Appendix K: Revised Noise Impact Assessment

Noise Impact Assessment

Bulk Recovery Solutions Pty Ltd
Resource Recovery Facility
Ingleburn, NSW.

Prepared for: KDC Pty Ltd
December 2019
MAC170598RP1V03

Muller Acoustic Consulting

Document Information

Noise Impact Assessment

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by KDC Pty Ltd (KDC) to complete a Noise Impact Assessment (NIA) for the proposed upgrade to the Bulk Recovery Solutions Pty Ltd (BRS) resource recovery facility (the 'project') located at the existing BRS site, Ingleburn, NSW.

The project is located at the eastern end cul-de-sac at Lot 16, DP 717203, 16 Kerr Road, Ingleburn, NSW. To the north east of the site is Henderson Road and to the south east of the site is the Main Southern Railway. Industrial receivers are situated to the north west, west and south of the site and all utilise Kerr Road for access.

The nearest residential receivers are located to the south east of the project site, across the Main Southern Railway with the nearest receiver at an offset distance of approximately 70m from the railway.

Key aspects considered as part of the NIA include:

- operational noise, including transportation and processing emissions;
- construction noise; and
- road traffic noise (off-site).

The NIA has been prepared to address the Secretary's Environmental Assessment Requirements (SEAR's) (SSD8593) issued by the DoPE (EPA, 27 Sept 2017). The NIA was completed to quantify potential acoustic impacts associated with the modified operation and construction of the project and to accompany the Environmental Assessment that has been submitted to Department of Planning and Environment (DoPE). Accordingly, the assessment has been completed in accordance with the following policies and guidelines:

- Environment Protection Authority (EPA) 2017, NSW Noise Policy for Industry (NPI);
- Department of Environment and Climate Change (DECC) 2009, Interim Construction Noise Guideline (ICNG); and
- Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

1.1 Background

BRS currently operates a Resource Recovery Facility (RRF) at 16 Kerr Road, Ingleburn under an existing approval from City of Campbelltown Council. The RRF currently operates in the external yards and south eastern end of the main building. Australian Weighing Equipment (AWE) currently operates within the main internal space of the building.

BRS currently process waste material in the form of waste concrete, cement, fly ash, road base and small amounts of liquid waste.

Following the decommissioning and relocation of the AWE to a new premises, BRS proposed to expand their current operations from 30,00 tonnes per annum to up to 225,000 tonnes per annum, with additional wastes to be processed onsite.

1.2 Proposed Operations

Day and evening operations onsite include the operation of the existing crushing plant in the crushing room at the south east boundary of site adjacent to the rail line. The crusher will be support by excavators within the crushing rooms with loaders, bobcat, forklifts and truck and dogs. The mud flocculant plant and batch plant will also operate during the daytime and evening periods along with associated agitator and loader movements.

Within the main building, a slump stand is proposed. A pug mill and DAF system are proposed along with a block making and product storage area.

During the night period only the flocculant plant, batch plant with associated agitators and internal main building operations are proposed.

Table 1 presents the proposed equipment and their associated operational times proposed for the project.

Table 1 Proposed Operational Periods			
Plant/Equipment	Day	Evening	Night
Excavators	✓	✓	x
Front End Loaders	✓	✓	x
Truck and Dog Manoeuvring	✓	✓	x
Truck and Dog Tipping	✓	✓	x
Crusher	✓	✓	x
Agitator Operating	✓	✓	✓
Agitator Manoeuvring	✓	✓	✓
Mud Flocculant Plant	✓	✓	✓
Pug Mill	✓	✓	x
Liquid Waste Plant	✓	✓	✓

The proposed modification would result in a total of 176 heavy vehicle movements per day. This includes the heavy vehicle requirements for the solid and liquid waste operations onsite and also allows several additional heavy vehicle movements for potential vehicles or other site consumable deliveries. Solid and liquid waste vehicles operating between 7am and10pm and concrete agitators operating between 3am and 10pm.

It has been assumed that all vehicle movements would travel along Aero Road and turn into Kerr Road, with an average of 10 truck movements per hour. During the night-time (10pm – 7am) period an average of four truck movements per hour are proposed.

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2 Receiver Review

The project is situated on the eastern edge of a large industrial area at Ingleburn, NSW. Receivers in the locality surrounding the project are primarily urban, residential and industrial. The nearest affected receivers to the project are presented in **Table 2**. **Figure 1** provides a locality plan identifying the position of these receivers in relation to the project.

Table 2 Receivers

Receiver	Category	Coordinates (MGA56)	
		Easting	Northing
R01	Residential	303323	6236644
R02	Residential	303333	6236637
R03	Residential	303339	6236645
R04	Residential	303345	6236650
R05	Residential	303357	6236666
R06	Residential	303367	6236637
R07	Residential	303385	6236621
R08	Residential	303397	6236615
R09	Residential	303421	6236602
R10	Residential	303356	6236587
R11	Residential	303328	6236570
R12	Residential	303304	6236594
R13	Residential	303295	6236583
R14	Residential	303285	6236569
R15	Residential	303272	6236556
R16	Residential	303262	6236549
R17	Residential	303250	6236533
R18	Residential	303240	6236519
R19	Residential	303233	6236513
R20	Residential	303218	6236498
R21	Residential	303211	6236488
IND1	Industrial	303259	6236850
IND2	Industrial	303179	6236781
IND3	Industrial	303122	6236765
IND4	Industrial	303092	6236726
IND5	Industrial	303243	6236665
IND6	Industrial	303214	6236635
IND7	Industrial	303191	6236606
AR1	Active Recreation	303444	6236724

FIGURE 1

LOCALITY PLAN

REF: MAC170598

0 100m

KEY	
R1	RECEIVER LOCATION
L1	LOGGER LOCATION
	SITE LOCATION

MAC
Muller Acoustic Consulting

*Imagery Source : nearmaps

3 Noise Policy and Guidelines

3.1 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997. The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, taking into account the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.

2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.

3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.

4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

3.1.1 Project Noise Trigger Levels

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) value of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.1.2 Project Intrusiveness Noise Level

The PINL ($LA_{eq(15\text{-}min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels needs to be measured.

3.1.3 Project Amenity Noise Level

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area.
- **Project Amenity Noise Levels (PANL)** – is the recommended levels for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: "*to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise levels applies for each new source of industrial noise as follows*":

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

The recommended amenity noise levels as per Table 2.2 of the NPI reproduced in **Table 3**.

Table 3 Amenity Criteria

Receiver Type	Noise Amenity Area	Time of day	Recommended Amenity Noise Level dB $LA_{eq(period)}$
Residential	Urban	Day	60
		Evening	55
		Night	45

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7.

Time of day is defined as follows: (These periods may be varied where appropriate, for example, see A3 in Fact Sheet A.)

- day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays
- evening – the period from 6pm to 10pm
- night – the remaining periods.

3.1.4 Maximum Noise Level Assessment

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed:

- $LA_{eq(15\text{-}min)}$ 40dBA or the prevailing RBL plus 5dB, whichever is the greater, and/or
- LA_{max} 52dBA or the prevailing RBL plus 15dB, whichever is the greater,

a detailed maximum noise level event assessment should be undertaken.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.2 Interim Construction Noise Guideline

The assessment and management of noise from construction work is completed with reference to the Interim Construction Noise Guideline (ICNG). The ICNG is specifically aimed at managing noise from construction work regulated by the EPA and is used to assist in setting statutory conditions in licences or other regulatory instruments. The types of construction regulated by the EPA under the POEO Act (1997), include construction, maintenance and renewal activities carried out by a public authority, such as road upgrades as described in Schedule 1 of the POEO Act.

The ICNG sets out procedures to identify and address the impact of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment.

The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks;
- Qualitative, which is suited to short term infrastructure maintenance (for projects with a typical duration of less than three weeks).

The methodology for a quantitative assessment requires a more complex approach, involving noise emission predictions from construction activities to the nearest relevant receptors. The qualitative assessment methodology is a more simplified approach that relies more on noise management strategies. This study has adopted a quantitative assessment approach.

The quantitative approach includes identification of potentially affected receptors, description of activities involved in the project, derivation of the construction noise management levels, quantification of potential noise impact at receptors and, provides management and mitigation recommendations. **Table 4** summarises the ICNG recommended standard hours for construction.

Table 4 Recommended Standard Hours for Construction

Period	Preferred Construction Hours
Day (Standard construction hours)	Monday to Friday - 7am to 6pm Saturdays - 8am to 1pm Sundays or Public Holidays - No construction

The recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm. Work conducted outside of standard hours are considered out of hours work (OOH). OOH periods are divided into two categories representing evening and night periods and cover the hours listed below:

Period 1 (evening/low risk period): Monday to Friday – 6pm to 10pm, Saturdays – 1pm to 6pm, Sundays – 8am to 6pm.

Period 2 (night/medium to high risk period): Monday to Friday – 10pm to 7am, Saturdays/Sundays – 6pm to 7am (8am on Sunday mornings).

3.2.1 Construction Noise Management Levels

Section 4 of the ICNG details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML), and are important indicators of the potential level of construction noise impact. **Table 5** provides the ICNG recommended $LA_{eq(15min)}$ NMLs and how they are to be applied.

Table 5 Noise Management Levels		
Time of Day	Management Level $LA_{eq(15\text{-}min)}$[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $LA_{eq(15\text{-}min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences; and if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours.	Noise affected RBL + 5dB	A strong justification would typically be required for work outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABLs.

3.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in **Section 5**.

4 Existing Environment

4.1 Background Noise Environment

To quantify the existing background noise environment of the area, unattended noise monitoring was conducted at two locations adjacent to the project site. The locations were selected to represent noise levels for two noise catchments primarily controlled by ambient traffic noise, non-site related industrial noise and urban ambient sources. Location 1, located on 24 Gordon Avenue, Ingleburn and is representative of Receivers R1 – R15. Location 2 was at 7 James Street, Ingleburn is representative of receivers R16 – R21. The selected monitoring locations are shown in **Figure 1.**

The unattended noise survey was conducted in general accordance with the procedures described in Australian Standard AS 1055-2018, "Acoustics - Description and Measurement of Environmental Noise".

The measurements were carried out using two Svantek Type 1, 977 noise analysers between Wednesday 28 February 2018 and Monday 12 March 2018.

Observations on-site identified the surrounding locality was typical of an urban environment, with birds, traffic noise and industrial noise audible. It is noted that the project site was inaudible at both unattended monitoring locations (L1 and L2). Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Data affected by adverse meteorological conditions have been excluded from the results in accordance with methodologies provided in Fact Sheet A4 of the NPI.

The results of long-term unattended noise monitoring are provided in **Table 6** and are presented as the noise monitoring charts in **Appendix B**.

Table 6 Background Noise Monitoring Summary			
Catchment and Representative Residential Receivers	Period[1]	Measured dB LA_{90}	Measured dB $LA_{eq(period)}$
L1 – Gordon Avenue (R1 – R15)	Day	42	53
	Evening	42	53
	Night	35	46
L2 – James Street (R16 – R21)	Day	42	57
	Evening	42 (43)[2]	58
	Night	38	55

Note: Excludes periods of wind or rain affected data, meteorological data obtained from the Bureau of Meteorology Holsworthy Aerodrome (33.9925°S 150.9489°E 68m AMSL)

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Bracketed value is measured RBL, although as per the NPI the RBL for evening can't be higher than day.

To gain a better understanding of the existing noise environment, MAC conducted attended noise monitoring at the nearest residential receiver, 2 Gordon Avenue, (R1) during calm clear weather conditions. The purpose of the measurements was to ascertain dominant ambient noise sources and to quantify any existing industrial noise contribution.

It is noted that the project site was barely audible during attended daytime noise surveys and inaudible during the evening and night measurements.

The results of attended noise measurements and observations conducted on 8 March 2018 are summarised in **Table 7**.

Table 7 Operator-Attended Noise Survey Results, 8 March 2018 – R1						
Period	Duration	Time (hrs)	Primary Noise Descriptor (dBA re 20 µPa)			Description and SPL, dBA
			L_{Amax}	L_{Aeq}	L_{A90}	
Day	15 mins	14:44	81	64	47	Train 49 – 81 Traffic 44 – 66 Birds 43 – 53 Transient project site noise 48 – 53 Industrial Hum (non-project) 42 – 48
		Project Contribution $L_{Aeq(15\text{-}min)}$				40
Evening	15 mins	21:09	87	64	41	Traffic 39 – 48 Insects 41 – 50 Train 45 – 87
		Project Contribution $L_{Aeq(15\text{-}min)}$				Nil
Night	15 mins	22:00	80	58	40	Traffic 34 – 48 Train 45 – 80 Aircraft 45 – 54
		Project Contribution $L_{Aeq(15\text{-}min)}$				Nil

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5 Noise Criteria

5.1 Operational Noise Criteria

5.1.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 8** and have been determined based on the RBL +5dBA.

Table 8 Intrusiveness Noise Levels

Receiver	Period[1]	Measured RBL dB LA_{90}	Intrusiveness Noise Level, dB $LA_{eq(15\text{-}min)}$
Residential (R1 – R15)	Day	42	47
	Evening	42	47
	Night	35	40
Residential (R16 – R21)	Day	42	47
	Evening	42	47
	Night	38	43

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

5.1.2 Project Amenity Noise Levels

The PANLs for residential receivers and other sensitive receivers potentially affected by the project are presented in **Table 9.**

Table 9 Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	Recommended ANL dB $LA_{eq(period)}$[2]	PANL dB $LA_{eq(period)}$[3]	PANL dB $LA_{eq(15\text{-}min)}$[4]
Residential (R1 – R15)	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Residential (R16 – R21)	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Industrial (I1 – I7)	All	When in use	70	65	68
Active Recreation (AR1)	All	When in use	55	50	53

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Note 2: Recommended amenity noise levels as per Table 2.2 of the NPI.

Note 3: Project Amenity Noise Level equals the amenity noise level – 5dB as there is other industry in the area.

Note 4: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI

5.1.3 Project Noise Trigger Levels

The PNTLs is the lower of either the PINL or the PANL. **Table 10** presents the derivation of the PNTL's in accordance with the methodologies outlined in the NPI.

Table 10 Project Noise Trigger Levels

Receiver	Period[1]	Intrusiveness Noise Level, dB $L_{Aeq(15\text{-}min)}$	Project Amenity Noise Level, dB $L_{Aeq(15\text{-}min)}$	PNTL, dB $L_{Aeq(15\text{-}min)}$
Residential (R1 – R15)	Day	47	58	47
	Evening	47	48	47
	Night	40	43	40
Residential (R16 – R21)	Day	47	58	47
	Evening	47	48	47
	Night	43	43	43
Industrial (I1 – I7)	When in use	N/A	68	68
Active Recreation (AR1)	When in use	N/A	53	53

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining period.

5.2 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011.

The 'Local Road' category, as specified in the RNP, has been adopted for Aero Road for this assessment. **Table 11** reproduces the road traffic noise assessment criteria for residential land uses are reproduced from the RNP relevant for this road type.

Table 11 Road Traffic Noise Assessment Criteria for Residential Land Uses

Road category	Type of project/development	Assessment Criteria	
		Day (7am to 10pm)	Night (10pm to 7am)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	55dB, $L_{Aeq(1\text{-}hr)}$	50dB, $L_{Aeq(1\text{-}hr)}$

Where existing noise levels exceed criteria noise levels from the project cannot increase overall levels by 2dB.

It is noted that RNPs relative increase criteria is not applicable to local roads, hence is not considered in this assessment.

5.3 Maximum Noise Level Assessment Criteria

Table 12 provides the sleep disturbance criteria for the nearest residential receivers. The sleep disturbance criteria have been derived based on the night RBL.

Table 12 Maximum Noise Level Assessment Screening Criterion

Residential Receivers R1 – R15			
$LA_{eq(15\text{-}min)}$		LA_{max}	
40dB $LA_{eq(15\text{-}min)}$ or RBL + 5dB		52dB LA_{max} or RBL + 15dB	
Trigger	40	Trigger	52
RBL + 5dB	40	RBL + 15dB	50
Highest	**40**	**Highest**	**52**
Residential Receivers R16 – R21			
$LA_{eq(15\text{-}min)}$		LA_{max}	
40dB $LA_{eq(15\text{-}min)}$ or RBL + 5dB		52dB LA_{max} or RBL + 15dB	
Trigger	40	Trigger	52
RBL + 5dB	43	RBL + 15dB	53
Highest	**43**	**Highest**	**53**

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.

Note: NPI identifies that maximum of the two values is to be adopted.

5.4 Construction Noise Management Levels

The construction noise management levels (criteria), established in accordance with the ICNG for the project are presented in **Table 13**.

Table 13 Construction Noise Management Levels

Location	Period	Rating Background Level RBL, dB LA_{90}	Noise Management Level dB $LA_{eq(15\text{-}min)}$
Residential receivers (R1 – R15)	Day	42	52
Residential Receivers (R16 – R21)	Day	42	52
Industrial Receivers (IND1 – IND7)	Day	N/A[1]	75
Active Recreational Receivers	Day	N/A[1]	65

Note 1: Not applicable when establishing construction criteria for this type of receiver.

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6 Noise Assessment Methodology

6.1 Operational Noise Modelling Methodology

A computer model was developed to determine the acoustic impact of project noise emissions to neighbouring receivers for the worst-case operational stages. Brüel and Kjær Predictor Type 7810 (Version 11.10) noise modelling software was used to assess potential noise impacts associated with the project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process.

Additionally, the model uses relevant noise source data (measured on site at the BRS site), ground type, shielding such as barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Plant and equipment were modelled at various locations and heights, representative of realistic operating conditions for assessed scenarios.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation'. The model was calibrated against attended noise measurement data for various operational modes of the plant.

6.2 Operational Noise Modelling Parameters

The model incorporated three-dimensional digitised ground contours for the fixed plant and surrounding site, as derived from proposed site plans (**Appendix C**), current and proposed building locations, export product storage locations and the surrounding land base topography, superimposed on each other. The noise model predicts LA_{eq} noise levels, although it should be noted that this assessment has assumed that all plant and equipment operate simultaneously. In practice, such an operating scenario would be unlikely to occur and the results should therefore be considered conservatively high. Where relevant, modifying factors in accordance with Fact Sheet A of the NPI have been applied to calculations.

6.2.1 Meteorological Analysis

Noise emissions from industry can be significantly influenced by prevailing weather conditions. Wind has the potential to increase noise at a receiver when it is at low velocities and travels from the direction of the noise source.

Meteorological conditions that enhance received noise levels include source to receiver winds and the presence of temperature inversions. To account for the potential for enhancements, the NPI specifies that the source to the receiver wind component speeds up to 3m/s for 30% or more of the time in any seasonal period (i.e. day, evening or night), are significant meteorological features and predictions must incorporate these conditions.

To determine the prevailing conditions for the project, weather data during the period January 2017 to January 2018 was obtained from the nearest Bureau of Meteorology's (BOM) weather station at Holsworthy Aerodrome located approximately 5km west of the project site. The data was analysed using the EPA's Noise Enhancement Wind Analysis (NEWA) program to determine the frequency of occurrence of winds speeds up to 3m/s in each seasonal period.

Table 14 summarises the results of the wind analysis and includes the dominant wind direction and percentage occurrence during each season for each assessment period. The results of the detailed analysis of meteorological data is presented in Appendix D.

Table 14 Seasonal Frequency of Occurrence Wind Speed Intervals

Season	Period	Wind Direction ±(45°)	% Wind Speeds (m/s) 0.5 to 3 m/s
Summer	Day	37.5	12
	Evening	112.5	28
	Night	135	30
Autumn	Day	270	19
	Evening	225	35
	Night	225	53
Winter	Day	292.5	28
	Evening	247.5	52
	Night	247.5	57
Spring	Day	315	23
	Evening	112.5	32
	Night	202.5	35

Noise enhancing meteorological conditions have been adopted for the prediction of noise levels enhanced by wind and in general accordance with default conditions as per Table D1 of NPI Fact Sheet D for calm and inversion conditions. The relevant meteorological conditions adopted in the noise modelling assessment are summarised in **Table 15**.

Table 15 Modelled Site Specific Meteorological Parameters

Period	Assessment Condition	Temperature	Wind Speed / Direction	Relative Humidity	Stability Class
Day	Calm	20°C	n/a	60%	n/a
Evening	Calm	15°C	n/a	60%	n/a
Evening	Prevailing	15°C	3m/s - ESE	60%	n/a
Evening	Prevailing	15°C	3m/s - WSW	60%	n/a
Night	Calm	10°C	n/a	60%	n/a
Night	Prevailing	10°C	3m/s - ESE	60%	n/a
Night	Prevailing	10°C	3m/s - WSW	60%	n/a
Night	Inversion	10°C	n/a	60%	F Class

6.3 Noise Attenuation Assumptions

The noise model adopted the following noise controls and mitigation measures.

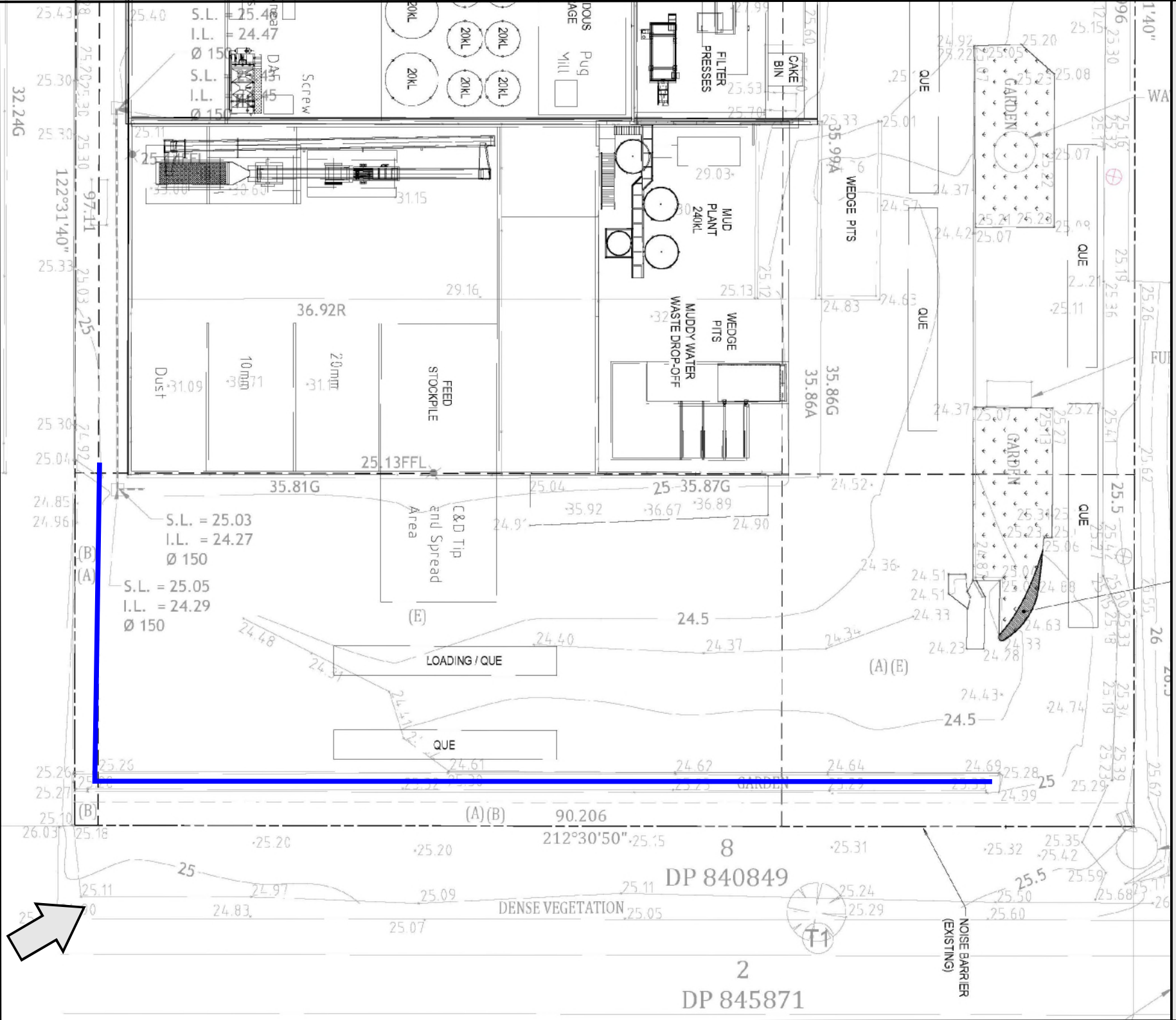
- The buildings are of a tilt slab concrete construction with a 0.6mm corrugated steel roof;
- A wall should be constructed to enclose the south west corner of the rear yard as shown in **Figure 2**. The wall should be constructed to a height of 6.5m (or equivalent to the height of the existing wall) and consist of materials with a surface density of at least 10kg/m^2, and not contain any gaps (ie lapped and capped timber or equivalent). To allow for easement drainage, drains maybe included in the design of the noise wall. To ensure the acoustic performance of the wall, hinged flaps are to be used to cover all drain ways. Flaps should consist of materials with a surface density of at least 10kg/m^2, and not allow any gaps in the wall;
- The batching plant is to be fully enclosed such that the agitator is fully within the building during loading. The enclosure should consist of similar material as outlined above;
- The slumping stand will be a minimum set back distance of 10m from the eastern roller doors inside the main building;
- The roller doors of the crusher are assumed open during the periods when the crusher is operational;

- Trucks will dump at the roller doors adjacent to the crusher as per site plans;
- Queuing will be in the allocated queuing bays in the main yard on the east of the building;
- Whilst queuing all trucks are assumed to be idling or completely switched off;
- All plant and equipment with be fitted with broadband reversing alarms;
- Onsite Speed limit is 20km/hr;
- Agitators will not drive through the wash bay and southern end of the site;
- The existing noise barrier wall and buildings were incorporated in the construction assessment; and
- Construction fleets were located at the proposed south west noise barrier wall and the proposed batching plant site.

FIGURE 2

BARRIER LOCATION

REF: MAC170598



KEY	
	6.5m Yard Wall

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6.3.1 Sound Power Levels - Operation

Fixed and mobile plant noise emission data used in modelling for this assessment were measured onsite at the BRS facility or obtained from the MAC noise database for relevant noise sources that are proposed to be used for the project. The noise emission levels used in modelling are summarised in **Table 16**. **Appendix E** provides the octave sound power data of modelled plant for the operational scenarios.

Table 16 Equipment Sound Power Levels and Operational Periods re dBA 10^{-12}W

Plant /Equipment	Location	Height	No of	Sound Power Level (LW), dBA	Day	Evening	Night
Excavators	Crusher Room	1.5m	2	98	✓	✓	x
Front End Loaders	Crusher Yard	1.5m	1	106	✓	✓	x
Front End Loaders	Batching Plant Yard	1.5m	2	101	✓	✓	x
Truck & Dog Onsite	Yard Areas	1.5m	3 trucks Per hour	102	✓	✓	x
Liquid Waste Truck	Yard Areas	1.5m	3 trucks Per hour	102	✓	✓	x
Truck Idling	Queue Points Yard Areas	1.5m	4	86	✓	✓	x
Truck & Dog Tipping	Crusher Yard	1.5m	1	102	✓	✓	x
Agitator Manoeuvring Onsite	Batching Plant Yard	1.5m	2 agitators per hour[2]	102	✓	✓	✓
Slump Stand Operations[1]	Main Warehouse	2.0m	1	109	✓	✓	✓
Mud Flocculant Plant	Flocculant Bay	1.5m	1	110	✓	✓	✓
Pugmill	Main Warehouse	1.0m	1	102	✓	✓	x

Table 16 Equipment Sound Power Levels and Operational Periods re dBA 10^{-12}W							
Crusher	Crusher Room	2.0m	1	114	✓	✓	x
Liquid Waste Plant[1]	Liquid waste area	2.0m	1	98	✓	✓	x
Concrete Plant[1]	Batching Plant Yard	5.0m	1	101	✓	✓	✓
Forklift	Crusher Yard	1.5m	1	87	✓	✓	✓

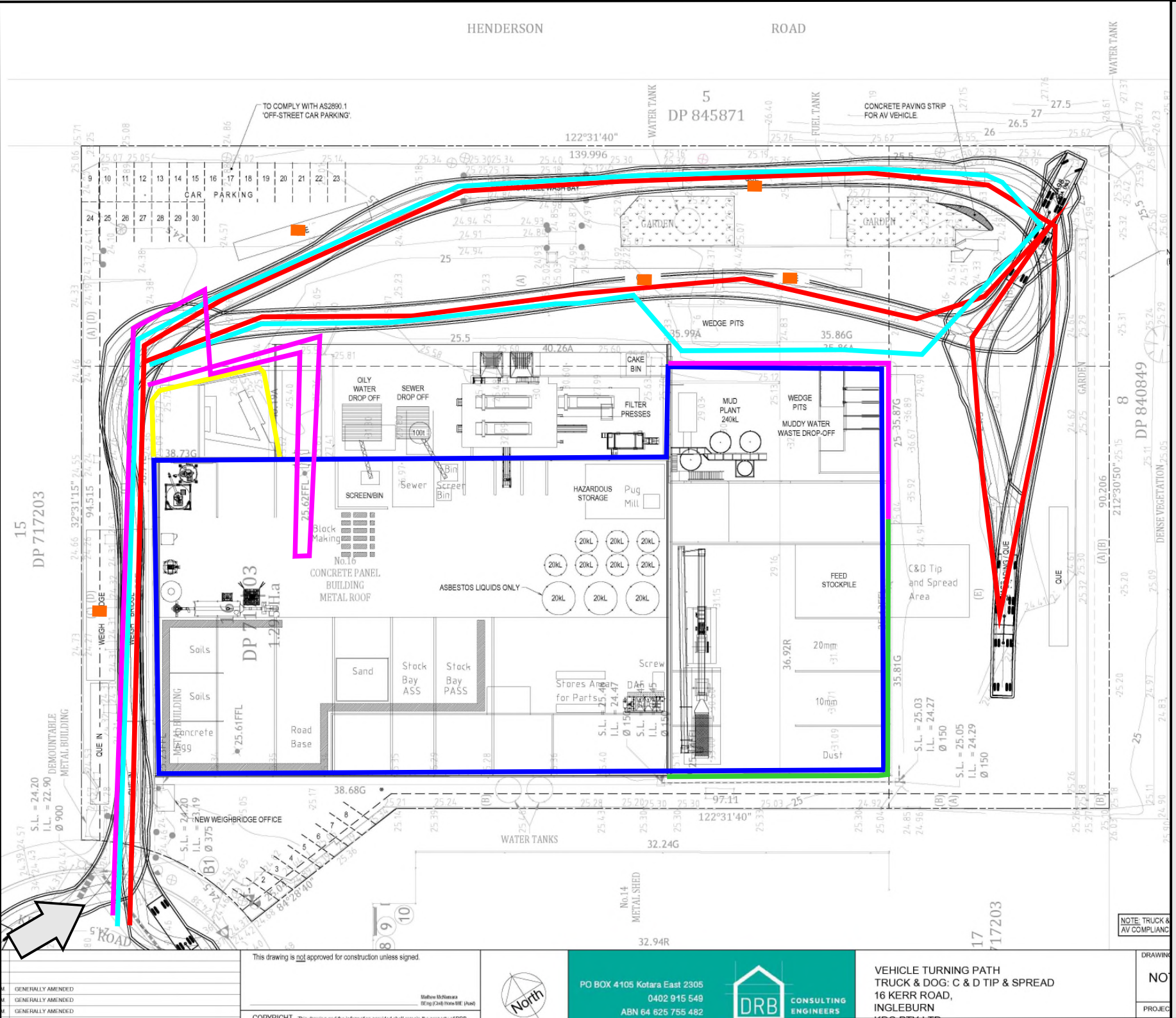
Note 1: Internal sources.

Figure 3 presents the assessed location and movement paths of the proposed noise sources.

FIGURE 3

SOURCE LOCATION

REF: MAC170598



KEY

- Truck Queue Point
- Batch Plant Emitting Facades
- Crusher Room Emitting Roof and Facades
- Solid Waste Truck Paths
- Batch Plant Truck Path
- Liquid Waste Truck Paths
- Liquid Waste Emitting Facades
- Internal Main Building Emitting Roof

This drawing is not approved for construction unless signed.

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482

DRB CONSULTING ENGINEERS

VEHICLE TURNING PATH
TRUCK & DOG: C & D TIP & SPREAD
16 KERR ROAD,
INGLEBURN

GENERALLY AMENDED
GENERALLY AMENDED
GENERALLY AMENDED

MAC Muller Acoustic Consulting

6.3.2 Sound Power Levels - Construction

The construction noise emission levels used in modelling are summarised in **Table 17**. The construction scenario adopted a generic construction fleet representative of plant used in building construction (ie excavations/footings). Plant items for this assessment were situated in and around the proposed wall extension at the south eastern area of the site and concrete batching plant to the north of site and provide an indicative worst-case representation of noise emissions during construction. The construction modelling assessment adopted methodologies consistent with the operational assessment for calm meteorological conditions with all plant set to 1.5m above relative ground level.

Table 17 Construction Equipment Sound Power Levels, re dBA 10^{-12}W

Road Trucks	103
Excavator/Backhoe/Concrete Truck	106
Hand tools (power tools)	97
Combined fleet construction/demolition noise level	108

Note 1: The adopted fleet sound power level is considered representative of construction activities and plant combinations for this type of project for a 15 minute assessment period.

6.4 Road Noise Methodology

The United States (US) Environment Protection Agency's road traffic calculation method was used to predict the LA_{eq} noise levels from site trucks travelling past existing residential receivers on Aero Road, Ingleburn, NSW, which is the key transport route for vehicles to and from site (truck & dog and agitators included). This method is an internationally accepted theoretical traffic noise prediction model and is ideal for calculating road traffic noise where relatively small traffic flows are encountered. **Section 7.2** provides the results of the traffic noise assessment.

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7 Noise Modelling Results and Discussion

7.1 Operational Scenario

Predicted noise levels for the proposed operational scenario are provided in Table 18 for calm weather conditions. Table 19 presents the predicted noise levels for the two prevailing (evening and night) weather conditions detailed in Table 15 assessed against the applicable PNTLs. Table 20 presents the predicted noise results for the night-time inversion conditions assessed against the night-time PNTLs.

Noise contours for the tabulated results are presented in Appendix F.

The results of the model show that noise emissions from the project comply with the PNTLs for all assessment periods at all assessed receivers.

Table 18 Predicted Operational Noise Levels, dBA $LA_{eq(15\text{-}min)}$ – Calm Conditions							
Receiver	Predicted Noise Level, $LA_{eq(15\text{-}min)}$ dBA			PNTL $LA_{eq(15\text{-}min)}$ dBA			Compliant
	Day	Evening	Night	Day	Evening	Night	
R01	43	43	<30	47	47	40	✓
R02	38	38	<30	47	47	40	✓
R03	39	39	<30	47	47	40	✓
R04	39	39	<30	47	47	40	✓
R05	39	39	31	47	47	40	✓
R06	37	37	<30	47	47	40	✓
R07	35	35	<30	47	47	40	✓
R08	36	36	32	47	47	40	✓
R09	33	33	<30	47	47	40	✓
R10	36	36	<30	47	47	40	✓
R11	38	38	<30	47	47	40	✓
R12	42	42	<30	47	47	40	✓
R13	40	40	<30	47	47	40	✓
R14	39	39	<30	47	47	40	✓
R15	38	38	<30	47	47	40	✓
R16	38	38	<30	47	47	43	✓
R17	37	37	<30	47	47	43	✓
R18	36	36	<30	47	47	43	✓
R19	36	36	<30	47	47	43	✓
R20	35	35	<30	47	47	43	✓
R21	34	34	<30	47	47	43	✓

Other Receivers

Receiver	Period	Predicted Noise Level, $LA_{eq(15\text{-}min)}$ dBA	Project Noise Trigger Level, $LA_{eq(15\text{-}min)}$ dBA	Compliant
IND1	When In Use	44	68	✓
IND2	When In Use	56	68	✓
IND3	When In Use	43	68	✓
IND4	When In Use	43	68	✓
IND5	When In Use	50	68	✓
IND6	When In Use	43	68	✓
IND7	When In Use	40	68	✓
AR1	When In Use	39	53	✓

Table 19 Predicted Operational Noise Levels, dBA $LA_{eq(15min)}$ – Prevailing Conditions							
Receiver	Evening Noise Level, $LA_{eq(15\text{-}min)}$ dBA			Night Noise Level, $LA_{eq(15\text{-}min)}$ dBA			Compliant
	Evening Wind Dir ESE	Evening Wind Dir WSW	PNTL	Night Wind Dir SE	Night Wind Dir SW	PNTL	
R01	43	43	47	<30	<30	40	✓
R02	38	39	47	<30	<30	40	✓
R03	38	39	47	<30	<30	40	✓
R04	38	39	47	<30	<30	40	✓
R05	39	40	47	31	31	40	✓
R06	36	38	47	<30	<30	40	✓
R07	34	37	47	<30	<30	40	✓
R08	35	38	47	31	32	40	✓
R09	32	36	47	<30	<30	40	✓
R10	35	38	47	<30	<30	40	✓
R11	37	40	47	<30	<30	40	✓
R12	41	42	47	<30	<30	40	✓
R13	39	40	47	<30	<30	40	✓
R14	38	40	47	<30	<30	40	✓
R15	37	39	47	<30	<30	40	✓
R16	37	39	47	<30	<30	43	✓
R17	36	38	47	<30	<30	43	✓
R18	35	37	47	<30	<30	43	✓
R19	34	37	47	<30	<30	43	✓
R20	33	36	47	<30	<30	43	✓
R21	33	36	47	<30	<30	43	✓
Other Receivers							
IND1	44	44	68	42	42	68	✓
IND2	56	56	68	52	52	68	✓
IND3	43	43	68	37	37	68	✓
IND4	44	44	68	38	37	68	✓
IND5	50	50	68	<30	<30	68	✓
IND6	43	43	68	<30	<30	68	✓
IND7	40	40	68	<30	<30	68	✓
AR1	37	42	53	34	38	53	✓

Table 20 Predicted Operational Noise Levels, dBA $LA_{eq(15\text{-}min)}$ – Night-time Inversion Conditions			
Receiver	Predicted Noise Level, $LA_{eq(15\text{-}min)}$ dBA	PNTL	Compliant
R01	<30	40	✓
R02	<30	40	✓
R03	<30	40	✓
R04	<30	40	✓
R05	32	40	✓
R06	30	40	✓
R07	32	40	✓
R08	35	40	✓
R09	31	40	✓
R10	<30	40	✓
R11	<30	40	✓
R12	<30	40	✓
R13	<30	40	✓
R14	<30	40	✓
R15	<30	40	✓
R16	<30	43	✓
R17	<30	43	✓
R18	<30	43	✓
R19	<30	43	✓
R20	<30	43	✓
R21	<30	43	✓
Other Receivers			
IND1	42	68	✓
IND2	52	68	✓
IND3	37	68	✓
IND4	38	68	✓
IND5	<30	68	✓
IND6	<30	68	✓
IND7	<30	68	✓
AR1	39	53	✓

7.2 Road Traffic Noise Results

The proposed modification would result in a total of 88 heavy vehicle movements per day (7am – 10pm) to and from the site. It has been assumed that all vehicle movements would travel along Aero Road and turn into Kerr Road, with an average of 8 heavy vehicle movements per hour during the peak am and pm periods. Current traffic flows along Aero Road during the am and pm peak periods are 328 vtph and 339 vtph respectively.

Road noise was calculated at a 20m offset distance from the centre line of Aero Road. This represents the offset distance for the closest residential receivers adjacent on Aero Road from the centre of the roadway. Therefore, results should be considered worst case.

Night-time (10pm – 7am) truck movements are proposed as part of the project with an average of four trucks movements per hour proposed.

The results of the traffic noise calculations are presented in Error! Reference source not found.. Results demonstrate that while existing traffic noise levels are above current road noise criteria, project related noise levels would remain below relevant criteria and not increase existing road traffic noise levels by more than 2dB(A).

Table 21 Operational Road Traffic Noise Levels - LAeq(1-hr), dBA

Period	Distance to Nearest Receiver (m)	Assessment Criteria	Existing Traffic	Future Project Traffic Noise	Existing + Future Project Combined	Increase
Day $L_{Aeq(1hr)}$, dB(A)						
AM Peak	20	55	65.3	52.4	65.5	0.2
PM Peak	20	55	65.4	52.4	65.6	0.2
Night $L_{Aeq(1hr)}$, dB(A)						
Day	20	50	61.9	47.1	62.0	0.1

7.3 Maximum Noise Level Assessment

In assessing sleep disturbance, typical L_{Amax} noise levels from transient events were assessed to the nearest residential receivers. The use of the L_{Amax} noise level provides a worst-case prediction since the LA1(1-minute) noise level of a noise event is likely to be less than the L_{Amax}. For the sleep disturbance assessment, a sound power level of 102dBA for forklift impact noise emissions are adopted for the yard and 115dBA for agitator impact noise emissions at the batching plant for this assessment with the night-time operational scenario adopted for the awakenings assessment.

Predicted noise levels from $L_{Aeq(15\text{-}min)}$ and L_{Amax} events for assessed receivers are presented in **Table 22**. Results identify that the sleep disturbance screening criterion will be satisfied for all assessed receivers.

Table 22 Maximum Noise Levels Assessment (Night)[1]

Receiver	Predicted Noise Level,			Screening Criterion		Compliant
		dB L_{Amax}				
	dB $L_{Aeq(15\text{-}min)}$	Forklift Impact	Agitator Impact	dB $L_{Aeq(15\text{-}min)}$	L_{Amax}	
R01	<30	48	46	40	53	✓
R02	<30	42	45	40	53	✓
R03	<30	42	52	40	53	✓
R04	<30	42	44	40	53	✓
R05	31	42	43	40	53	✓
R06	<30	37	50	40	53	✓
R07	<30	35	51	40	53	✓
R08	32	34	50	40	53	✓
R09	<30	<30	42	40	53	✓
R10	<30	33	45	40	53	✓
R11	<30	36	42	40	53	✓
R12	<30	44	48	40	53	✓
R13	<30	43	48	40	53	✓
R14	<30	42	43	40	53	✓
R15	<30	33	41	40	53	✓
R16	<30	33	41	43	53	✓
R17	<30	32	41	43	53	✓
R18	<30	32	40	43	53	✓
R19	<30	32	40	43	53	✓
R20	<30	<30	39	43	53	✓
R21	<30	<30	39	43	53	✓

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

7.4 Construction Noise Results

$LA_{eq(15\text{-}min)}$ noise emissions for construction are predicted to be above the relevant construction noise management levels at several receivers for construction works at the south west noise barrier wall and the batch plant. Accordingly, the project will adopt reasonable and feasible noise management initiatives to reduce construction noise impacts to the surrounding community. **Table 23** presents the results of the construction noise model assessment.

Table 23 Construction Noise Assessment Results

Receiver	Assessment Period	Predicted Noise Level dB	NML dB $LA_{eq(15\text{-}min)}$, dBA
R01	Day	43	52
R02	Day	36	52
R03	Day	41	52
R04	Day	39	52
R05	Day	37	52
R06	Day	39	52
R07	Day	38	52
R08	Day	37	52
R09	Day	34	52
R10	Day	37	52
R11	Day	47	52
R12	Day	60	52
R13	Day	57	52
R14	Day	58	52
R15	Day	57	52
R16	Day	56	52
R17	Day	55	52
R18	Day	54	52
R19	Day	53	52
R20	Day	52	52
R21	Day	51	52
Other Receivers			
IND1	Day	45	75
IND2	Day	46	75
IND3	Day	44	75
IND4	Day	37	75
IND5	Day	76	75
IND6	Day	63	75
IND7	Day	61	75
AR1	Day	41	65

Recommendations for consideration during construction activities to reduce emissions to the surrounding community for this project may include:

- toolbox and induction of personnel prior to shift to discuss noise control measures that may be implemented to reduce noise emissions to the community;
- implement any boundary fences/retaining walls as early as possible to maximise their attenuation benefits;
- where possible use mobile screens or construction hoarding to act as barriers between construction works and receivers;
- all plant should be shutdown when not in use. Plant to be parked/started at farthest point from relevant assessment locations;
- operating plant in a conservative manner (no over-revving);
- selection of the quietest suitable machinery available for each activity;
- avoidance of noisy plant/machinery working simultaneously where practicable;
- minimisation of metallic impact noise;
- all plant are to utilise a broadband reverse alarm in lieu of the traditional hi frequency type reverse alarm; and
- undertake letter box drops to notify receivers of potential works.

The application of construction mitigation measures will reduce the impact on surrounding noise sensitive receivers during the construction works.

8 Operational Mitigation Measures

Australian Standard AS 2436-2010 "Guide to Noise Control on Construction, Maintenance and Demolition Sites" sets out numerous practical recommendations to assist in mitigating construction noise emissions.

Recommendations provided in AS2436 include combinations of operational strategies, source noise control strategies, noise barrier controls, and community consultation.

It is estimated that adopting strategies contained in this standard may result in the significant noise attenuation:

8.1 Universal Work Practices

Universal work practices that can be applied to the proposal (and all subsequent activities) include:

- conduct toolbox talks pre-shift to communicate awareness regarding the importance of noise emission management;
- ensure site managers periodically check noise emissions at receivers adjacent to noisy activities so that potential problems can be rectified;
- UHF radios will be used for communication with no yelling allowed;
- no slamming of doors is allowed;
- plant will be parked in accessible and where possible shielded locations prior to being used for out of hours work;
- minimise the use of reverse alarms;
- minimise clustering of plant items;
- management are to communicate to staff and contractors the importance of minimising noise emissions to the community when arriving and leaving site; and

8.2 Consultation and Notification

General

- maintain good communication between the community and site staff;
- appoint a community liaison officer where required to maintain good communications between community and staff.

Complaints Handling

- provide a readily accessible contact point, of contact or complaints line and give complaints a fair hearing;
- have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow;
- records of all community complaints will be maintained on an up-to-date complaints register; The records will include:
    - date and time of the complaint;
    - the means by which the complaint was made (telephone, mail or email);
    - any personal details of the complainant that were provided, or if no details are provided, a note to that effect;
    - the nature of the complaint;
    - any actions taken by the site supervisor/construction contractor in relation to the complaint, including any follow up contact with the complainant and the timing for implementing action; and
    - if no action was taken by site supervisor/construction contractor in relation to the complaint, the reason why no action was taken.

8.3 Plant and Equipment and On Site

- all plant will be driven in a conservative manner (no over-revving);
- machinery will not be permitted to 'warm-up' before the nominated working hours or adjacent to receivers;
- where possible, machinery will be located/orientated to direct noise away from the closest sensitive receivers;
- undertake regular maintenance of machinery to minimise noise emissions. Maintenance will be confined to standard daytime construction hours and where possible, away from noise sensitive receivers;
- the quietest suitable machinery reasonably available will be selected for each work activity;
- the offset distance between noisy items of plant/machinery and nearby sensitive receivers will be maximised;

- where practicable, ensure the coincidence of noisy plant/machinery working simultaneously in close proximity to sensitive receivers is avoided; and
- keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).

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9 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has conducted a Noise Impact Assessment (NIA) of potential impacts from the proposed expansion of the Resource Recovery Facility operations (the 'project') at the existing Bulk Recovery Solutions Pty Ltd site, 16 Kerr Road Ingleburn, NSW. The assessment has quantified potential operational noise emissions pertaining to processing and delivery and export of raw and processed materials via road trucks from the site.

The results of the NIA demonstrate that operational noise levels comply with the relevant NPI criteria for all assessment periods at all assessed noise sensitive receivers.

Additionally, the NIA demonstrates that the road noise criteria as specified in the RNP will be satisfied at receiver distances of greater than 20m.

Furthermore, sleep disturbance is not anticipated, as maximum noise levels are predicted to remain below the EPA screening criterion for sleep disturbance.

Results identify that noise levels from the proposed construction works are anticipated to be above the standard hours construction Noise Management Levels at several of the nearest surrounding receivers. Accordingly, noise management measures have been provided in Section 7.4 of this report for the proponent's consideration.

Based on the NIA results, there are no noise related issues which would prevent the approval of the project. Additionally, the results of the assessment show compliance with the relevant operational, road and construction noise policies with the appropriate ameliorative measures in place during construction phase.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Terms

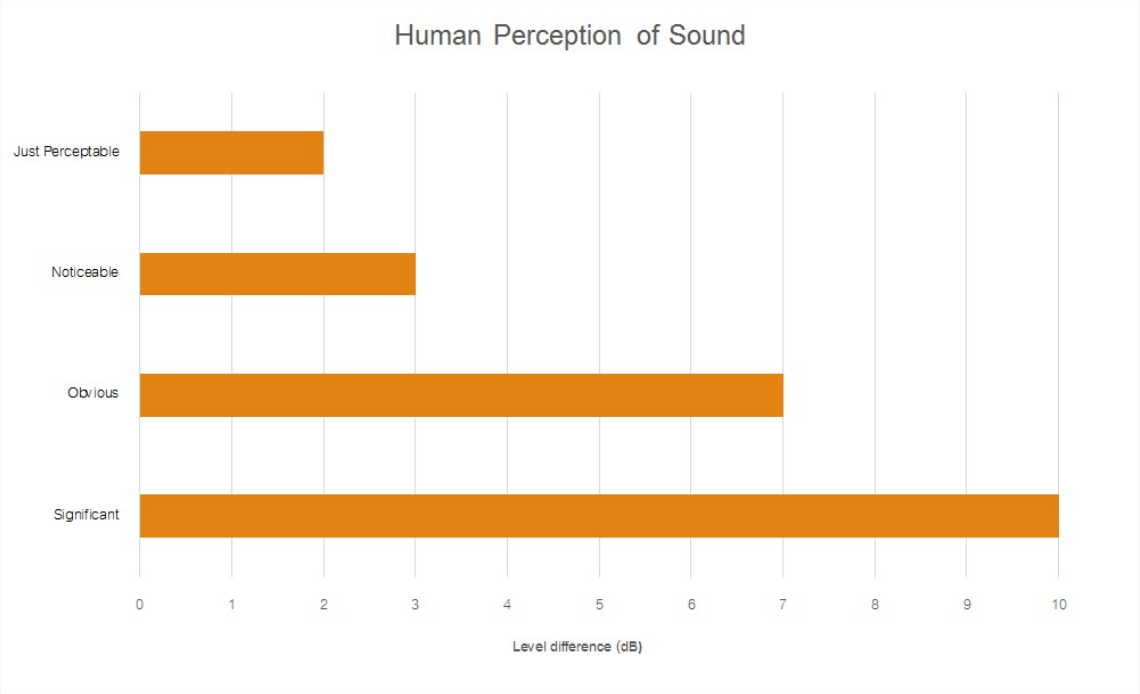
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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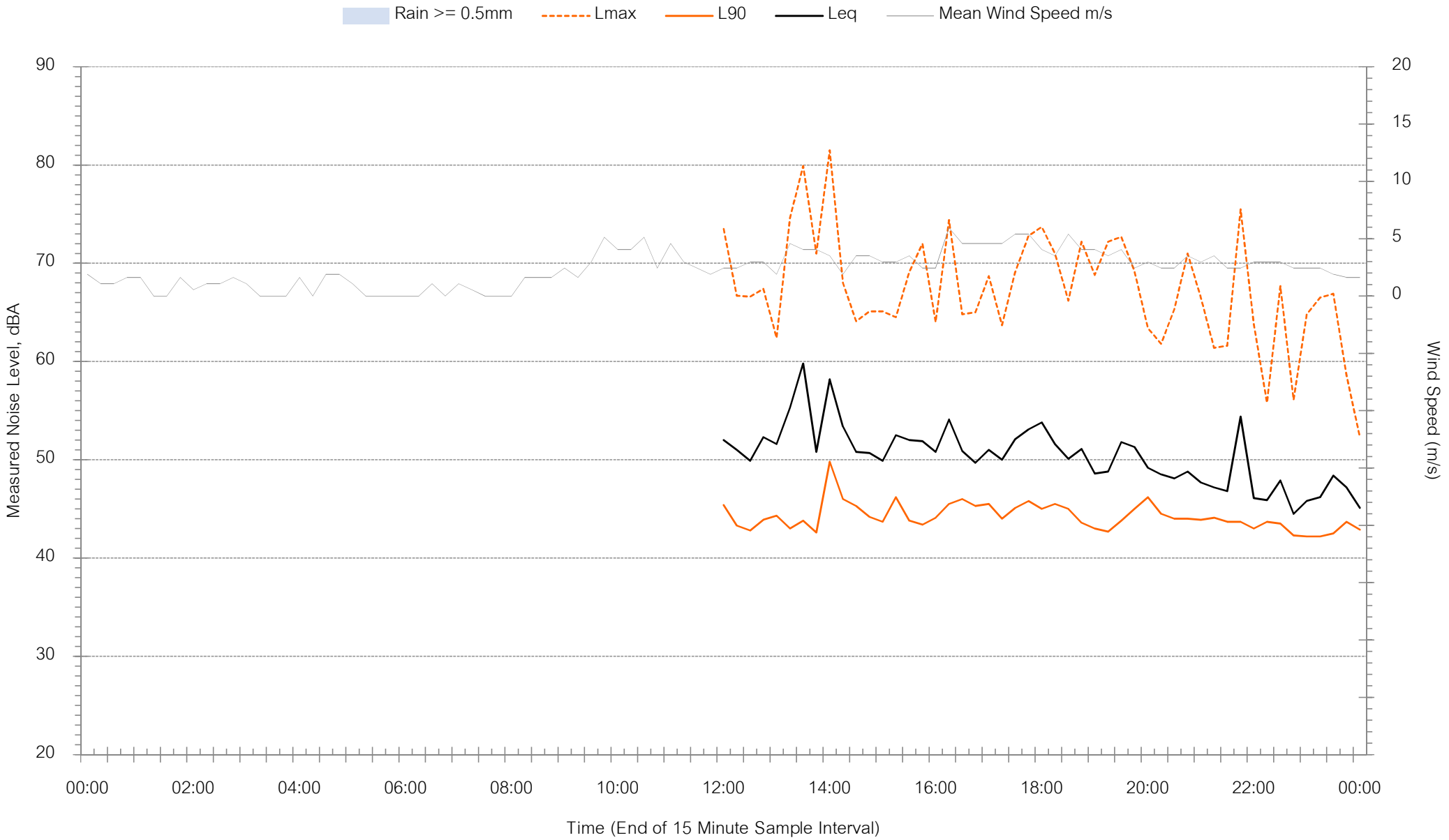
Appendix B – Noise Logging Charts

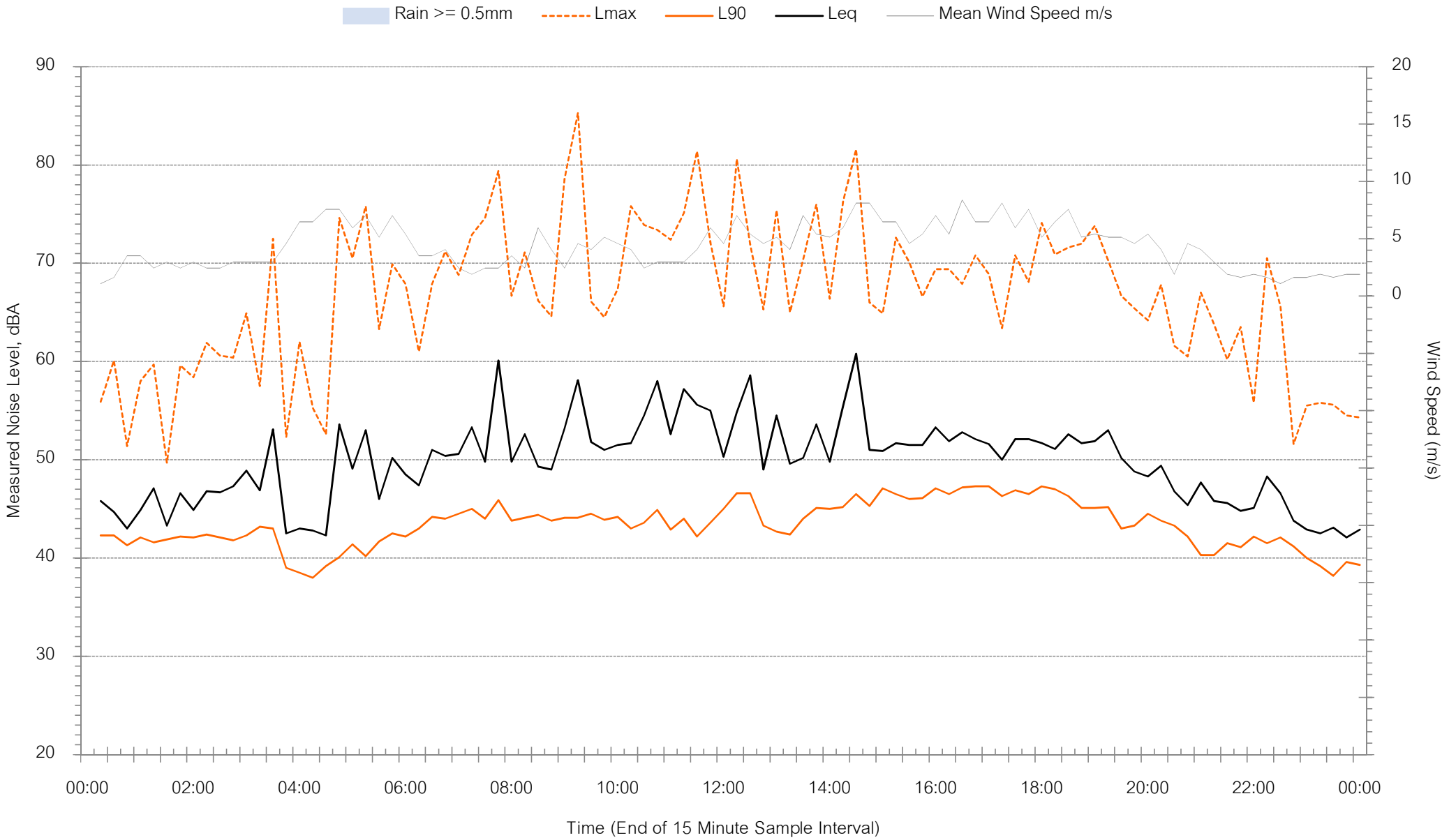
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Wednesday 28 February 2018



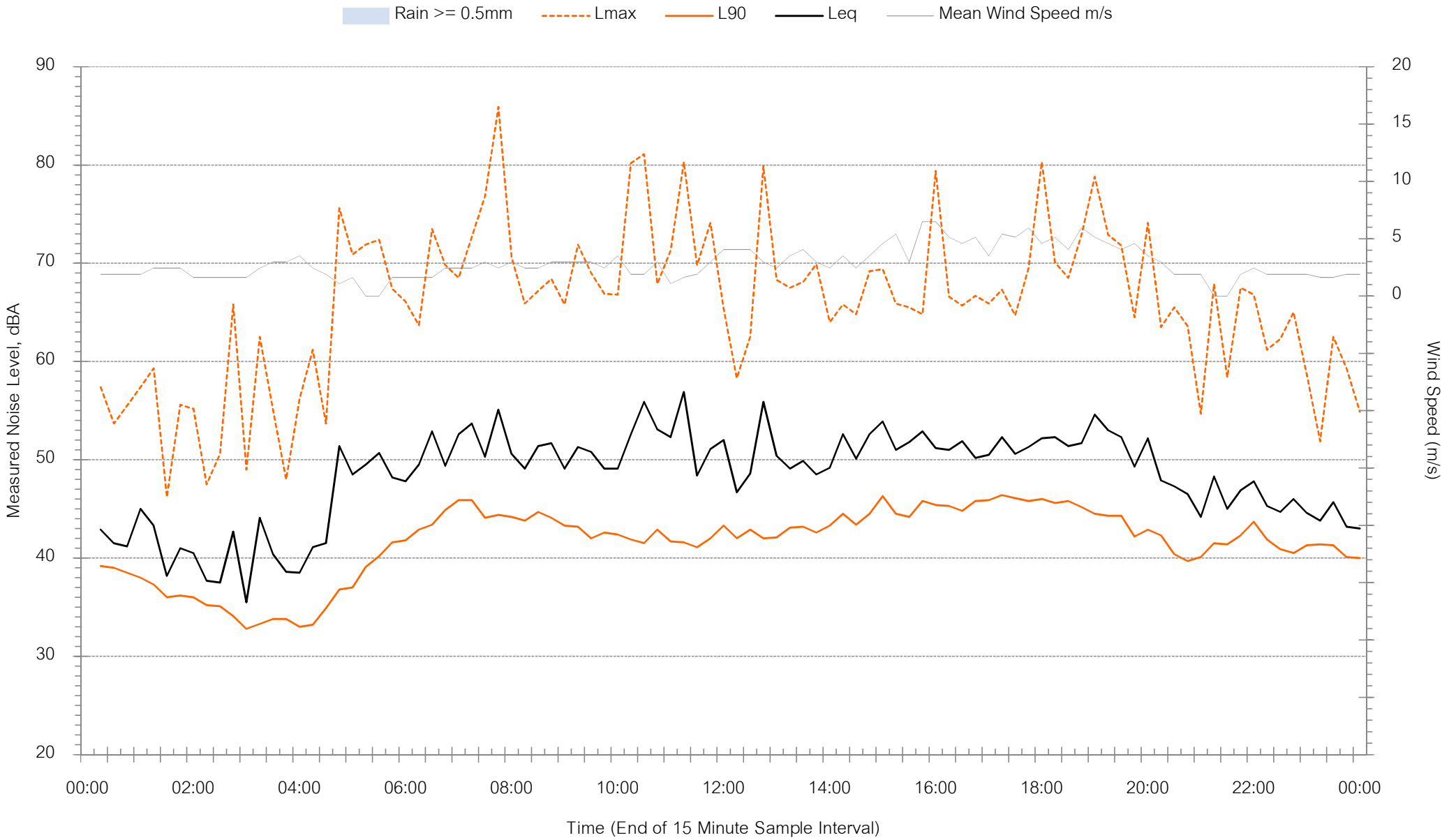
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Thursday 1 March 2018



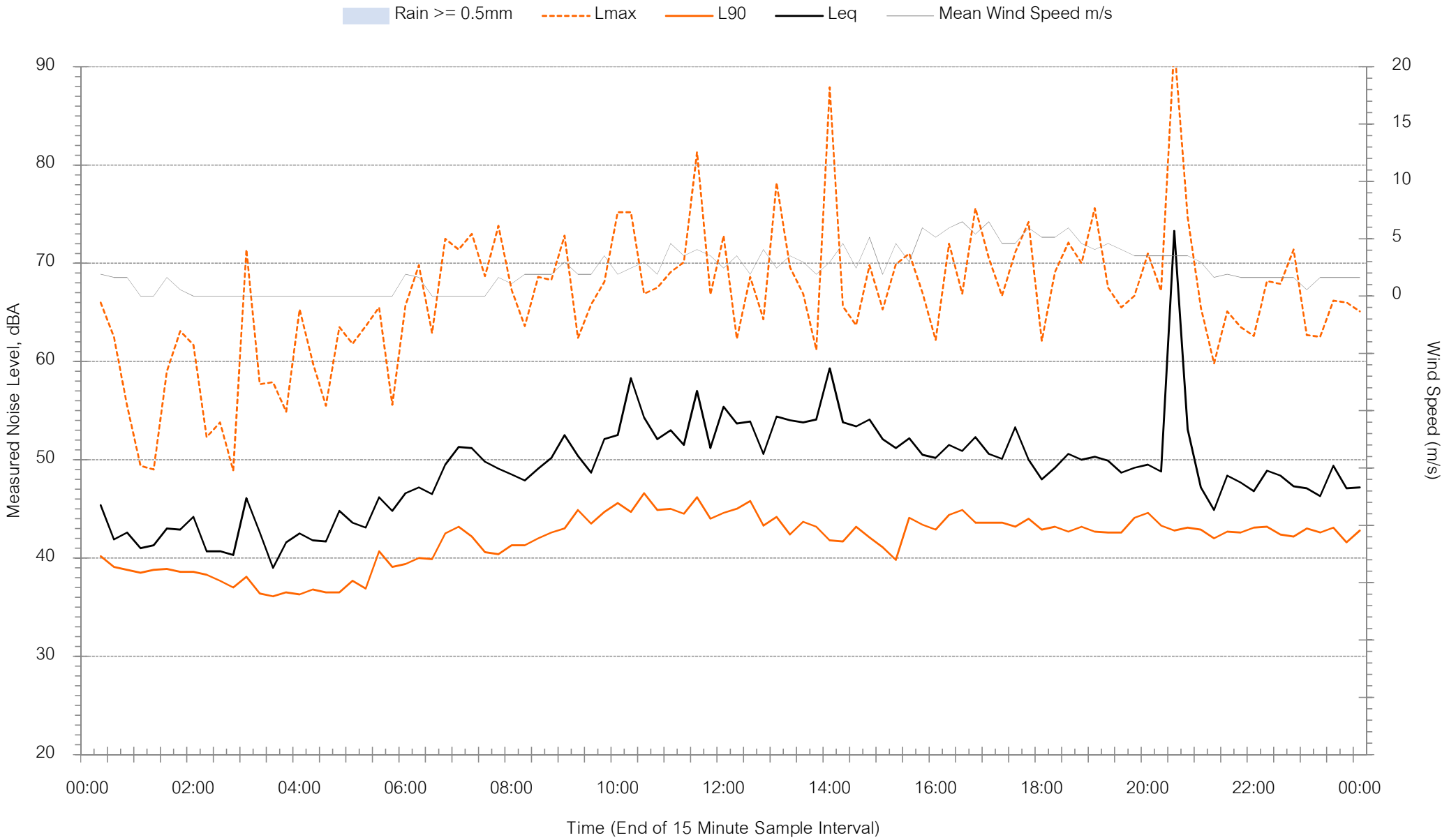
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Friday 2 March 2018



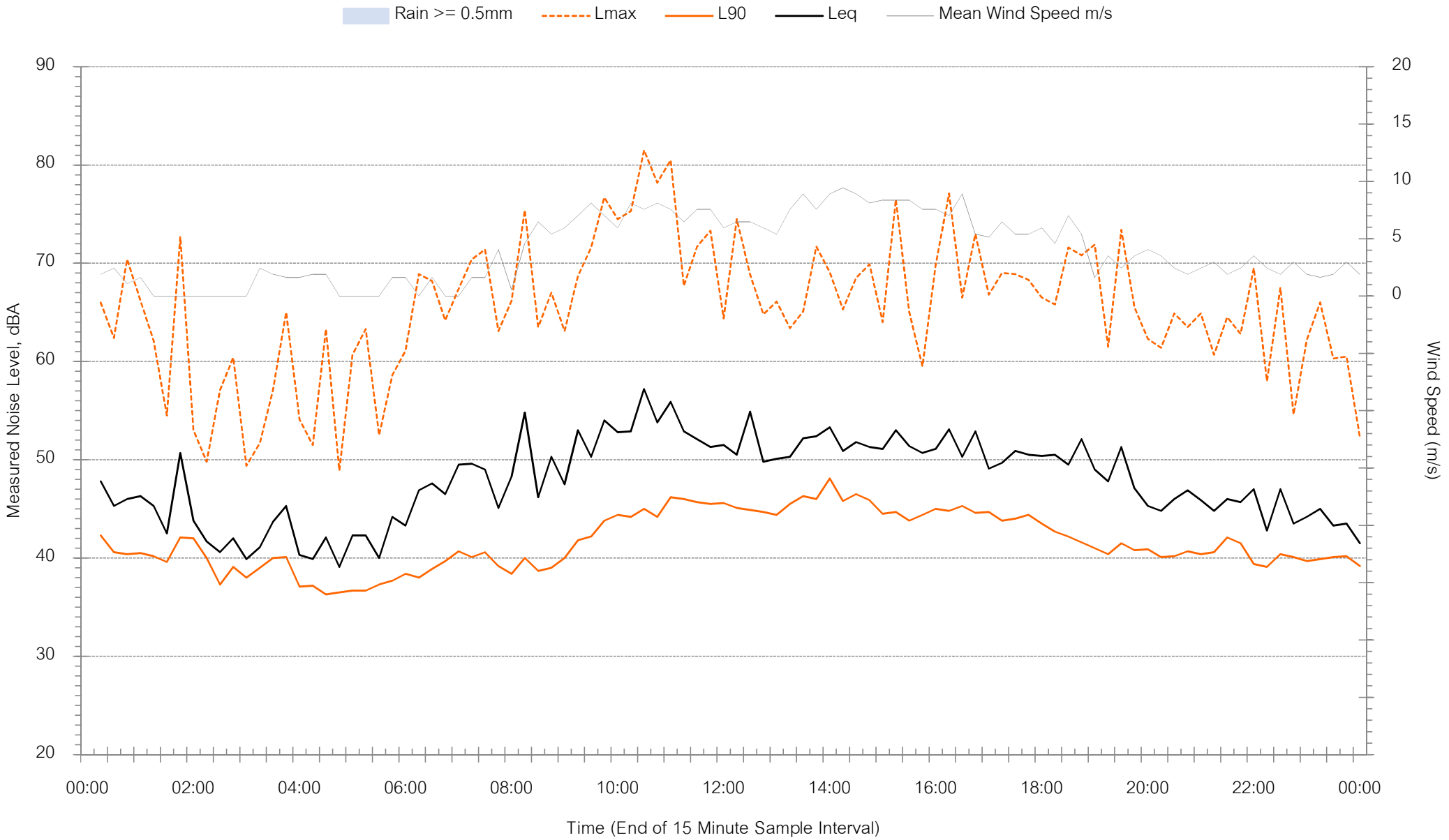
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Saturday 3 March 2018



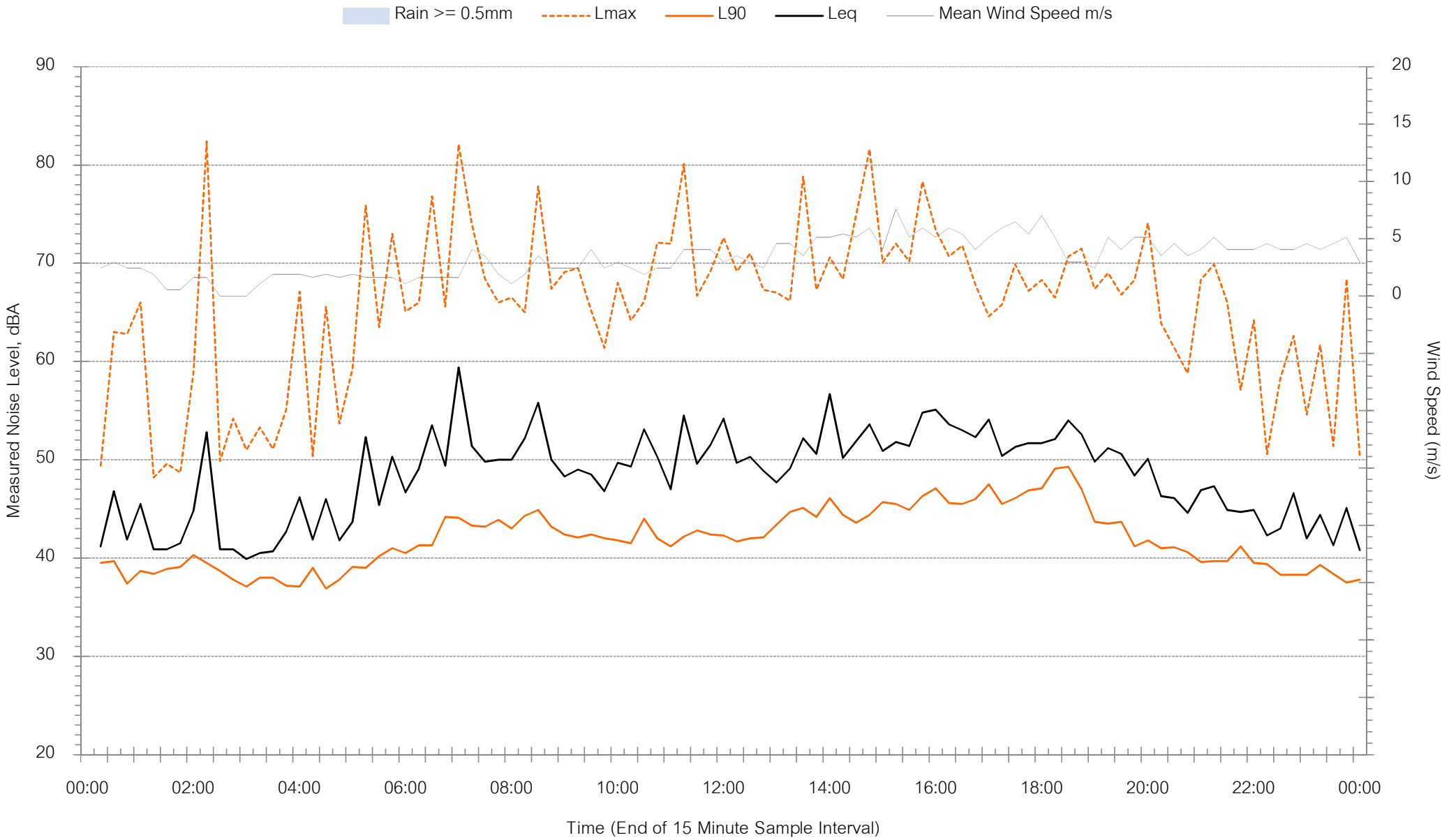
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Sunday 4 March 2018



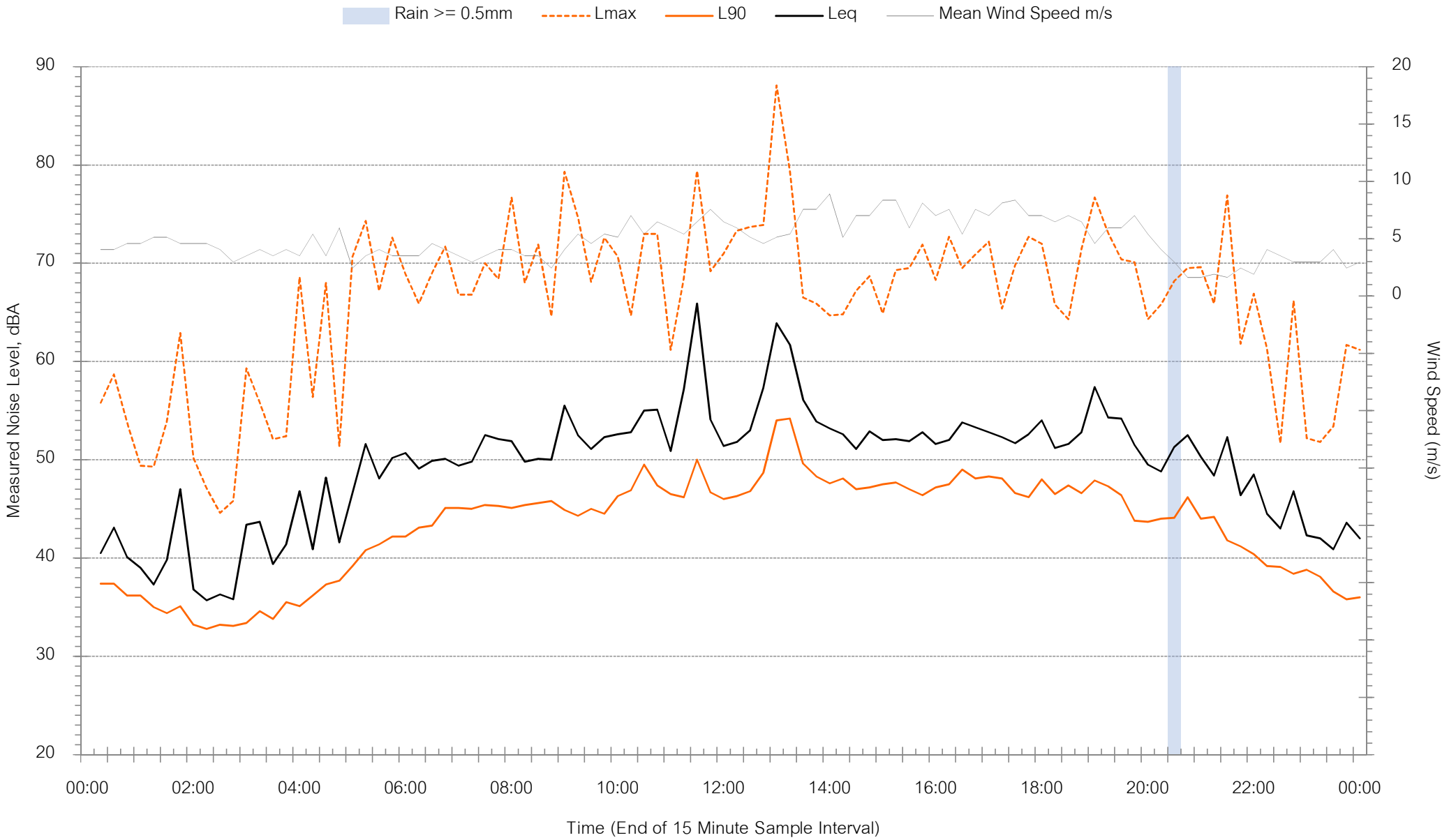
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Monday 5 March 2018



Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Tuesday 6 March 2018

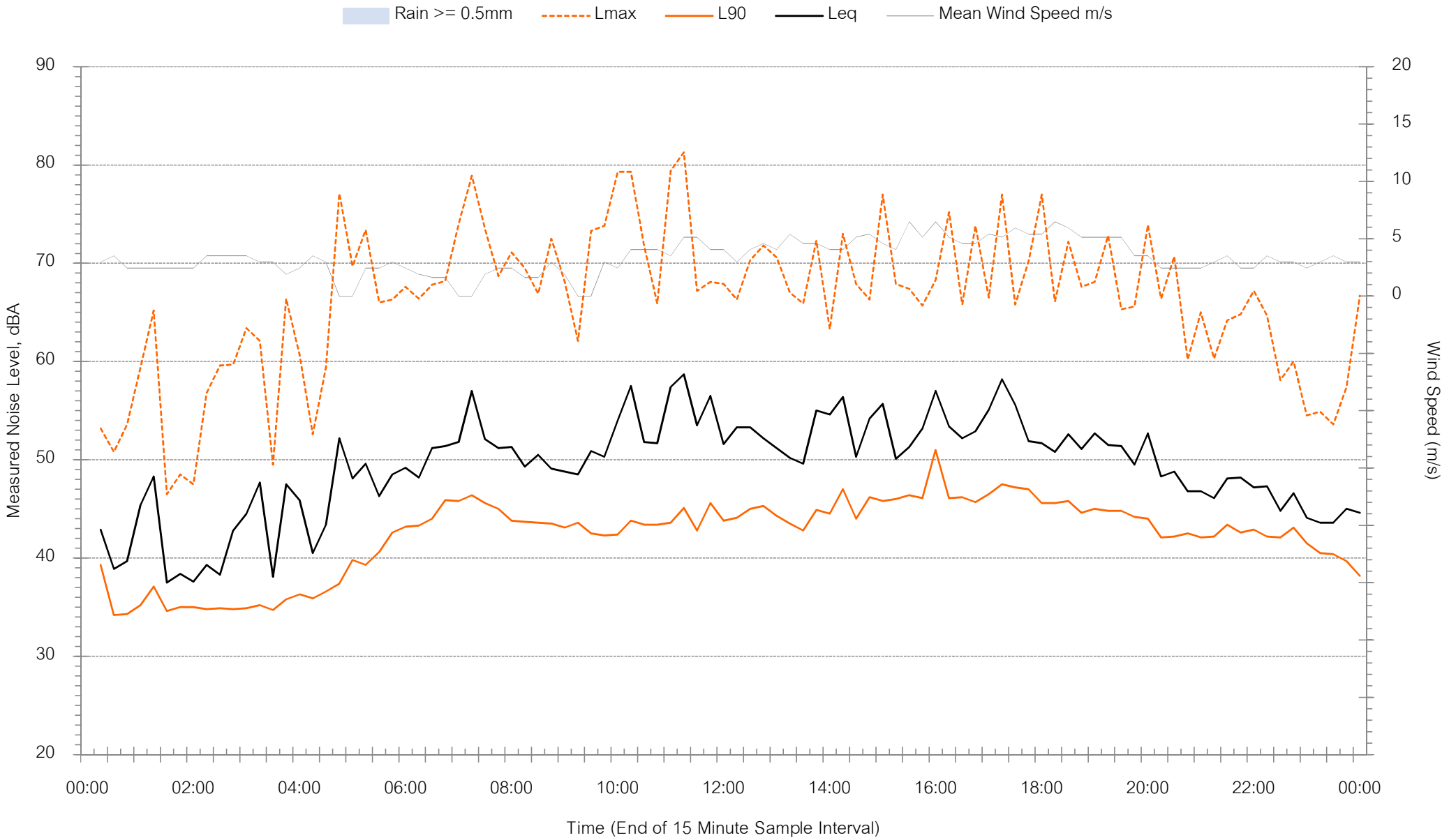


Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Wednesday 7 March 2018

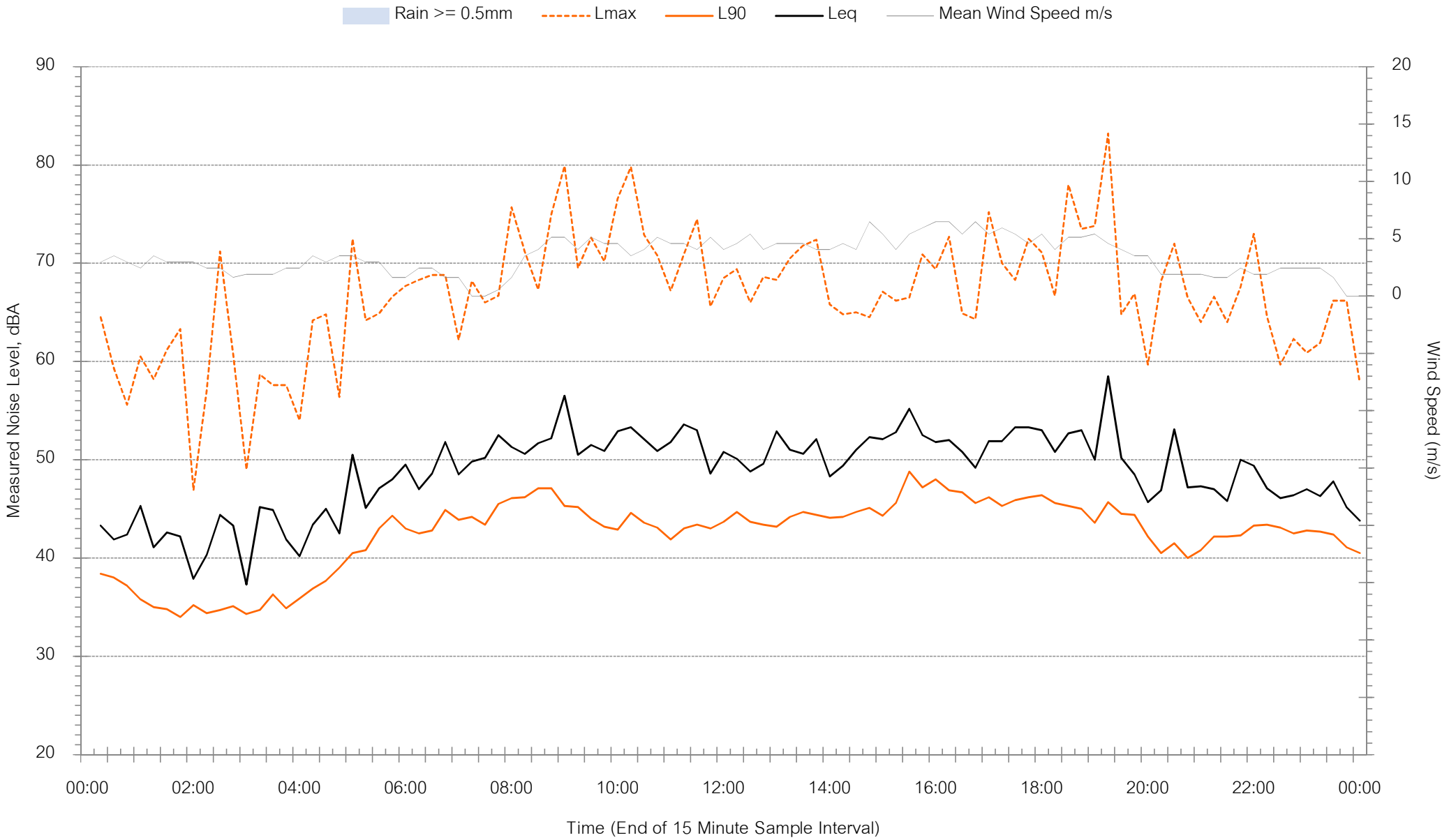
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Thursday 8 March 2018



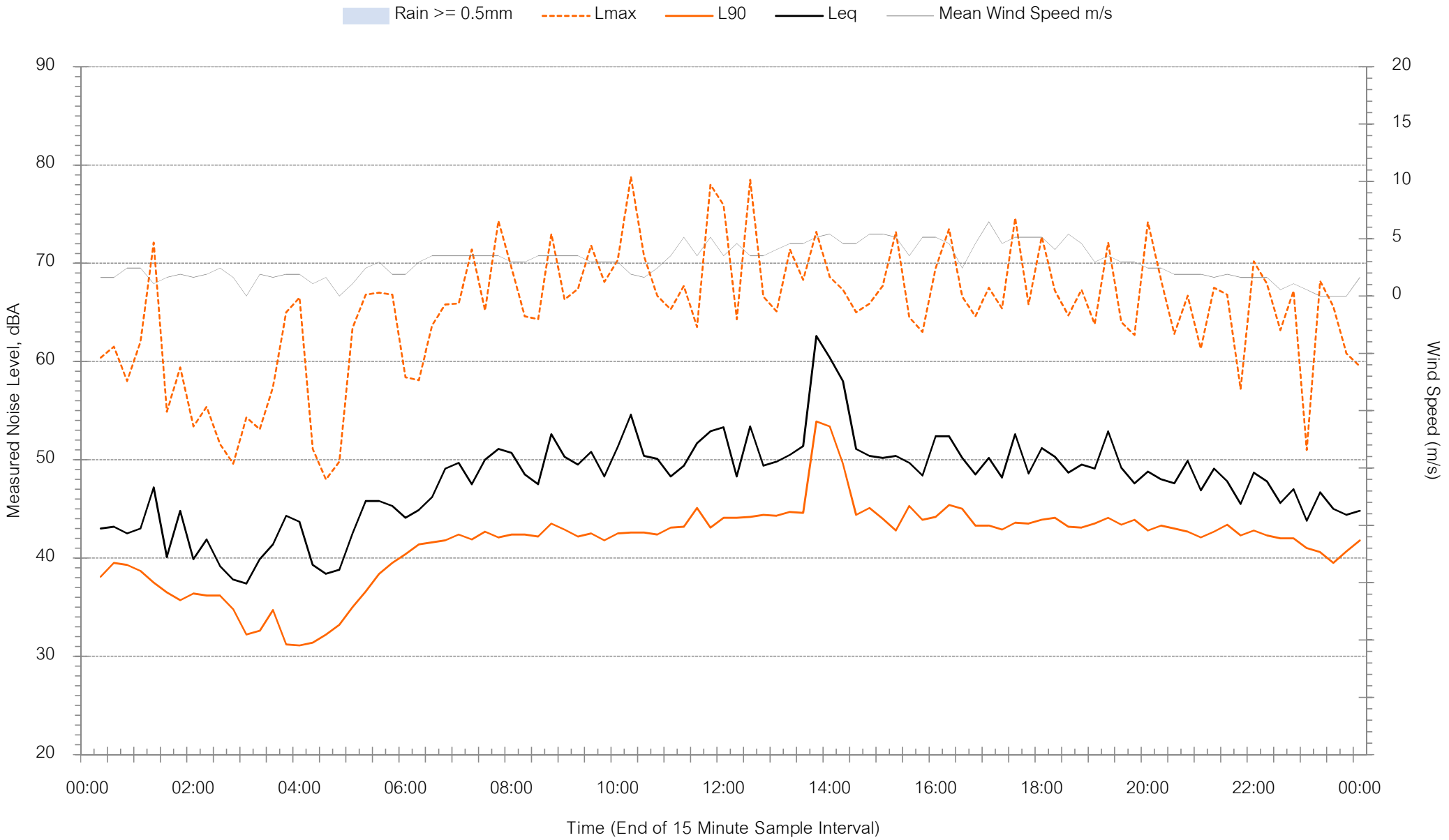
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Friday 9 March 2018



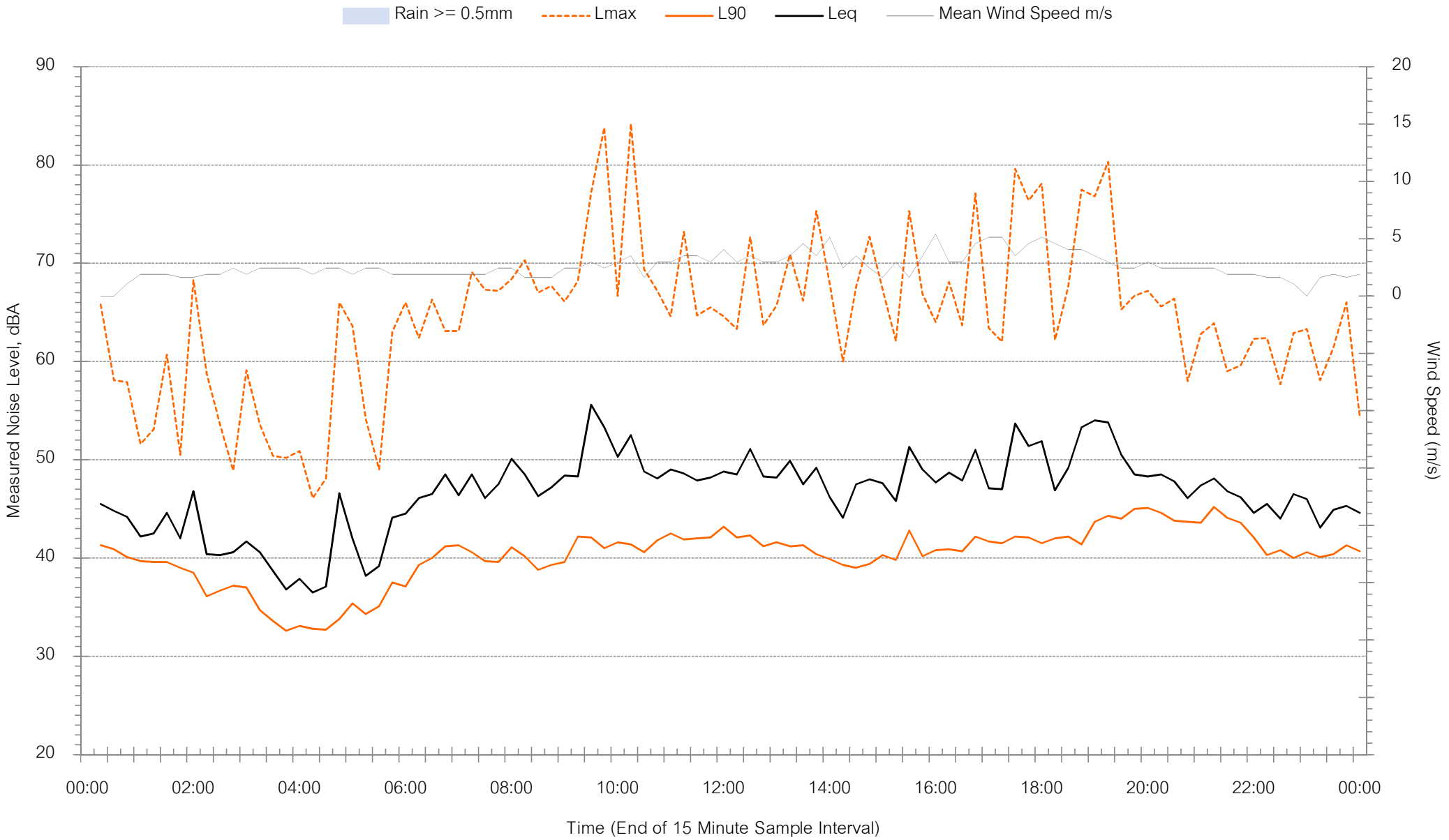
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Saturday 10 March 2018



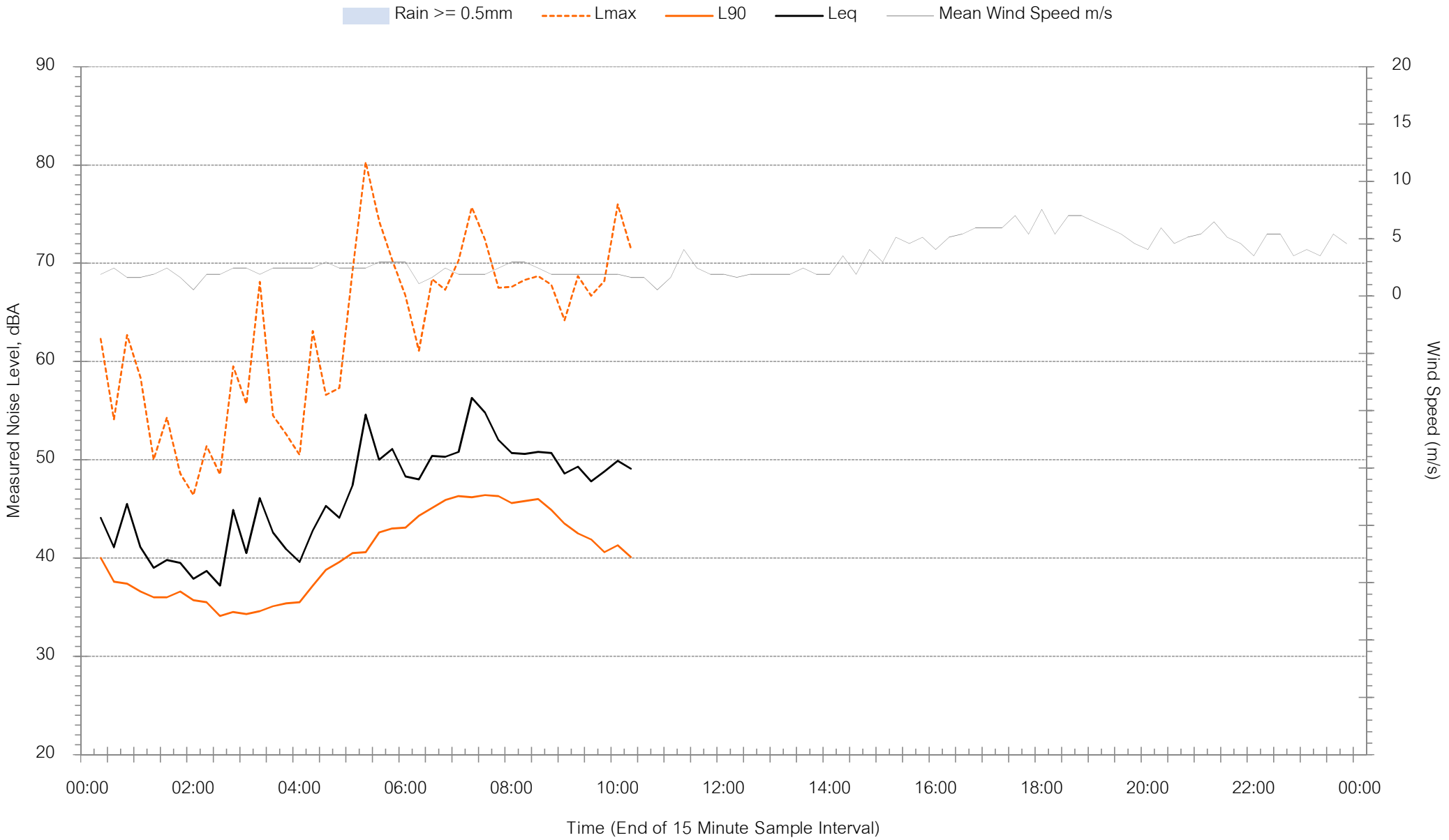
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Sunday 11 March 2018



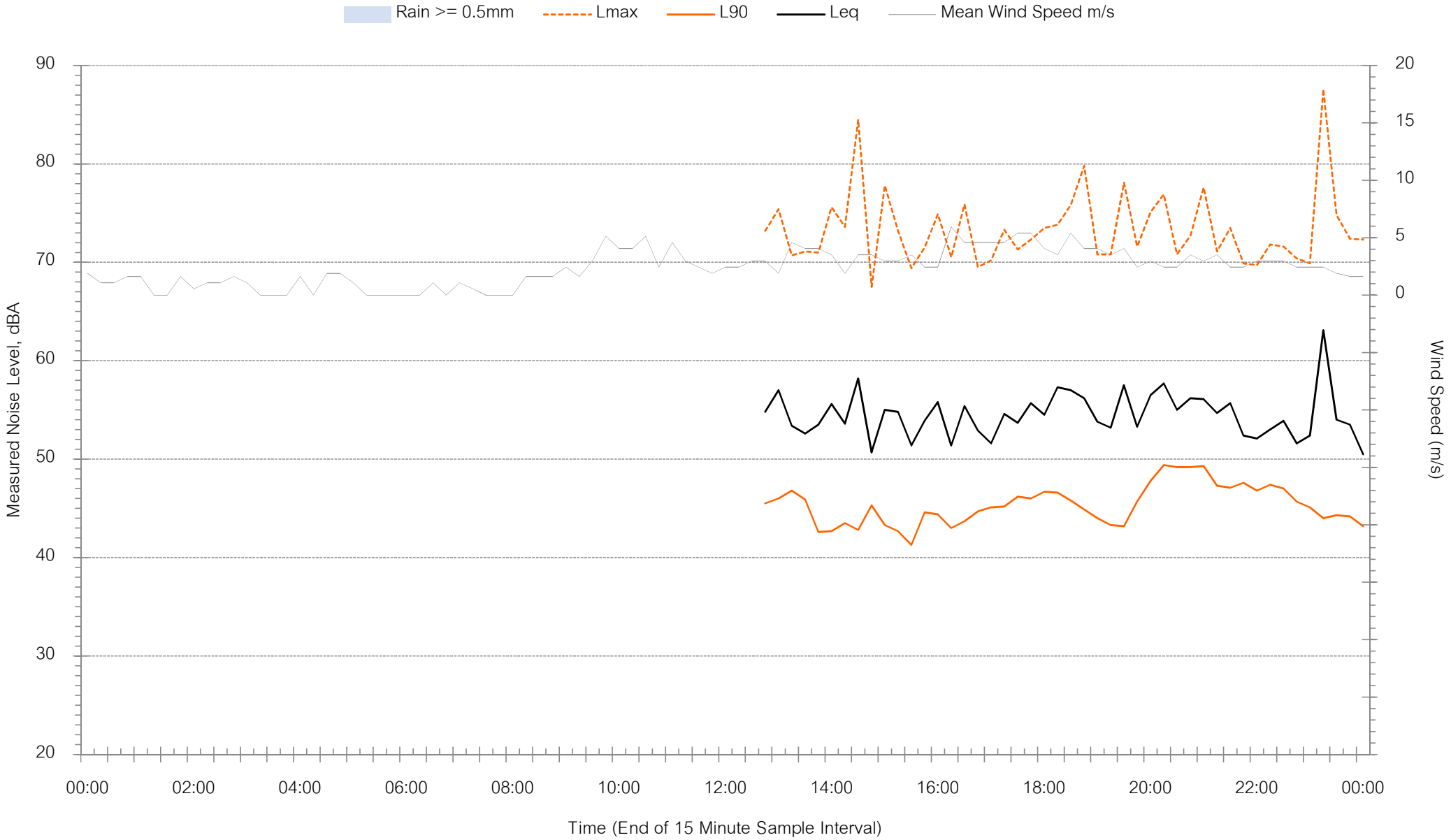
Background Noise Levels

Logger 1 - Gordon Avenue, Ingleburn - Monday 12 March 2018



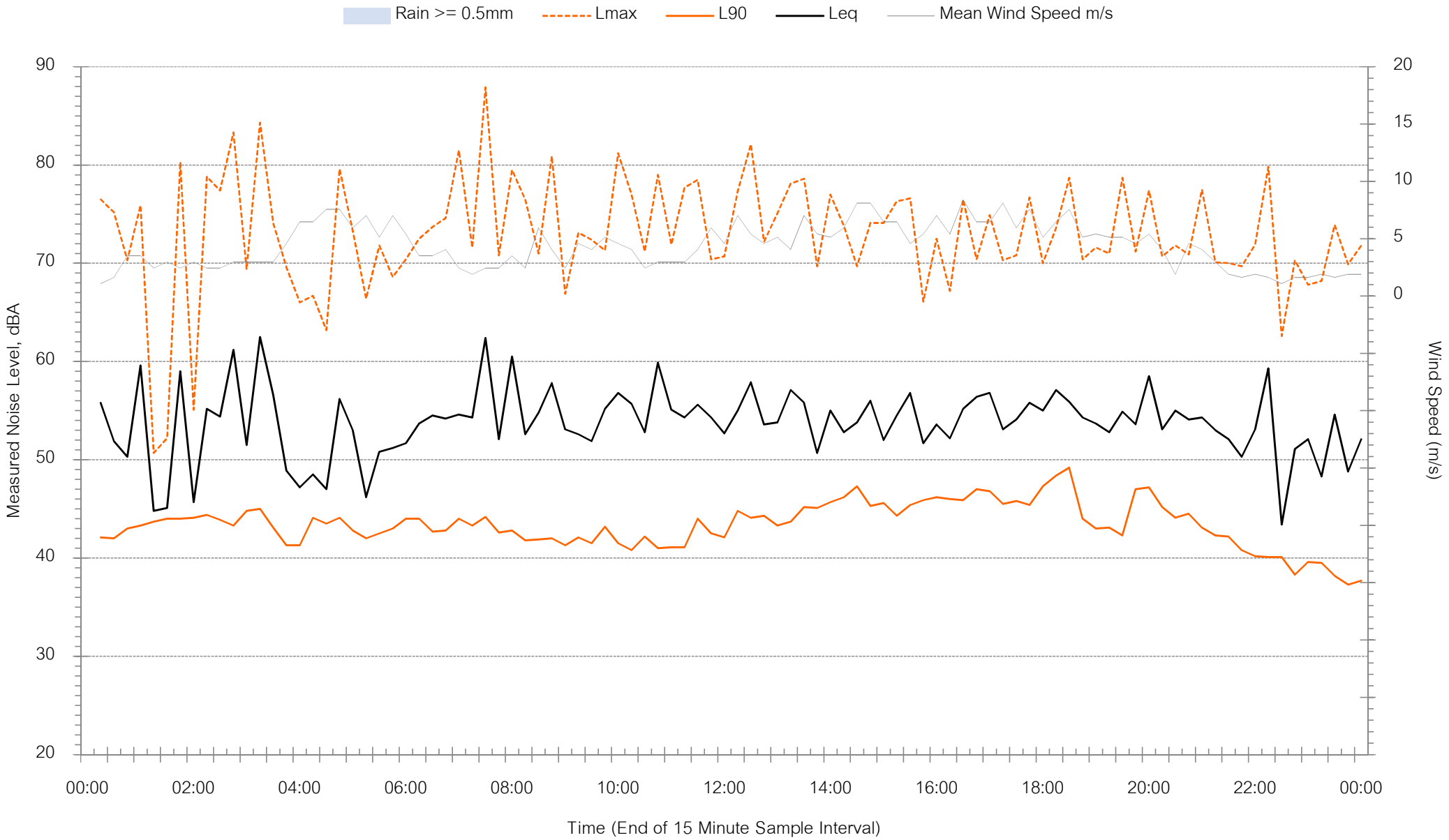
Background Noise Levels

Logger 2 - James Street, Ingleburn - Wednesday 28 February 2018



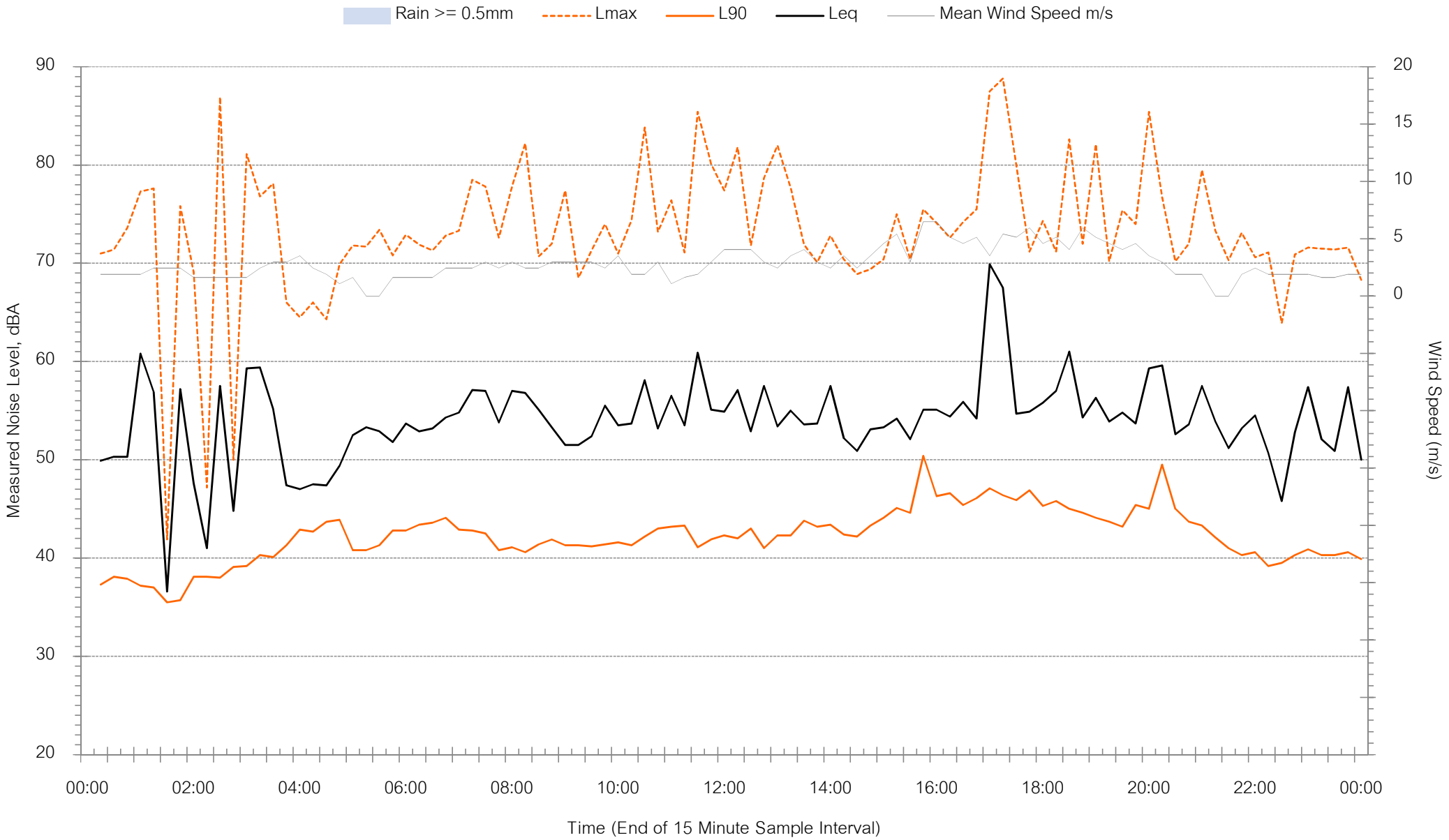
Background Noise Levels

Logger 2 - James Street, Ingleburn - Thursday 1 March 2018



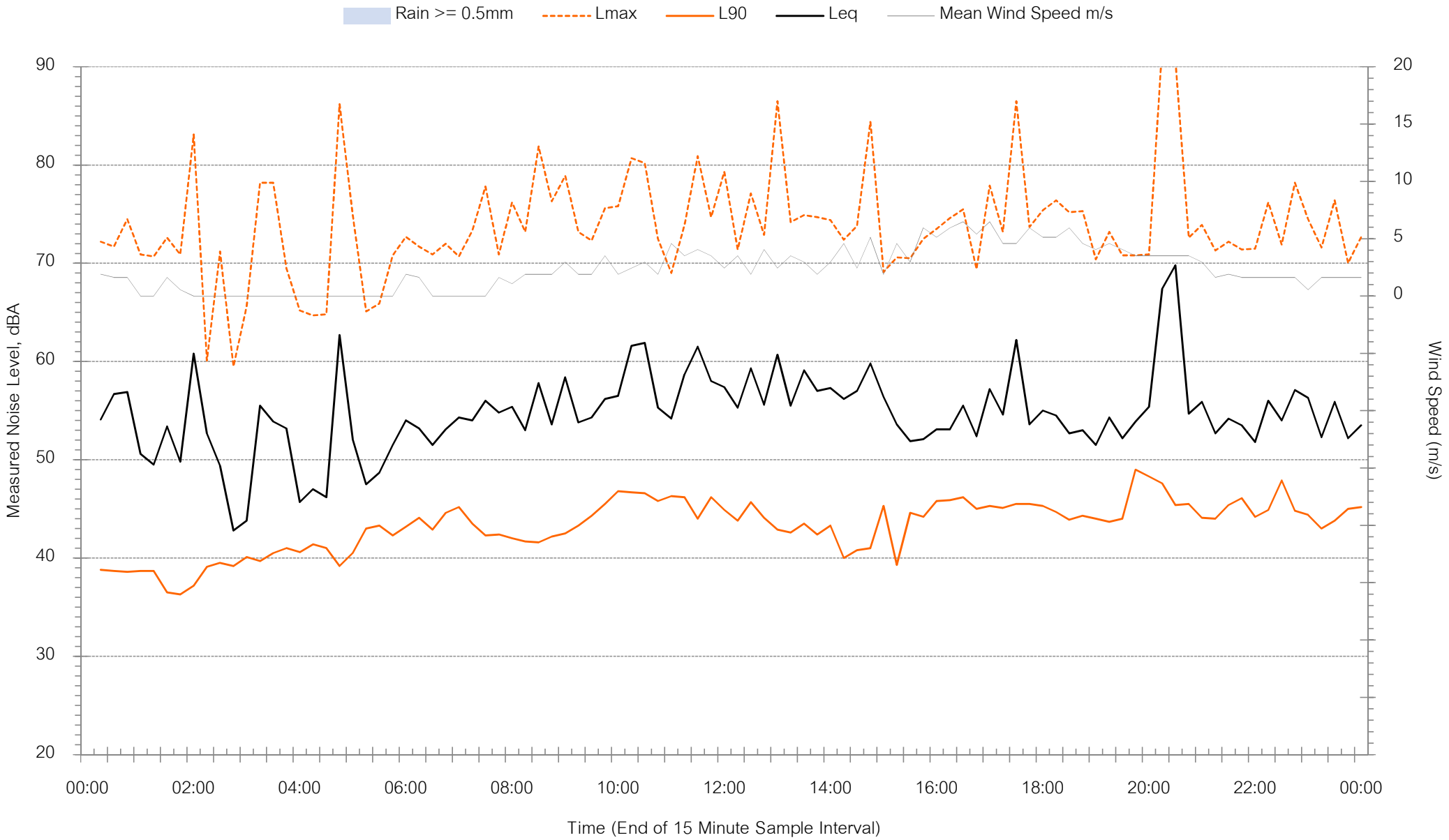
Background Noise Levels

Logger 2 - James Street, Ingleburn - Friday 2 March 2018



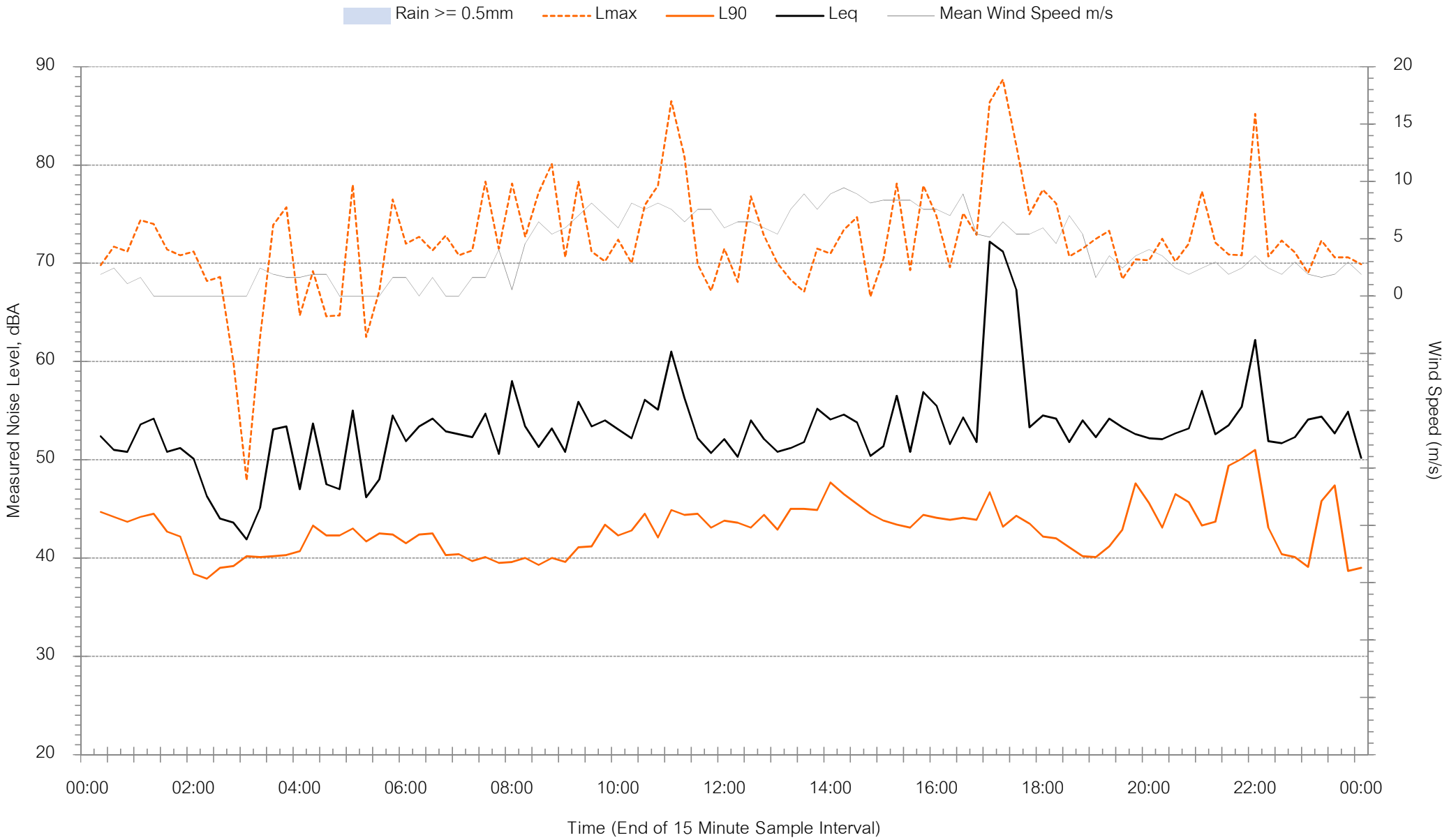
Background Noise Levels

Logger 2 - James Street, Ingleburn - Saturday 3 March 2018



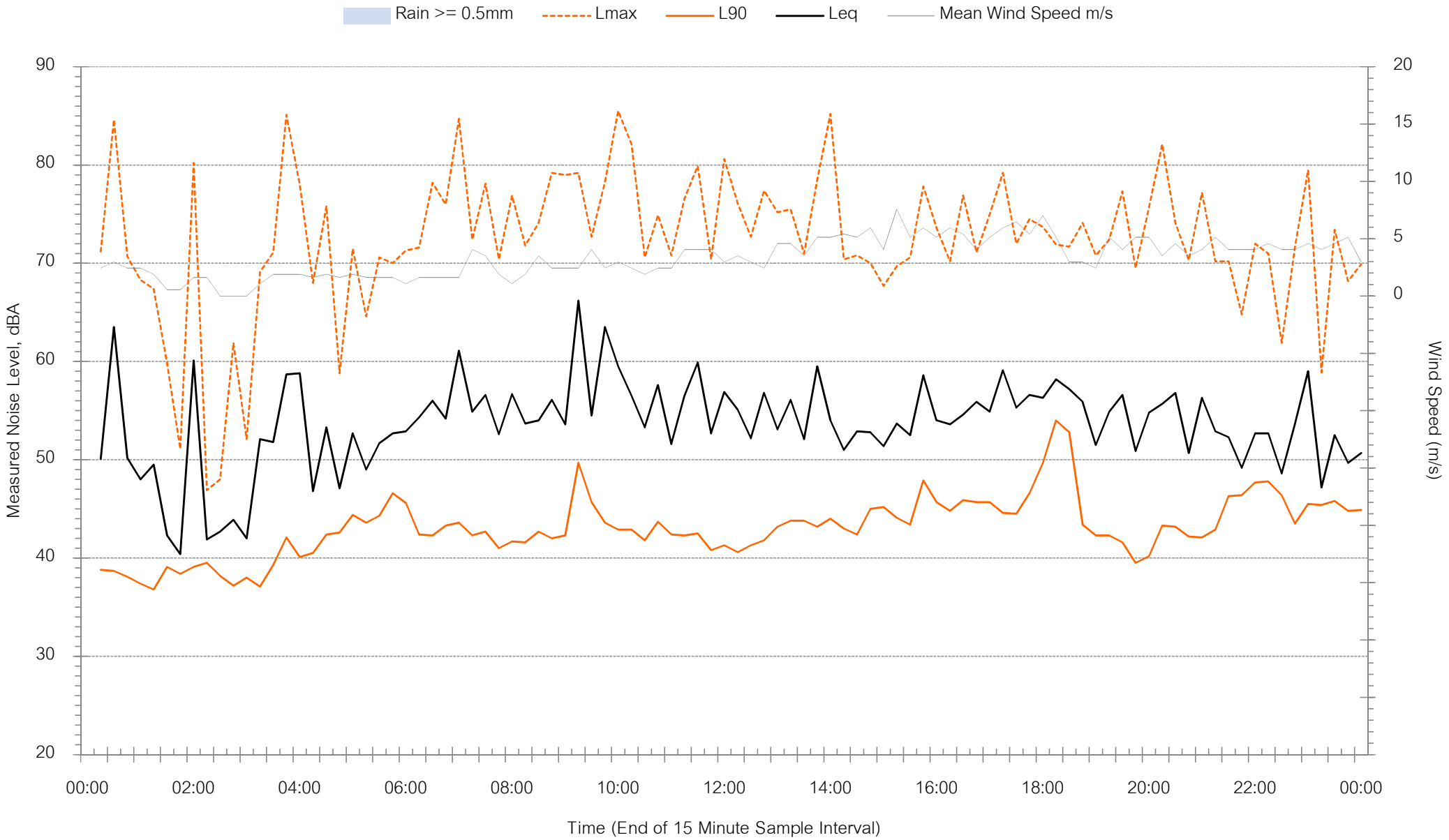
Background Noise Levels

Logger 2 - James Street, Ingleburn - Sunday 4 March 2018



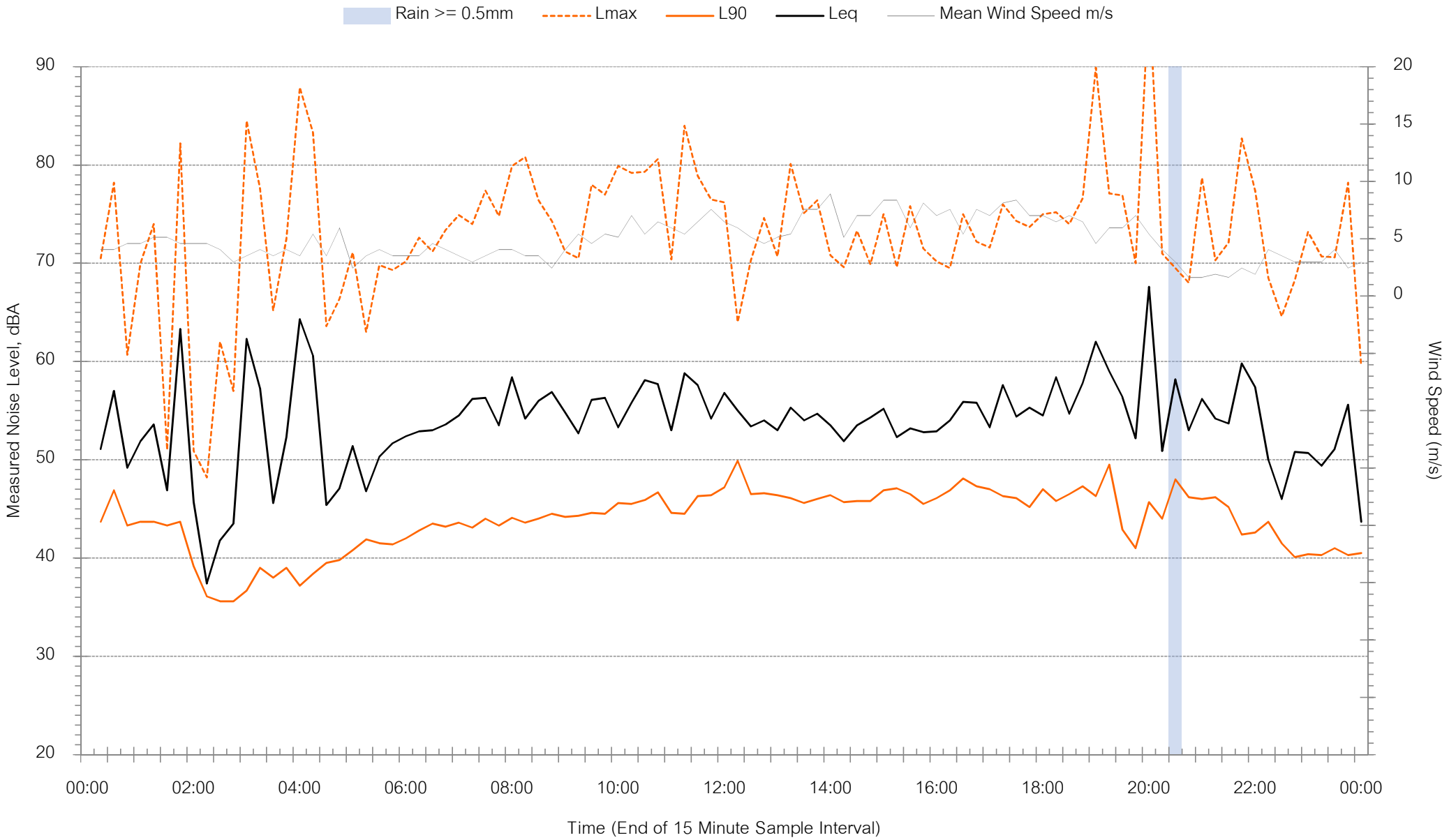
Background Noise Levels

Logger 2 - James Street, Ingleburn - Monday 5 March 2018



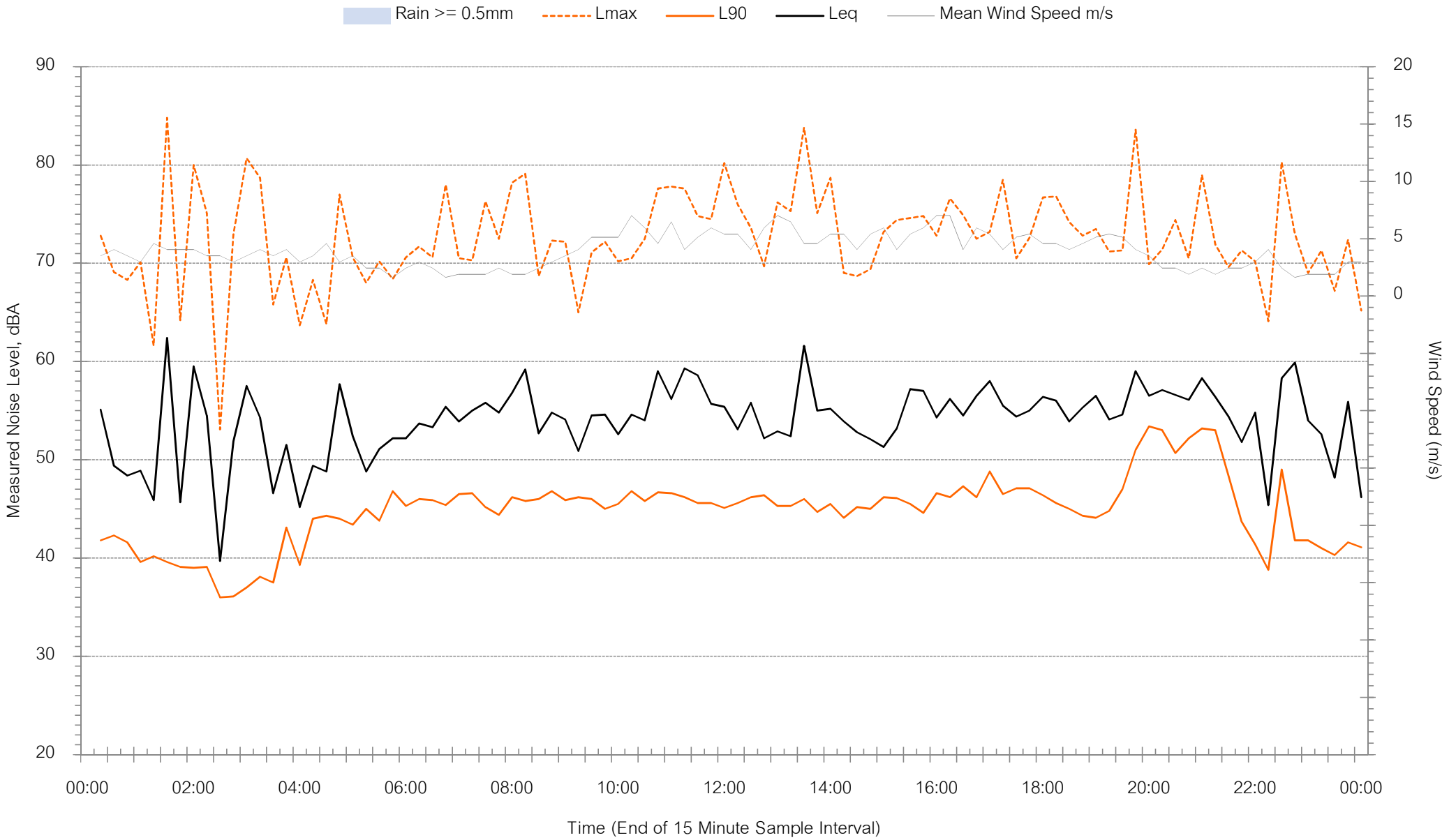
Background Noise Levels

Logger 2 - James Street, Ingleburn - Tuesday 6 March 2018



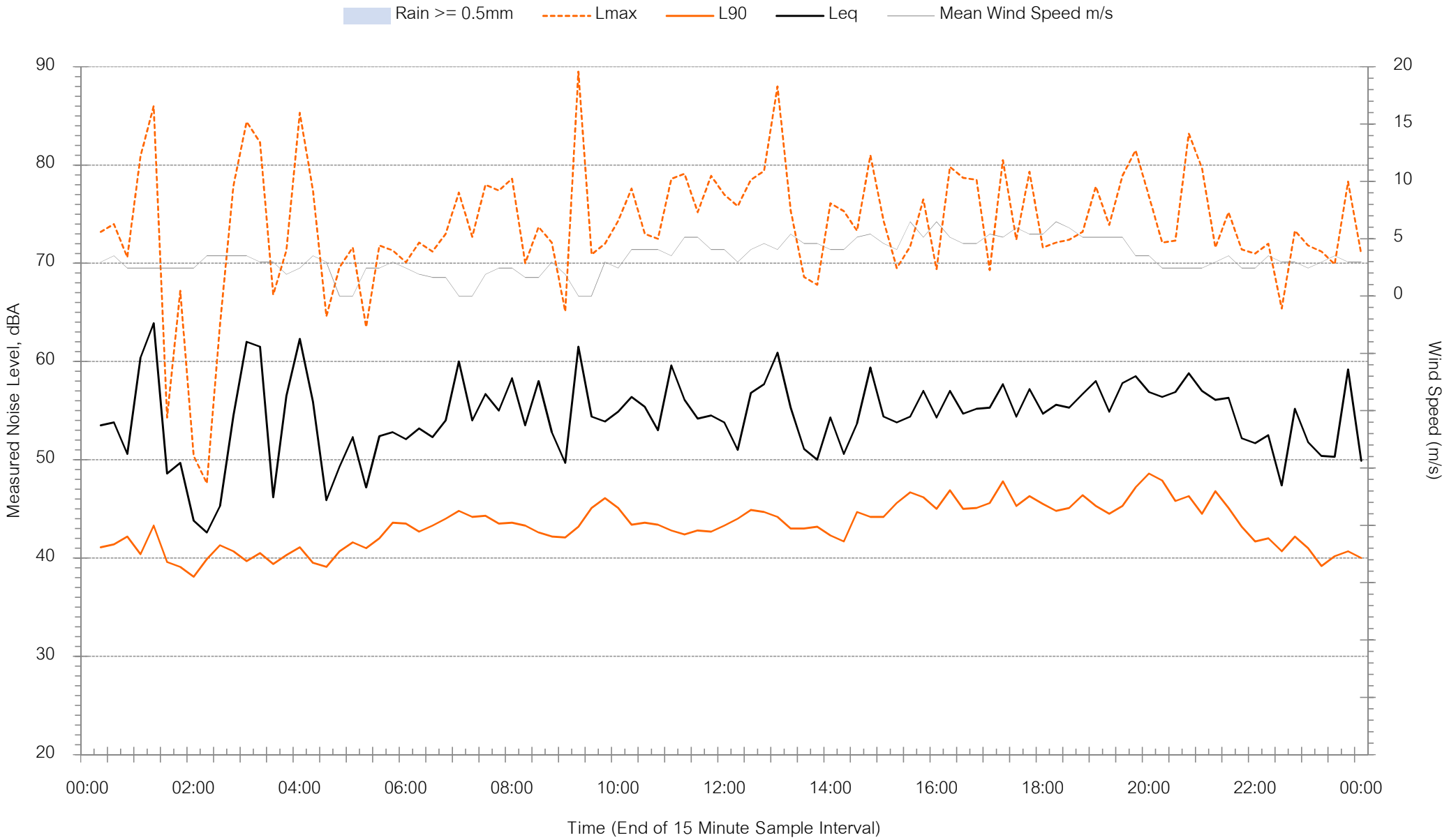
Background Noise Levels

Logger 2 - James Street, Ingleburn - Wednesday 7 March 2018



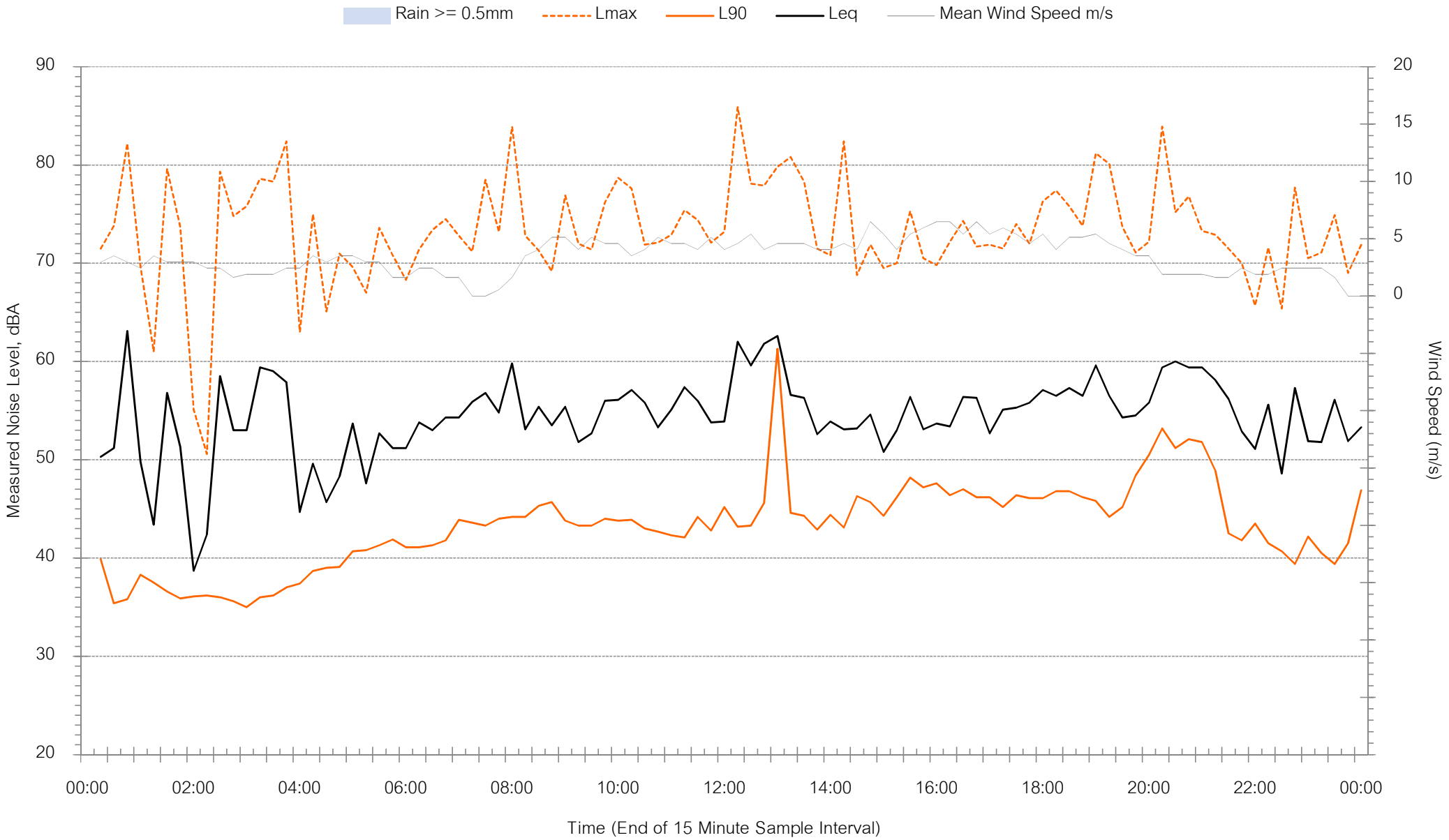
Background Noise Levels

Logger 2 - James Street, Ingleburn - Thursday 8 March 2018



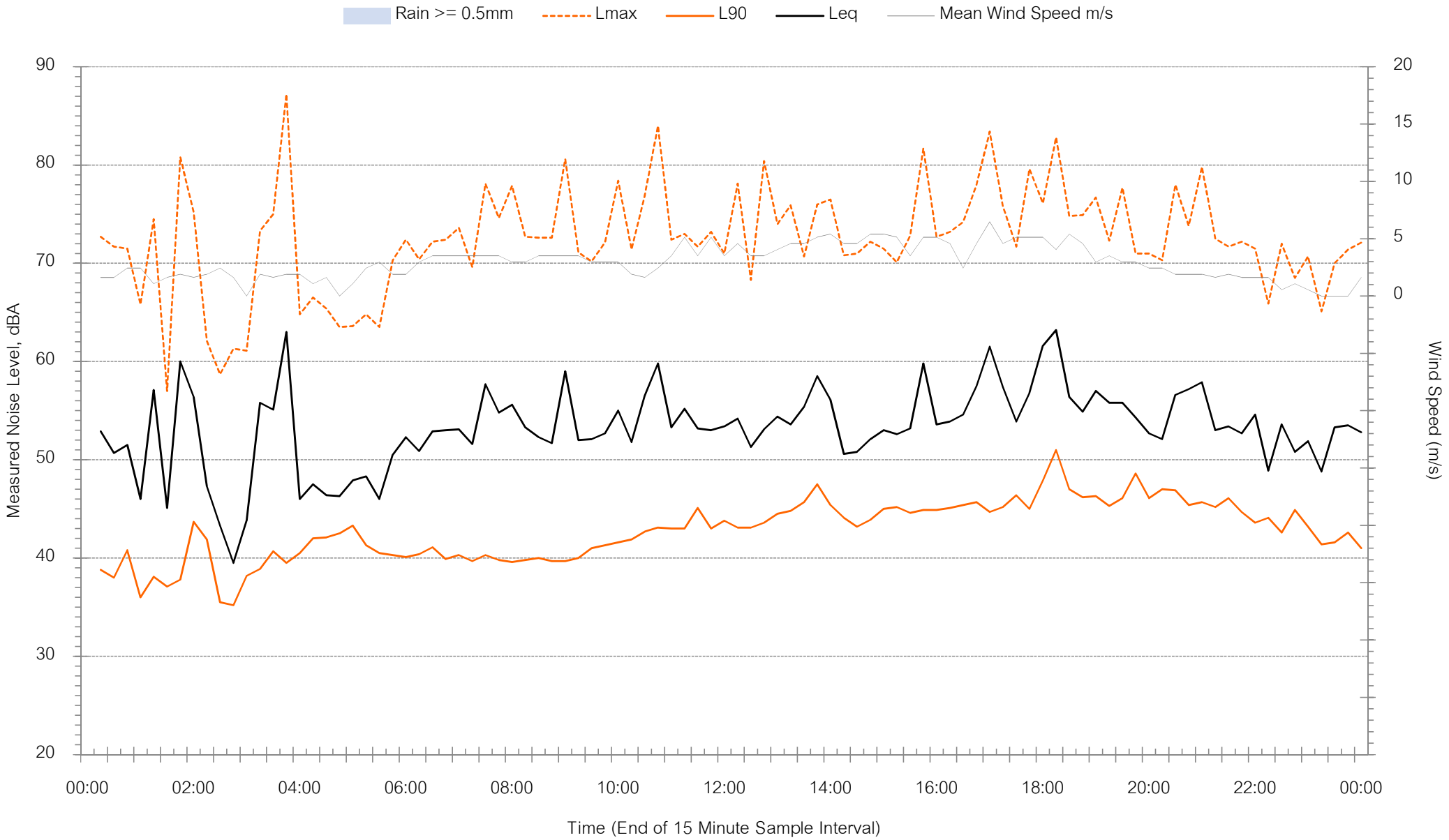
Background Noise Levels

Logger 2 - James Street, Ingleburn - Friday 9 March 2018



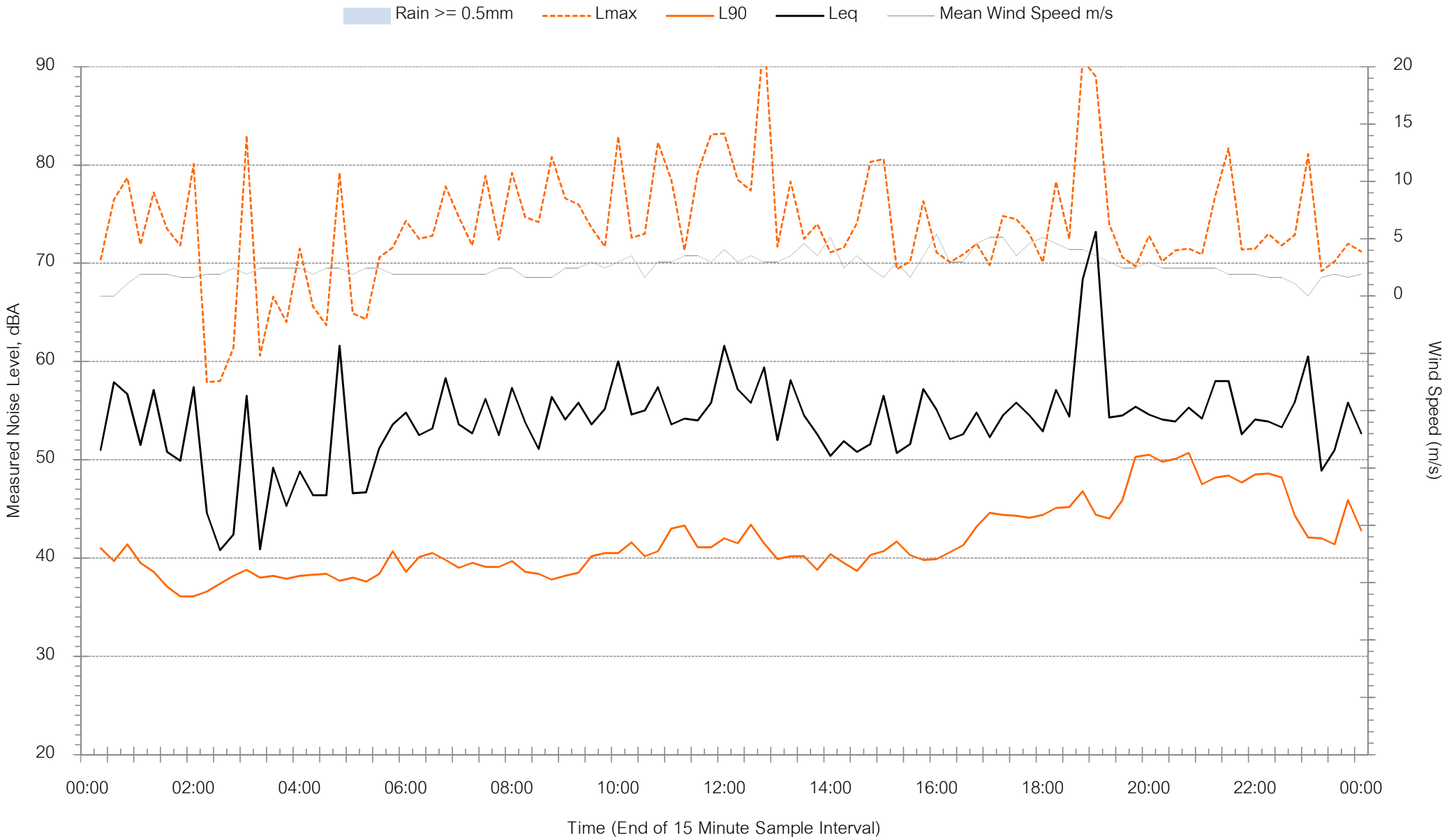
Background Noise Levels

Logger 2 - James Street, Ingleburn - Saturday 10 March 2018



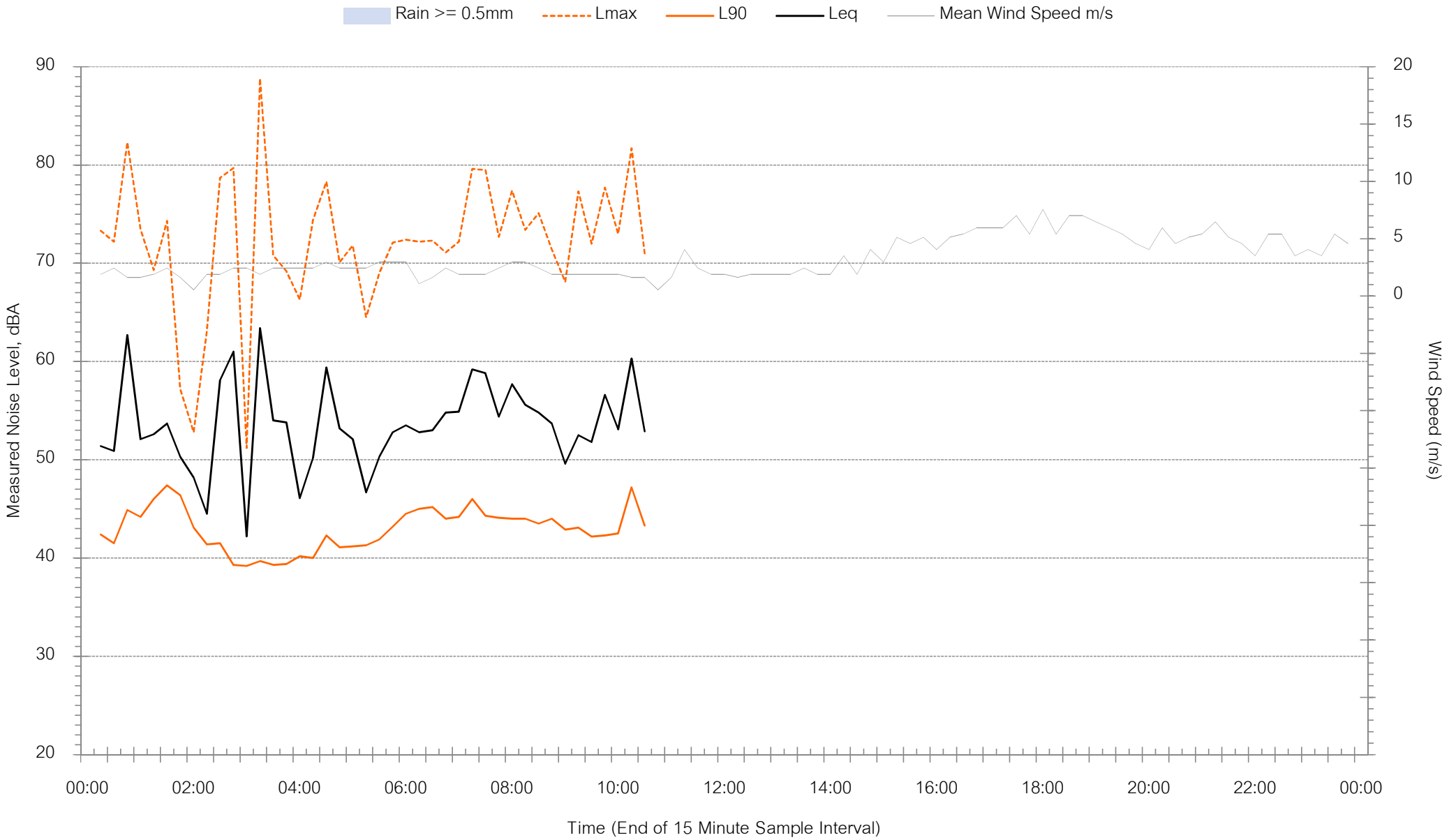
Background Noise Levels

Logger 2 - James Street, Ingleburn - Sunday 11 March 2018



Background Noise Levels

Logger 2 - James Street, Ingleburn - Monday 12 March 2018



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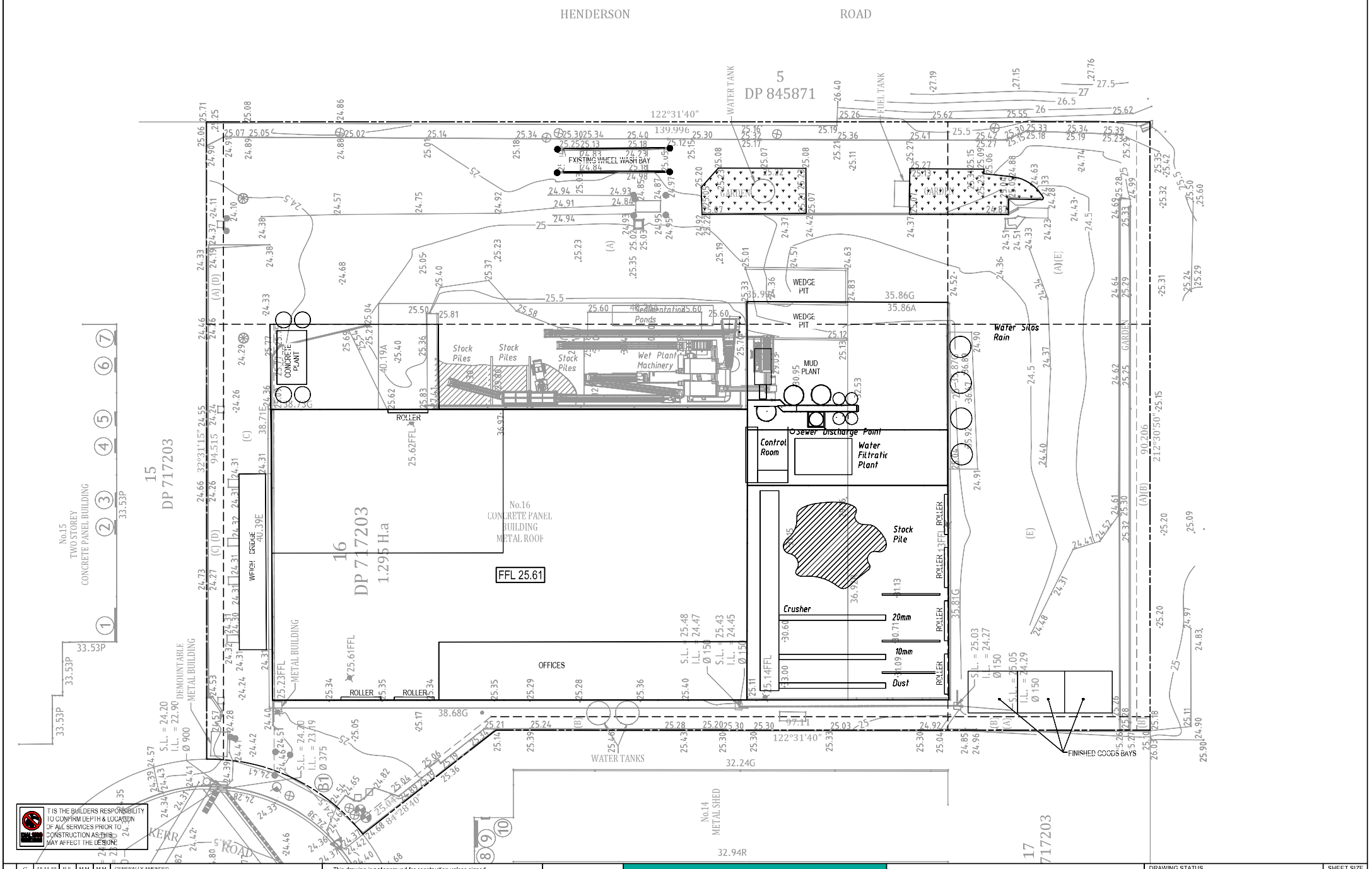
Appendix C – Site Plans



THIS IS THE BUILDERS RESPONSIBILITY TO CONFIRM DEPTH & LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION AS THIS MAY AFFECT THE DESIGN.

REVISIONS						
G	15.11.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
F	12.11.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
E	09.02.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
D	13.11.18	R.F.	M.M.	M.M.	GENERALLY AMENDED
C	01.11.18	R.F.	M.M.	M.M.	GENERALLY AMENDED
B	17.09.18	R.F.	M.M.	M.M.	ISSUED FOR INFORMATION
A	06.07.18	R.F.	M.M.	M.M.	ISSUED FOR INFORMATION
REV	DATE	DRN	CHK	APP	DRAWING STATUS

This drawing is not approved for construction unless signed.

Mathew McNamara
BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

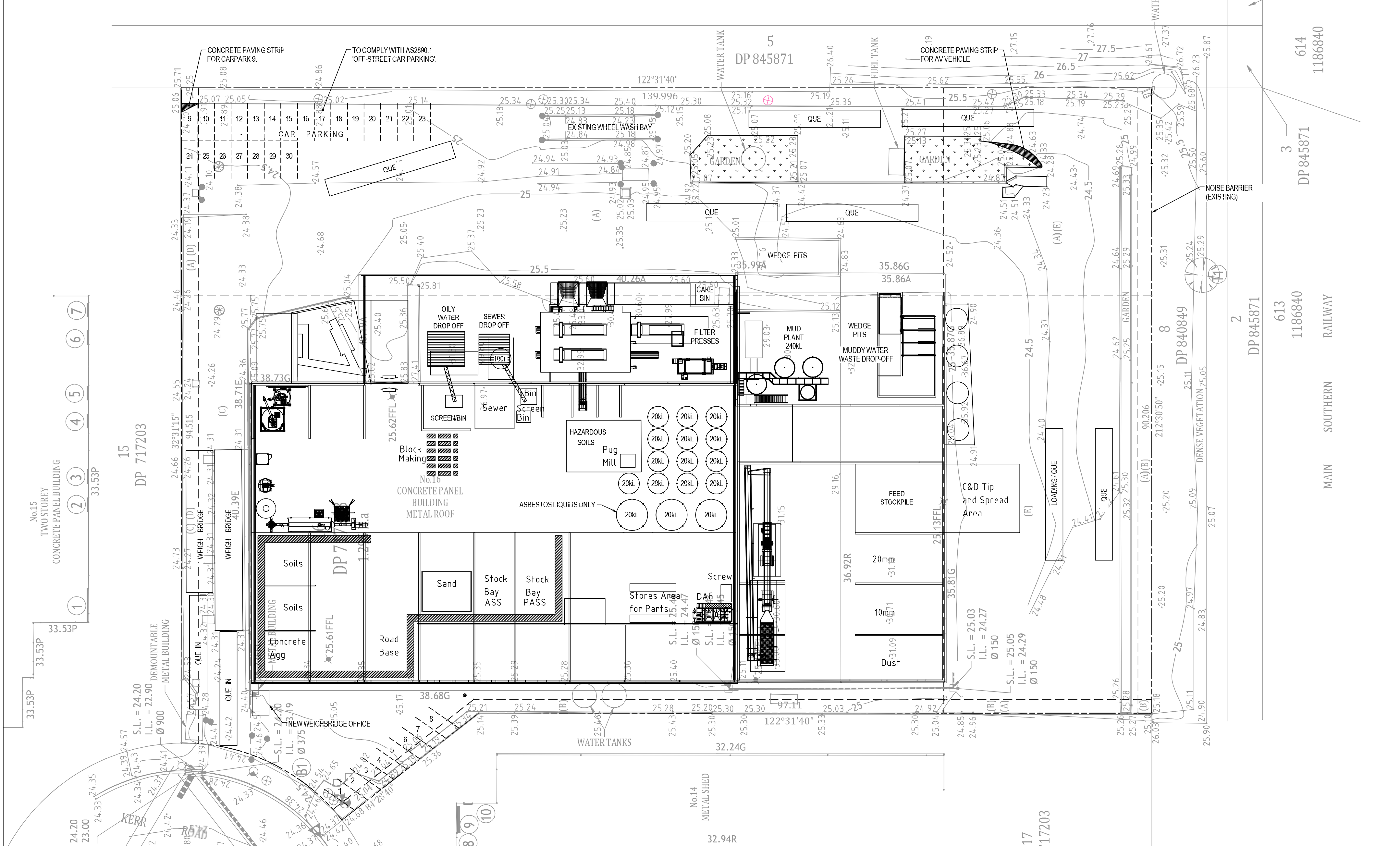
APPROVED SITE PLAN
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS: NOT FOR CONSTRUCTION

SHEET SIZE: A1
SCALE: 1:250

PROJECT REF No.: 180009
DRAWING No.: SITE01
REVISION: G

(A) - EASEMENT TO DRAIN WATER 30 WIDE (DP 260710)
(B) - EASEMENT FOR GAS PIPELINE 2 WIDE (DP 717203)
(C) - EASEMENT TO DRAIN WATER 10 WIDE (DP 717203)
(D) - EASEMENT FOR WATER SUPPLY WORKS 2.5 WIDE (DP 717203)
(E) - EASEMENT TO DRAIN WATER 30 WIDE (DP 717203)



REV	DATE	DRN	CHK	APP	DRAWING STATUS
I	11.12.19	RF	MM	MM	PUG MILL LOCATION & TANKS AMENDED
H	15.11.19	RF	MM	MM	GENERALLY AMENDED
G	12.11.19	RF	MM	MM	GENERALLY AMENDED
F	09.02.19	RF	MM	MM	GENERALLY AMENDED
E	03.05.19	RF	MM	MM	GENERALLY AMENDED
D	14.03.19	RF	MM	MM	GENERALLY AMENDED
C	04.02.19	RF	MM	MM	GENERALLY AMENDED

REVISIONS

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Mathew McNamara
BEng (Civil) Hons MIE (Aust)

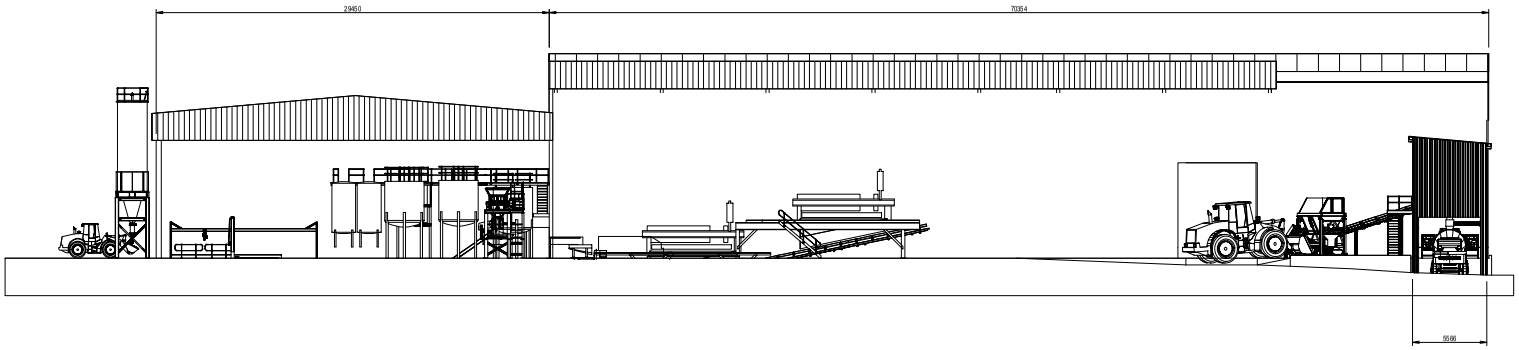
North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

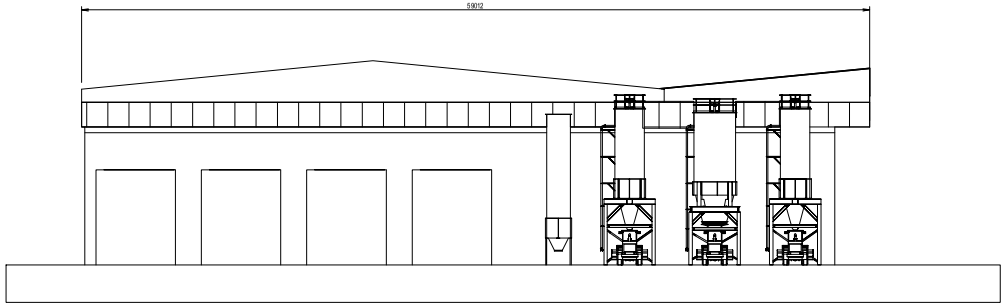
PROPOSED SITE PLAN
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS	SHEET SIZE
NOT FOR CONSTRUCTION	A1
	SCALE 1:250

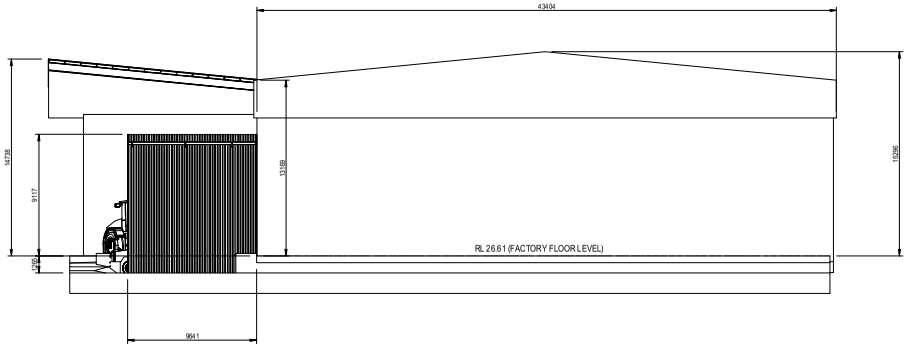
PROJECT REF No.	DRAWING No.	REVISION
180009	SITE02	I



NORTH EAST ELEVATION
1:200



SOUTH EAST ELEVATION
1:200



NORTH WEST ELEVATION
1:200

REVISIONS						
	B	21.11.18	R.F.	M.M.	M.M.	BUILDING DIMENSIONS AMENDED
	A	16.11.18	R.F.	M.M.	M.M.	ISSUED FOR INFORMATION
	REV	DATE	DRN	CHK	APP	DRAWING STATUS

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Mathew McNamara
BEng (Civil) Hons ME (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

BUILDING ELEVATIONS
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS: NOT FOR CONSTRUCTION

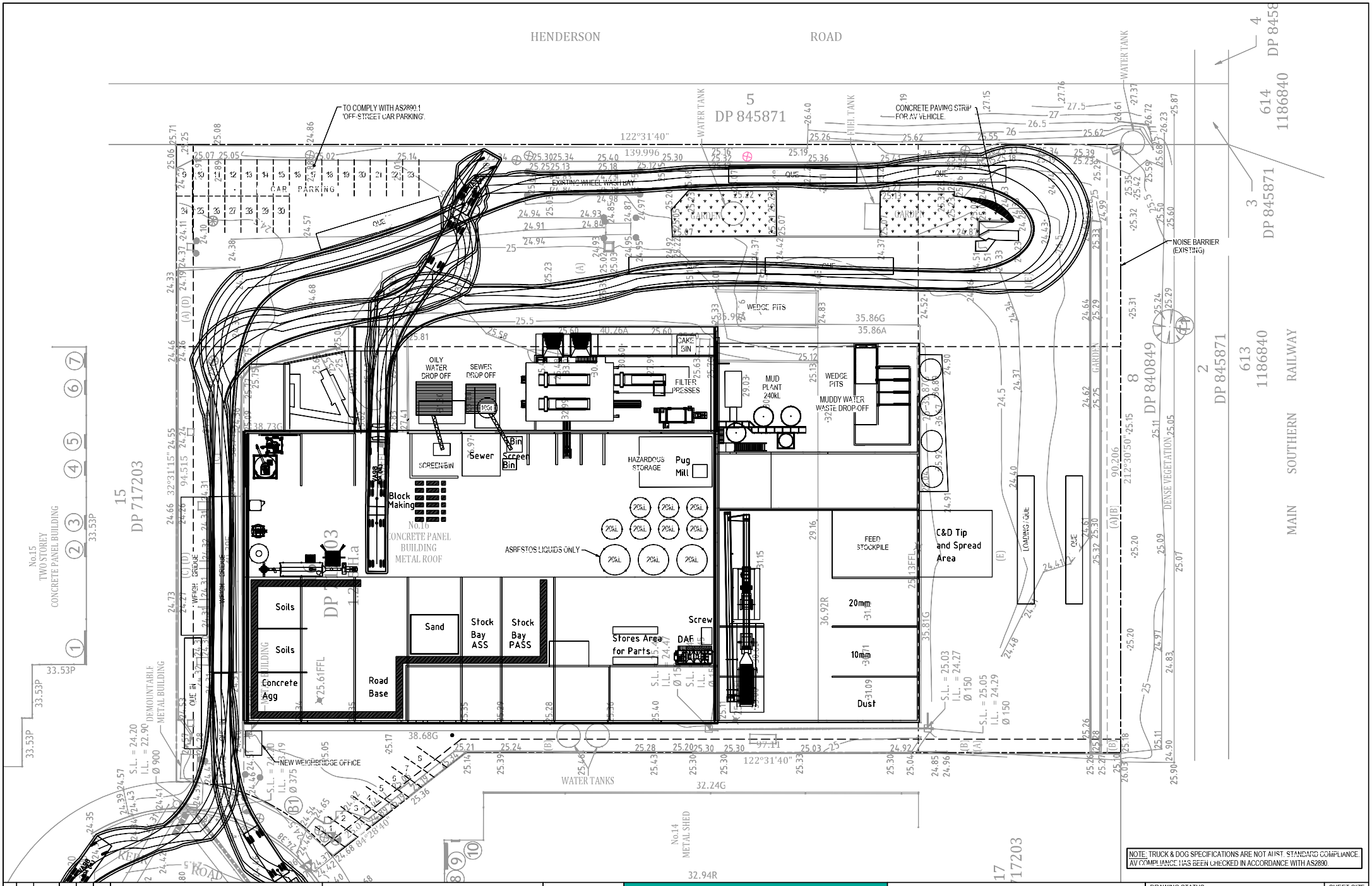
SHEET SIZE: A1

SCALE: 1:250

PROJECT REF No.: 180009

DRAWING No.: SITE03

REVISION: B



NOTE: TRUCK & DOG SPECIFICATIONS ARE NOT AUST. STANDARD COMPLIANCE. AV COMPLIANCE HAS BEEN CHECKED IN ACCORDANCE WITH AS2890.

REVISIONS						
E	15.11.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
D	12.11.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
C	14.03.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
B	05.02.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
A	01.11.18	R.F.	M.M.	M.M.	ISSUED FOR INFORMATION
REV	DATE	DRN	CHK	APP	DRAWING STATUS

This drawing is not approved for construction unless signed.

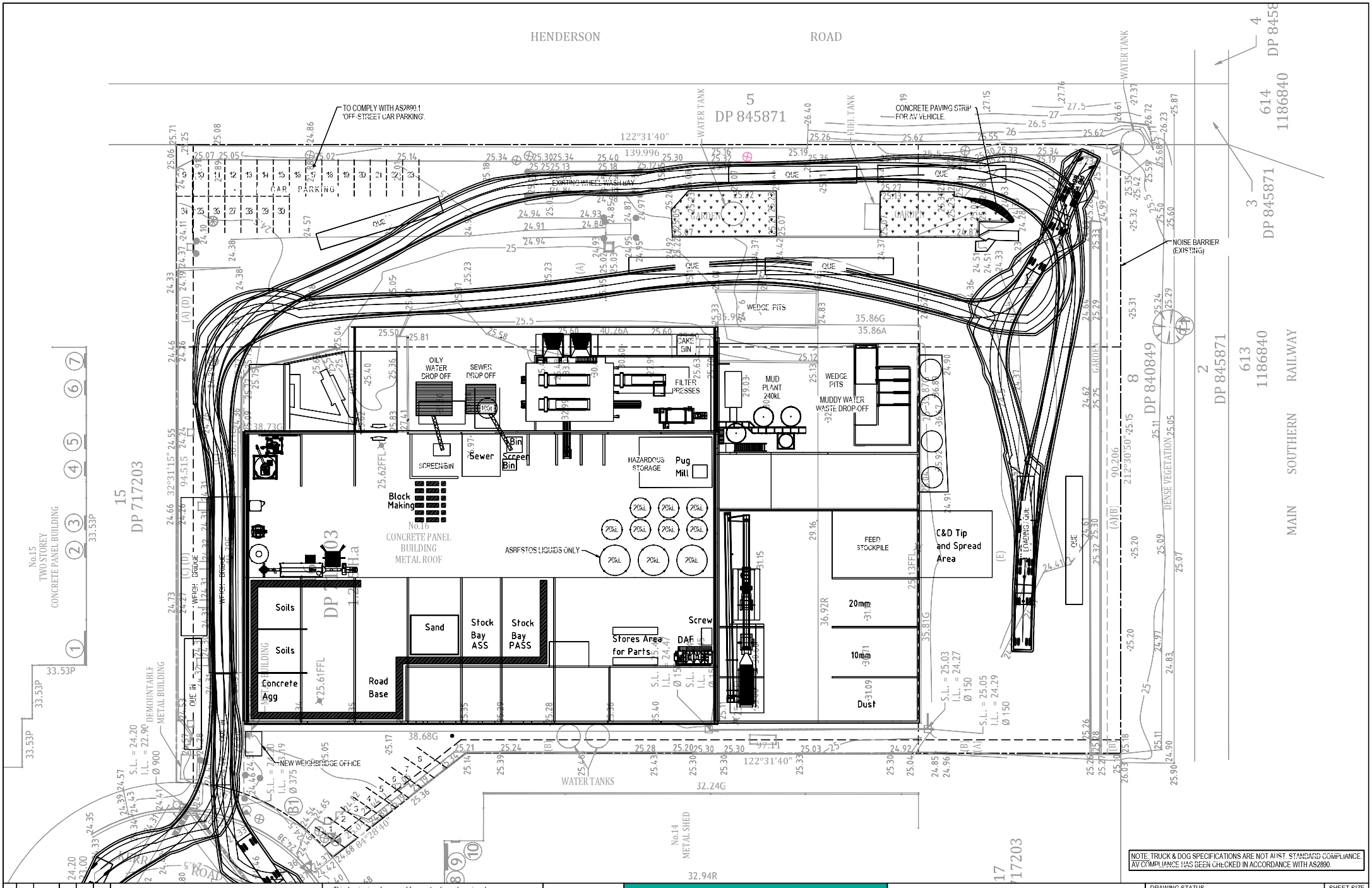
Mathew McNamara BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

VEHICLE TURNING PATH
TRUCK & DOG: INTERNAL DROP OFF
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS	SHEET SIZE
NOT FOR CONSTRUCTION	A1
	SCALE 1:250
PROJECT REF No. 180009	DRAWING No. TURN01
	REVISION E



REVISIONS						
E	15.11.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
D	12.11.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
C	14.03.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
B	05.02.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
A	01.11.18	R.F.	M.M.	M.M.		ISSUED FOR INFORMATION
REV	DATE	DRN	CHK	APP		DRAWING STATUS

This drawing is not approved for construction unless signed.

Mathew McNamara BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

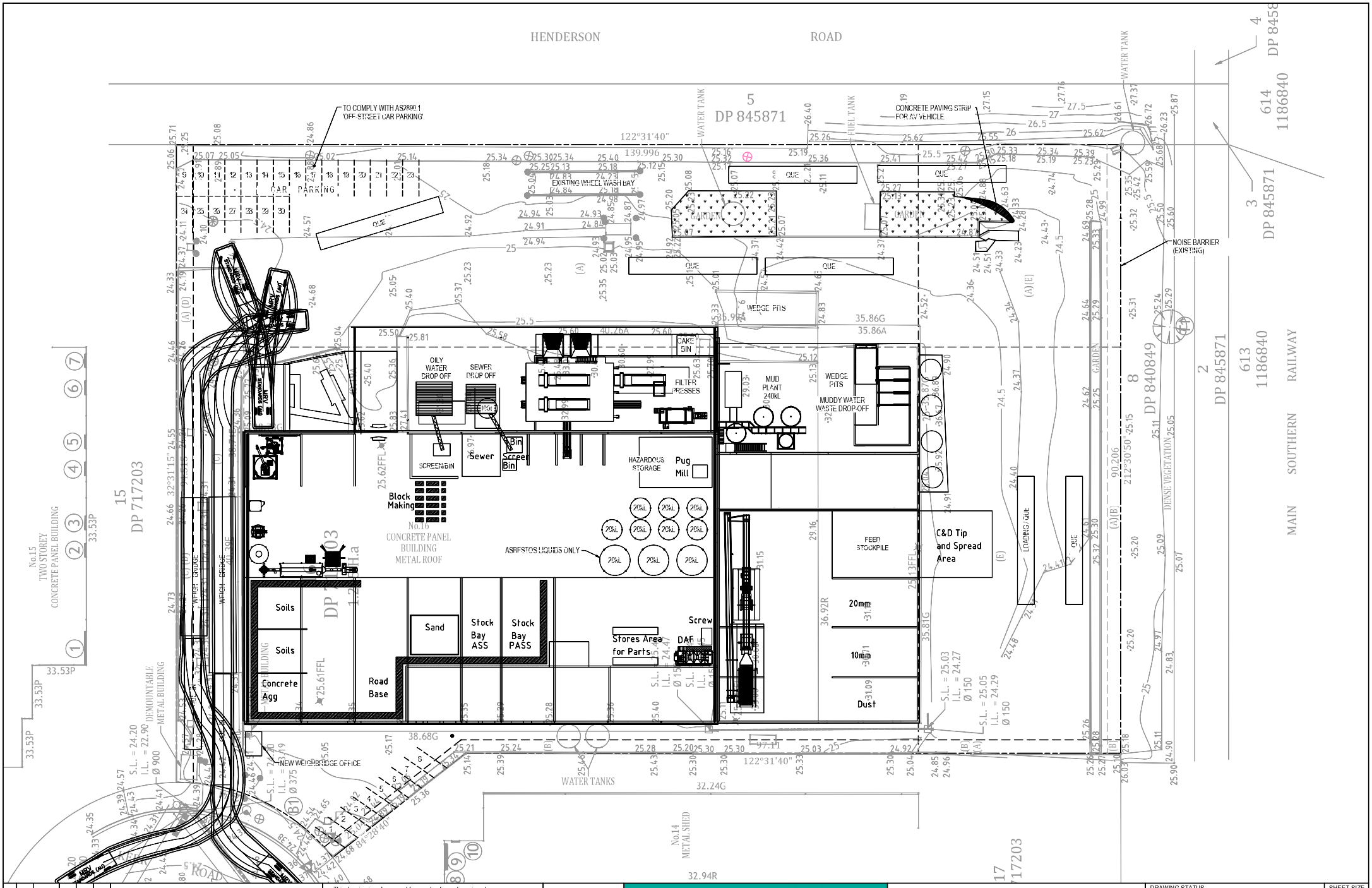
VEHICLE TURNING PATH
TRUCK & DOG: C & D TIP & SPREAD
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS: NOT FOR CONSTRUCTION

SHEET SIZE: A1

SCALE: 1:250

PROJECT REF No.	DRAWING No.	REVISION
180009	TURN02	E



REVISIONS						
	E	15.11.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
	D	12.11.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
	C	14.03.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
	B	05.02.19	R.F.	M.M.	M.M.	GENERALLY AMENDED
	A	01.11.18	R.F.	M.M.	M.M.	ISSUED FOR INFORMATION
	REV	DATE	DRN	CHK	APP	DRAWING STATUS

This drawing is not approved for construction unless signed.

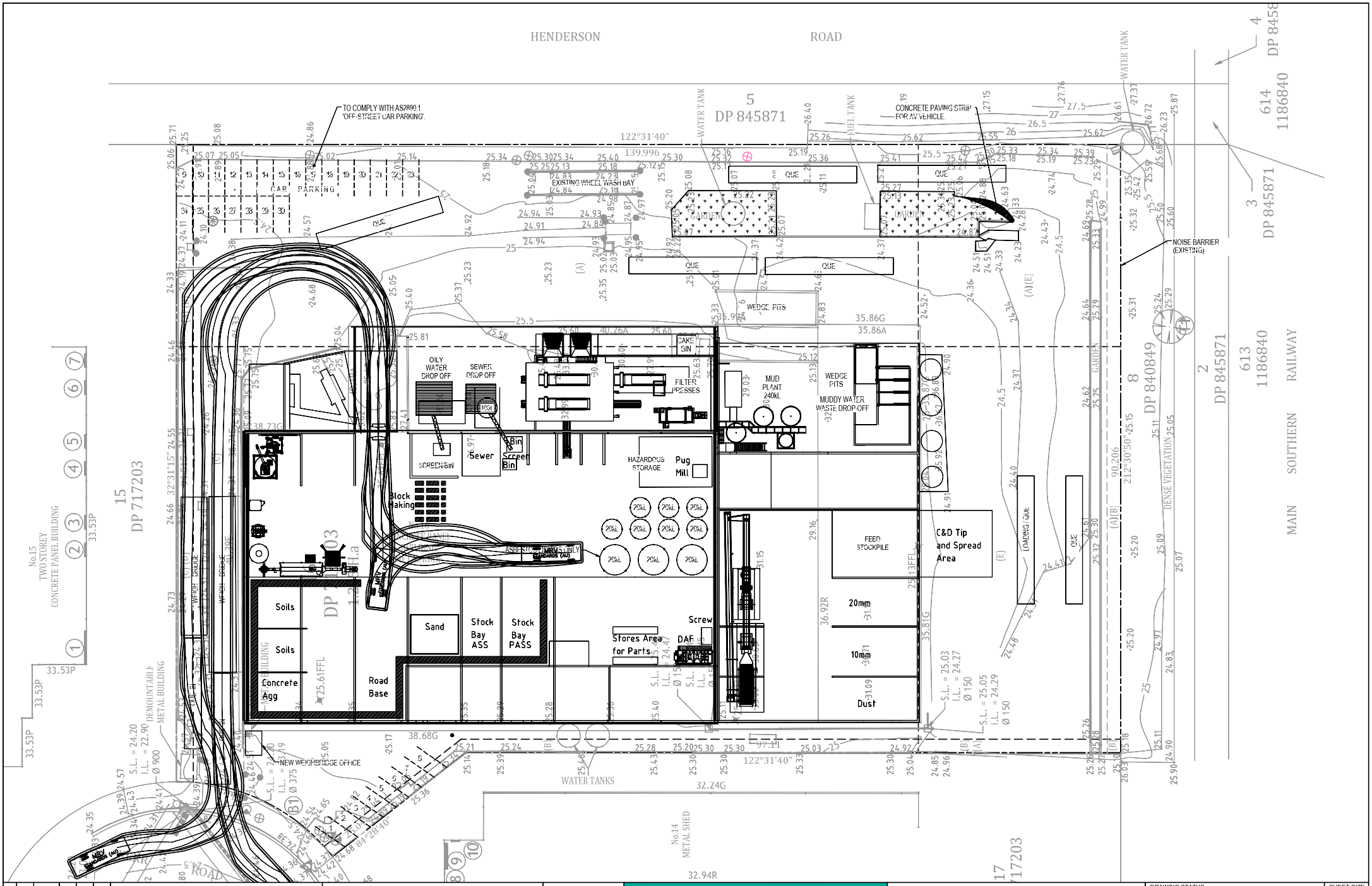
Mathew McNamara
BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

VEHICLE TURNING PATH
CONCRETE AGITATOR (AS2890 MRV)
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS	SHEET SIZE
NOT FOR CONSTRUCTION	A1
	SCALE 1:250
PROJECT REF No. 180009	DRAWING No. TURN03
	REVISION E



REVISIONS						
E	15.11.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
D	12.11.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
C	14.03.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
B	05.02.19	R.F.	M.M.	M.M.		GENERALLY AMENDED
A	01.11.18	R.F.	M.M.	M.M.		ISSUED FOR INFORMATION
REV	DATE	DRN	CHK	APP		DRAWING STATUS

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Mathew McNamara
BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

VEHICLE TURNING PATH
MRV: INTERNAL DROP OFF
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS: NOT FOR CONSTRUCTION

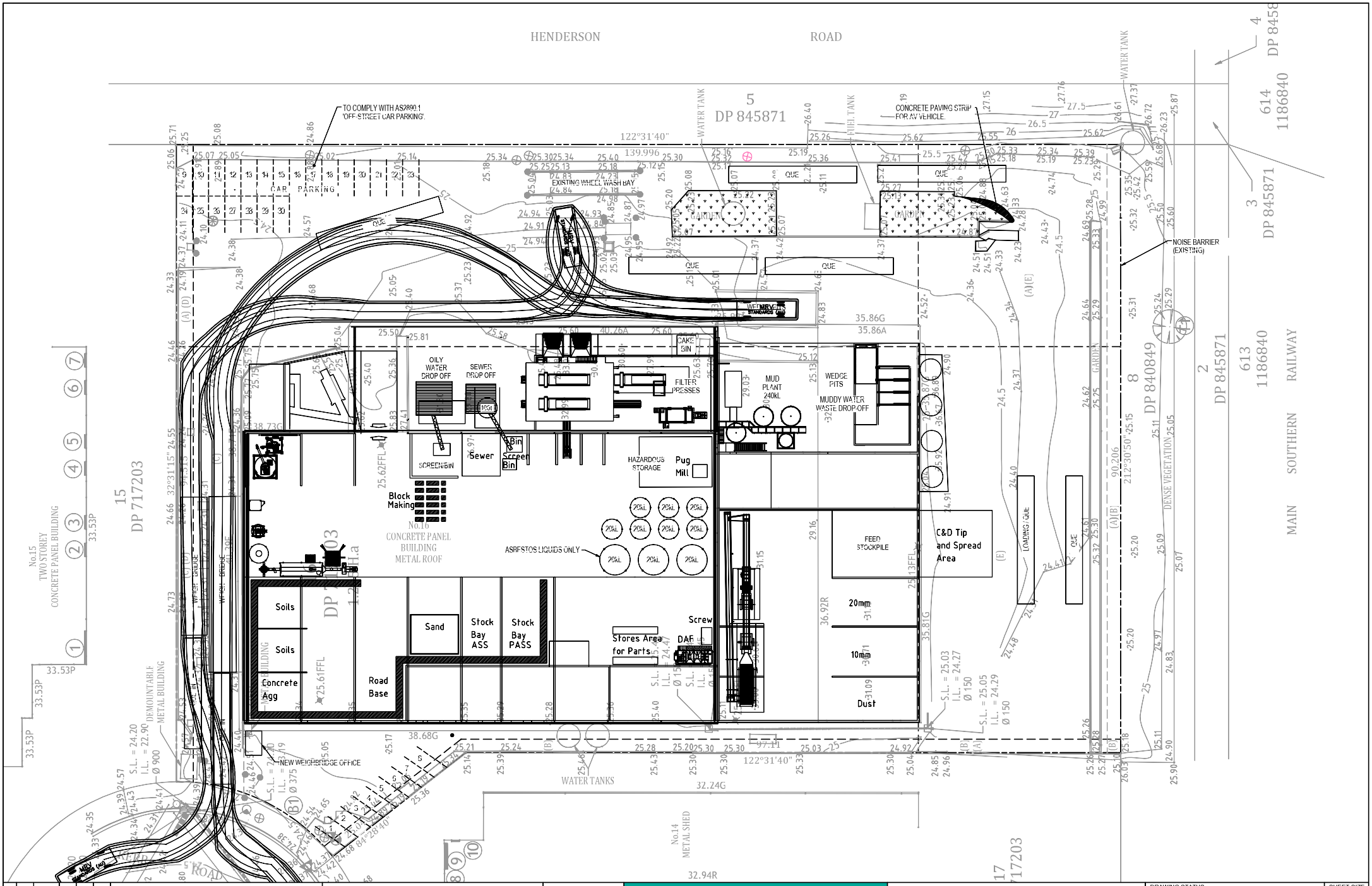
SHEET SIZE: A1

SCALE: 1:250

PROJECT REF No.: 180009

DRAWING No.: TURN04

REVISION: E



REVISIONS						
B	15.11.19	R.F.	M.M	M.M	GENERALLY AMENDED	
A	12.11.19	R.F.	M.M	M.M	ISSUED FOR DA	
REV	DATE	DRN	CHK	APP	DRAWING STATUS	

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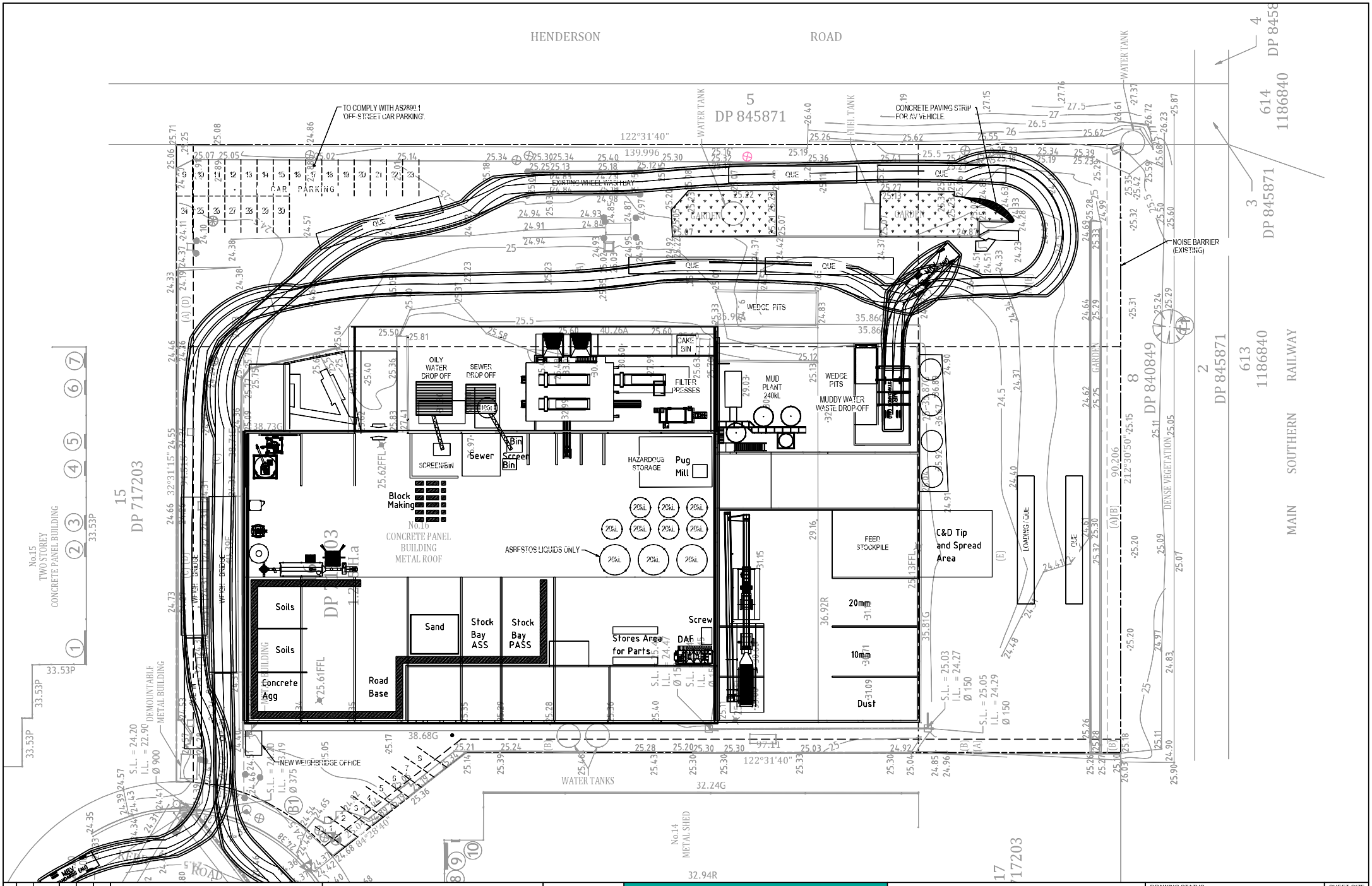
Mathew McNamara BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

VEHICLE TURNING PATH
MRV: EXTERNAL WEDGE PIT
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS	SHEET SIZE
NOT FOR CONSTRUCTION	A1
	SCALE 1:250
PROJECT REF No. 180009	DRAWING No. TURN05
	REVISION B



REVISIONS

REV	DATE	DRN	CHK	APP	DRAWING STATUS
B	15.11.19	R.F.	M.M	M.M	GENERALLY AMENDED
A	12.11.19	R.F.	M.M	M.M	ISSUED FOR DA

This drawing is not approved for construction unless signed.

Mathew McNamara BEng (Civil) Hons MIE (Aust)

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

VEHICLE TURNING PATH
MRV: INTERNAL WEDGE PIT
16 KERR ROAD,
INGLEBURN
KDC PTY LTD

DRAWING STATUS: NOT FOR CONSTRUCTION

SHEET SIZE: A1

SCALE: 1:250

PROJECT REF No.: 180009

DRAWING No.: TURN06

REVISION: B

Appendix D – NEWA Analysed Meteorology

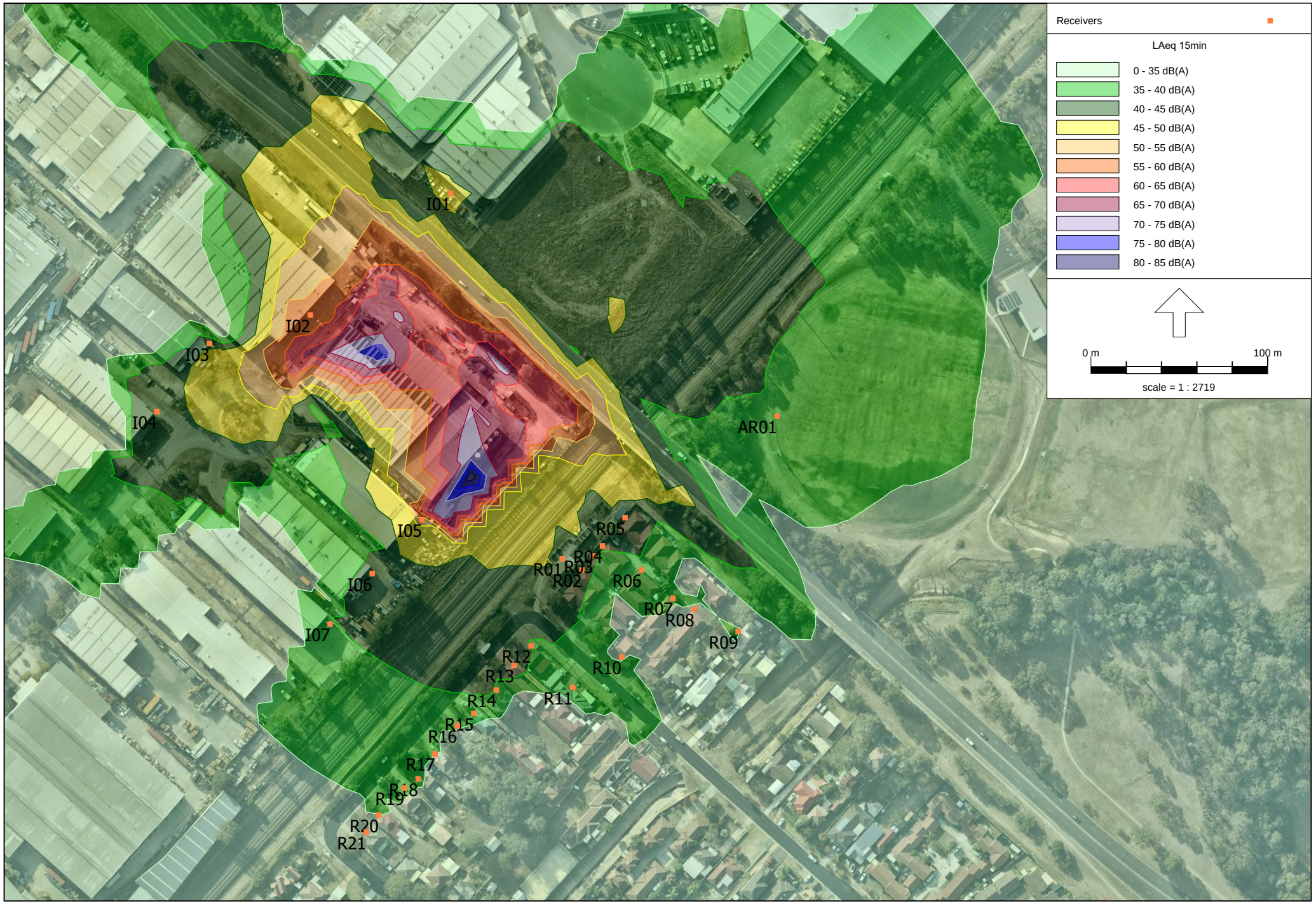
Table D1 NEWA Analysed Meteorological Conditions, Holsworthy NSW									
Direction	Season	Day	Evening	Night	Direction	Season	Day	Evening	Night
		Percentage Occurrence %					Percentage Occurrence %		
0	Summer	11	5	6	180	Summer	6	10	30
0	Autumn	12	3	2	180	Autumn	9	25	21
0	Winter	12	5	5	180	Winter	9	22	15
0	Spring	10	6	5	180	Spring	3	19	27
22.5	Summer	12	10	8	202.5	Summer	6	10	30
22.5	Autumn	12	5	2	202.5	Autumn	10	34	46
22.5	Winter	9	5	5	202.5	Winter	13	39	44
22.5	Spring	11	10	7	202.5	Spring	3	15	35
45	Summer	12	20	11	225	Summer	7	7	26
45	Autumn	13	13	4	225	Autumn	17	35	53
45	Winter	5	5	3	225	Winter	23	51	55
45	Spring	9	17	10	225	Spring	6	13	34
67.5	Summer	11	28	16	247.5	Summer	8	6	22
67.5	Autumn	12	16	7	247.5	Autumn	18	33	50
67.5	Winter	5	5	3	247.5	Winter	26	52	57
67.5	Spring	9	25	11	247.5	Spring	7	11	33
90	Summer	8	27	20	270	Summer	8	4	16
90	Autumn	12	20	7	270	Autumn	19	29	45
90	Winter	5	7	3	270	Winter	27	43	53
90	Spring	7	30	14	270	Spring	9	7	26
112.5	Summer	9	28	27	292.5	Summer	7	2	8
112.5	Autumn	15	24	9	292.5	Autumn	18	12	15
112.5	Winter	7	9	3	292.5	Winter	28	24	27
112.5	Spring	7	32	19	292.5	Spring	10	5	12
135	Summer	8	26	30	315	Summer	9	1	5
135	Autumn	13	22	10	315	Autumn	15	5	5
135	Winter	8	11	5	315	Winter	23	14	11
135	Spring	6	30	22	315	Spring	23	14	11
157.5	Summer	5	9	24	337.5	Summer	12	2	5
157.5	Autumn	8	16	7	337.5	Autumn	12	4	2
157.5	Winter	6	10	4	337.5	Winter	15	6	6
157.5	Spring	3	19	19	337.5	Spring	12	4	5

Appendix E – Noise Source LW Data

Table E1 LAeq(15-min) dB(A) Sound Power Level Specta re dBA10^{-12} Watts									
Noise Source	Octave Band Centre Frequency (Hz), dBA								LW
	63	125	250	500	1000	2000	4000	8000	dBA
Crusher	90	92	98	105	106	109	107	101	114
Excavators	82	85	88	92	92	91	88	79	98
Bob Cat	78	86	88	92	90	93	87	76	98
Mud Flocculant Plant	85	88	92	98	102	101	98	93	106
Small Loaders	68	86	87	87	94	97	95	89	101
Large Loader	77	95	94	100	101	98	93	90	106
Forklift	65	74	75	81	82	80	78	70	87
Truck and Dog/Agitators	89	95	90	89	93	97	92	85	102
Concrete Plant	84	94	94	95	95	89	83	78	101

Appendix F – Noise Contours

Day / Evening Operation - Calm Conditions



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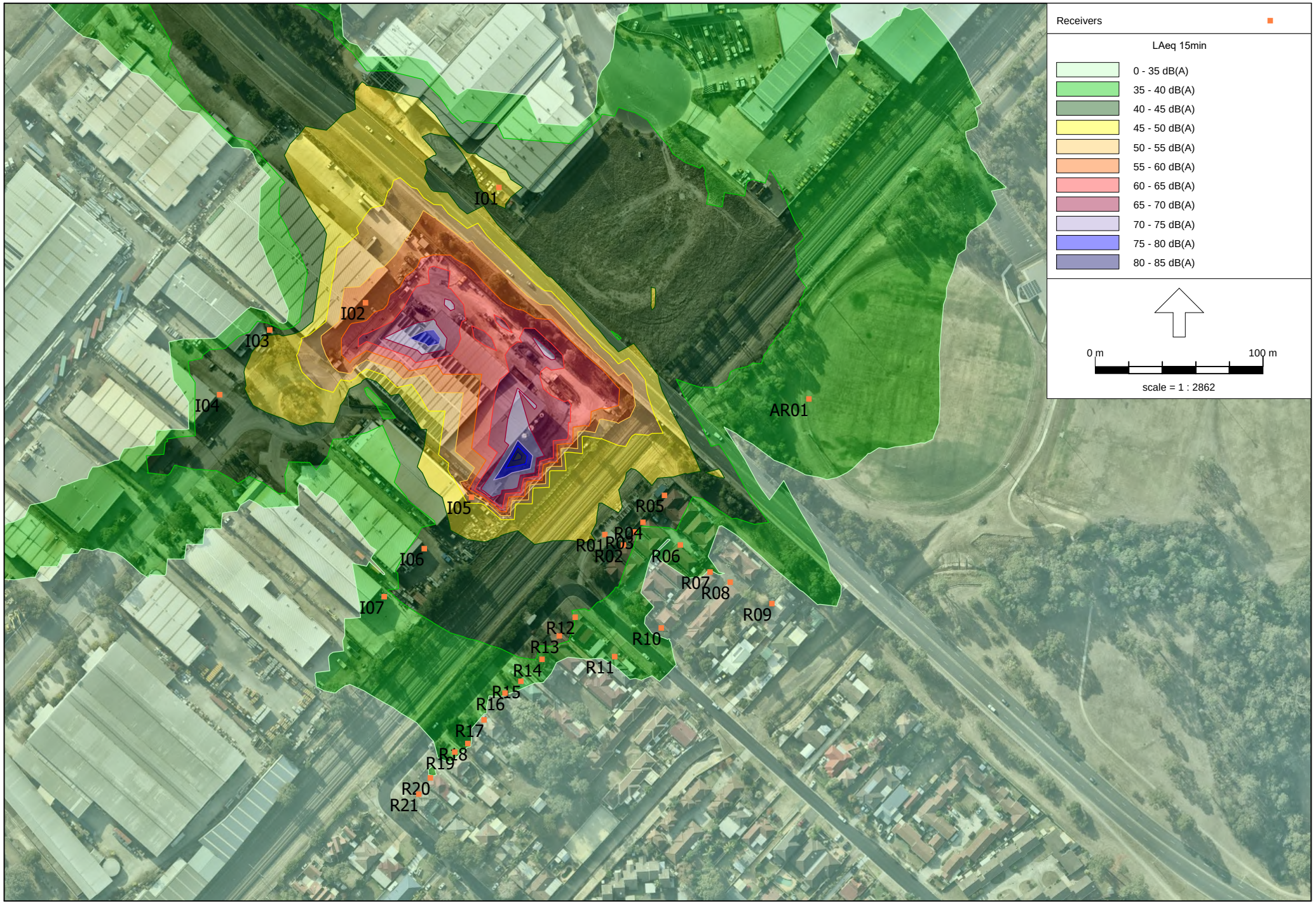
Evening Operation - Prevailing East South East Wind Conditions



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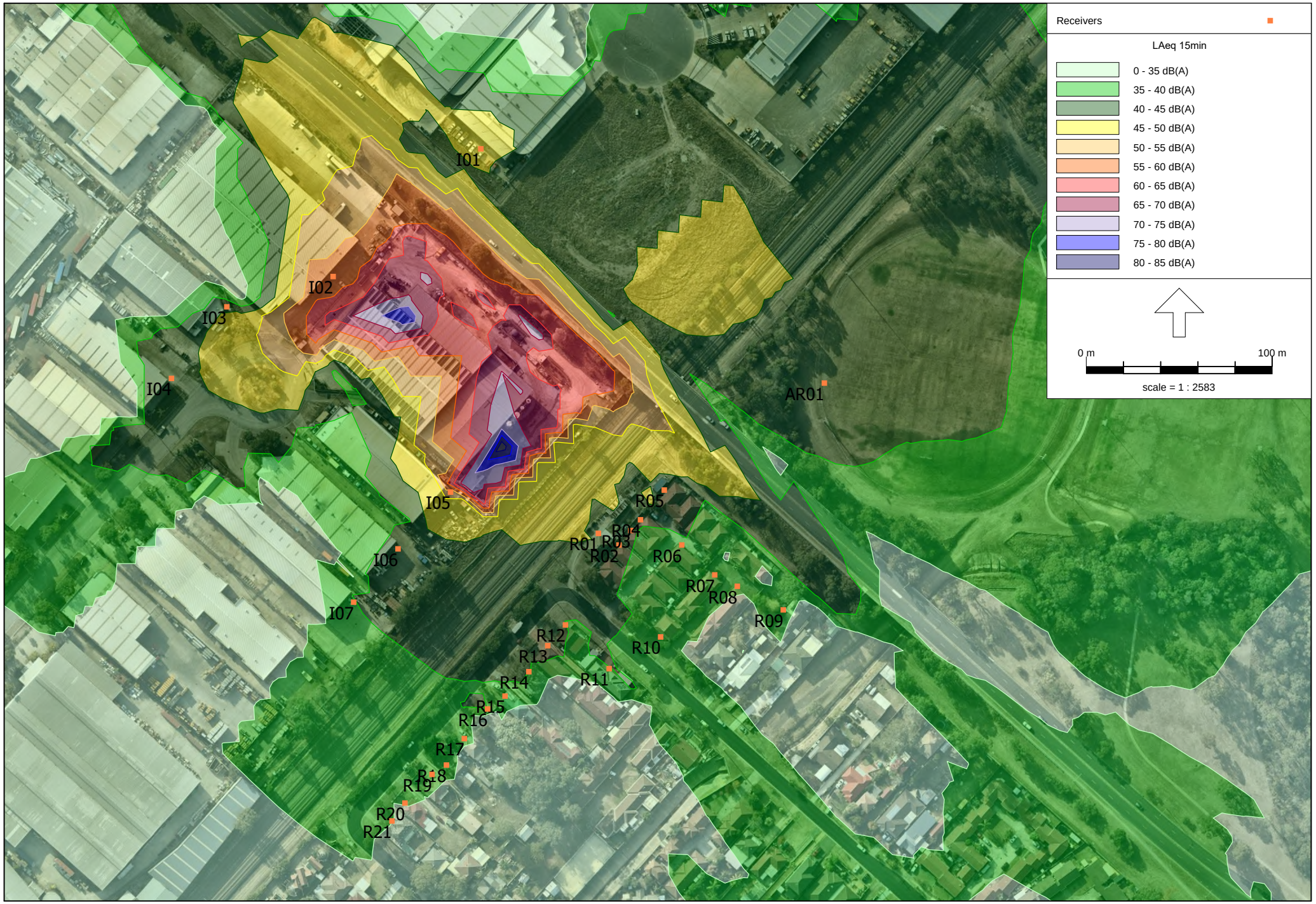
Evening Operation - Prevailing South West Wind Conditions



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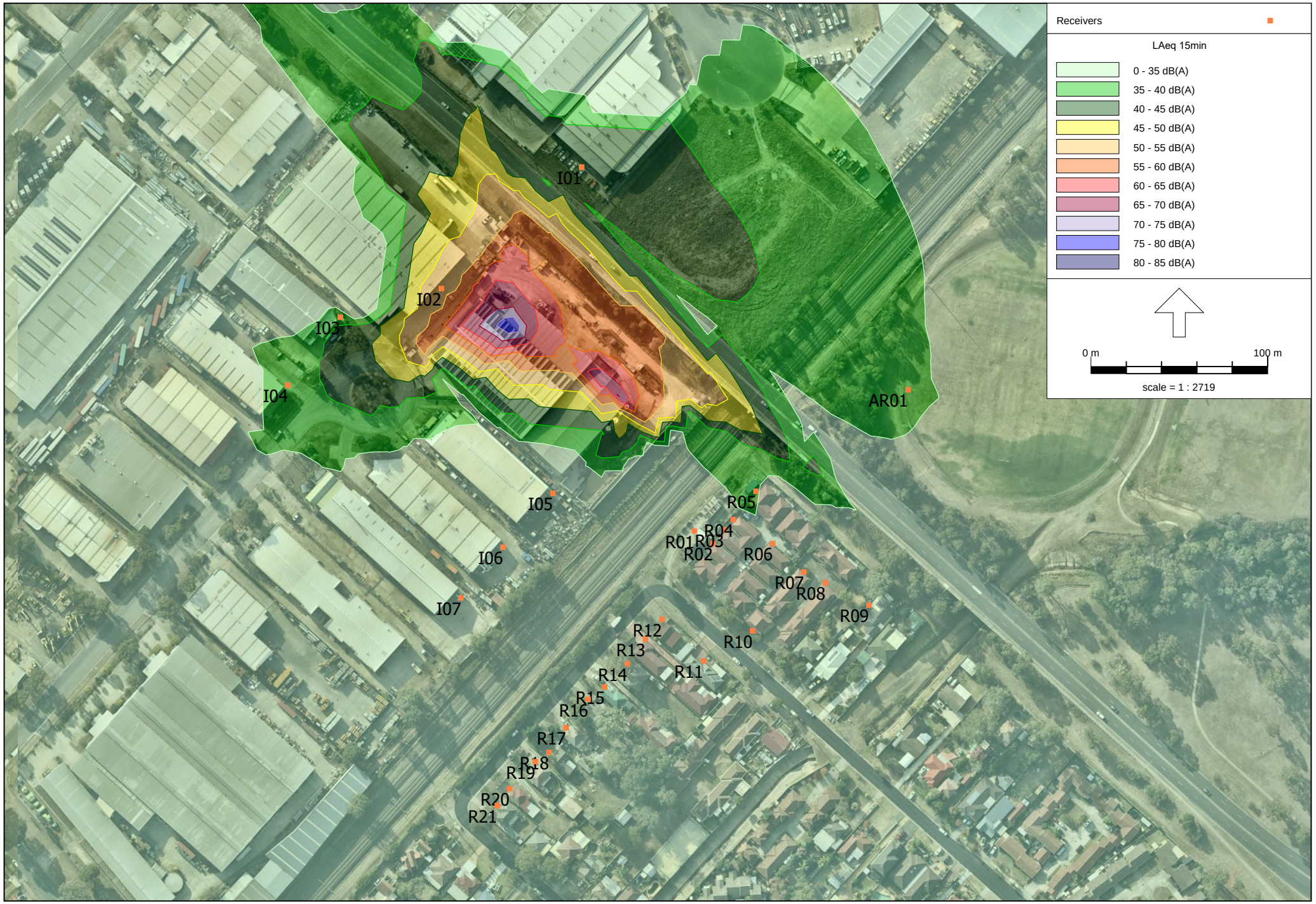
Night Operation - Calm Conditions



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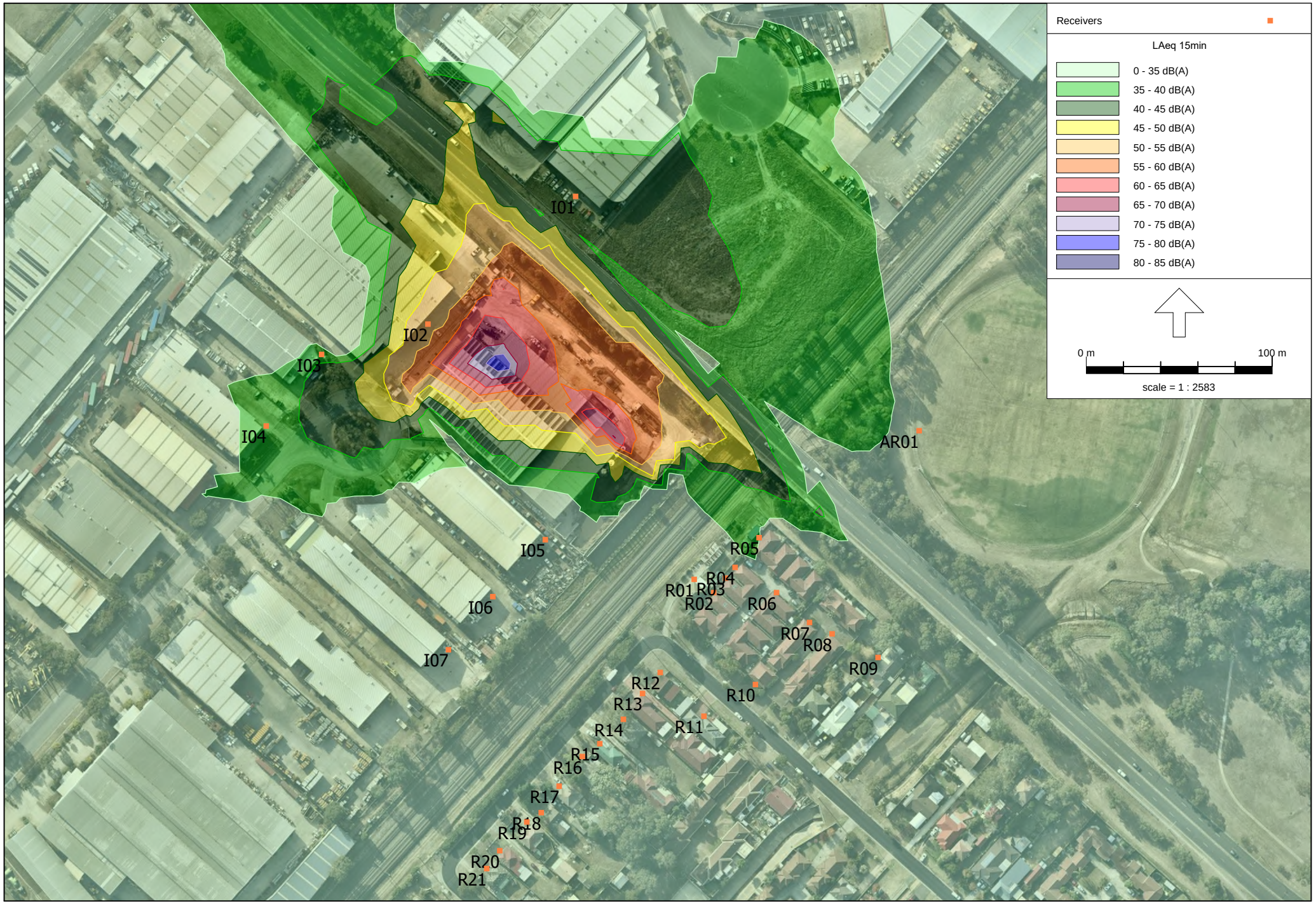
Night Operation - Prevailing North East Wind Conditions



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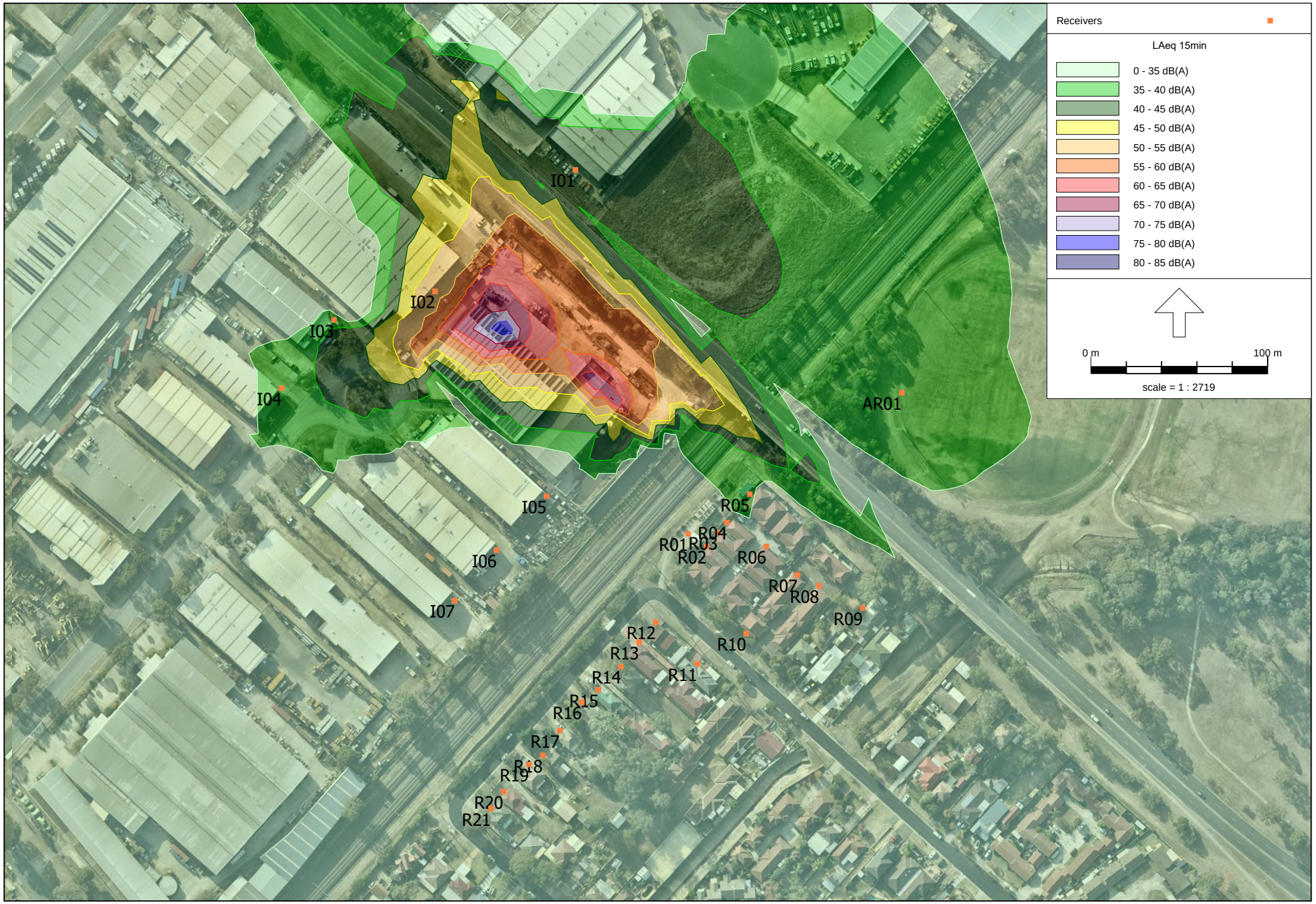
Night Operation - Prevailing South West Wind Conditions



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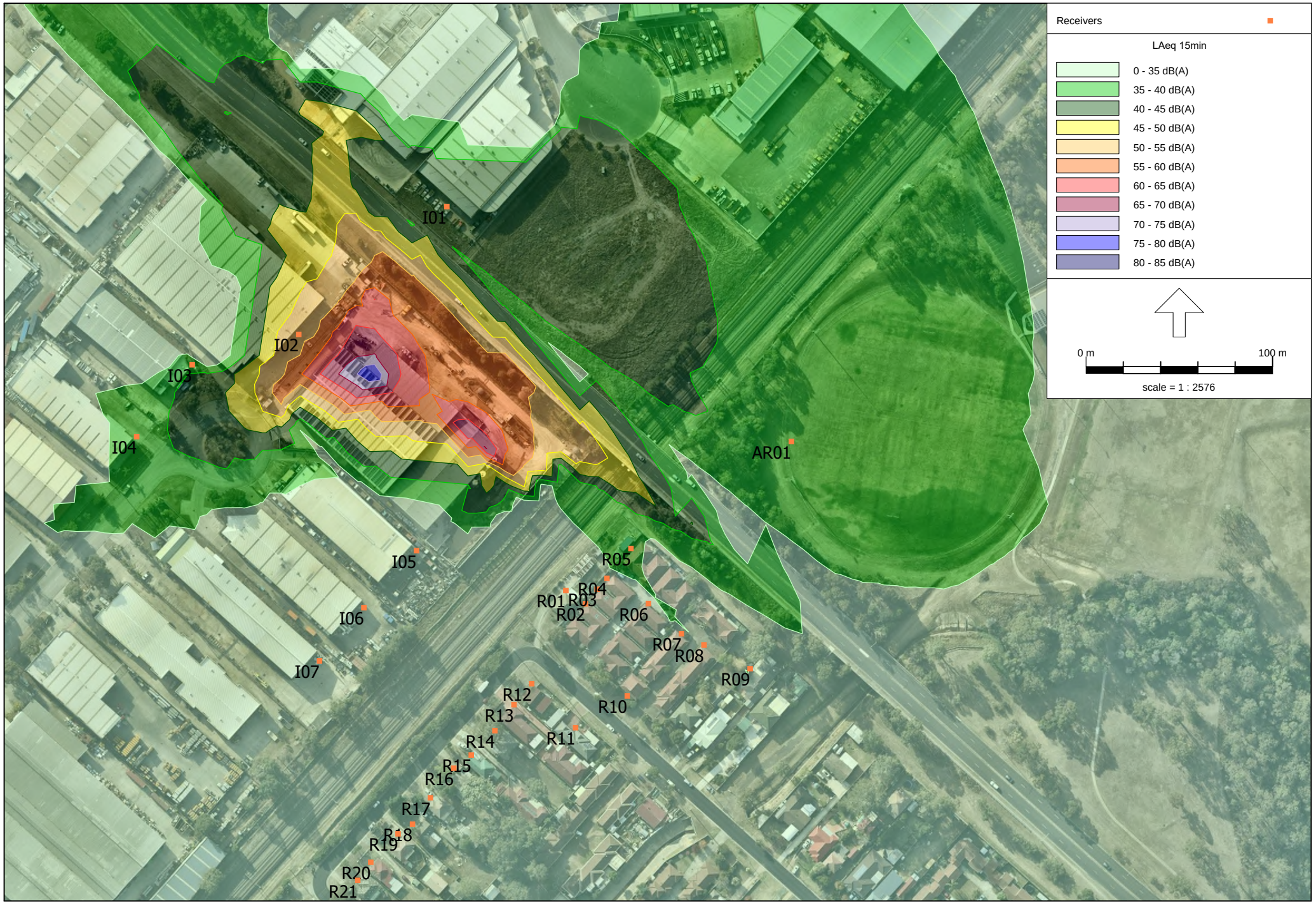
Night Operation - Inversion Conditions



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