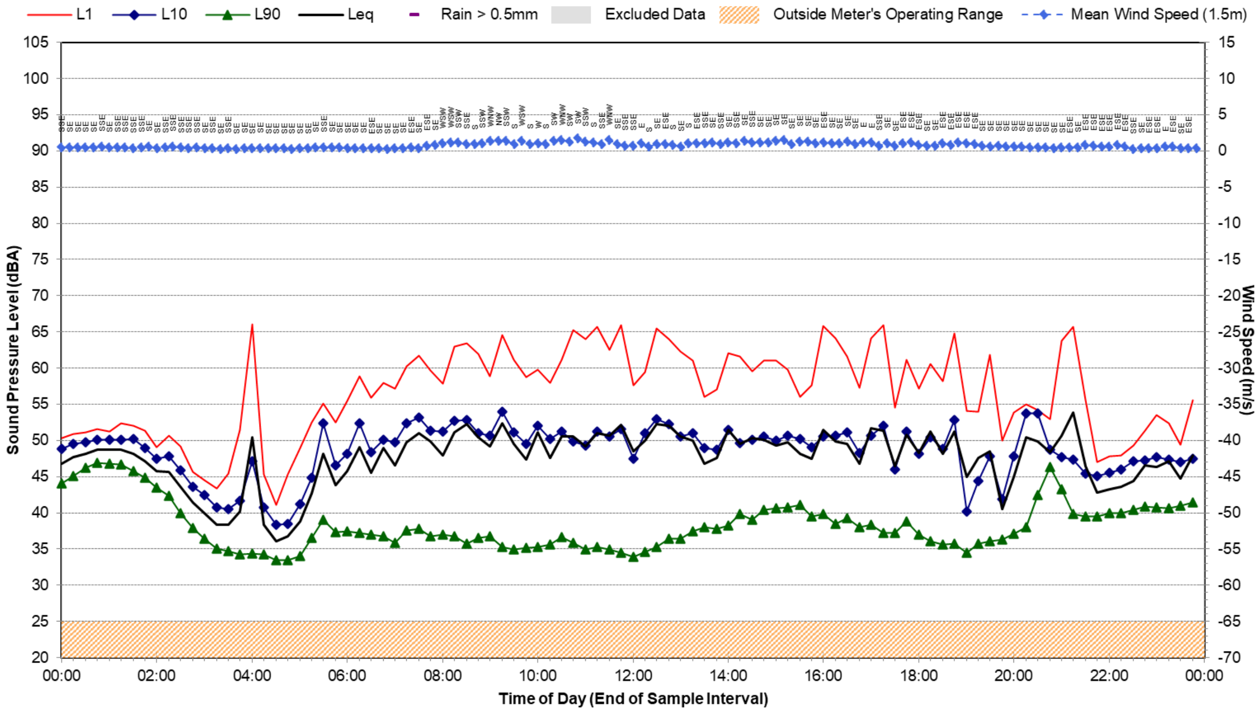
Statistical Ambient Noise Levels


Statistical Ambient Noise Levels
Location D - Thursday, 23 December 2021
L1
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, 24 December 2021
L1
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)

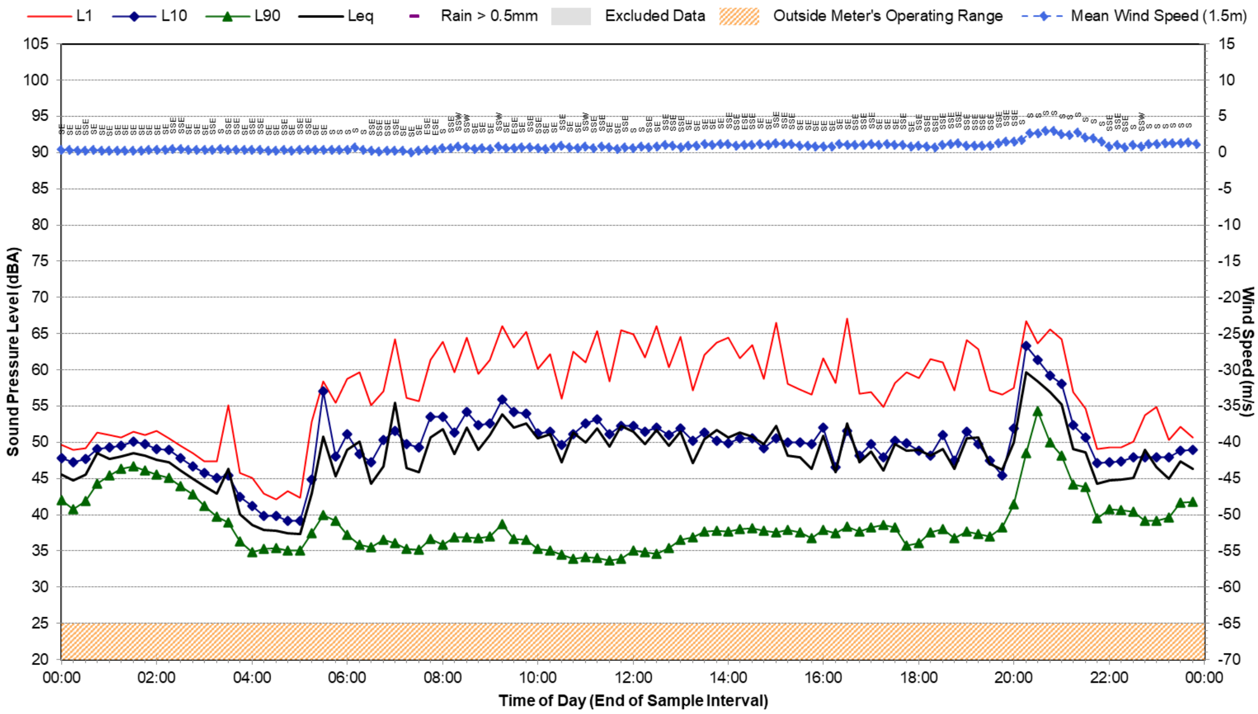
Statistical Ambient Noise Levels

Location D - Saturday, 25 December 2021



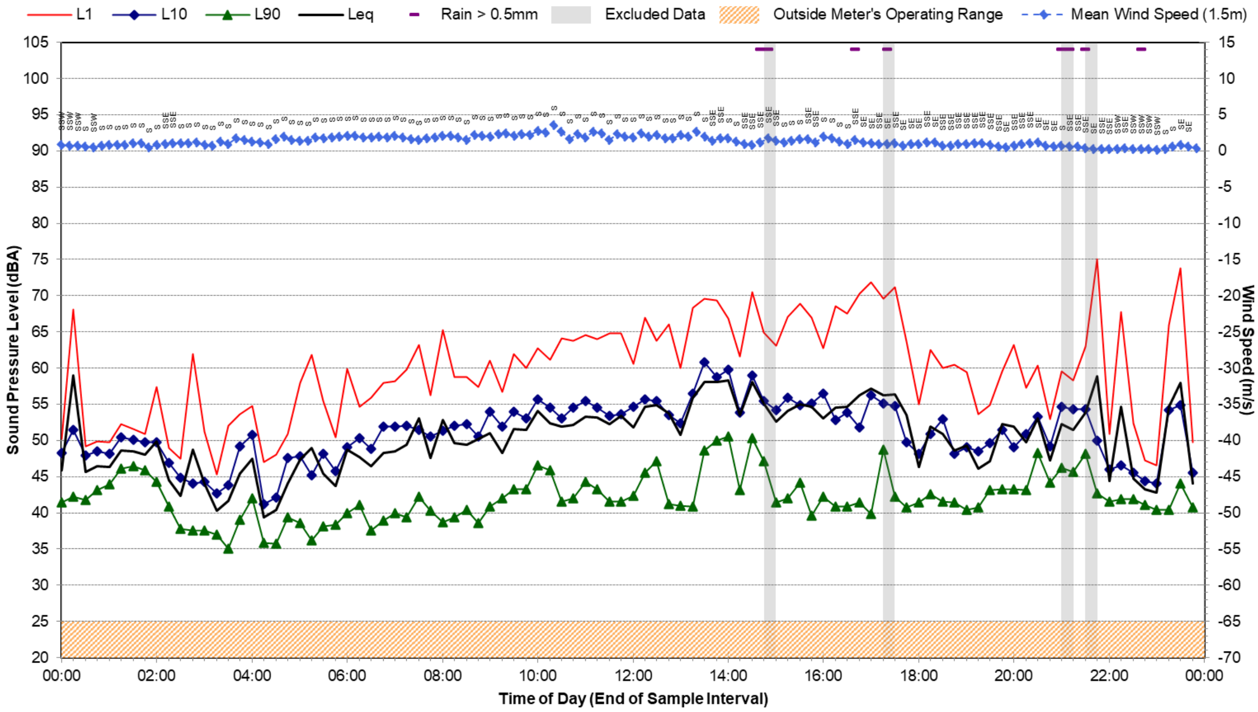
Statistical Ambient Noise Levels

Location D - Sunday, 26 December 2021



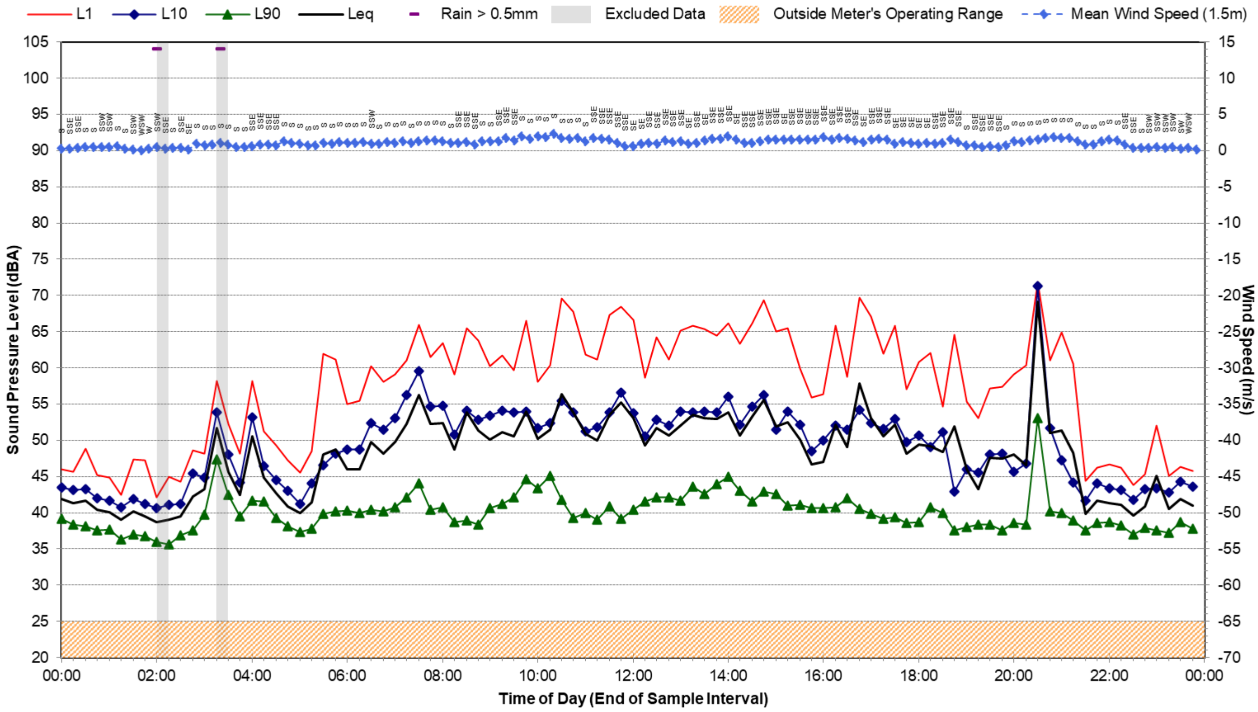
Statistical Ambient Noise Levels

Location D - Monday, 27 December 2021



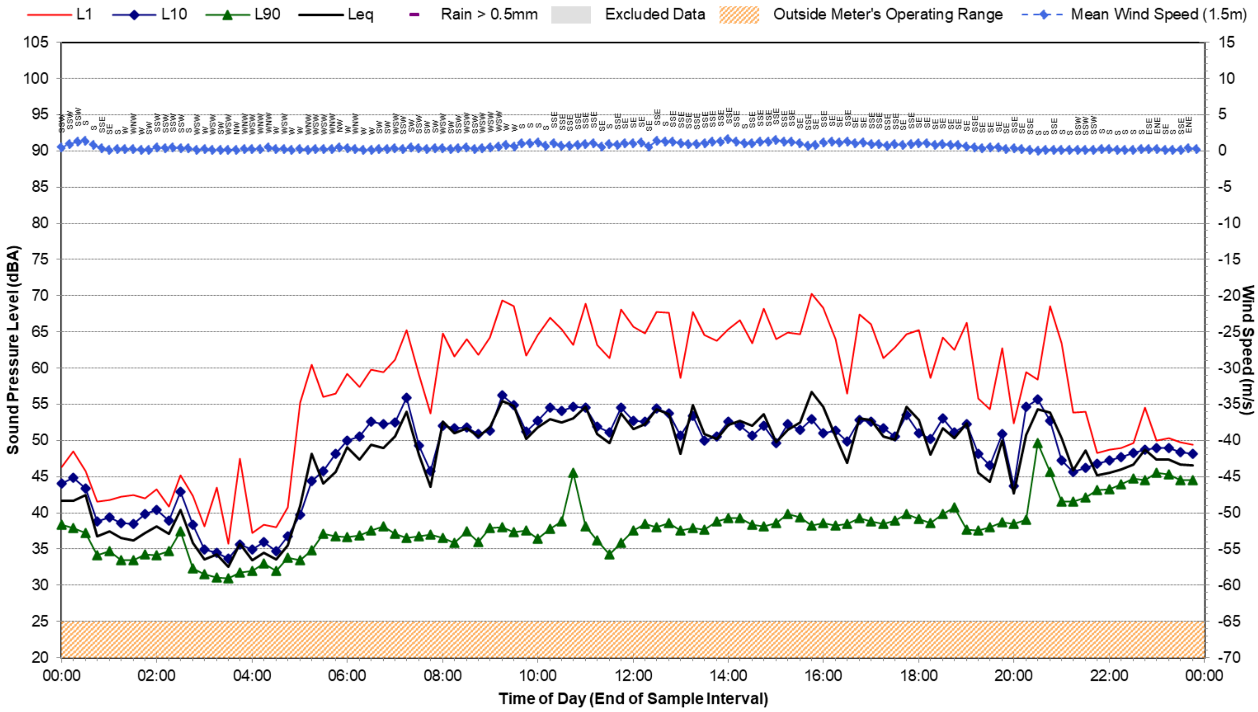
Statistical Ambient Noise Levels

Location D - Tuesday, 28 December 2021



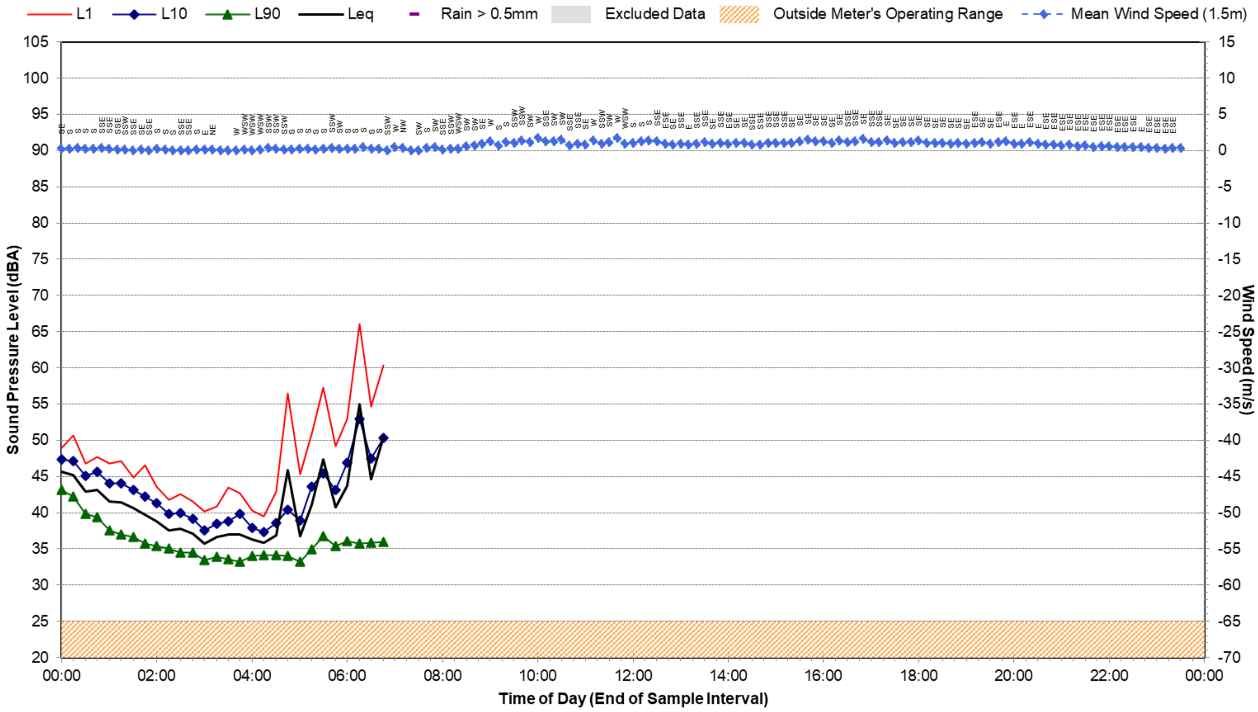
Statistical Ambient Noise Levels

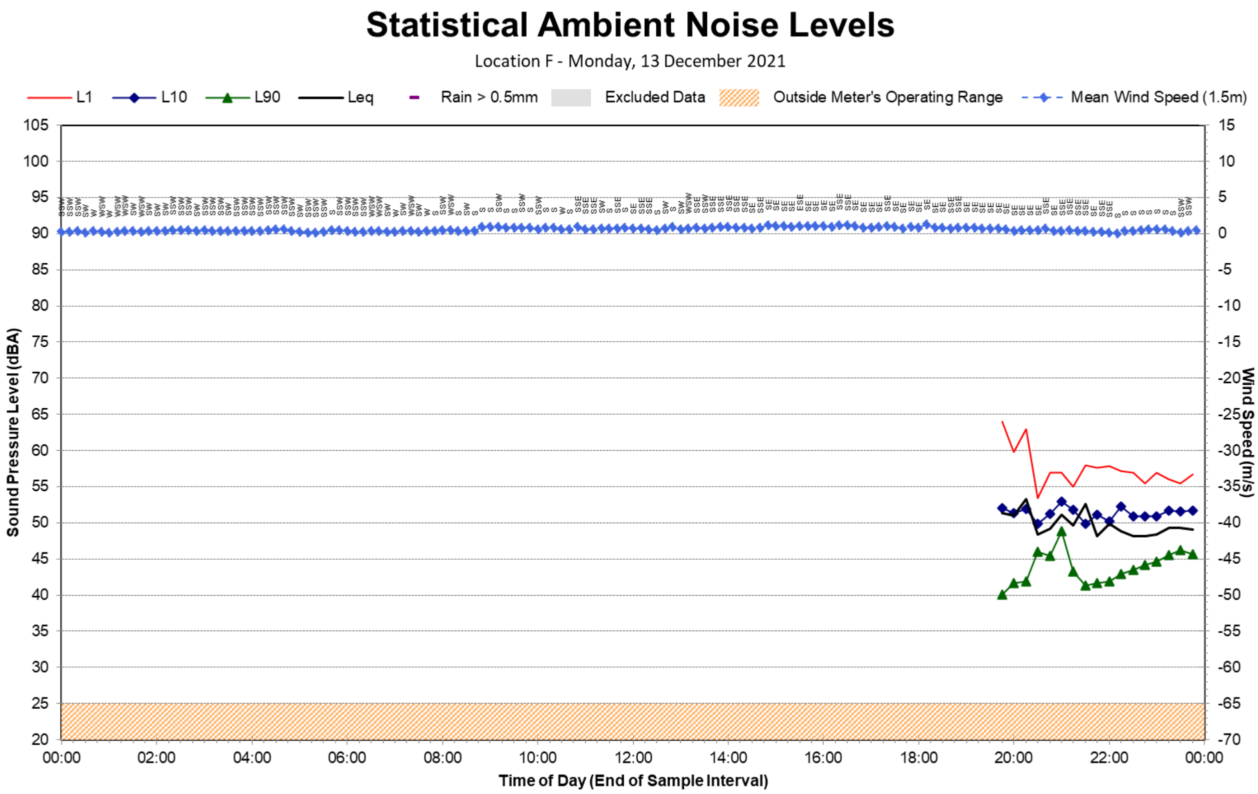
Location D - Wednesday, 29 December 2021

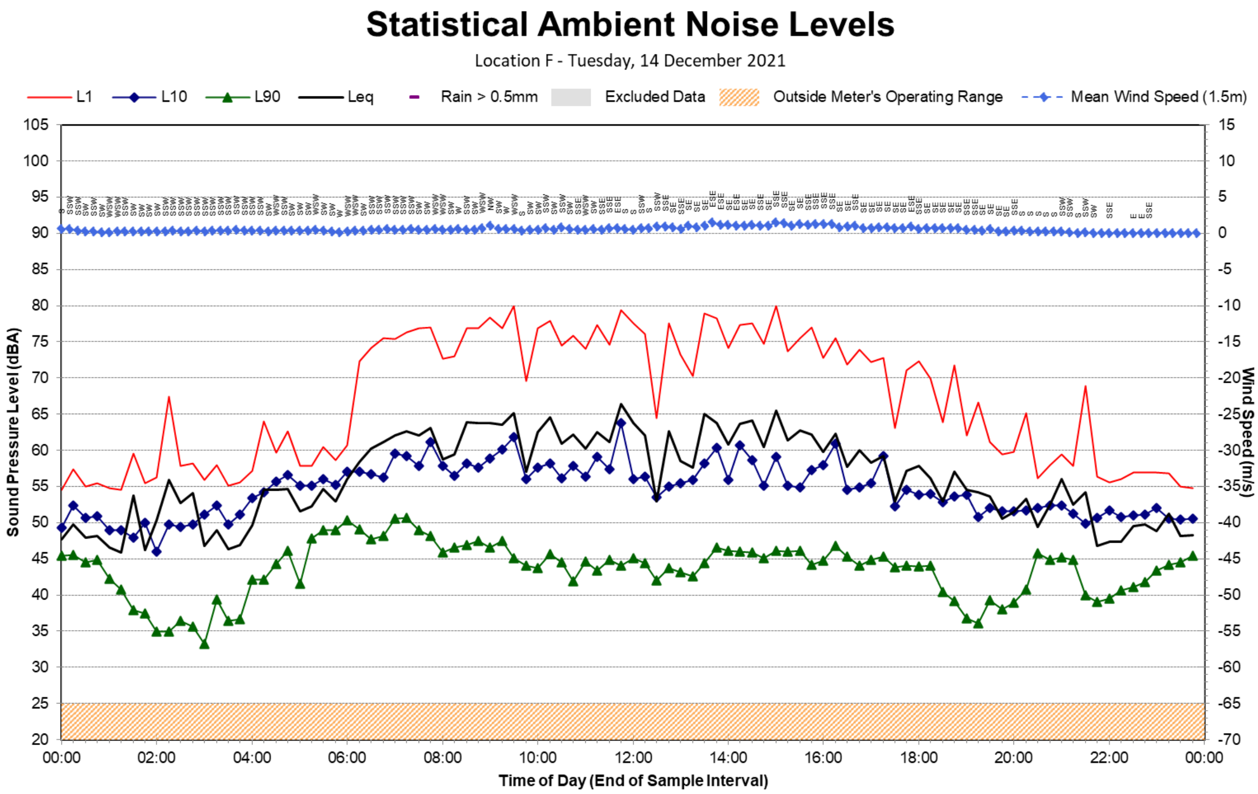


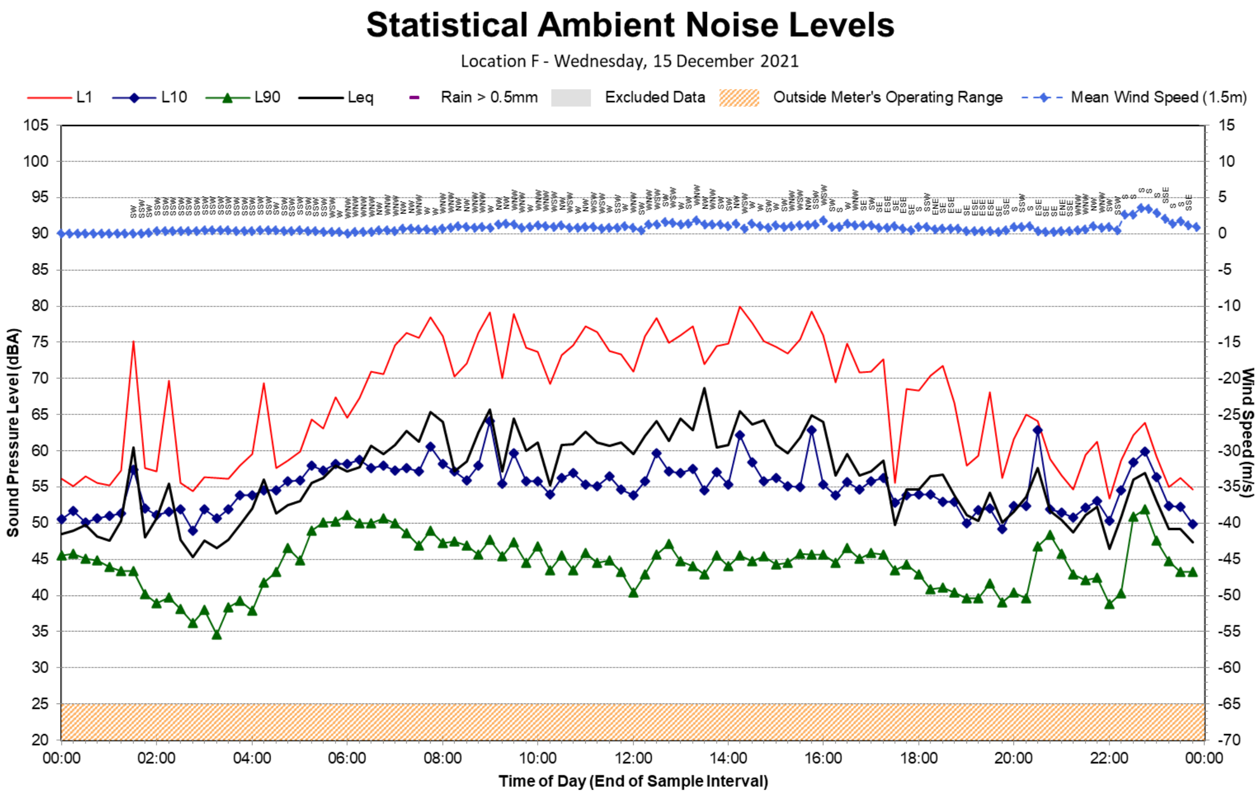
Statistical Ambient Noise Levels

Location D - Thursday, 30 December 2021

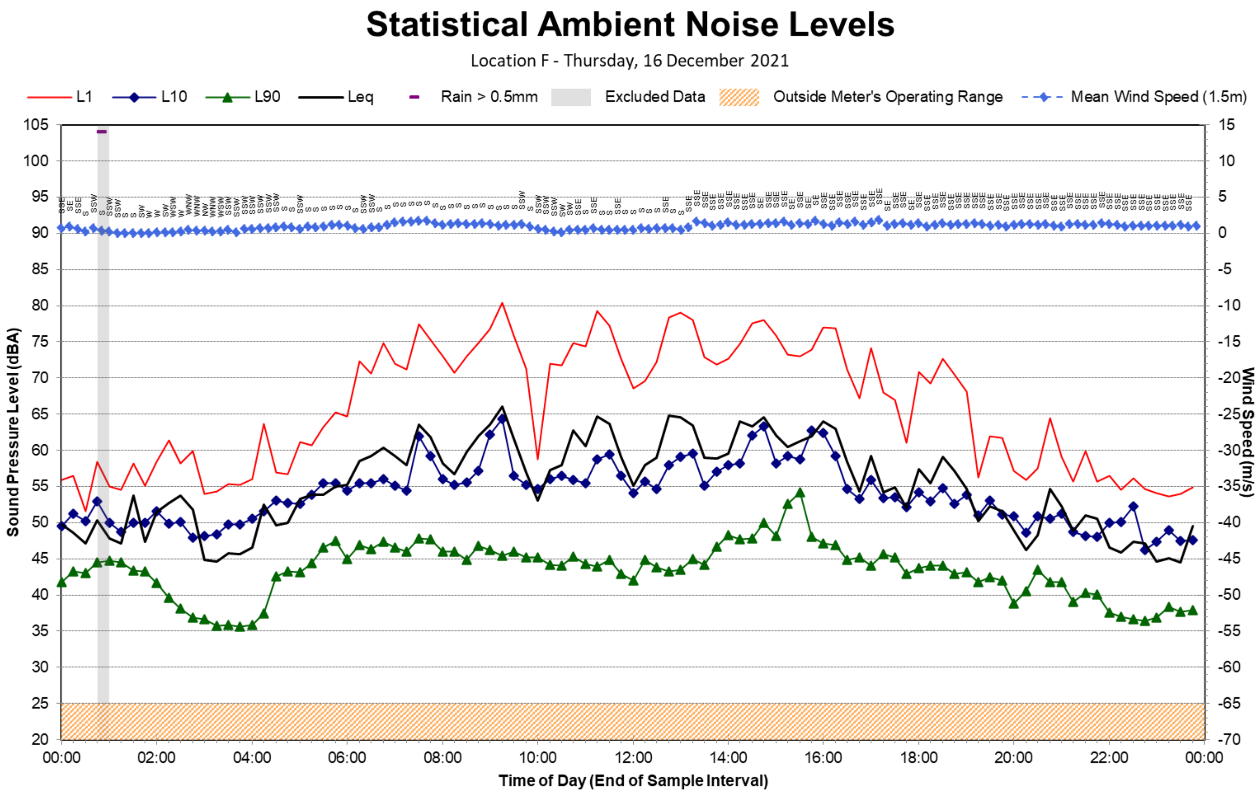



Statistical Ambient Noise Levels
Location F - Monday, 13 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location F - Tuesday, 14 December 2021
L1
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)



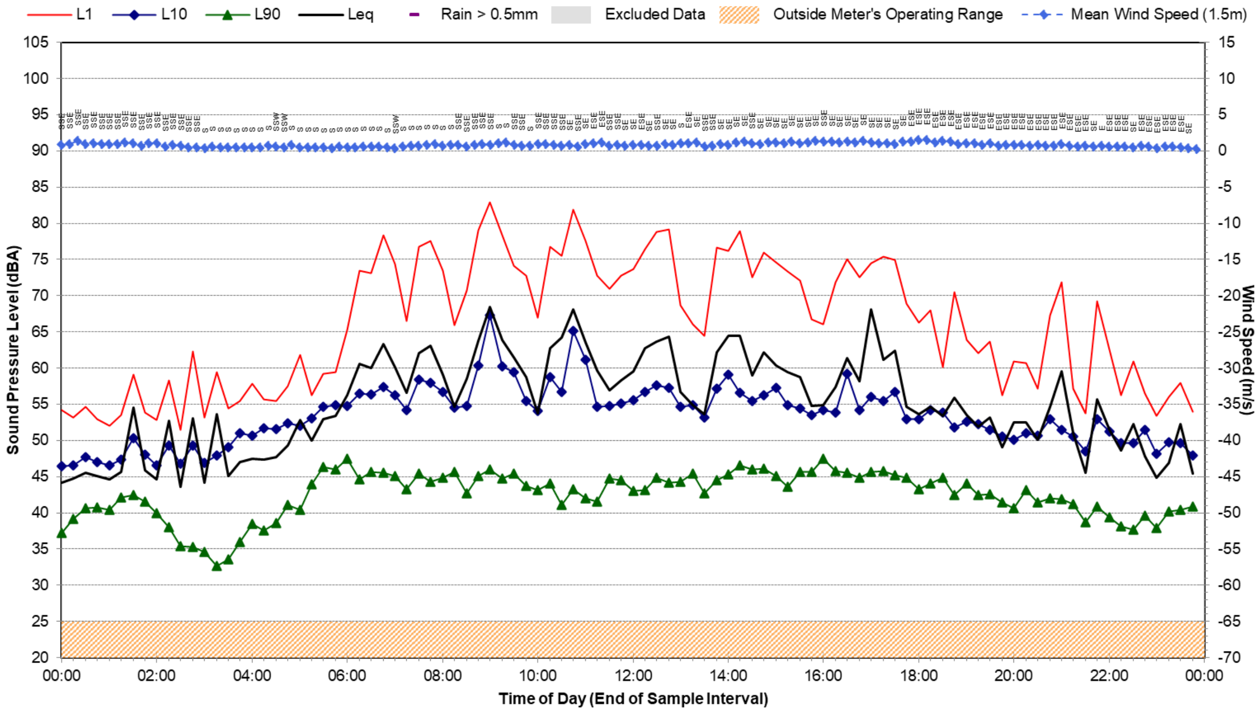
Statistical Ambient Noise Levels
Location F - Wednesday, 15 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)



Statistical Ambient Noise Levels
Location F - Thursday, 16 December 2021
L1
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)

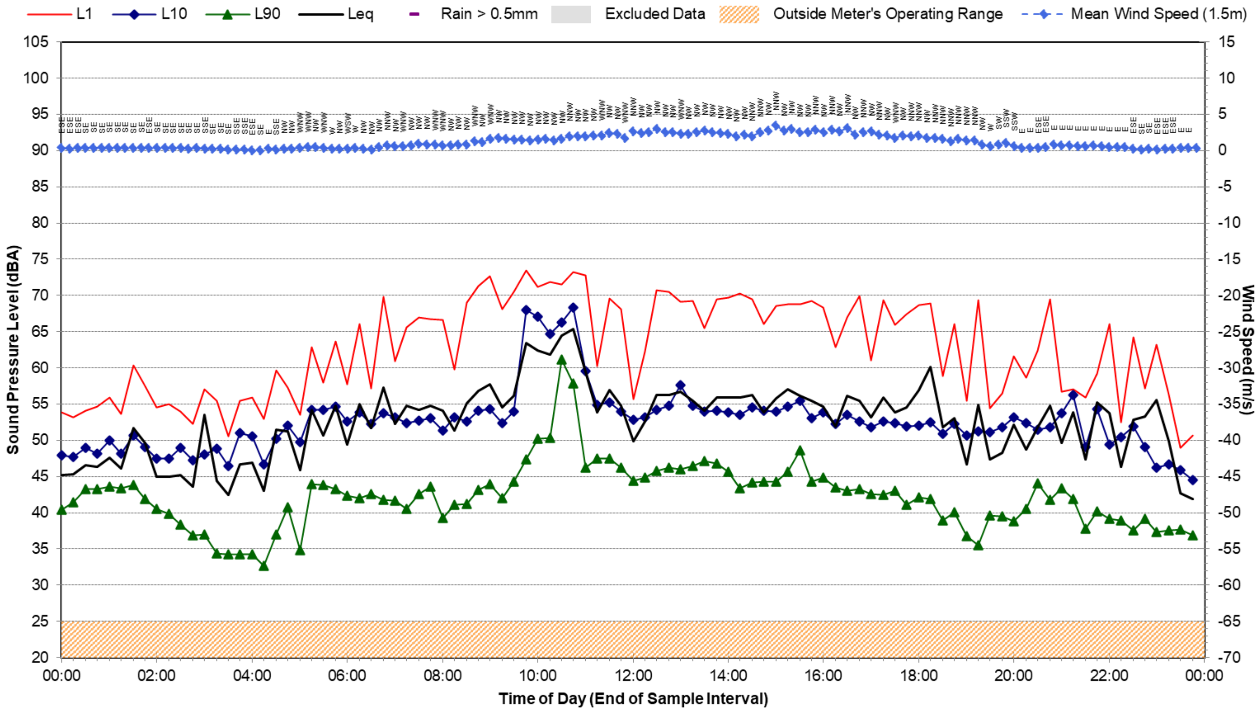
Statistical Ambient Noise Levels

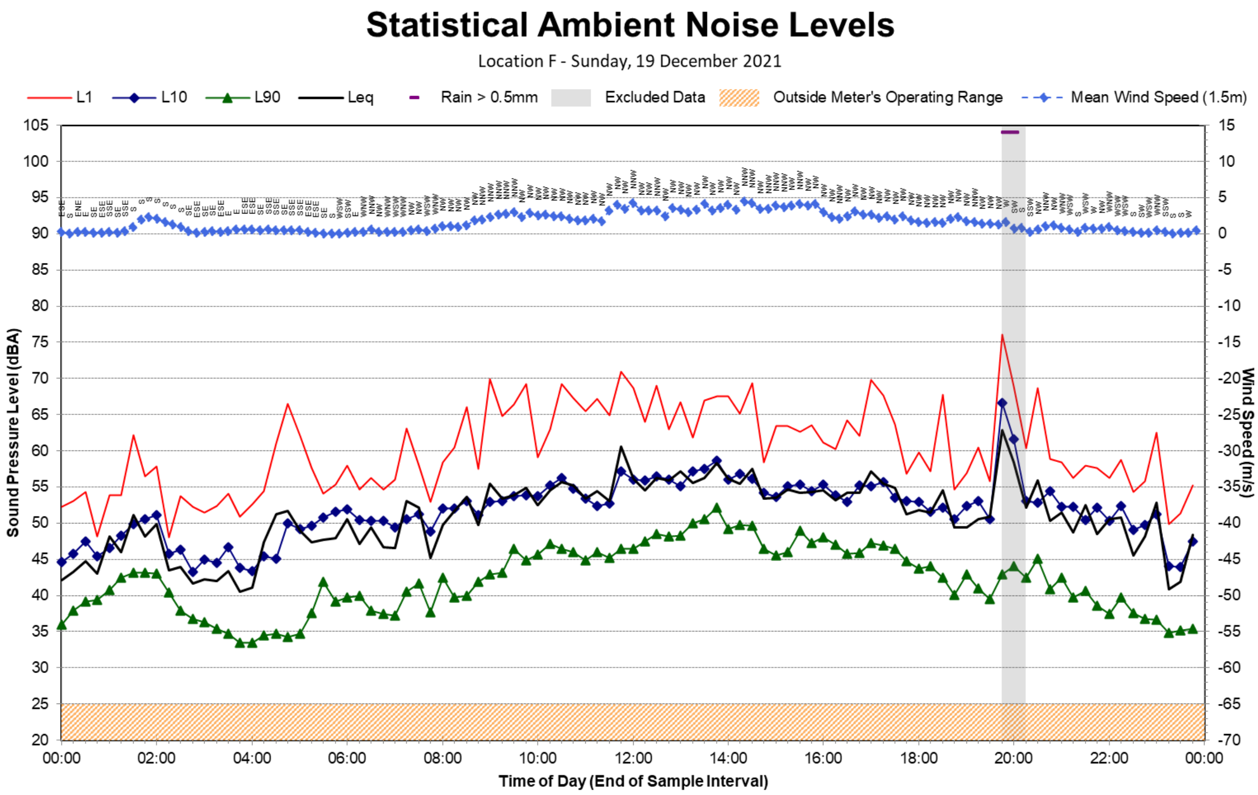
Location F - Friday, 17 December 2021



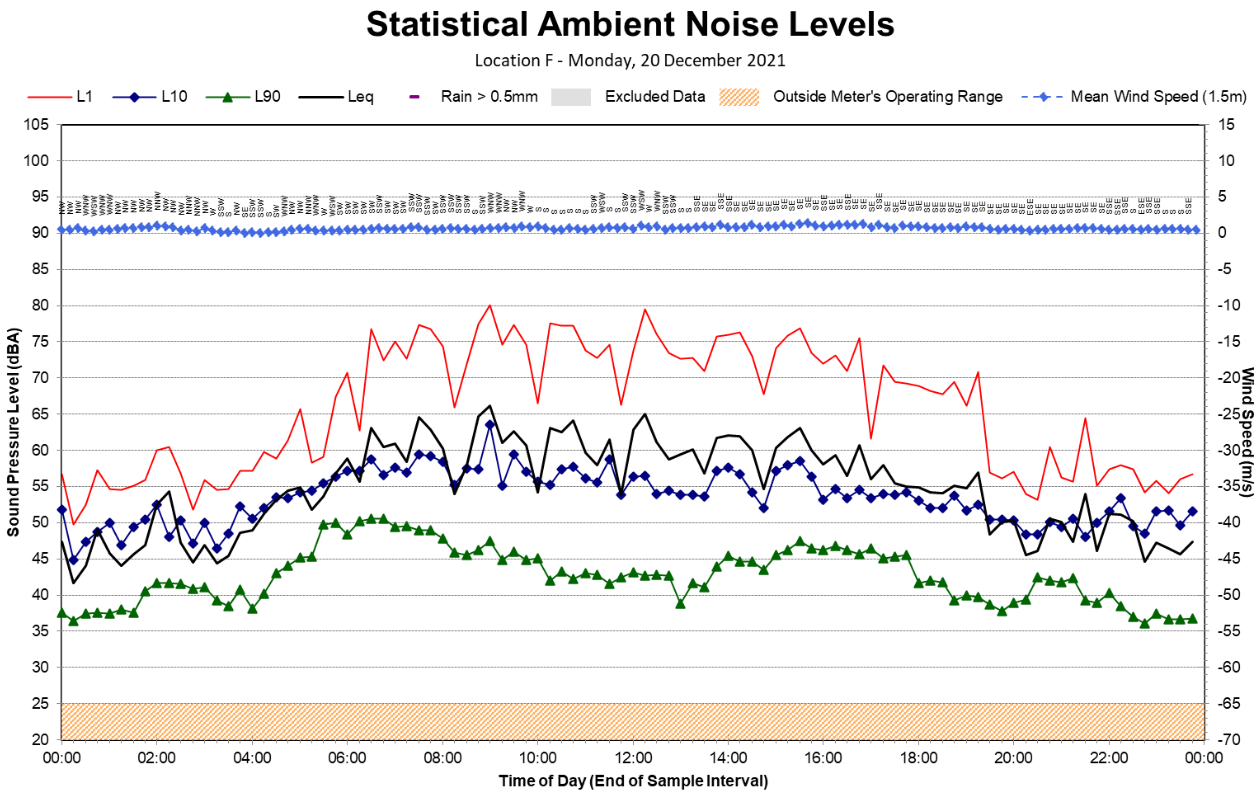
Statistical Ambient Noise Levels

Location F - Saturday, 18 December 2021

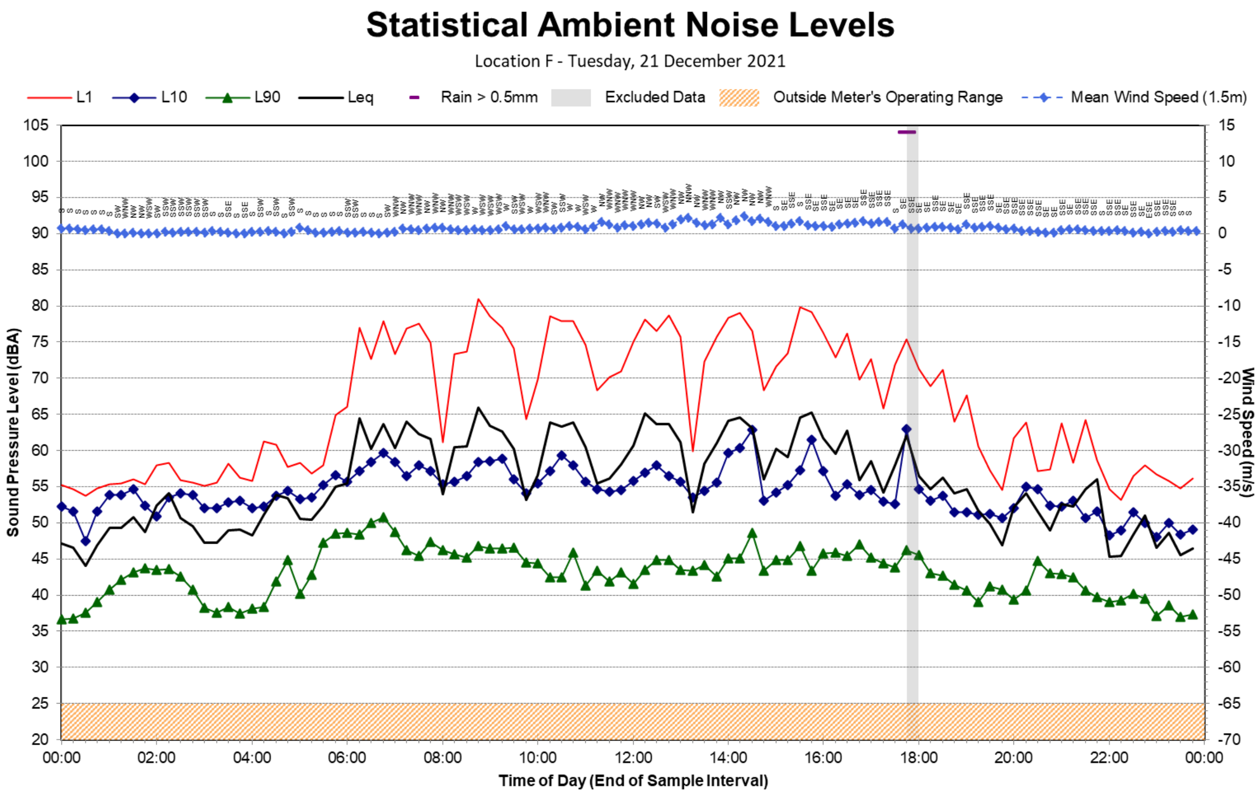


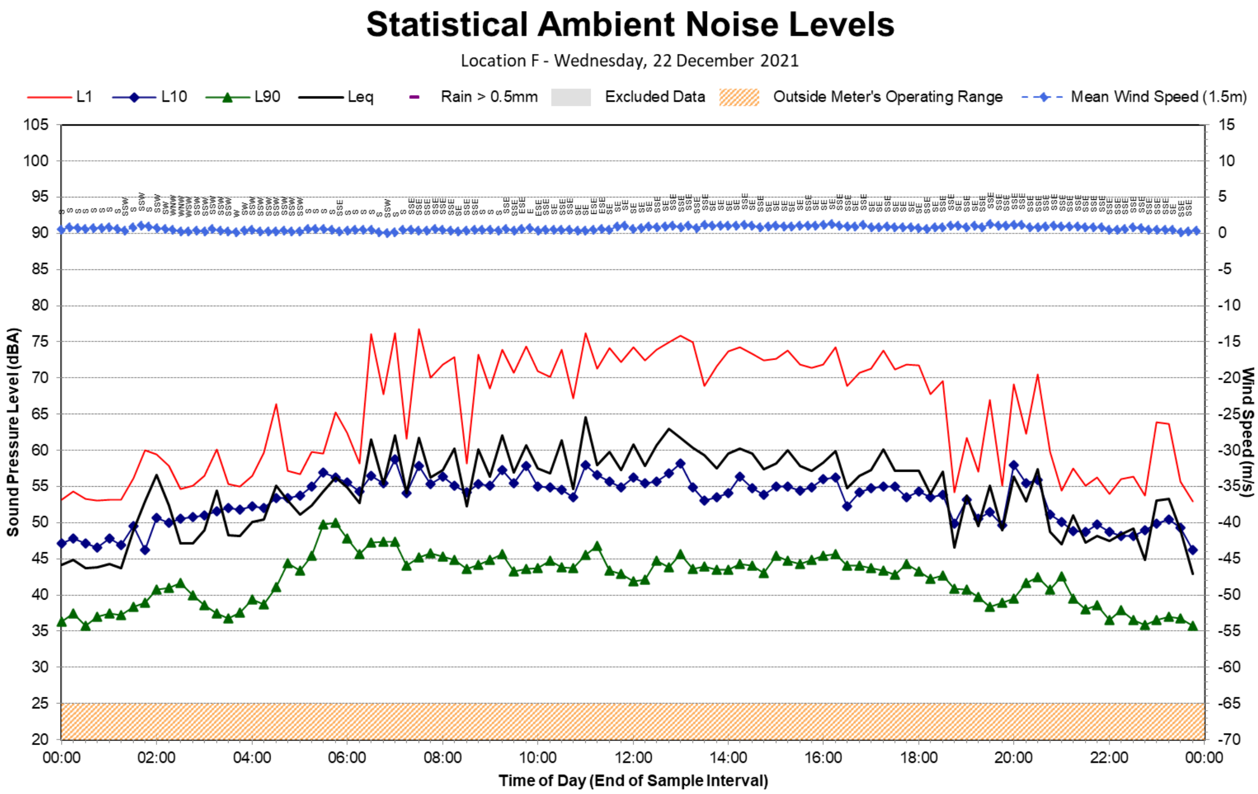


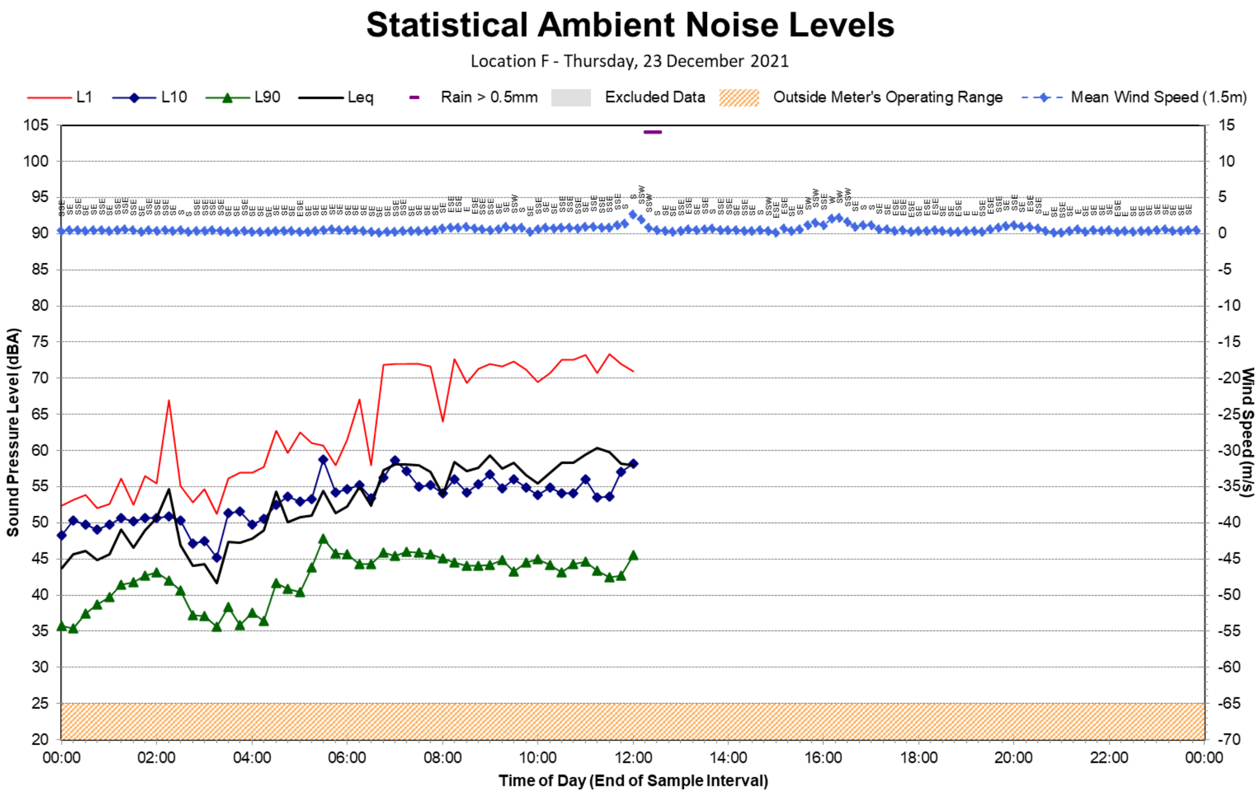
Statistical Ambient Noise Levels
Location F - Sunday, 19 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

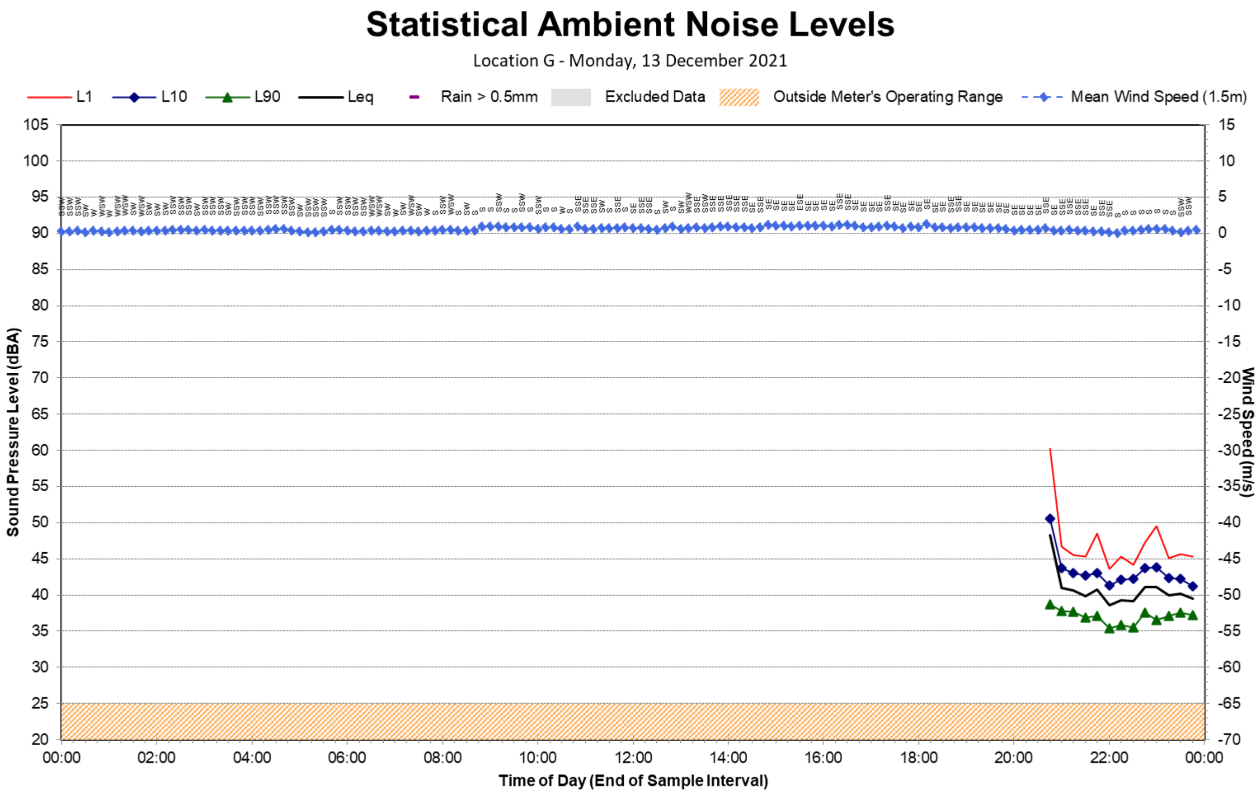


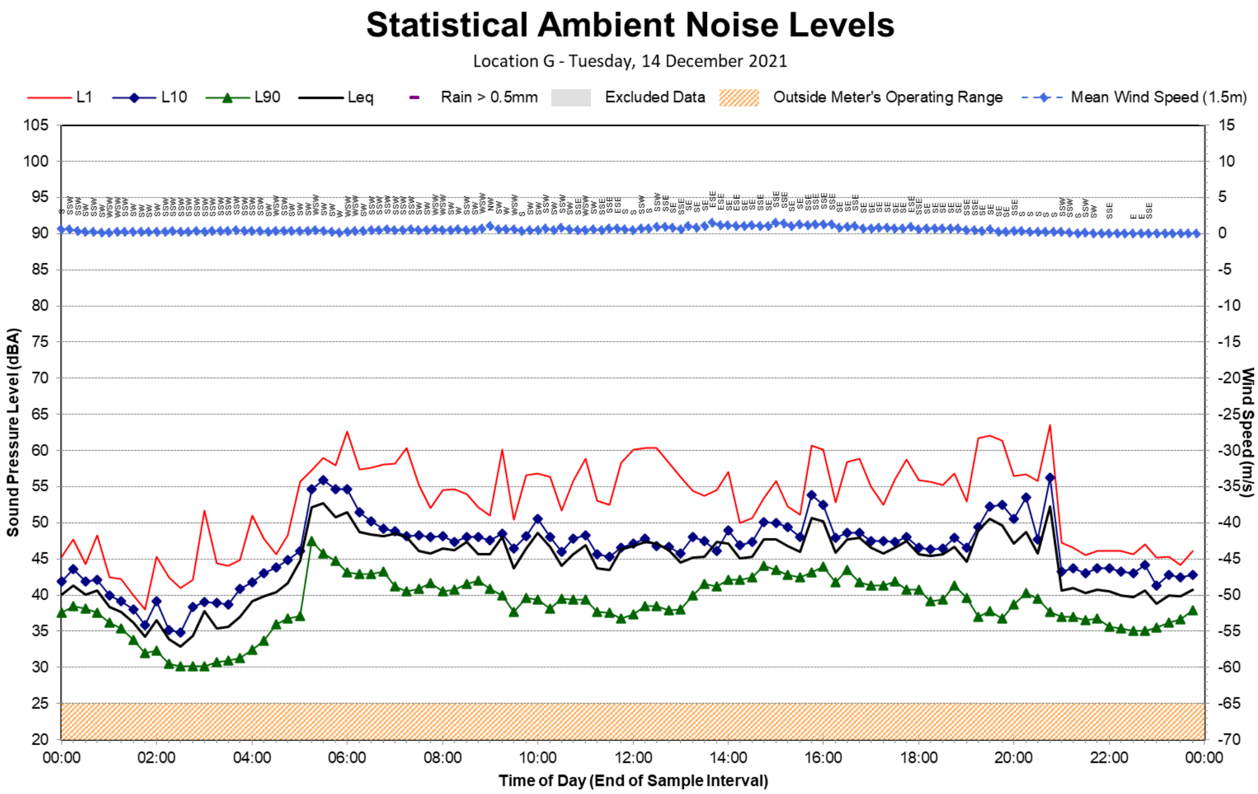
Statistical Ambient Noise Levels
Location F - Monday, 20 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

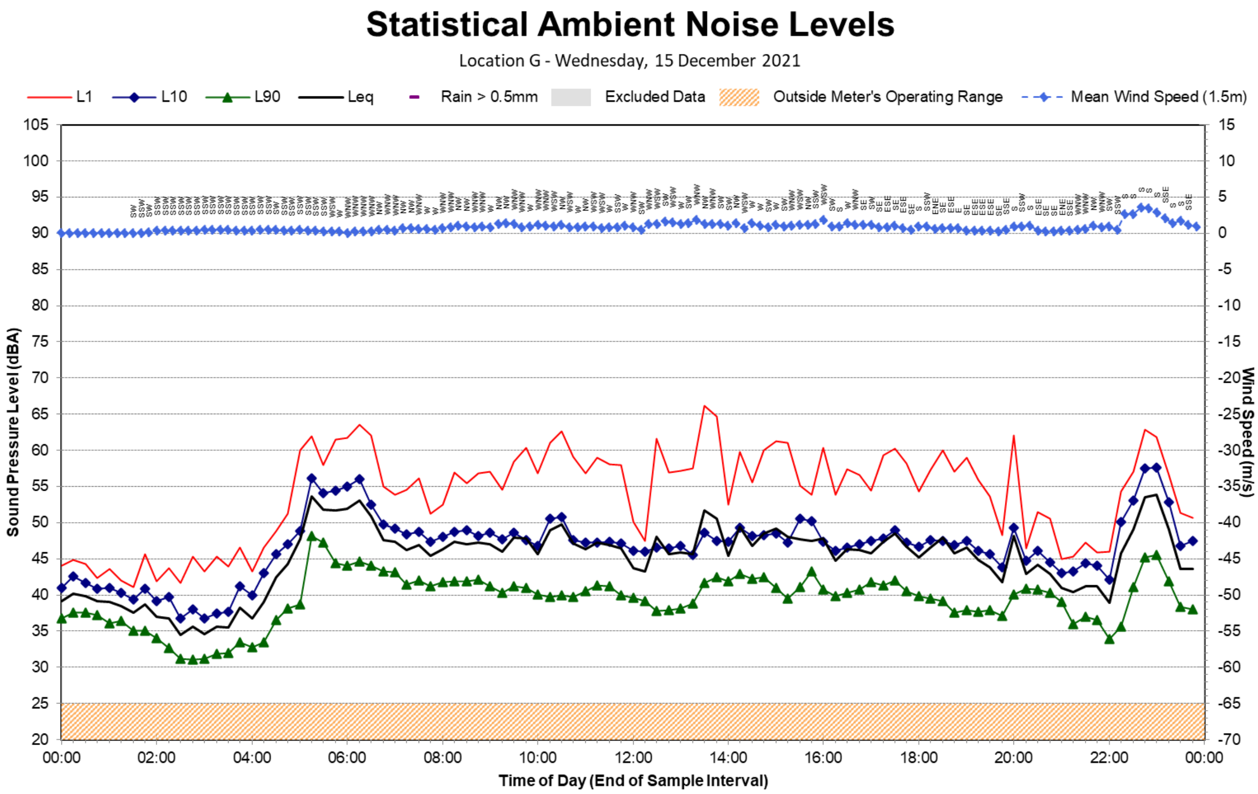

Statistical Ambient Noise Levels
Location F - Tuesday, 21 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

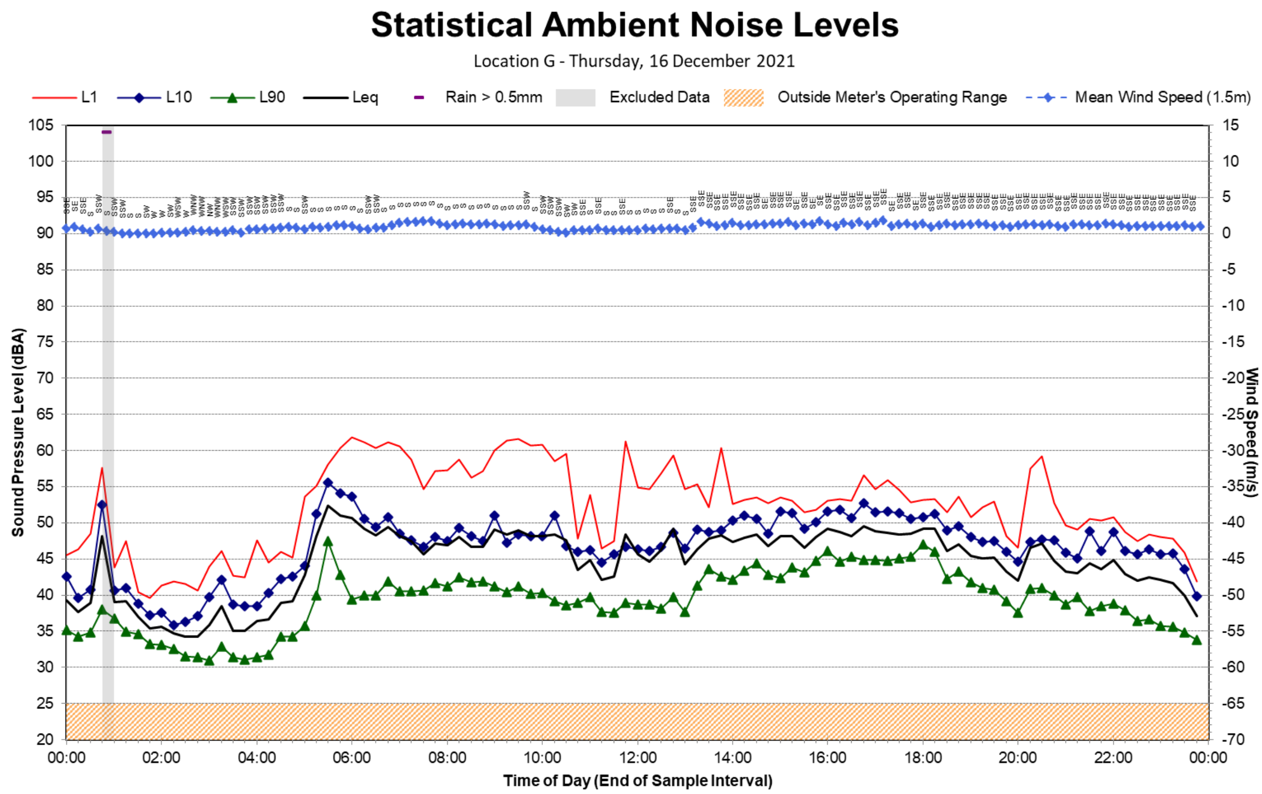

Statistical Ambient Noise Levels
Location F - Wednesday, 22 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

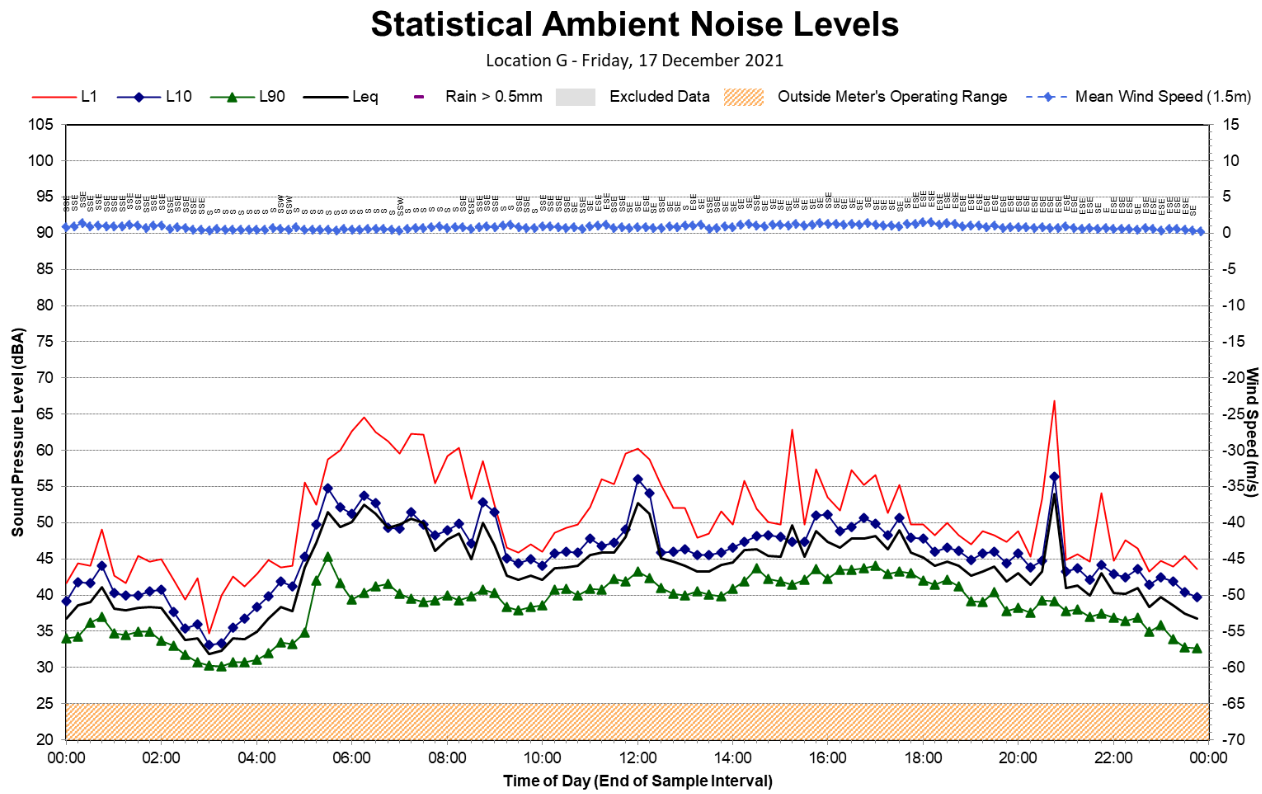

Statistical Ambient Noise Levels
Location F - Thursday, 23 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

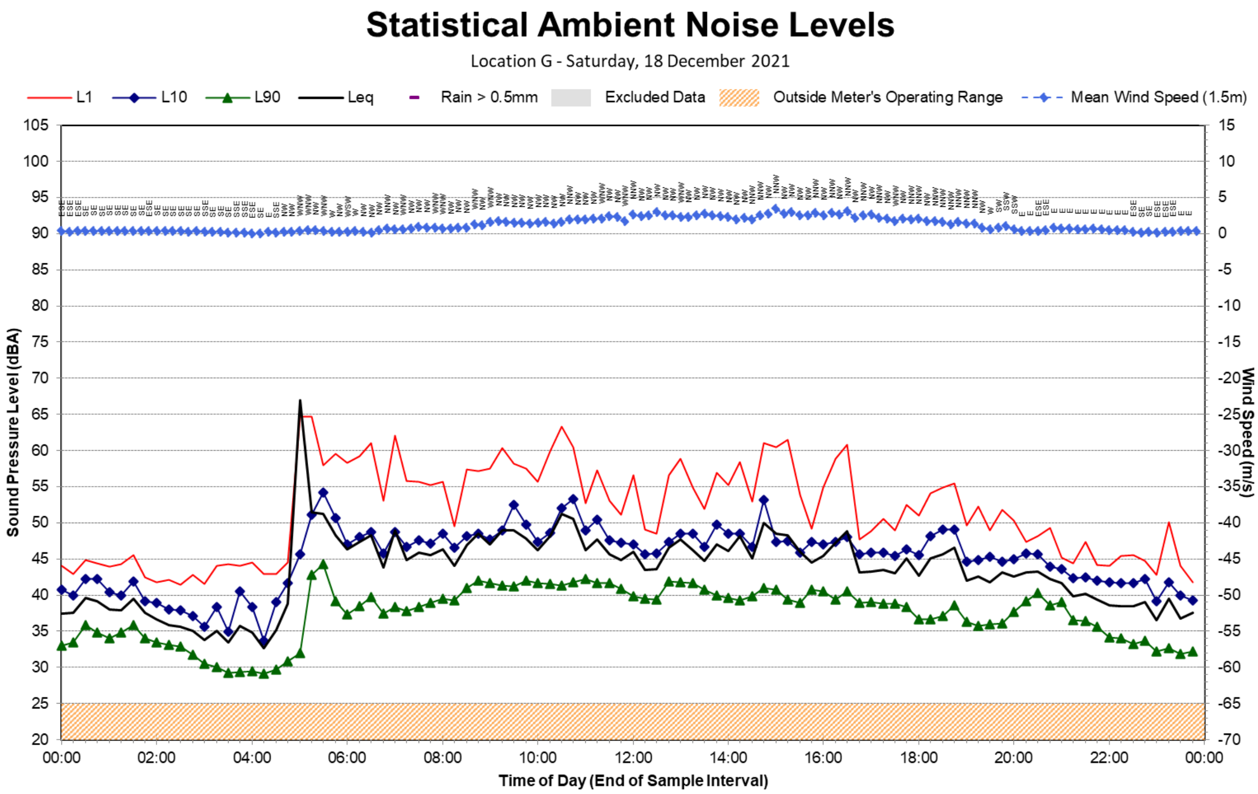

Statistical Ambient Noise Levels
Location G - Monday, 13 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

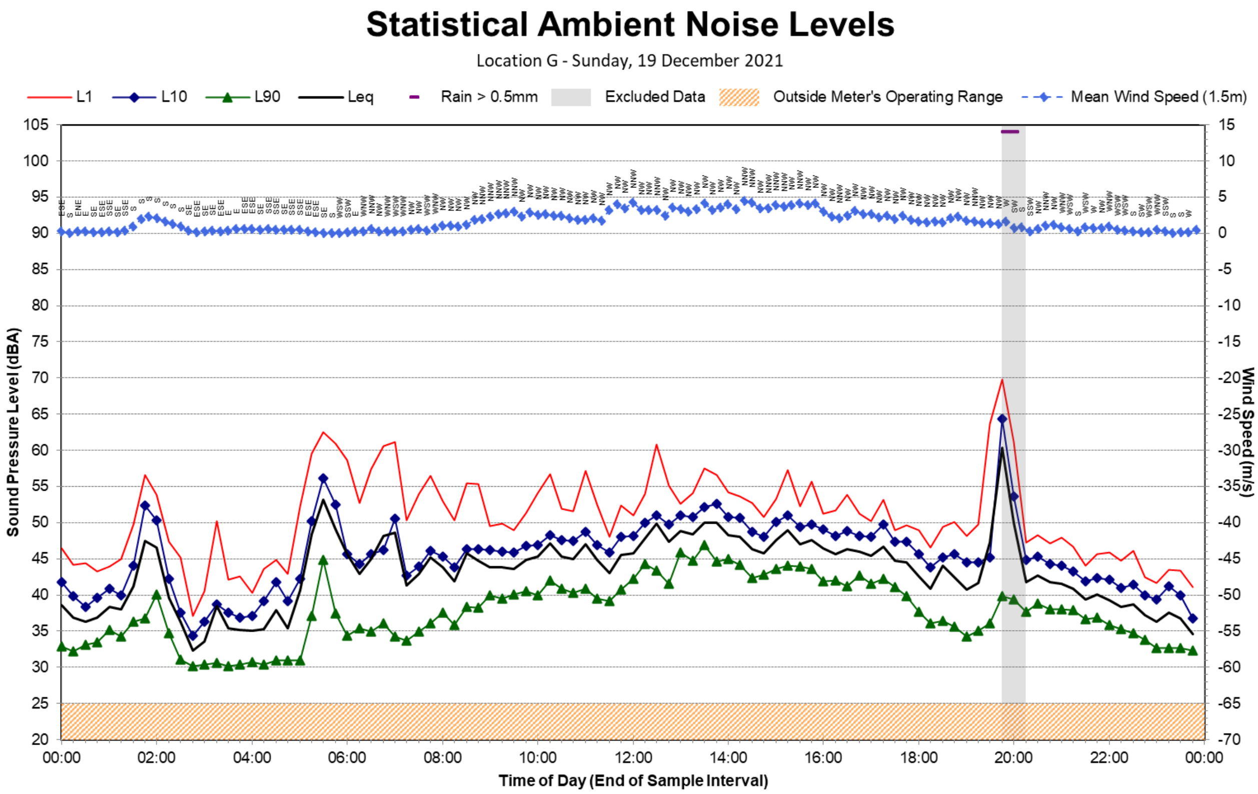

Statistical Ambient Noise Levels
Location G - Tuesday, 14 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location G - Wednesday, 15 December 2021
L1
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, 16 December 2021
L1
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

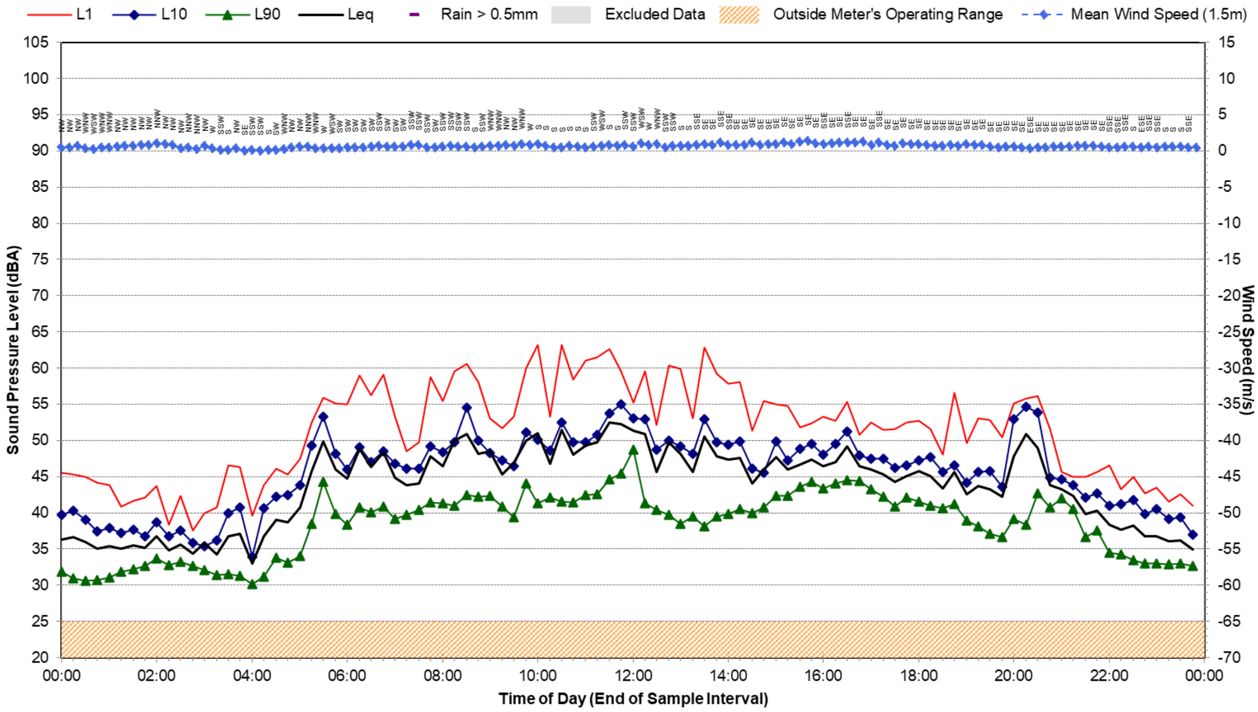

Statistical Ambient Noise Levels
Location G - Friday, 17 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00


Statistical Ambient Noise Levels
Location G - Saturday, 18 December 2021
L1
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, 19 December 2021
L1
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)

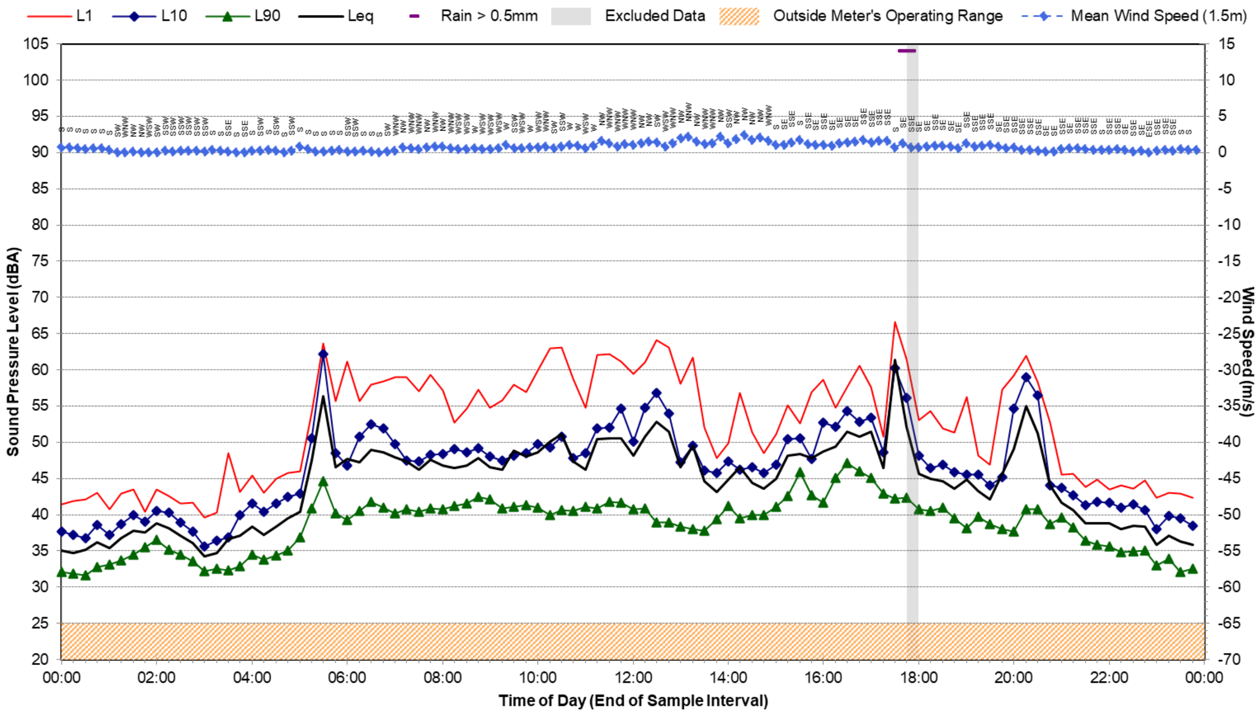
Statistical Ambient Noise Levels

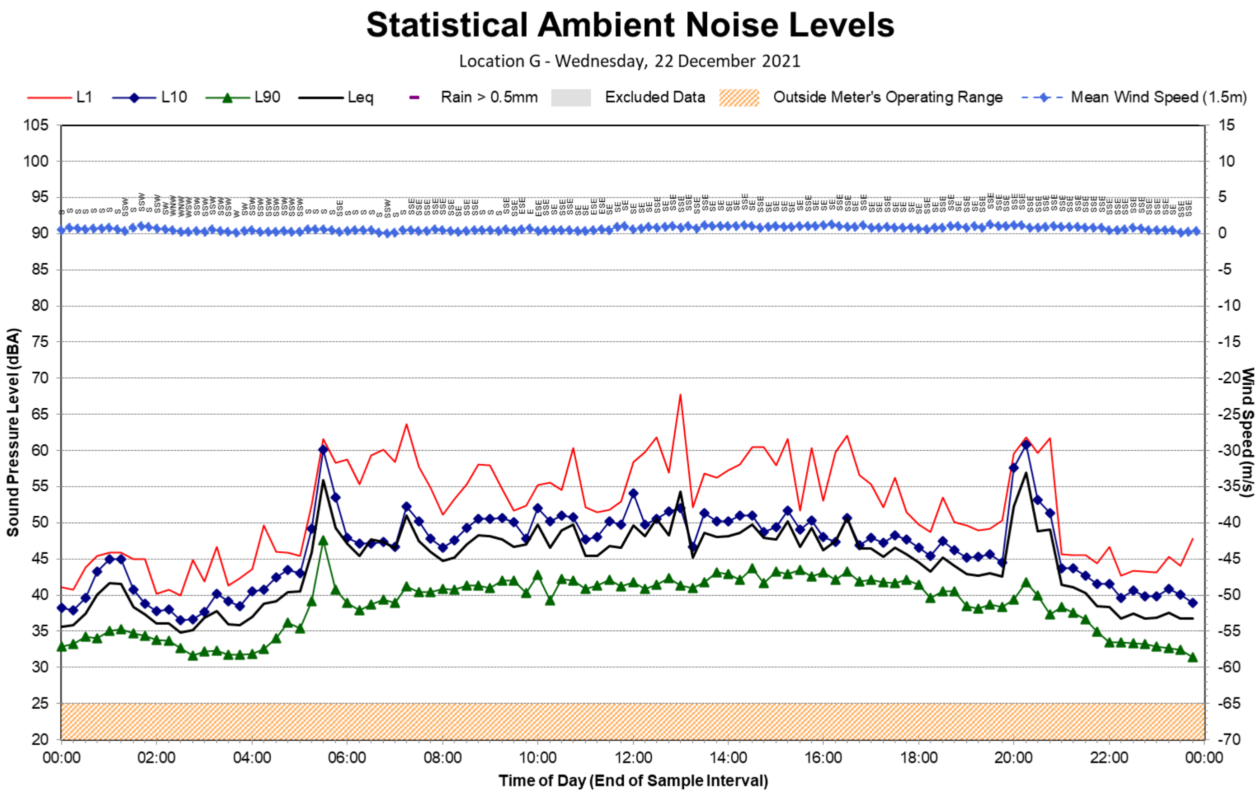
Location G - Monday, 20 December 2021

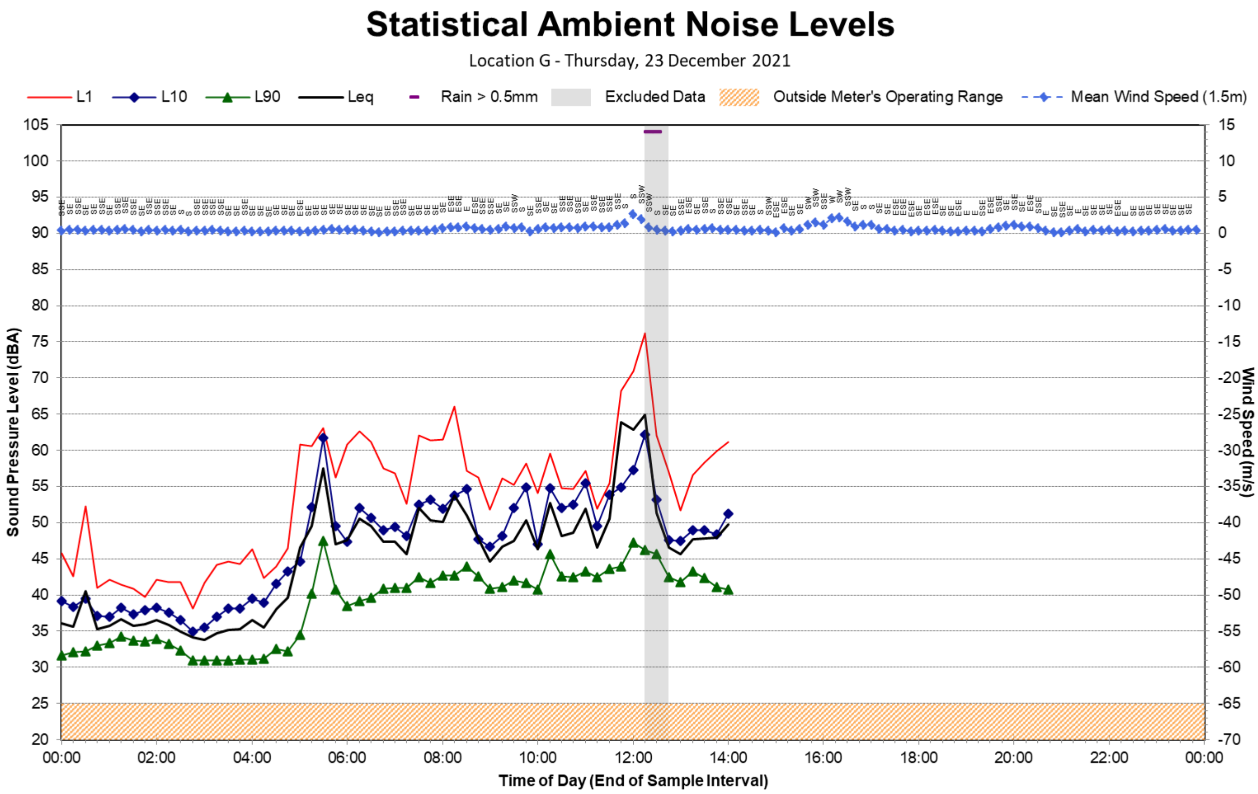


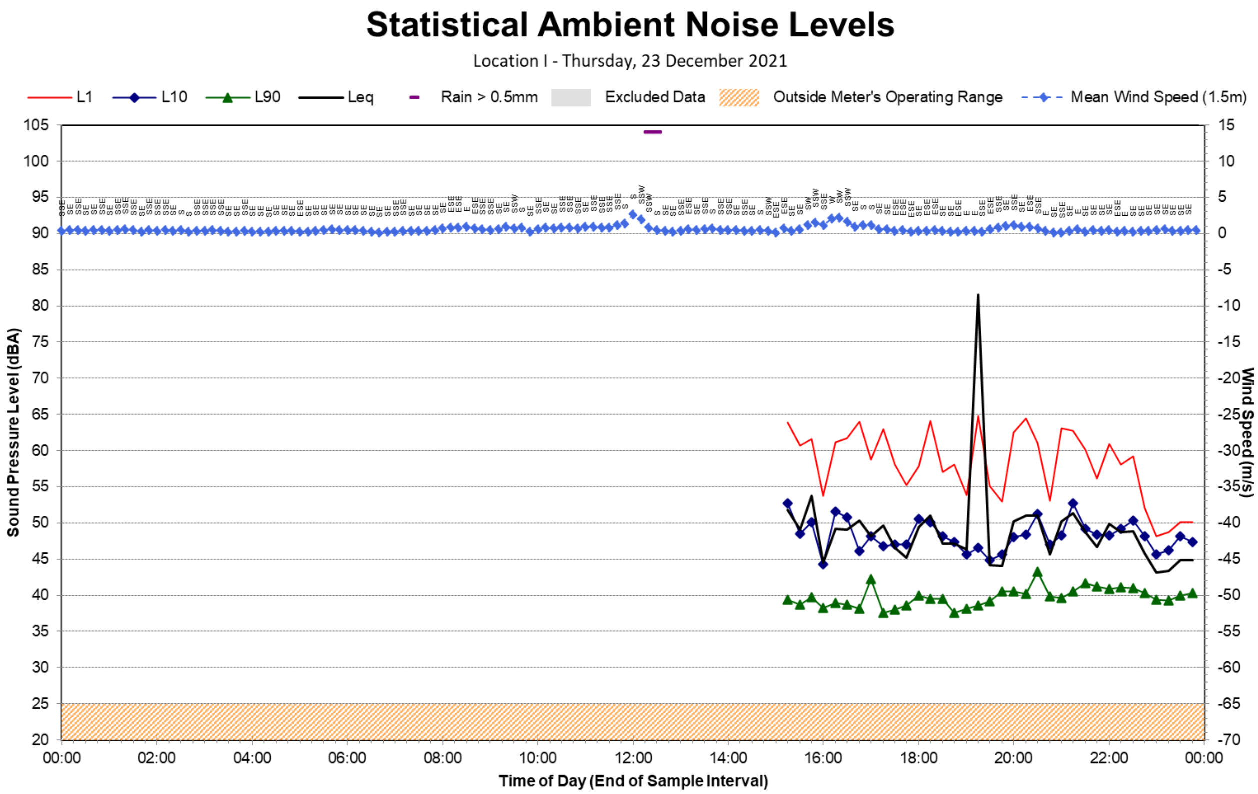
Statistical Ambient Noise Levels

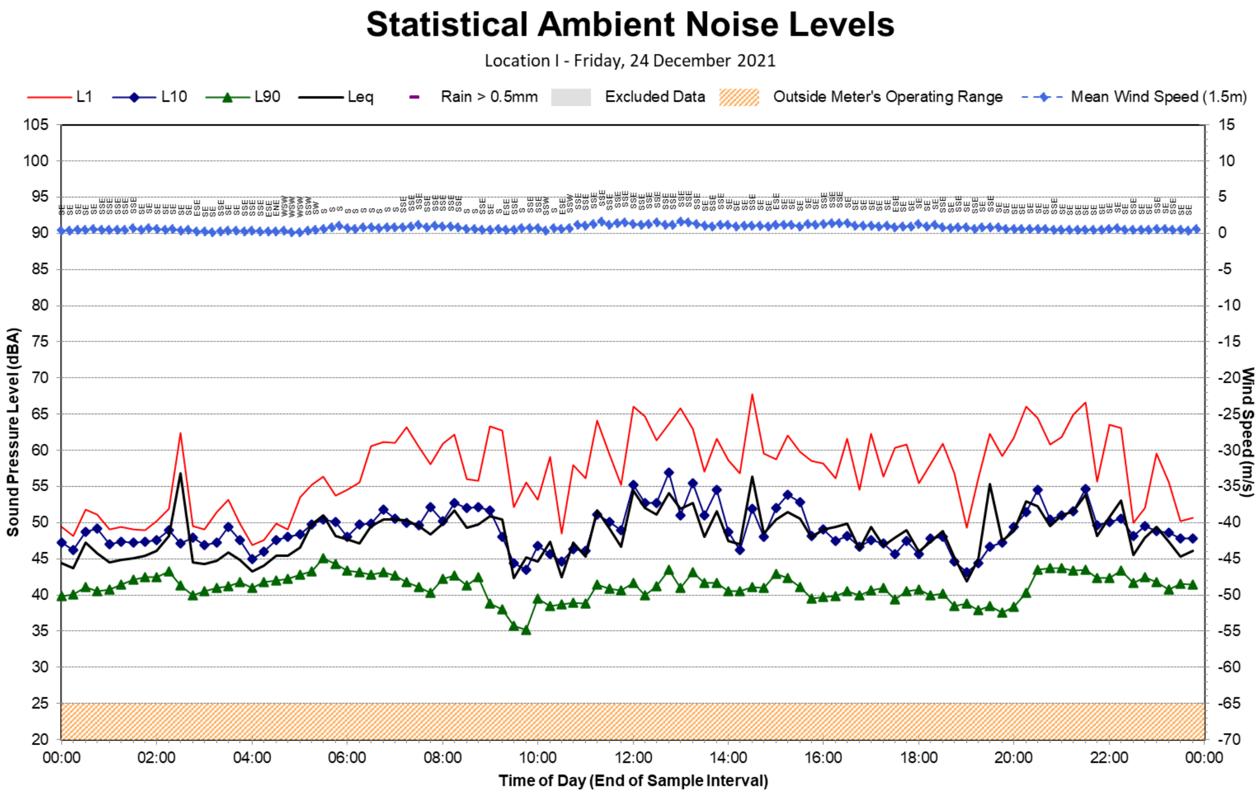
Location G - Tuesday, 21 December 2021

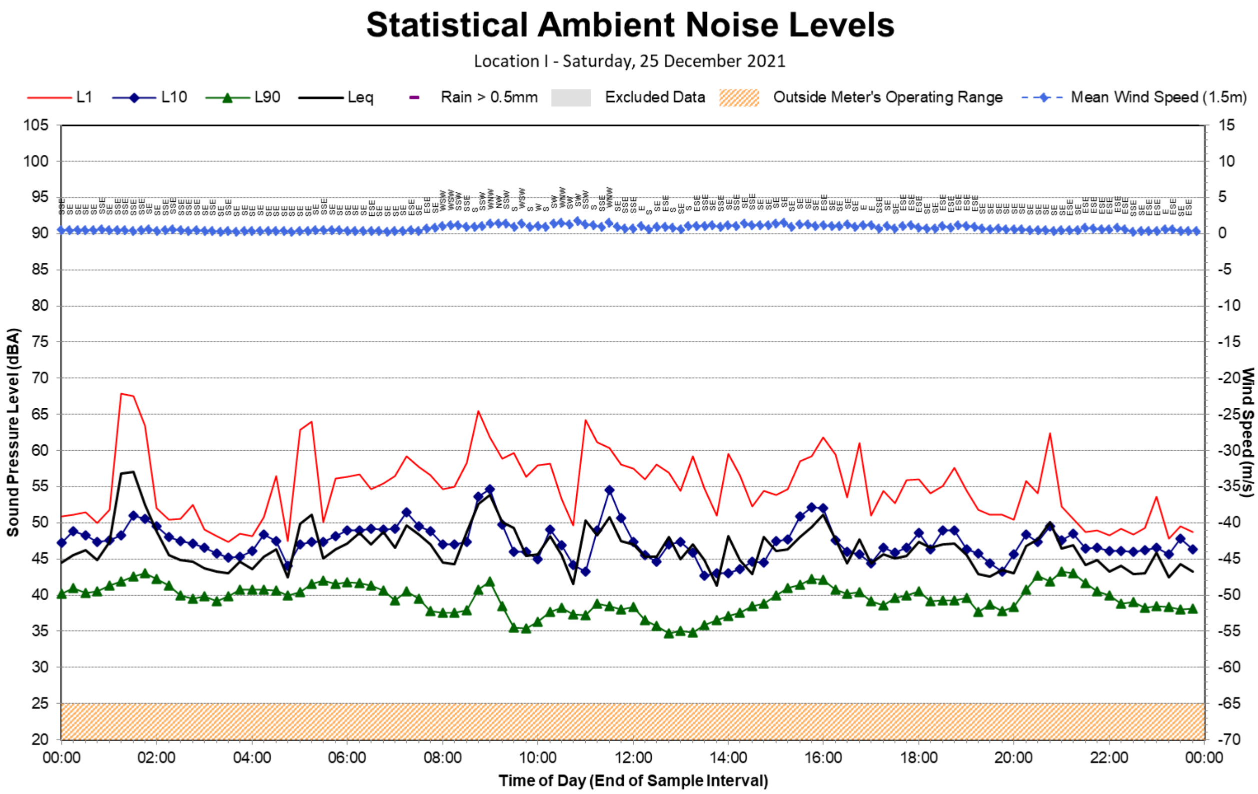


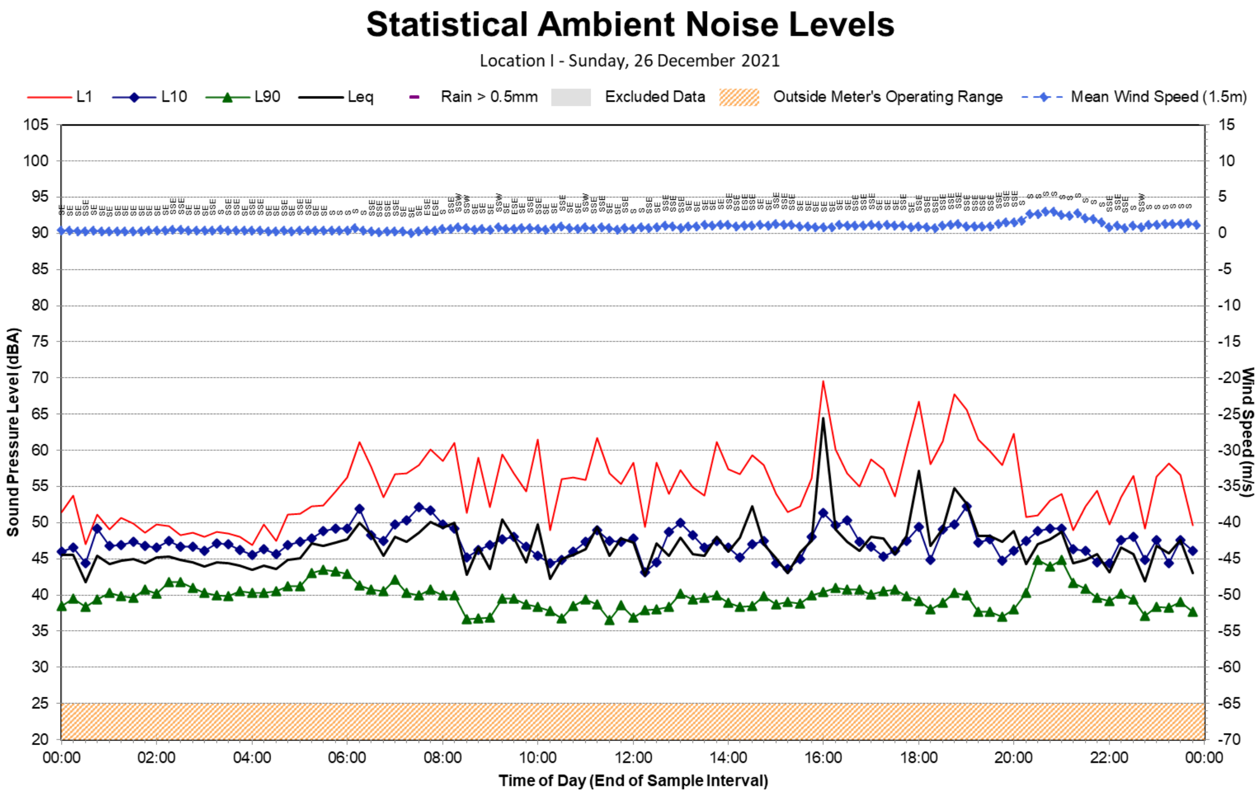

Statistical Ambient Noise Levels
Location G - Wednesday, 22 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

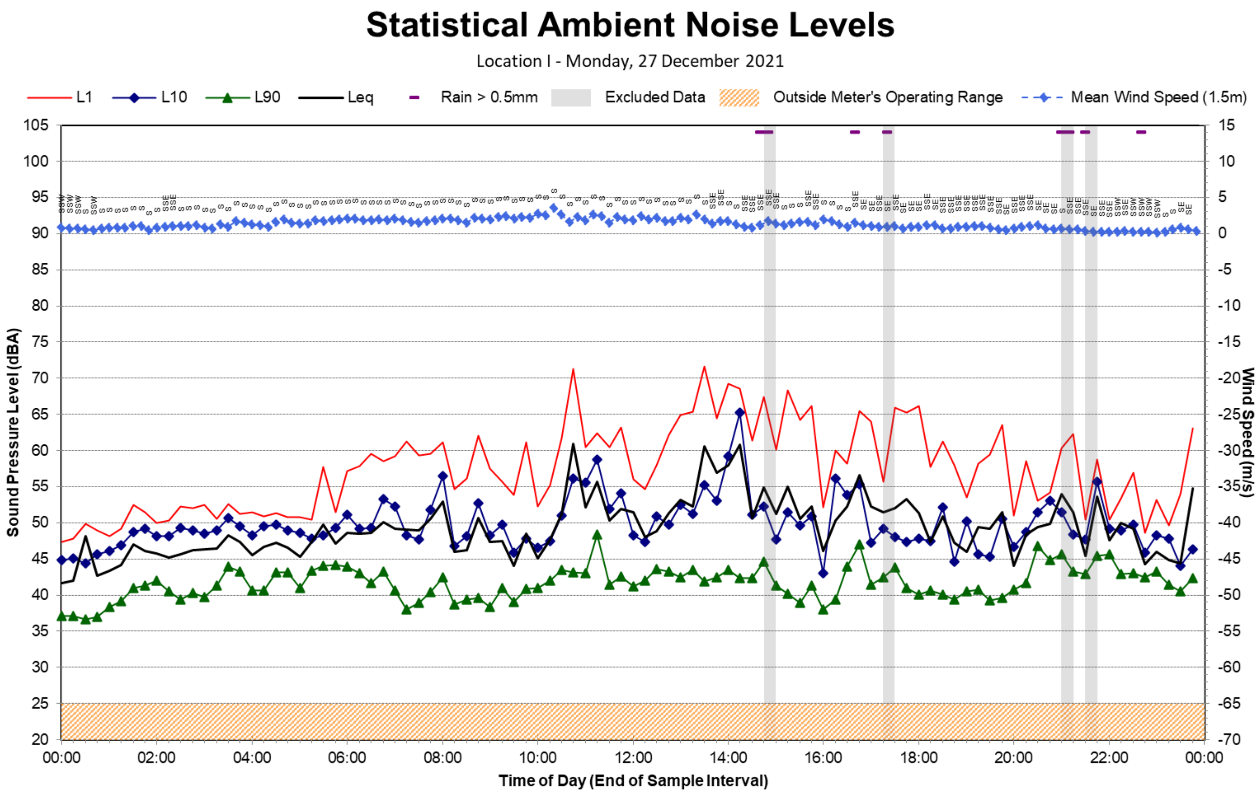

Statistical Ambient Noise Levels
Location G - Thursday, 23 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

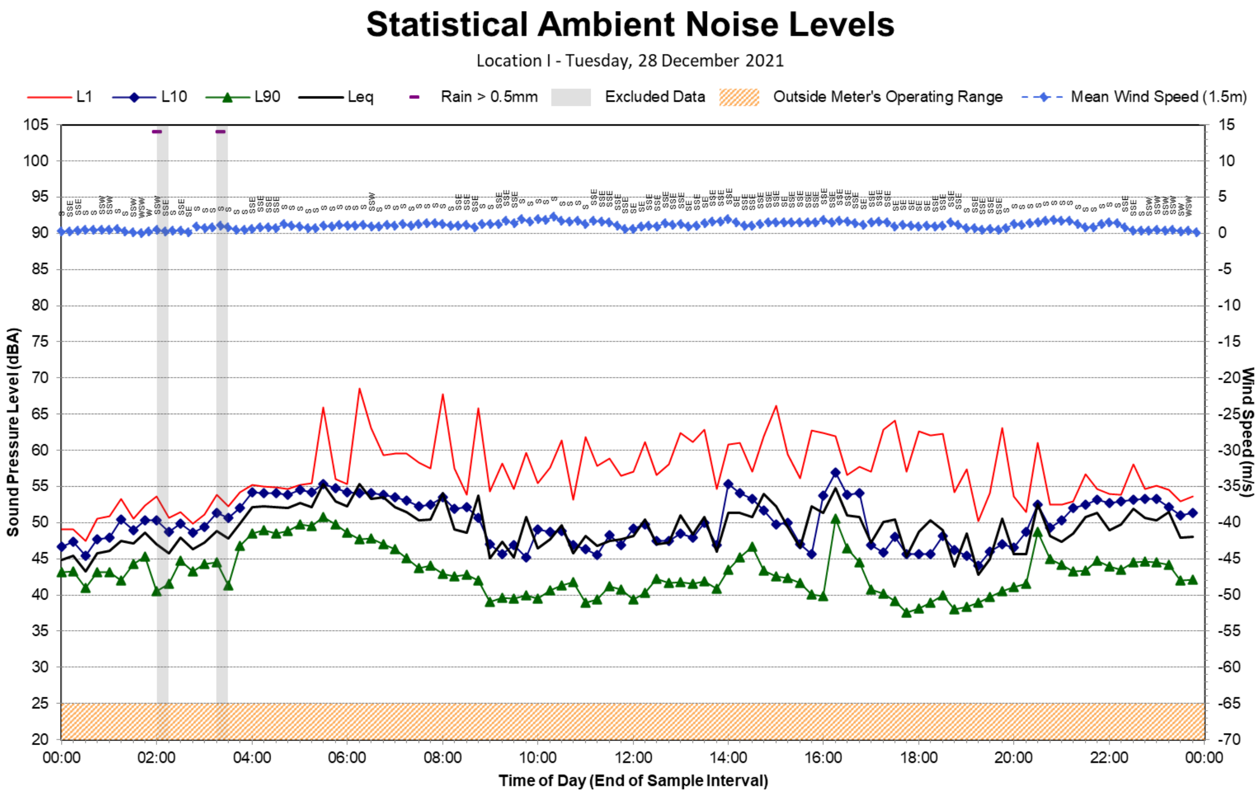

Statistical Ambient Noise Levels
Location I - Thursday, 23 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

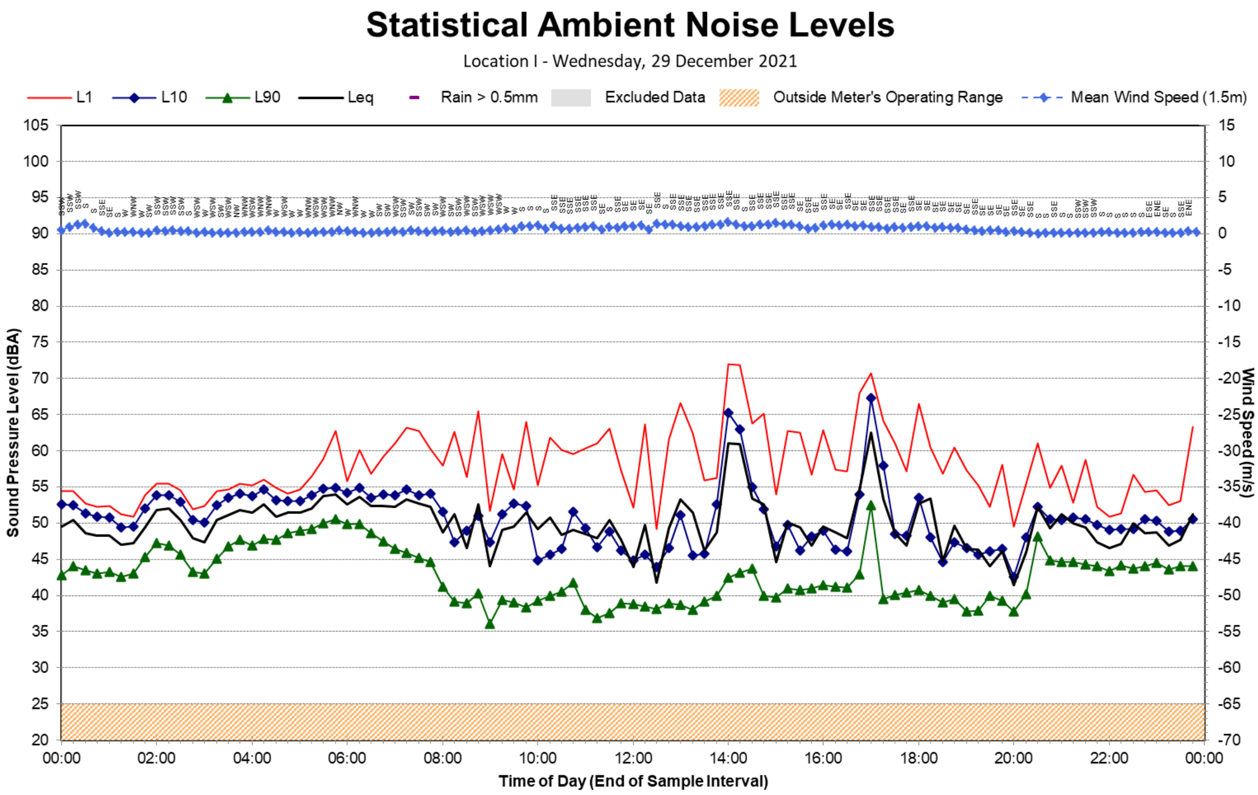

Statistical Ambient Noise Levels
Location I - Friday, 24 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

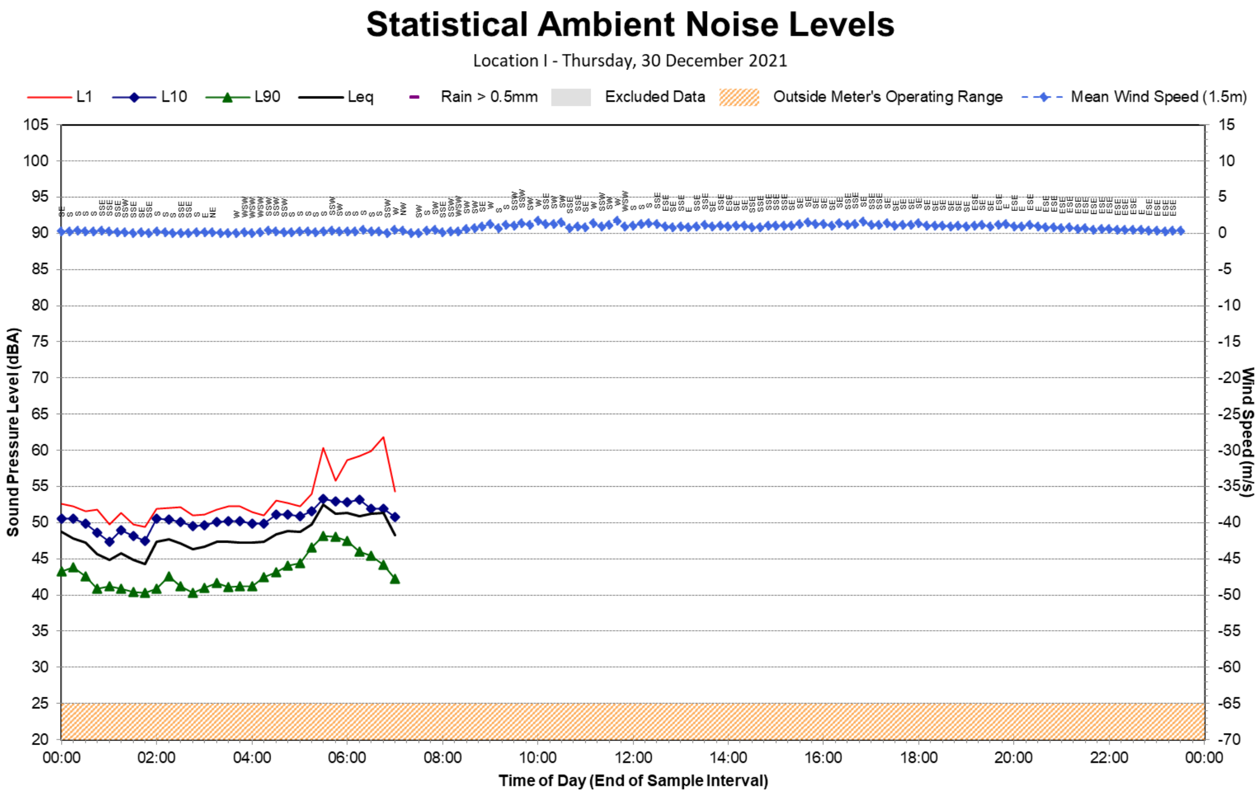

Statistical Ambient Noise Levels
Location I - Saturday, 25 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Sunday, 26 December 2021
L1
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, 27 December 2021
L1
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)

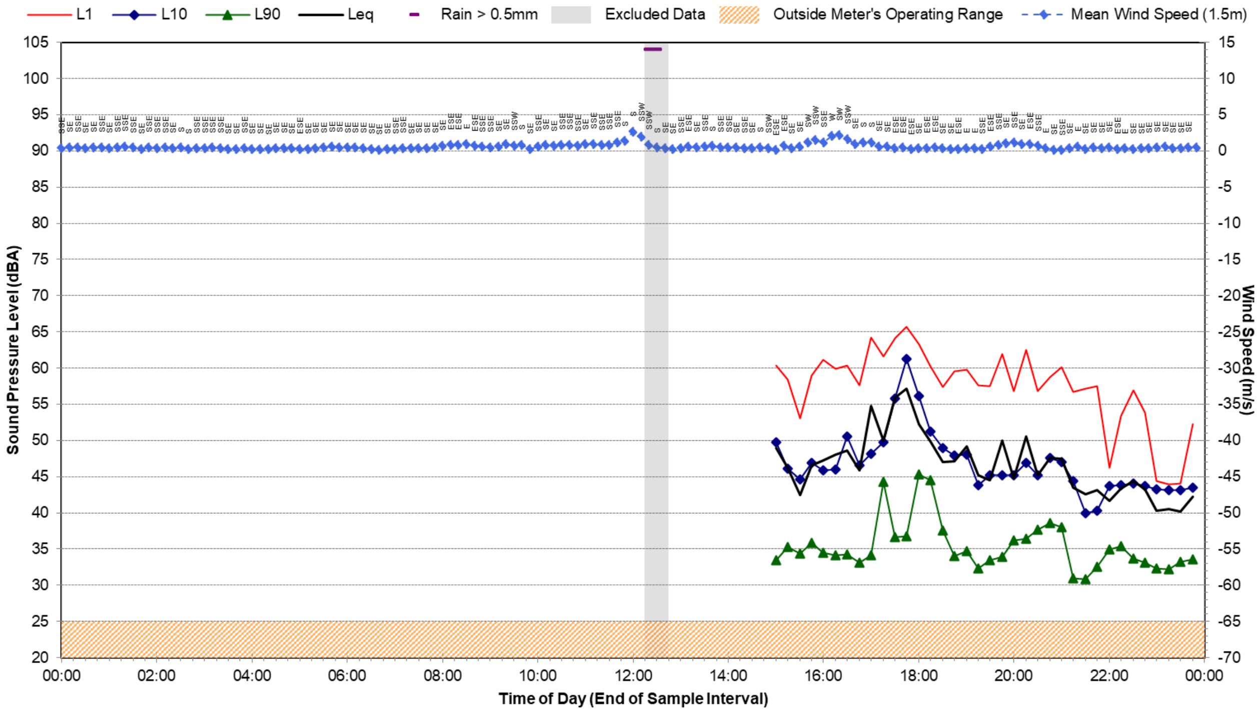

Statistical Ambient Noise Levels
Location I - Tuesday, 28 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location I - Wednesday, 29 December 2021
L1
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, 30 December 2021
L1
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)

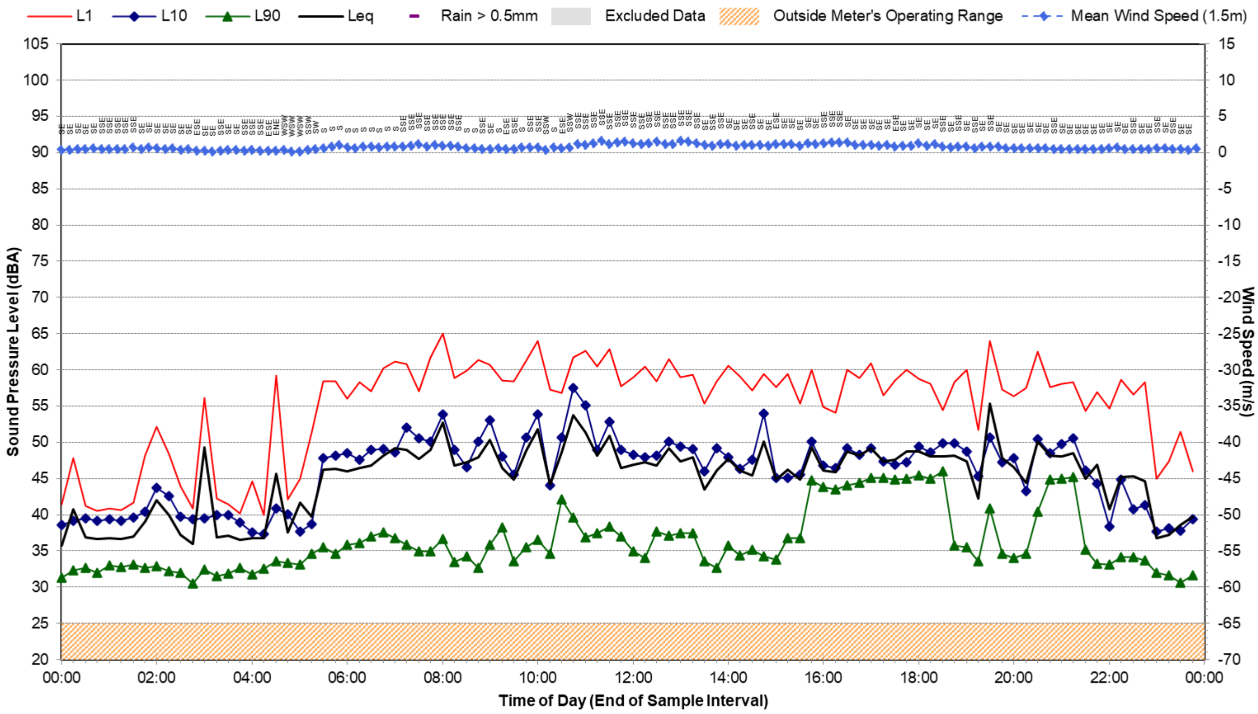
Statistical Ambient Noise Levels

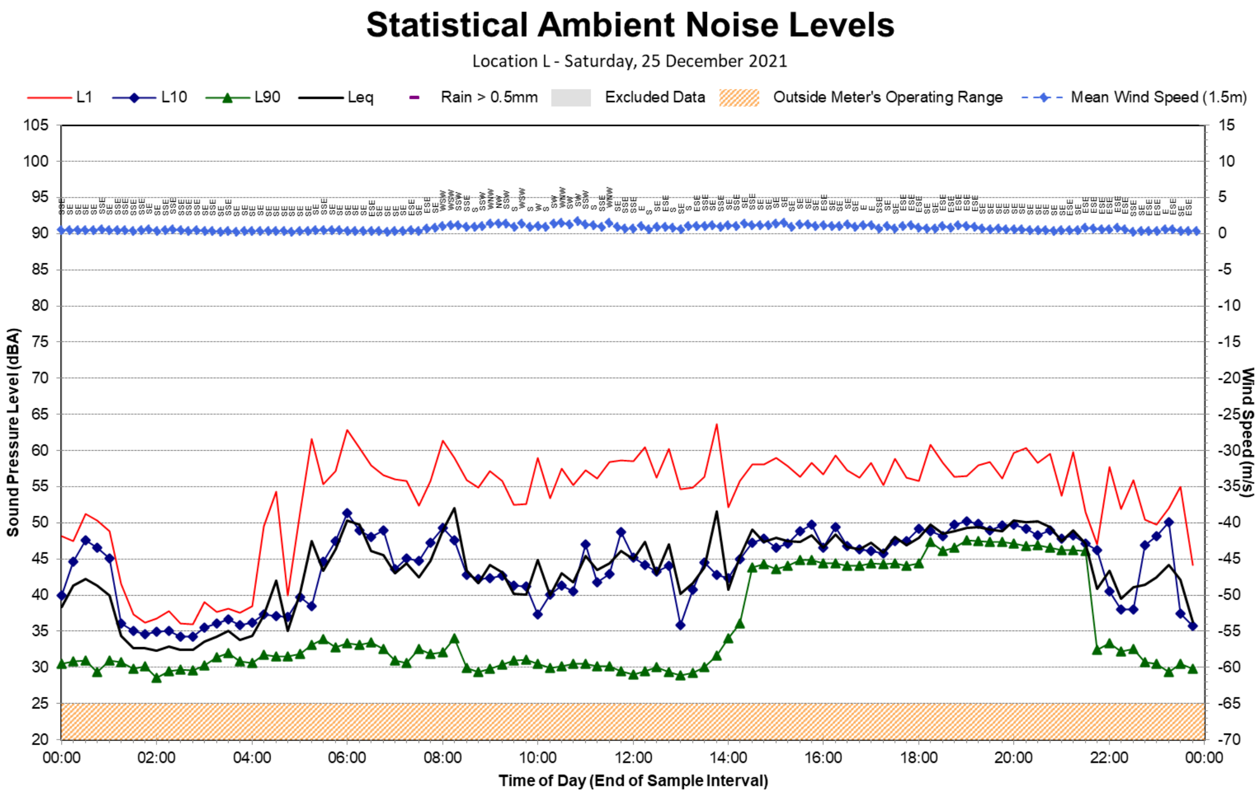
Location L - Thursday, 23 December 2021

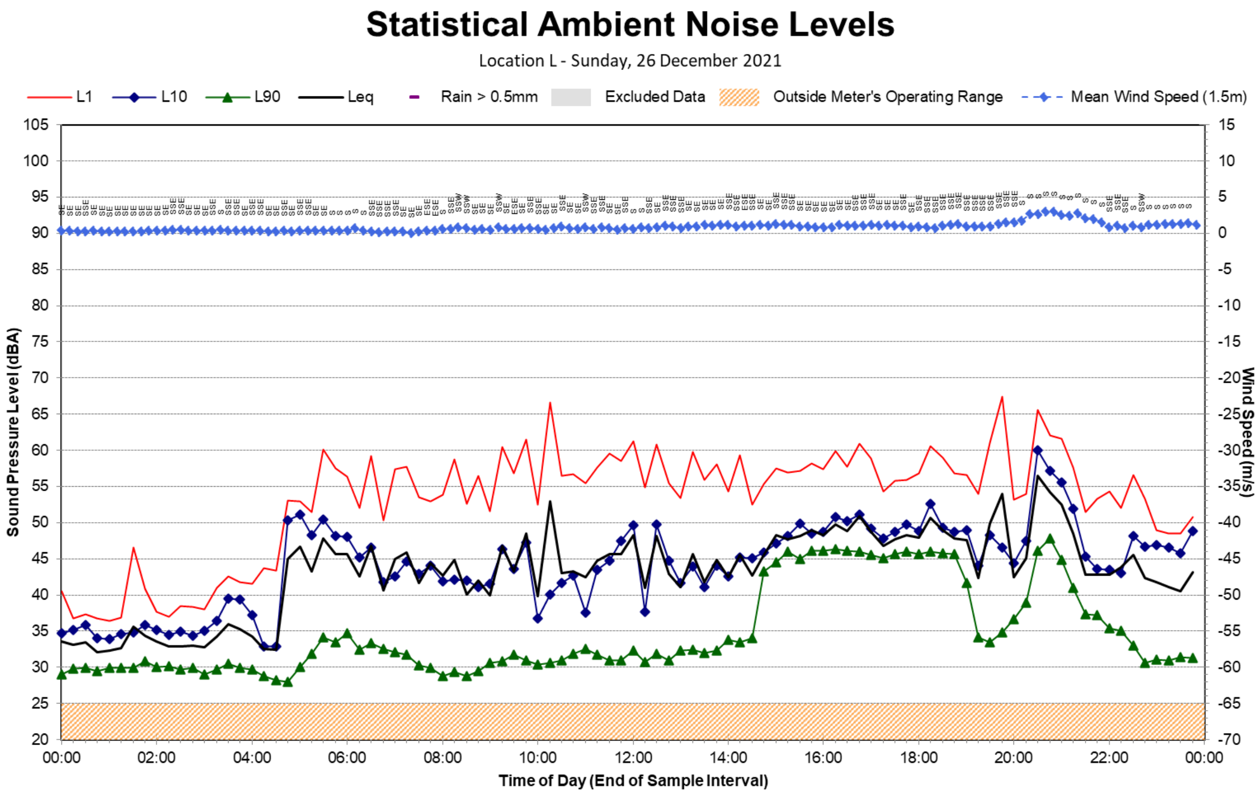


Statistical Ambient Noise Levels

Location L - Friday, 24 December 2021

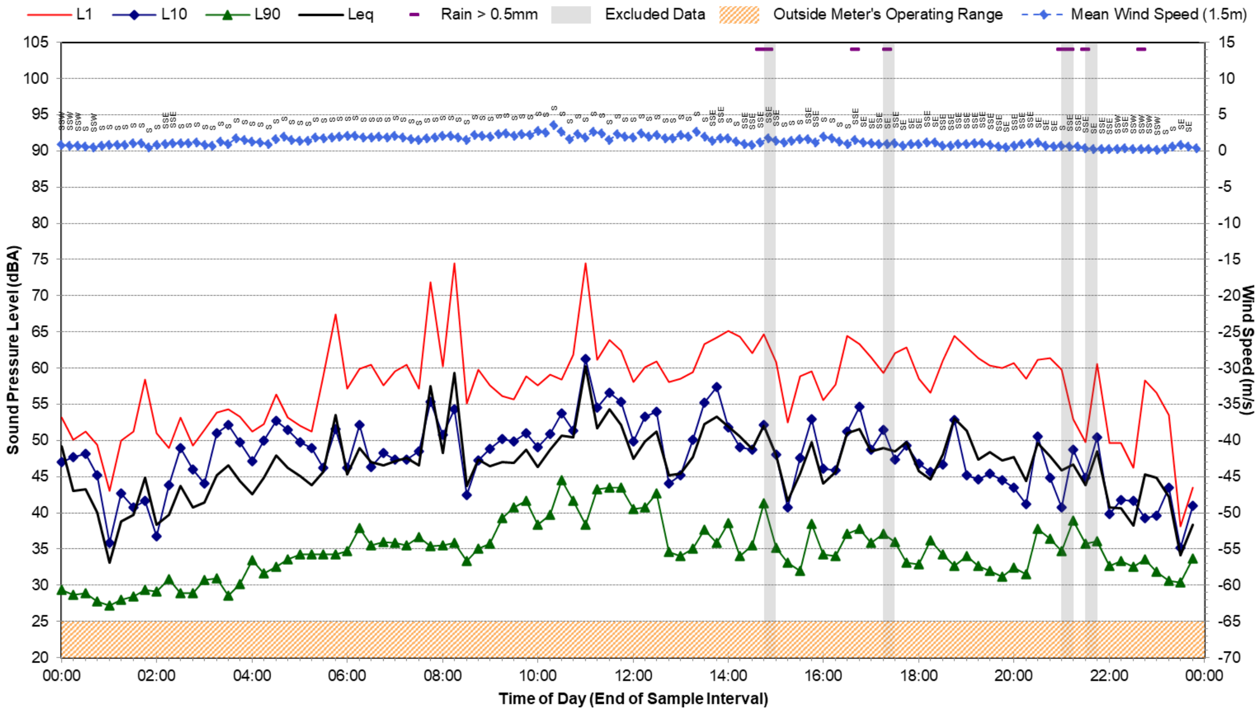



Statistical Ambient Noise Levels
Location L - Saturday, 25 December 2021
L1
L10
L90
Leq
Rain > 0.5mm
Excluded Data
Outside Meter's Operating Range
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Location L - Sunday, 26 December 2021
L1
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)

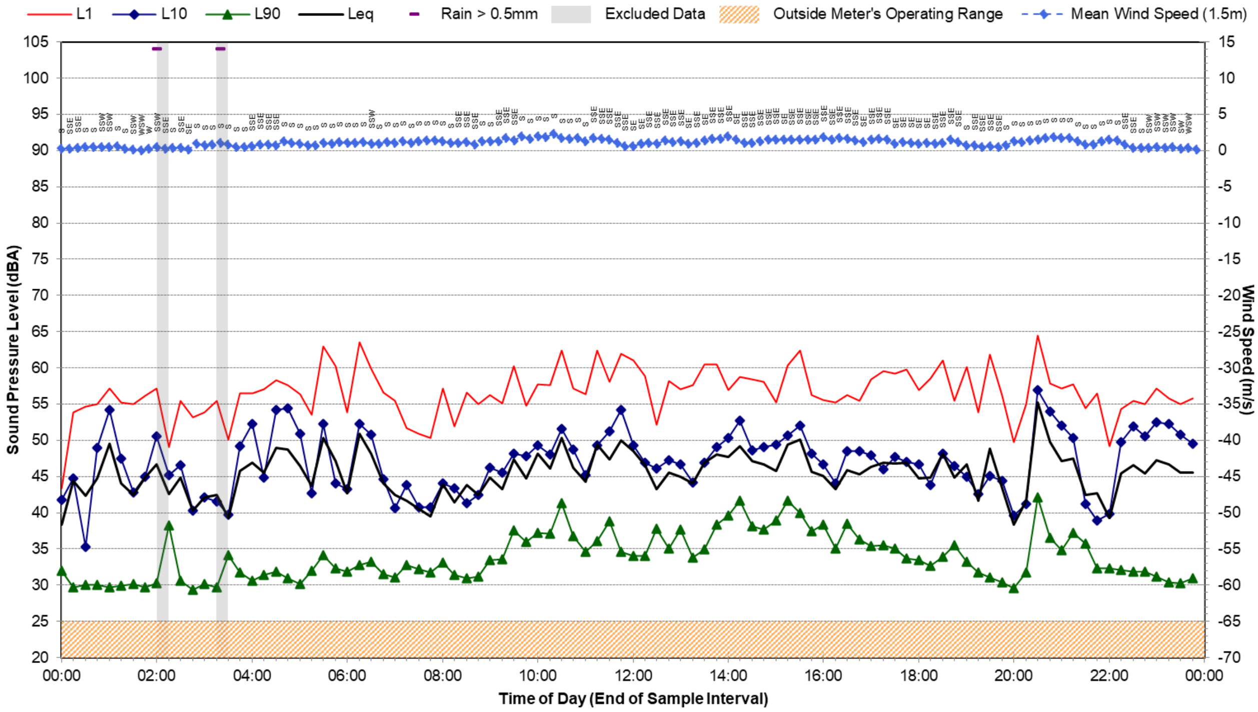
Statistical Ambient Noise Levels

Location L - Monday, 27 December 2021



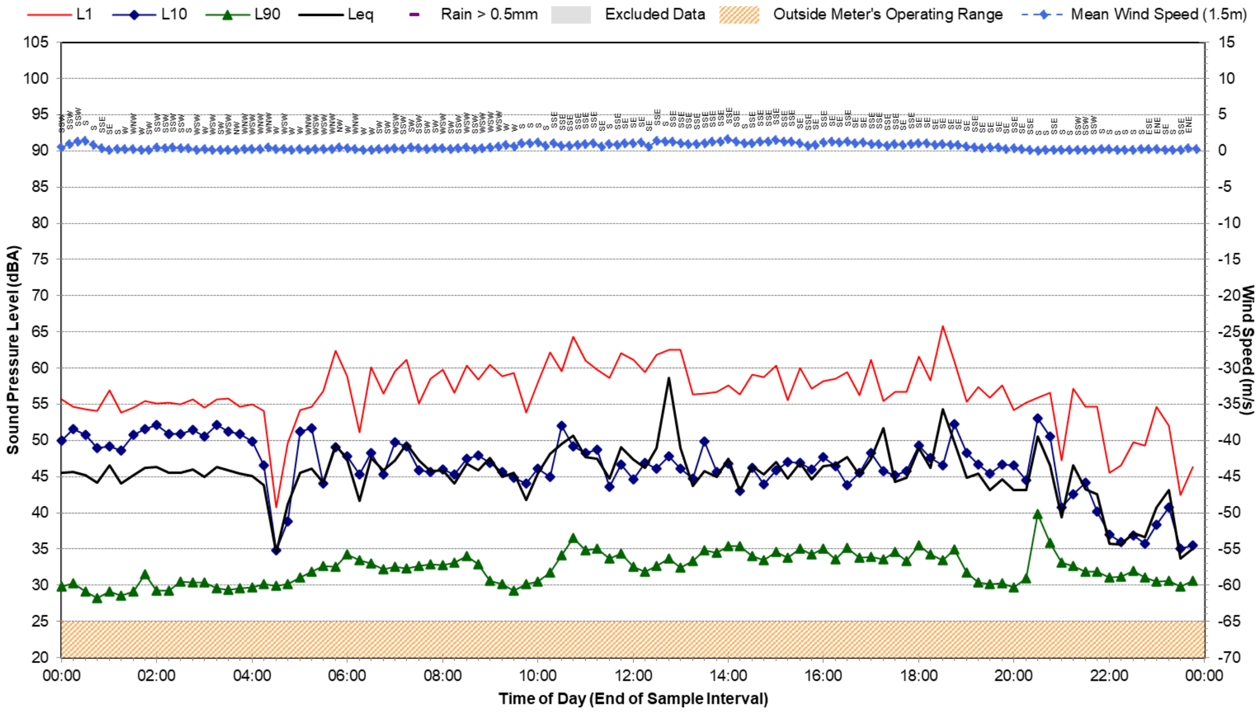
Statistical Ambient Noise Levels

Location L - Tuesday, 28 December 2021



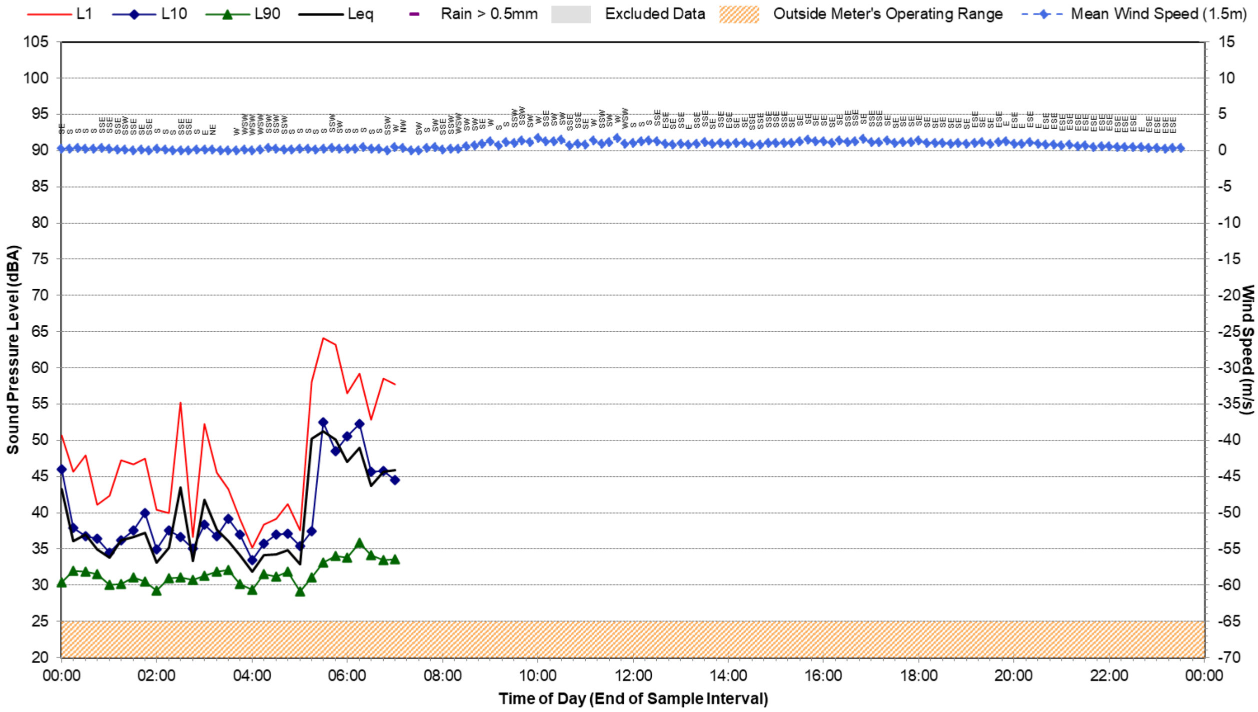
Statistical Ambient Noise Levels

Location L - Wednesday, 29 December 2021



Statistical Ambient Noise Levels

Location L - Thursday, 30 December 2021



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Appendix 2

Air and Water Monitoring Results

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Deposited Dust 2008 to 2021

Month	D1			D2			D3		
	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash
Jan-08	0.4	1.4	0.01	0.1	0.6	<0.1	14	2.6	4.1
Feb-08	4.5	1.6	2.8	0.6	0.6	0.3	9.2	3.2	3.6
Mar-08	0.4	1.6	0.1	0.4	0.6	0.1	0.8	3.1	0.3
Apr-08	1.1	1.6	0.6	2.4	0.7	1.1	0.9	3.1	0.5
May-08	0.2	1.6	<0.1	0.4	0.7	<0.1	0.1	3.1	<0.1
Jun-08	0.4	1.6	0.3	0.7	0.7	0.4	1.3	3.1	0.6
Jul-08	1	1.5	0.6	0.5	0.7	0.3	0.7	3.1	0.4
Aug-08	0.6	1.5	0.3	1	0.8	0.4	1.3	3.1	0.7
Sep-08	1	1.2	0.6	5	1.1	<0.1	1	3.1	0.6
Oct-08	0.8	1.2	0.4	1.4	1.2	0.8	2.7	3.2	1
Nov-08	1.2	1.2	0.8	1.2	1.2	0.8	1.7	3.1	1.1
Dec-08	1.1	1.1	0.8	3	1.4	1.1	1.6	2.9	0.9
Jan-09	0.4	1.1	<0.1	4.4	1.8	0.7	1.5	1.9	0.9
Feb-09	2.8	0.9	2.1	5.8	2.2	2.8	2.7	1.4	2
Mar-09	2	1.1	1.2	0.8	2.2	0.3	0.8	1.4	0.4
Apr-09	0.6	1.0	0.5	1.6	2.2	0.7	0.8	1.4	0.5
May-09	0.4	1.0	<0.1	1.3	2.2	0.4	0.8	1.4	0.4
Jun-09	0.2	1.0	<0.1	1	2.3	0.3	0.6	1.4	0.3
Jul-09	0.8	1.0	0.5	3.6	2.5	0.8	0.8	1.4	0.5
Aug-09	1	1.0	0.7	18	3.9	9.6	1.8	1.4	1.1
Sep-09	4.3	1.3	3.6	9	4.3	4.6	5.2	1.8	4.3
Oct-09	0.8	1.3	0.5	1.7	4.3	0.6	1.4	1.6	0.9
Nov-09	1.4	1.3	1.1	4	4.5	2	1.6	1.6	1.1
Dec-09	0.6	1.3	0.3	0.8	4.3	0.4	5.6	2.0	4.8
Jan-10	1.9	1.4	0.9	**11.3	4.3	1.5	1.9	2.0	1.1
Feb-10	0.6	1.2	0.2	0.6	3.9	<0.1	3.2	2.0	1.5
Mar-10	0.8	1.1	0.2	1.8	3.9	0.4	2.4	2.2	1.8
Apr-10	0.8	1.1	0.3	4.9	4.2	1.8	3	2.4	2.1
May-10	0.3	1.1	<0.1	2.2	4.3	0.8	3	2.5	2.2
Jun-10	0.6	1.2	0.2	1.1	4.3	0.4	0.7	2.6	0.3
Jul-10	0.4	1.1	<0.1	0.5	4.1	0.2	1.9	2.6	1.1
Aug-10	0.6	1.1	0.3	2.6	2.7	0.4	1.6	2.6	1.2
Sep-10	0.9	0.8	0.3	1.6	2.0	0.2	0.9	2.3	0.5
Oct-10	0.9	0.8	0.3	3.5	2.1	1.5	0.9	2.2	0.4
Nov-10	1	0.8	0.2	0.7	1.8	0.2	0.9	2.2	0.3
Dec-10	1	0.8	0.5	0.7	1.8	0.3	1.8	1.9	1.1
Jan-11	0.7	0.7	0.3	4.1	2.0	0.9	0.9	1.8	0.5
Feb-11	0.5	0.7	0.2	2.9	2.2	0.7		1.6	
Mar-11	0.7	0.7	0.2	0.6	2.1	0.3	4.9	1.9	3.8
Apr-11	0.4	0.7	0.1	1.1	1.8	0.5	5.4	2.1	4.8
May-11	0.7	0.7	0.3	1.1	1.7	0.4	1.7	2.0	1.1
Jun-11	0.6	0.7	0.1	0.5	1.7	0.2	1.6	2.0	1
Jul-11	0.4	0.7	0.1	0.1	1.6	<0.1	0.6	1.9	0.3
Aug-11	1.3	0.8	0.8	0.4	1.4	0.2	0.8	1.9	0.5
Sep-11	1	0.8	0.5	1.2	1.4	0.5	0.6	1.8	0.3

Deposited Dust 2008 to 2021

Month	D1			D2			D3		
	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash
Oct-11	0.5	0.7	0.3	1	1.2	0.8	0.8	1.8	0.4
Nov-11	1.1	0.7	0.4	1.2	1.2	0.4	2	1.9	0.8
Dec-11	0.9	0.7	0.3	0.6	1.2	0.2	0.4	1.8	0.3
Jan-12	0.7	0.7	0.1	0.4	0.9	<0.1	0.4	1.7	0.1
Feb-12	0.8	0.8	<0.1	0.3	0.7	<0.1	0.7	1.7	<0.1
Mar-12	1.3	0.8	0.3	1.1	0.8	0.3	1	1.3	0.4
Apr-12	0.9	0.9	0.2	1.3	0.8	0.4	1.2	1.0	0.4
May-12	0.5	0.8	0.3	0.6	0.7	0.2	2.8	1.1	1
Jun-12	0.6	0.8	0.2	4.1	1.0	1.5	1.1	1.0	0.4
Jul-12	0.4	0.8	0.1	0.9	1.1	0.3	0.4	1.0	0.2
Aug-12	1	0.8	0.5	0.8	1.1	0.4	1.3	1.1	0.6
Sep-12	1.3	0.8	0.5		1.1		0.8	1.1	0.5
Oct-12	0.7	0.9	0.3	0.5	1.1	0.3	1.1	1.1	0.5
Nov-12	1	0.8	0.4	1.3	1.1	0.5	1.5	1.1	0.9
Dec-12	1.6	0.9	0.9	3.9	1.4	2.1	1.3	1.1	0.3
Jan-13	0.8	0.9	0.4	0.6	1.4	0.2	0.9	1.2	0.4
Feb-13	0.6	0.9	0.2	1	1.5	0.4	1	1.2	0.4
Mar-13	0.7	0.8	0.2	1.1	1.5	0.4	4.7	1.5	1
Apr-13	0.5	0.8	0.1	3.5	1.7	0.6	1.9	1.6	0.8
May-13	0.3	0.8	0.1	0.8	1.7	0.3	1	1.4	0.5
Jun-13	0.4	0.8	0.2	0.5	1.4	0.4	0.5	1.4	0.4
Jul-13	0.2	0.8	0.2	0.3	1.3	0.2	0.5	1.4	0.3
Aug-13	0.5	0.7	0.3	0.7	1.3	0.4	1.2	1.4	1
Sep-13	0.8	0.7	0.5	0.8	1.3	0.5	1.5	1.4	0.9
Oct-13	0.8	0.7	0.7	0.9	1.3	0.8	3.6	1.6	1.7
Nov-13	1.0	0.7	0.5	0.8	1.2	0.6	4.0	1.8	2.4
Dec-13	0.7	0.6	0.5	0.8	1.0	0.5	3.3	2.0	2.3
Jan-14	0.6	0.6	0.3	0.6	1.0	0.3	2.2	2.1	1.6
Feb-14	0.9	0.6	0.6	0.2	0.9	0.2	2	2.2	1.5
Mar-14	1.0	0.6	0.5	3.2	1.1	1	3.2	2.1	1.1
Apr-14	0.4	0.6	0.1	0.5	0.8	0.1	2.3	2.1	1.4
May-14	0.5	0.7	0.5	5.6	1.2	1.8	2.5	2.2	1.5
Jun-14	0.5	0.7	0.5	0.4	1.2	0.2	2.4	2.4	2
Jul-14	0.8	0.7	0.3	0.7	1.3	0.3	1.3	2.5	0.7
Aug-14	0.2	0.7	0.2	0.2	1.2	0.2	0.6	2.4	0.5
Sep-14	0.4	0.7	0.1	0.6	1.2	0.1	0.6	2.3	0.1
Oct-14	0.6	0.6	0.3	1.3	1.2	0.8	1.1	2.1	0.6
Nov-14	1.4	0.7	0.9	1.6	1.3	0.9	6.2	2.3	3.1
Dec-14	0.3	0.6	0.3	0.7	1.3	0.5	3.8	2.4	2.9
Jan-15	*16.2	0.6	13.1	0.8	1.3	0.4	2.2	2.4	1.2
Feb-15	0.6	0.6	0.4	6.5	1.8	1.9	3.2	2.5	1.5
Mar-15	0.5	0.6	0.5	0.5	1.6	0.3	0.9	2.3	0.6
Apr-15	0.7	0.6	0.3	0.8	1.6	0.3	5	2.5	3.5
May-15	0.2	0.6	0.2	1.5	1.3	0.9	2.9	2.5	2.2
Jun-15	0.2	0.5	0.1	0.2	1.3	0.2	1.8	2.5	1.2
Jul-15	0.2	0.5	0.2	0.3	1.3	0.2	1.8	2.5	1.4

Deposited Dust 2008 to 2021

Month	D1			D2			D3		
	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash
Aug-15	0.8	0.5	0.5	0.5	1.3	0.4	3	2.7	2.8
Sep-15	0.5	0.5	0.2	0.8	1.3	0.5	1.6	2.8	1.2
Oct-15	1	0.6	0.6	0.7	1.2	0.4	1.5	2.8	1.1
Nov-15	0.8	0.5	0.4	0.8	1.2	0.3	1.0	2.4	0.7
Dec-15	2.0	0.7	0.9	1.1	1.2	0.6	3.0	2.3	2.5
Jan-16	0.9	0.7	0.7	0.5	1.2	0.3	0.6	2.2	0.3
Feb-16	0.5	0.7	0.3	0.5	0.7	0.3	0.7	2.0	0.5
Mar-16	0.3	0.7	0.3	0.4	0.7	0.4	1.0	2.0	1
Apr-16	0.4	0.7	0.2	0.5	0.7	0.4	1.4	1.7	0.7
May-16	0.4	0.7	0.3	0.4	0.6	0.3	0.6	1.5	0.3
Jun-16	0.3	0.7	0.2	0.5	0.6	0.4	0.8	1.4	0.5
Jul-16	0.3	0.7	0.1	0.2	0.6	0.1	0.9	1.3	0.6
Aug-16	0.5	0.7	0.2	0.5	0.6	0.3	4.2	1.4	2.2
Sep-16	0.4	0.7	0.2	0.4	0.5	0.2	1.1	1.4	0.7
Oct-16	0.5	0.6	0.4	0.6	0.5	0.3	0.8	1.3	0.4
Nov-16	0.6	0.6	0.5	0.5	0.5	0.3	2.9	1.5	1.2
Dec-16	1.0	0.5	0.7	1.3	0.5	0.8	3.6	1.6	1.7
Jan-17	0.4	0.5	0.3	0.7	0.5	0.4	1	1.6	0.6
Feb-17	0.6	0.5	0.6	11	1.4	9	1.6	1.7	1.1
Mar-17	0.5	0.5	0.2	0.8	1.5	0.5	2.3	1.8	1.3
Apr-17	0.2	0.5	0.1	4.1	1.8	1.1	0.6	1.7	0.3
May-17	0.2	0.5	0.1	0.4	1.8	0.2	0.4	1.7	0.4
Jun-17	0.4	0.5	0.2	4.4	2.1	2.1	0.9	1.7	0.5
Jul-17	0.4	0.5	0.2	0.5	2.1	0.2	1.1	1.7	0.5
Aug-17	0.3	0.5	0.3	0.5	2.1	0.3	0.6	1.4	0.4
Sep-17	0.5	0.5	0.3	0.6	2.1	0.4	1.1	1.4	0.7
Oct-17	0.7	0.5	0.4	0.7	2.1	0.4	1	1.4	0.8
Nov-17	0.8	0.5	0.4	1.8	2.2	0.8	1.1	1.3	0.7
Dec-17	0.7	0.5	0.4	0.7	2.2	0.4	0.8	1.0	0.5
Jan-18	0.8	0.5	0.5	1.6	2.3	0.9	1.8	1.1	1.1
Feb-18	0.5	0.5	0.4	0.8	1.4	0.5	1.2	1.1	0.8
Mar-18	0.4	0.5	0.4	0.6	1.4	0.5	5.1	1.3	1.2
Apr-18	0.5	0.5	0.3	1	1.1	0.7	3.9	1.6	3.1
May-18	0.3	0.5	0.2	0.8	1.2	0.5	0.8	1.6	0.5
Jun-18	0.7	0.6	0.3	3.1	1.1	0.8	1	1.6	0.5
Jul-18	0.3	0.5	0.2	0.5	1.1	0.4	0.3	1.6	0.3
Aug-18	0.5	0.6	0.4	0.5	1.1	0.4	0.6	1.6	0.5
Sep-18	0.7	0.6	0.4	0.7	1.1	0.4	0.8	1.5	0.5
Oct-18	0.3	0.5	0.2	0.5	1.1	0.4	0.7	1.5	0.5
Nov-18	0.6	0.5	0.4	2.0	1.1	1.1	3.0	1.7	2.3
Dec-18	1.1	0.6	0.8	2.0	1.2	1.1	2.9	1.8	2
Jan-19	1.2	0.6	1	1.7	1.2	1.1	1.5	1.8	1.1
Feb-19	0.7	0.6	0.6	1.6	1.3	1.1	1.3	1.8	1
Mar-19	1.3	0.7	0.9	1.8	1.4	1.5	2	1.6	1.5
Apr-19	0.3	0.7	0.3	0.8	1.3	0.7	0.9	1.3	0.9

Deposited Dust 2008 to 2021

Month	D1			D2			D3		
	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash	Insoluble Matter	Rolling Annual Average	Ash
May-19	0.4	0.7	0.2	0.9	1.3	0.5	0.8	1.3	0.5
Jun-19	0.5	0.7	0.3	1.7	1.2	0.8	0.7	1.3	0.5
Jul-19	0.3	0.7	0.2	0.4	1.2	0.3	0.4	1.3	0.3
Aug-19	0.4	0.7	0.2	0.5	1.2	0.4	0.7	1.3	0.4
Sep-19	0.5	0.6	0.3	0.6	1.2	0.5	0.6	1.3	0.4
Oct-19	1	0.7	0.6	2.9	1.4	1.3	1.5	1.4	1.1
Nov-19	0.4	0.7	0.2	0.9	1.3	0.5	0.8	1.3	0.5
Dec-19	0.5	0.7	0.3	1.7	1.2	0.8	0.7	1.3	0.5
Jan-20	1.4	0.9	1.1	1.6	1.5	1.4	3.7	1.6	2.3
Feb-20	1.9	1.0	1.5	2.5	1.6	1.7	3.0	1.8	1.7
Mar-20	0.4	1.0	0.1	1.2	1.6	0.5	0.8	1.7	0.4
Apr-20	0.4	0.9	0.3	0.4	1.5	0.3	0.5	1.6	0.5
May-20	0.6	0.9	0.2	1.0	1.5	0.3	1.0	1.5	0.4
Jun-20	0.3	0.9	0.2	0.5	1.4	0.2	0.9	1.5	0.5
Jul-20	0.3	0.9	0.2	0.3	1.3	0.3	0.6	1.6	0.4
Aug-20	0.7	0.9	0.4	0.7	1.4	0.4	1.0	1.6	0.7
Sep-20	0.5	0.9	0.3	0.9	1.4	0.4	1.0	1.6	0.5
Oct-20	0.9	0.9	0.5	0.9	1.2	0.5	1.2	1.6	0.7
Nov-20	1.2	0.9	0.7	1.8	1.3	1	1.6	1.6	1.1
Dec-20	0.5	0.8	0.2	2.4	1.2	0.9	1.0	1.4	0.5
Jan-21	1.4	0.9	1.1	1.6	1.5	1.4	3.7	1.6	2.3
Feb-21	1.9	1	1.5	2.5	1.6	1.7	3	1.8	1.7
Mar-21	0.4	1	0.1	1.2	1.6	0.5	0.8	1.7	0.4
Apr-21	0.4	0.9	0.3	0.4	1.5	0.3	0.5	1.6	0.5
May-21	0.6	0.9	0.2	1	1.5	0.3	1	1.5	0.4
Jun-21	0.3	0.9	0.2	0.5	1.4	0.2	0.9	1.5	0.5
Jul-21	0.3	0.9	0.2	0.3	1.3	0.3	0.6	1.6	0.4
Aug-21	0.7	0.9	0.4	0.7	1.4	0.4	1	1.6	0.7
Sep-21	0.5	0.9	0.3	0.9	1.4	0.4	1	1.6	0.5
Oct-21	0.9	0.9	0.5	0.9	1.2	0.5	1.2	1.6	0.7
Nov-21	1.2	0.9	0.7	1.8	1.3	1	1.6	1.6	1.1
Dec-21	0.5	0.8	0.2	2.4	1.2	0.9	1	1.4	0.5
Average*	**0.7**	**0.8**	**0.5**	**1.5**	**1.5**	**0.7**	**1.8**	**1.8**	**1.0**
Stnd Dev*	**0.6**	**0.3**	**1.1**	**2.0**	**0.9**	**1.1**	**1.7**	**0.5**	**0.9**
Min*	**0.2**	**0.5**	**0.01**	**0.1**	**0.5**	**0.1**	**0.1**	**1**	**0.1**
Max*	**4.5**	**1.6**	**13.1**	**18**	**4.5**	**9.6**	**14**	**3.2**	**4.8**

* Since 2008

** Contaminated sample (e.g. bird droppings)

Surface Water 2008 to 2021

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
1	Jun-10	7.9	460	19	NS
8	Jun-10	NS	NS	NS	Dry
9	Jun-10	NS	NS	NS	Dry
10	Jun-10	7.3	880	8	NS
11	Jun-10	7.5	690	20	NS
FMCU	Jun-10	6.9	388	NS	NS
FMCD	Jun-10	0	0	0	0
1	Jul-10	6.22	504	18	Pond
8	Jul-10	7.16	1110	2	Pond
9	Jul-10	7.2	1300	27	Trickle
10	Jul-10	7.12	1350	8	Trickle
11	Jul-10	7.06	865	13	Pond
FMCU	Jul-10	7.9	590	8	Trickle
FMCD	Jul-10	7.99	128	1	Steady
1	Aug-10	6.55	492	12	Slow
8	Aug-10	6.75	988	1	Trickle
9	Aug-10	6.92	516	44	Trickle
10	Aug-10	6.67	1220	10	Trickle
11	Aug-10	6.89	602	13	Slow
FMCU	Aug-10	7.31	543	7	Still
FMCD	Aug-10	7.38	130	2	Steady
1	Sep-09	7.05	464	4	Still
8	Sep-10	7.14	947	3	Trickle
9	Sep-10	7.23	1410	6	Trickle
10	Sep-10	7.25	1700	2	Trickle
11	Sep-10	7	671	14	Still
FMCU	Sep-10	7.29	534	4	Pond
FMCD	Sep-10	7.44	121	1	Steady
1	Oct-10	7.19	484	5	Still
8	Oct-10	7.29	1010	2	Still
9	Oct-10	7.74	1570	7	Trickle
10	Oct-10	7.59	1840	6	Trickle
11	Oct-10	7.22	734	16	Still
FMCU	Oct-10	7.07	456	7	Still
FMCD	Oct-10	6.93	121	1	Steady
1	Nov-10	6.89	402	12	Still
8	Nov-10	7.13	461	2	Still
9	Nov-10	7.1	307	45	Trickle
10	Nov-10	7.09	751	32	Trickle
11	Nov-10	6.95	340	6	Still
FMCU	Nov-10	6.94	509	16	Trickle
FMCD	Nov-10	7.14	294	23	Steady

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
1	Dec-10	6.7	436.0	28.0	Still
8	Dec-10	7.16	732	6	Still
9	Dec-10	7.32	1070	32	Still
10	Dec-10	7.17	1410	10	Trickle
11	Dec-10	6.85	493	36	Still
FMCU	Dec-10	6.8	465.0	7.0	Trickle
FMCD	Dec-10	7.21	1580	<5	Slow
1	Jan-11	6.9	536.0	36.0	Still
8	Jan-11	7.19	943	<5	Trickle
9	Jan-11	NS	NS	NS	-
10	Jan-11	7.41	1680	5	Still
11	Jan-11	7.05	568	18	Slow
FMCU	Jan-11	6.7	528.0	14.0	Still
FMCD	Jan-11	6.79	138	6	Slow
1	Feb-11	6.7	424.0	100	Still
8	Feb-11	7.25	624	49	Still
9	Feb-11	NS	NS	NS	-
10	Feb-11	7.16	519	31	Still
11	Feb-11	7.44	1570	20	Still
FMCU	Feb-11	6.7	488.0	16.0	Still
FMCD	Feb-11	6.85	139	<5	Slow
1	Mar-11	NS	NS	NS	Dry
8	Mar-11	7.29	151	20	Still
9	Mar-11	NS	NS	NS	-
10	Mar-11	NS	NS	NS	Dry
11	Mar-11	7.13	578	16	Still
FMCU	Mar-11	NS	NS	NS	Dry
FMCD	Mar-11	6.73	122	<5	Steady
1	Apr-11	NS	NS	NS	Dry
8	Apr-11	7.27	650	9	Still
9	Apr-11	NS	NS	NS	-
10	Apr-11	7.12	487	230	Trickle
11	Apr-11	6.82	577	48	Still
FMCU	Apr-11	7.1	292.0	20.0	Still
FMCD	Apr-11	7.26	133	<5	Steady
1	May-11	NS	NS	NS	Dry
8	May-11	7.22	717	5	Still
9	May-11	NS	NS	NS	-
10	May-11	6.99	1203	5	Still
11	May-11	6.87	320	22	Still
FMCU	May-11	6.5	278.0	12.0	Still
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

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
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	Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
1	Jun-12	6.97	699	22	-	1	Dec-12	0.0	0.0	0.0	Dry
8	Jun-12	7.35	841	<5	-	8	Dec-12	0	0	0	NS
9	Jun-12	NS	NS	NS	NS	9	Dec-12	NS	NS	NS	NS
10	Jun-12	7.41	825	22	-	10	Dec-12	0	0	0	NS
11	Jun-12	7.1	822	19	-	11	Dec-12	0	0	0	NS
FMCU	Jun-12	7.03	228	29	-	FMCU	Dec-12	7.4	427.0	16.0	-
FMCD	Jun-12	7.13	215	26	-	FMCD	Dec-12	7.69	142	5	-
1	Jul-12	6.97	906	<5	-	1	Jan-13	0.0	0.0	0.0	Dry
8	Jul-12	7.3	431	32	-	8	Jan-13	0	0	0	NS
9	Jul-12	NS	NS	NS	NS	9	Jan-13	NS	NS	NS	NS
10	Jul-12	7.66	1020	12	-	10	Jan-13	0	0	0	NS
11	Jul-12	0	0	0	NS	11	Jan-13	0	0	0	NS
FMCU	Jul-12	7.35	624	22	-	FMCU	Jan-13	7.7	461.0	20.0	-
FMCD	Jul-12	7.52	230	40	-	FMCD	Jan-13	7.77	157	<5	-
1	Aug-12	7.13	1330	17	-	1	Feb-13	6.9	483.0	28.0	-
8	Aug-12	7.36	717	174	-	8	Feb-13	0	0	0	NS
9	Aug-12	NS	NS	NS	NS	9	Feb-13	NS	NS	NS	NS
10	Aug-12	7.67	1520	9	-	10	Feb-13	7.08	724	18	-
11	Aug-12	7.43	1070	25	-	11	Feb-13	6.72	391	23	-
FMCU	Aug-12	7.32	477	6	-	FMCU	Feb-13	6.7	325.0	5.0	-
FMCD	Aug-12	7.52	235	6	-	FMCD	Feb-13	7.21	257	6	-
1	Sep-12	7.18	1590	17	-	1	Mar-13	7.0	922.0	24.0	-
8	Sep-12	0	0	0	NS	8	Mar-13	0	0	0	NS
9	Sep-12	NS	NS	NS	NS	9	Mar-13	NS	NS	NS	NS
10	Sep-12	7.62	1720	106	-	10	Mar-13	7.47	1210	6	-
11	Sep-12	7.4	1290	95	-	11	Mar-13	6.98	595	13	-
FMCU	Sep-12	7.21	500	7	-	FMCU	Mar-13	7.1	284.0	26.0	-
FMCD	Sep-12	7.57	206	<5	-	FMCD	Mar-13	7.19	300	<5	-
1	Oct-12	7.24	1760	18	-	1	Apr-13	7.1	1030.0	8.0	-
8	Oct-12	0	0	0	NS	8	Apr-13	0	0	0	NS
9	Oct-12	NS	NS	NS	NS	9	Apr-13	NS	NS	NS	NS
10	Oct-12	7.67	1750	12	-	10	Apr-13	7.42	1490	6	-
11	Oct-12	7.62	1650	57	-	11	Apr-13	7.1	675	10	-
FMCU	Oct-12	7.37	453	16	-	FMCU	Apr-13	7.1	269.0	25.0	-
FMCD	Oct-12	7.65	171	8	-	FMCD	Apr-13	7.37	172	82	-
1	Nov-12	0	0	0	Dry	1	May-13	7.0	648.0	22.0	-
8	Nov-12	0	0	0	NS	8	May-13	0	0	0	NS
9	Nov-12	NS	NS	NS	NS	9	May-13	NS	NS	NS	NS
10	Nov-12	0	0	0	NS	10	May-13	7.55	1070	38	-
11	Nov-12	7.67	2550	108	-	11	May-13	7.16	603	15	-
FMCU	Nov-12	7.11	549	36	-	FMCU	May-13	0.0	0.0	0.0	NS
FMCD	Nov-12	7.44	149	43	-	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

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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

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
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	Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
1	Jan-15	6.52	218	64	Low	1	Jul-15	7.0	872.0	<5	Low
8	Jan-15	5.55	116.3	17	Low	8	Jul-15	6.56	642	<5	Low
9	Jan-15	NS	NS	NS	NS	9	Jul-15	NS	NS	NS	NS
10	Jan-15	7.02	673	104	Mod	10	Jul-15	7.03	1364	<5	Low
11	Jan-15	6.17	229	51	Mod	11	Jul-15	7.22	1492	<5	Low
FMCU	Jan-15	6.49	204	13		FMCU	Jul-15	NS	NS	NS	N
FMCD	Jan-15	6.97	201	10		FMCD	Jul-15	7.27	223	<5	Low
1	Feb-15	6.44	2910	14	Low	1	Aug-15	5.8	762.0	<5	Low
8	Feb-15	NS	NS	NS	No	8	Aug-15	7.62	533	7	N
9	Feb-15	NS	NS	NS	NS	9	Aug-15	NS	NS	NS	NS
10	Feb-15	6.95	766	<5	Low	10	Aug-15	7.52	1315	<5	Low
11	Feb-15	6.75	545	19	Low	11	Aug-15	7.67	1072	7	N
FMCU	Feb-15	NS	NS	NS	N	FMCU	Aug-15	7.9	267.0	<5	N
FMCD	Feb-15	7.12	164.5	<5	Low	FMCD	Aug-15	7.92	145.7	17	Low
1	Mar-15	NS	NS	NS	N	1	Sep-15	7.3	698.0	15.0	No
8	Mar-15	NS	NS	NS	N	8	Sep-15	7.25	499	<5	No
9	Mar-15	NS	NS	NS	NS	9	Sep-15	NS	NS	NS	NS
10	Mar-15	6.89	1107	<5	Low	10	Sep-15	7.7	1237	<5	Low
11	Mar-15	NS	NS	NS	N	11	Sep-15	6.72	714	8	N
FMCU	Mar-15	NS	NS	NS	N	FMCU	Sep-15	7.2	252.0	8.0	N
FMCD	Mar-15	7.53	170	<5	Low	FMCD	Sep-15	8	135.4	<5	Low
1	Apr-15	6.67	382	22	Low	1	Oct-15	7.0	578.0	13.0	N
8	Apr-15	6.45	506	<5	Low	8	Oct-15	7.04	459	9	N
9	Apr-15	NS	NS	NS	NS	9	Oct-15	NS	NS	NS	NS
10	Apr-15	6.69	803	<5	Low	10	Oct-15	7.57	1332	8	Low
11	Apr-15	6.62	1334	53	Low	11	Oct-15	6.92	822	18	No
FMCU	Apr-15	7.11	307	14	Low	FMCU	Oct-15	7.0	226.9	<5	No
FMCD	Apr-15	6.13	372	9	Low	FMCD	Oct-15	7.6	134.9	<5	Low
1	May-15	6.28	838	6	Low	1	Nov-15	7.3	442.0	<5	Low
8	May-15	6.15	478	<5	Low	8	Nov-15	6.99	452	<5	N
9	May-15	NS	NS	NS	NS	9	Nov-15	NS	NS	NS	NS
10	May-15	6.46	977	<5	Low	10	Nov-15	7.38	1022	<5	Low
11	May-15	6.23	1140	23	Low	11	Nov-15	7.13	1945	40	Low
FMCU	May-15	7.04	214	13	Mod	FMCU	Nov-15	7.5	232.5	<5	N
FMCD	May-15	6.71	217	9	Mod	FMCD	Nov-15	7.4	148.9	<5	Low
1	Jun-15	6.02	599	<5	Low	1	Dec-15	7.1	286.0	30.0	N
8	Jun-15	5.97	482	<5	Low	8	Dec-15	7.07	294	<5	Low
9	Jun-15	NS	NS	NS	NS	9	Dec-15	NS	NS	NS	NS
10	Jun-15	6.35	834	<5	Low	10	Dec-15	7.28	901	6	Low
11	Jun-15	6.15	1426	<5	Low	11	Dec-15	7.08	626	10	N
FMCU	Jun-15	6.33	202	6	Low	FMCU	Dec-15	7.2	208.3	14.0	N
FMCD	Jun-15	6.08	200	<5	Mod	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	Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
1	Jan-17	6.91	259	113	NF	1	Jul-17	7.8	565.0	5.0	NF
8	Jan-17	NS	NS	NS	NF	8	Jul-17	7.04	506	<5	NF
9	Jan-17	NS	NS	NS		9	Jul-17	NS	NS	NS	
10	Jan-17	NS	NS	NS	NF	10	Jul-17	7	1438	<5	NF
11	Jan-17	6.51	142.1	9	NF	11	Jul-17	7.37	387	14	NF
FMCU	Jan-17	7.05	181.7	22		FMCU	Jul-17	7.5	298.0	14.0	Light brown
FMCD	Jan-17	7.19	164.4	9		FMCD	Jul-17	8.15	110.1	<5	
1	Feb-17	6.93	443	16	NF	1	Aug-17	8.1	494.0	5.0	NF
8	Feb-17	NS	NS	NS	NF	8	Aug-17	7.33	536	<5	NF
9	Feb-17	NS	NS	NS		9	Aug-17	NS	NS	NS	
10	Feb-17	NS	NS	NS	NF	10	Aug-17	7.27	1361	<5	NF
11	Feb-17	6.6	171.9	22	NF	11	Aug-17	7.31	476	176	NF
FMCU	Feb-17	6.98	198.3	23		FMCU	Aug-17	6.7	303.0	122.0	
FMCD	Feb-17	7.49	173.2	5		FMCD	Aug-17	6.83	110.8	86	
1	Mar-17	6.34	404	5	LF	1	Sep-17	7.4	586.0	37.0	NF
8	Mar-17	5.89	580	<5	LF	8	Sep-17	7.21	581	28	NF
9	Mar-17	NS	NS	NS		9	Sep-17	NS	NS	NS	
10	Mar-17	6.76	1092	9	LF	10	Sep-17	6.89	2071	30	NF
11	Mar-17	6.5	904	10	NF	11	Sep-17	7.64	222	24	NF
FMCU	Mar-17	6.09	252.9	8		FMCU	Sep-17	7.4	340.0	<5	
FMCD	Mar-17	7.45	241	9		FMCD	Sep-17	7.22	202.3	<5	
1	Apr-17	6.92	592	11	NF	1	Oct-17	NS	NS	NS	NF
8	Apr-17	6.33	521	<5	LF	8	Oct-17	NS	NS	NS	NF
9	Apr-17	NS	NS	NS		9	Oct-17	NS	NS	NS	
10	Apr-17	6.85	1044	<5	LF	10	Oct-17	7.07	2240	111	NF
11	Apr-17	6.94	978	10	NF	11	Oct-17	NS	NS	NS	NF
FMCU	Apr-17	6.55	289	6		FMCU	Oct-17	6.2	468.0	23.0	Pooled
FMCD	Apr-17	7.29	186.6	<5		FMCD	Oct-17	8.15	225	<5	
1	May-17	6.93	603	17	NF	1	Nov-17	7.3	202.1	33.0	NF
8	May-17	6.7	685	16	NF	8	Nov-17	6.28	348	<5	NF
9	May-17	NS	NS	NS		9	Nov-17	NS	NS	NS	
10	May-17	7.34	1493	30	NF	10	Nov-17	7	456	21	NF
11	May-17	5.88	348	14	NF	11	Nov-17	NS	NS	NS	NF
FMCU	May-17	7.48	291	<5		FMCU	Nov-17	6.5	163.5	10.0	
FMCD	May-17	6.94	168.6	<5		FMCD	Nov-17	7.53	149.2	5	
1	Jun-17	6.67	450	6	LF	1	Dec-17	6.4	242.0	24.0	NF
8	Jun-17	6.67	455	<5	NF	8	Dec-17	NS	NS	NS	NF
9	Jun-17	NS	NS	NS		9	Dec-17	NS	NS	NS	
10	Jun-17	6.68	811	8	NF	10	Dec-17	6.43	1185	41	NF
11	Jun-17	6.75	1278	15	NF	11	Dec-17	NS	NS	NS	NF
FMCU	Jun-17	7.38	267	8		FMCU	Dec-17	6.5	190.8	16.0	
FMCD	Jun-17	8.24	186	5		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	Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
1	Jan-18	NS	NS	NS	N	1	Jul-18	NS	NS	NS	N
8	Jan-18	NS	NS	NS	N	8	Jul-18	7.13	630	24	
9	Jan-18	NS	NS	NS	N	9	Jul-18	NS	NS	NS	
10	Jan-18	NS	NS	NS		10	Jul-18	7.19	1776	11	
11	Jan-18	6.69	178.2	16		11	Jul-18	7	276	5	
FMCU	Jan-18	NS	NS	NS	L	FMCU	Jul-18	6.8	210.0	5.0	
FMCD	Jan-18	7.2	190.9	5		FMCD	Jul-18	8.02	255	5	
1	Feb-18	NS	NS	NS	N	1	Aug-18	7.3	253.0	31.0	
8	Feb-18	NS	NS	NS	N	8	Aug-18	NS	NS	NS	N
9	Feb-18	NS	NS	NS	N	9	Aug-18	NS	NS	NS	
10	Feb-18	NS	NS	NS		10	Aug-18	7.25	1343	5	
11	Feb-18	6.59	158.9	13		11	Aug-18	6.95	134.4	5	
FMCU	Feb-18	5.42	313	16		FMCU	Aug-18	6.3	239.0	13.0	
FMCD	Feb-18	7.98	208.2	10		FMCD	Aug-18	7.35	149.5	7	
1	Mar-18	NS	NS	NS	N	1	Sep-18	6.9	225.6	57.0	
8	Mar-18	6.87	389	7		8	Sep-18	NS	NS	NS	N
9	Mar-18	NS	NS	NS		9	Sep-18	NS	NS	NS	
10	Mar-18	6.91	1071	235		10	Sep-18	6.9	1469	5	
11	Mar-18	7.03	275	5		11	Sep-18	6.85	139.9	5	
FMCU	Mar-18	6.67	245	6		FMCU	Sep-18	6.8	193.9	10.0	
FMCD	Mar-18	7.89	151.8	8		FMCD	Sep-18	7.76	126.6	6	
1	Apr-18	7.14	580	10		1	Oct-18	6.7	486.0	5.0	
8	Apr-18	6.85	583	8		8	Oct-18	6.58	367	5	
9	Apr-18	NS	NS	NS		9	Oct-18	NS	NS	NS	
10	Apr-18	6.82	1121	16		10	Oct-18	6.98	1077	5	
11	Apr-18	7.4	311	5		11	Oct-18	6.74	272	5	
FMCU	Apr-18	6.06	291	7		FMCU	Oct-18	6.5	434.0	10.0	
FMCD	Apr-18	7.12	157.1	5		FMCD	Oct-18	8.03	148.4	11	
1	May-18	7.08	625	10		1	Nov-18	6.7	324.0	10.0	
8	May-18	6.8	650	9		8	Nov-18	6.89	441	12	
9	May-18	NS	NS	NS		9	Nov-18	NS	NS	NS	
10	May-18	7.35	1436	5		10	Nov-18	6.94	1437	12	
11	May-18	7.2	182.8	5		11	Nov-18	6.74	182.9	22	
FMCU	May-18	7.11	288	6		FMCU	Nov-18	6.9	440.0	15.0	
FMCD	May-18	8.44	154.8	5		FMCD	Nov-18	8.08	166.9	5	
1	Jun-18	6.96	302	9		1	Dec-18	6.4	294.0	15.0	
8	Jun-18	6.15	410	5		8	Dec-18	6.32	326	6	
9	Jun-18	NS	NS	NS		9	Dec-18	NS	NS	NS	
10	Jun-18	6.96	1157	8		10	Dec-18	6.95	523	23	
11	Jun-18	6.85	359	5		11	Dec-18	6.65	204	14	
FMCU	Jun-18	6.63	193.9	5		FMCU	Dec-18	6.9	239.0	5.0	
FMCD	Jun-18	7.8	147.7	26		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

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)	Flow
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

Groundwater 2008 to 2021

Groundwater Quality Monitoring Results – 2008/2009

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)
6	Jun-08	6.1	3740	362
7	Jun-08	6.8	2200	1130
12	Jun-08	6.1	4640	148
13	Jun-08	6.8	12830	32
JRD1	Jun-08	7	2660	132
JRD2	Jun-08	6.7	600	130
6	Jul-08	6.1	3970	174
7	Jul-08	7.1	2590	616
12	Jul-08	6.7	6720	121
13	Jul-08	6.7	14710	6
JRD1	Jul-08	6.8	3210	28
JRD2	Jul-08	7	3040	15
6	Aug-08	6.1	3930	804
7	Aug-08	6.7	2350	98
12	Aug-08	6.8	10130	216
13	Aug-08	7	13610	15
JRD1	Aug-08	7.0	3220	35
JRD2	Aug-08	7.2	2980	57
6	Sep-08	6.2	2860	261
7	Sep-08	6.9	2300	130
12	Sep-08	6.6	1630	152
13	Sep-08	6.8	13580	30
JRD1	Sep-08	7.3	3230	71
JRD2	Sep-08	6.5	220	78
6	Oct-08	6.4	3950	14
7	Oct-08	6.6	2260	878
12	Oct-08	6.8	11530	407
13	Oct-08	6.8	13910	9
JRD1	Oct-08	6.8	3650	28
JRD2	Oct-08	6	220	125
6	Nov-08	6	3750	550
7	Nov-08	6.9	2250	670
12	Nov-08	6.7	8880	182
13	Nov-08	7	13180	3
JRD1	Nov-08	6.7	3830	12
JRD2	Nov-08	6.9	240	178

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)
6	Dec-08	6.1	3750	356
7	Dec-08	6.8	2490	416
12	Dec-08	6.9	11300	173
13	Dec-08	7	13280	11
JRD1	Dec-08	6.9	3800	28
JRD2	Dec-08	6.4	410	180
6	Jan-09	6.6	4260	1160
7	Jan-09	6.5	2250	160
12	Jan-09	6.8	12440	1550
13	Jan-09	6.8	14450	7
JRD1	Jan-09	6.8	3830	13
JRD2	Jan-09	7.1	3080	16
6	Feb-09	6.3	3090	165
7	Feb-09	6.6	2070	177
12	Feb-09			
13	Feb-09	6.9	13090	18
JRD1	Feb-09	6.9	3790	59
JRD2	Feb-09	6.7	500	63
6	Mar-09	6.3	3820	204
7	Mar-09	6.5	2090	534
12	Mar-09	6.3	2390	106
13	Mar-09	7	13250	9
JRD1	Mar-09	6.8	3870	14
JRD2	Mar-09	6.7	490	27
6	Apr-09	6.7	3340	192
7	Apr-09	6.3	2060	196
12	Apr-09	6.8	7970	727
13	Apr-09	6.8	14680	2
JRD1	Apr-09	6.6	3770	11
JRD2	Apr-09	7	2620	15
6	May-09	6.8	4250	136
7	May-09	7	2530	264
12	May-09	6.7	11550	454
13	May-09	6.9	13410	18
JRD1	May-09	6.7	3260	23
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

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)
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

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)
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
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)
6	Jan-15	6.64	2190	550
7	Jan-15	0	0	0
12	Jan-15	0	0	0
13	Jan-15	7.06	5490	75
JRD1	Jan-15	NS	NS	NS
JRD2	Jan-15	6.6	1784	171
6	Feb-15	6.74	2310	38
7	Feb-15	0	0	0
12	Feb-15	0	0	0
13	Feb-15	6.97	5480	40
JRD1	Feb-15	NS	NS	NS
JRD2	Feb-15	6.58	446	24
6	Mar-15	6.78	2350	424
7	Mar-15	0	0	0
12	Mar-15	0	0	0
13	Mar-15	6.91	5890	76
JRD1	Mar-15	NS	NS	NS
JRD2	Mar-15	6.68	788	110
6	Apr-15	6.45	2440	626
7	Apr-15	0	0	0
12	Apr-15	0	0	0
13	Apr-15	6.68	3220	86
JRD1	Apr-15	NS	NS	NS
JRD2	Apr-15	6.74	2080	130
6	May-15	6.53	2270	44
7	May-15	0	0	0
12	May-15	0	0	0
13	May-15	6.95	4030	27
JRD1	May-15	NS	NS	NS
JRD2	May-15	6.83	1910	41
6	Jun-15	6.47	2290	38
7	Jun-15	0	0	0
12	Jun-15	0	0	0
13	Jun-15	6.92	4250	71
JRD1	Jun-15	NS	NS	NS
JRD2	Jun-15	6.7	2030	37.0

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)
6	Jul-15	6.9	2099	90.0
7	Jul-15	0	0	0
12	Jul-15	0	0	0
13	Jul-15	7.28	2540	94
JRD1	Jul-15	NS	NS	NS
JRD2	Jul-15	7.3	914	9.0
6	Aug-15	7.4	2260	62
7	Aug-15	0	0	0
12	Aug-15	0.0	0	0.0
13	Aug-15	7.45	4780	122
JRD1	Aug-15	NS	NS	NS
JRD2	Aug-15	7.7	2168	24.0
6	Sep-15	6.65	2399	31
7	Sep-15	0.0	0	0.0
12	Sep-15	0	0	0
13	Sep-15	7.1	4810	62
JRD1	Sep-15	NS	NS	NS
JRD2	Sep-15	6.94	2580	38
6	Oct-15	6.74	2267	68
7	Oct-15	0	0	0
12	Oct-15	0	0	0
13	Oct-15	7.01	4040	23
JRD1	Oct-15	NS	NS	NS
JRD2	Oct-15	7.13	1961	100
6	Nov-15	6.8	2450	103.0
7	Nov-15	0	0	0
12	Nov-15	0	0	0
13	Nov-15	7.01	4040	23
JRD1	Nov-15	NS	NS	NS
JRD2	Nov-15	7.12	2335	196
6	Dec-15	6.81	2417	342
7	Dec-15	0	0	0
12	Dec-15	0	0	0
13	Dec-15	7.15	5290	30
JRD1	Dec-15	NS	NS	NS
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
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
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

Sample Site	Date	pH	EC (uS/cm)	TSS (mg/L)
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

Appendix 3

Subsidence Management Plan

End of Year Report 2021

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DONALDSONCOAL

Part of the Yancoal Australia Group

Abel Mine
Subsidence Management Plan
End of Year Report 2021

31 March 2022

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 2021 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 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 Area 4 (Panels 27, 28, 29)	1 October 2014

Infrastructure Owners	Management Plans	Approved
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 7/07/2010	Weekly Surveys	11/02/2011 24/06/2011 1/08/2012
Panel 2	*Subsidence Survey*			22/12/2010 21/06/2011 20/06/2012 9/10/2013
Panel 3	*Subsidence Survey*	*23/12/2010*	Weekly Surveys	*10/06/2011* *25/10/2011*

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
				9/05/2012
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*23/12/2010*		
Panel 4	*Subsidence Survey*	*4/03/2011*	Weekly Surveys	*24/08/2011* *9/05/2011* *3/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*4/03/2011*		
Panel 5	*Subsidence Survey*	*27/05/2011*		*4/11/2011* *2/05/2012* *18/02/2013* *14/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*27/05/2011*		
Panel 6	*Subsidence Survey*	*14/09/2011*		*1/05/2012* *4/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*14/09/2011*		
Panel 7	*Subsidence Survey*	*8/02/2012*		*2/08/2012* *28/05/2013* *13/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*8/02/2012*		
	Subsidence Survey	*13/02/2012*		*31/10/2012*

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
Panel 8				*17/05/2013* *6/09/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*13/02/2012*		
Panel 15	*Subsidence Survey*	*9/02/2012*		*27/04/2012* *14/01/2013* *17/05/2013*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*9/02/2012*		
Panel 20	*Subsidence Survey*	*29/08/2012*		*10/01/2013* *8/01/2014* *9/07/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*29/08/2012*		
Panel 19	*Subsidence Survey*	*1/05/2013*		*14/09/2013* *9/07/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*1/05/2013*		
Panel 19A	*Subsidence Survey*	*7/01/2013*		*4/06/2013* *14/09/2013* *5/11/2013* *7/01/2014* *7/07/2014*
	Visual inspection		Weekly Surveys	
	Photographic	*7/01/2013*		

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
	monitoring			
Panel 21	*Subsidence Survey*	*7/11/2012*		*16/05/2013* *24/01/2014* *1/09/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*7/11/2012*		
Panel 22	*Subsidence Survey*	*11/04/2013*		*30/07/2013* *28/01/2014* *19/02/2015*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*11/04/2013*		
Panel 23	*Subsidence Survey*	*12/07/2013*		*8/04/2014* *3/03/2015* *28/10/2015*
	Visual inspection		Daily	
	Photographic monitoring	*12/07/2013*		
Panel 24	*Subsidence Survey*	*19/02/2013*		*1/10/2014* *3/03/2015* *22/10/2015*
	Visual inspection		Daily	
	Photographic monitoring	*19/02/2013*		
Panel 25	*Subsidence Survey*	*13/03/2014*		*3/12/2015* *22/09/2015*
	Visual inspection		Daily	
	Photographic	*13/03/2014*		

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
	monitoring			
Panel 26	*Subsidence Survey*	*9/05/2014*		*6/08/2015* *31/01/2017*
	Visual inspection		Daily	
	Photographic monitoring	*9/05/2014*		
Panel 27	*Subsidence Survey*	*16/10/2014*		*3/09/2015* *31/01/2017*
	Visual inspection		Daily	
	Photographic monitoring	*22/09/2014*		
Panel 28	*Subsidence Survey*	*6/05/2014*		*20/12/2016* *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* *8/01/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*14/11/2012*		

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
Tailgate Headings	*Subsidence Survey*	*18/05/2012*		*19/12/2012* *13/06/2013* *14/01/2014*
	Visual inspection		Weekly Surveys	
	Photographic monitoring	*18/05/2012*		
East Mains Headings	*Subsidence Survey*	*9/07/2012*		*14/01/2013* *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 8/09/2010 over P2	Weekly Surveys	*11/02/2011 & 24/06/2011 Over P1* *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	
	Photographic monitoring	Same date as Panel surveys		
	Subsidence Survey	28/03/2012	*As detailed in Management*	Same date as Panel

Survey / Monitoring Line	Survey / Monitoring Description	Pre – Mining Survey	Survey / Inspection / Monitoring Dates	Post – Mining
TransGrid Transmission Towers			*Plan*	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 2021.

Sampling Site	pH	EC (µS/cm)	TSS (mg/L)
6	6.03 – 7.3 (6.64)	138 – 2602 (1,937)	20– 447 (143)
13	No Access to site	No Access to site	No Access to site
JRD2	5.23 – 7.2 (6.66)	491 – 2,546 (1,765)	35 – 367 (136)

Table 6 – Summary of Surface Water Quality Monitoring Results 1 January to 31 December 2021

Sampling Site	pH	EC (µS/cm)	Turbidity (NTU)	TSS (mg/L)
1	6.34 - 7.32 (6.99)	223 - 999 (676)	9.1 – 72.4 (33.3)	<5 – 42 (15.5)
8	6.15 – 6.79 (6.79)	194 – 656 (486)	13.4 – 65.9 (27.9)	<5 – 31 (8.3)
10	6.26 – 7.7 (7.19)	195 – 1,768 (1,227)	3.3 – 59.8 (14.3)	<5 – 28 (10.6)
11	6.57 – 7.50 (7.09)	223 – 3078 (1512)	4.1 – 75.3 (18.6)	<5 -40 (15)
FMCU	6.82 - 7.91 (7.17)	158 – 585 (320)	21.6 – 24.2 (22.9)	<5 – 18 (9.4)
FMCD	6.9 – 7.86 (7.26)	111 – 577 (239)	17.3 – 18.8 (18.0)	<5 – 42 (12.4)

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) and January 2016 (430.8mm). This also occurred in March 2021 (234.8). 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 111µS/cm and 3076µS/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 marked reduction in March 2021 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 Sites 1, 8 and 10 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) levels did not exceed the industry standard TSS criteria (50mg/L) at any of the sites.
Exceedances of Turbidity at sites 8, 10 and 11 corresponded to a high rainfall event in march. 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. 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. 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.

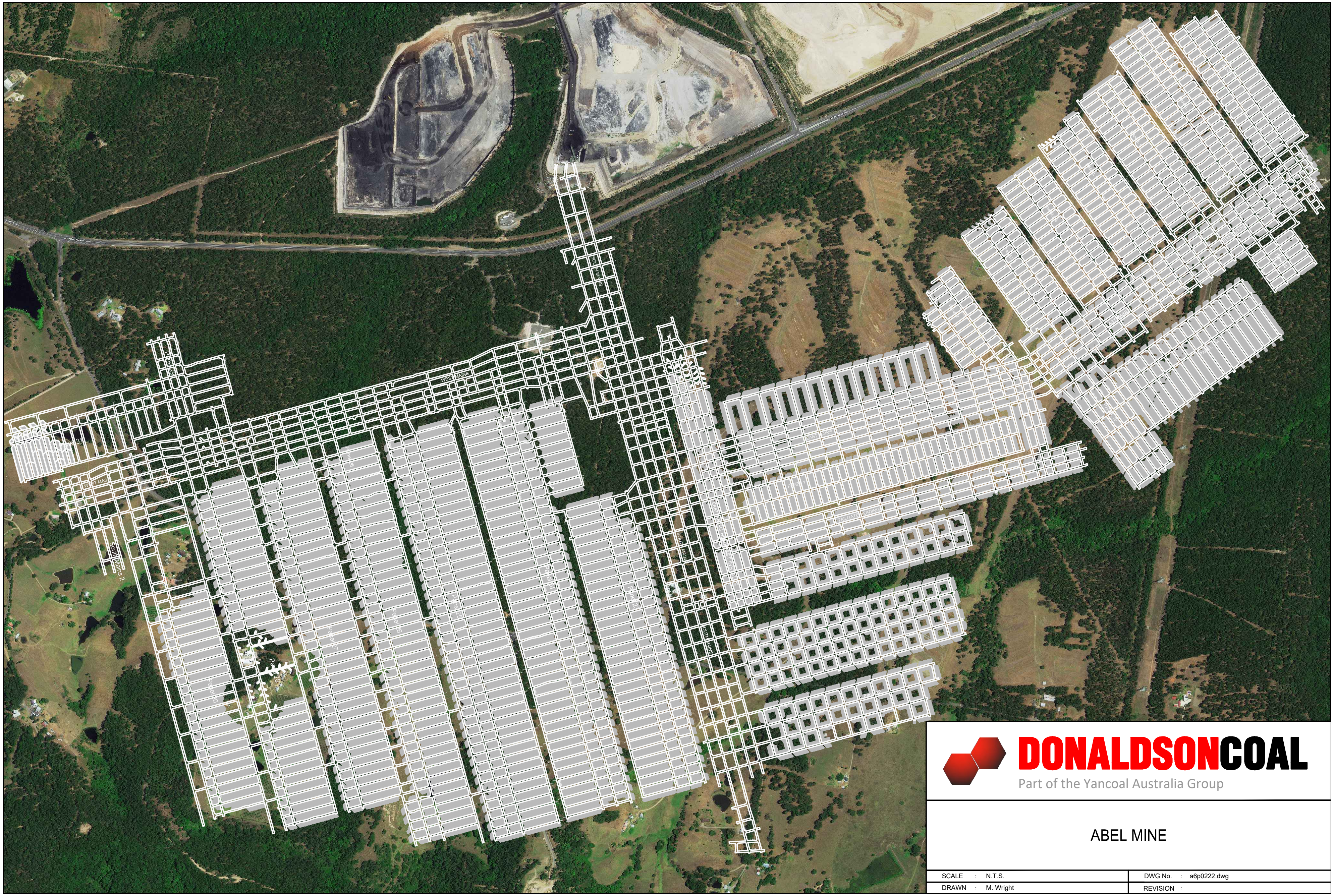
During the period access to Site 13 was restricted with no access granted by the property owner.

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.



DONALDSONCOAL
Part of the Yancoal Australia Group

ABEL MINE

SCALE : N.T.S.		DWG No. : a6p0222.dwg	
DRAWN : M. Wright		REVISION :	

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