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Report

ENERGY FROM WASTE FACILITY, EASTERN CREEK (SSD 6236) – NOISE IMPACT ASSESSMENT

THE NEXT GENERATION NSW PTY LTD

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GLOSSARY OF TERMS

Item	Explanation
ABL	The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night-time) for each day. It is determined by calculating the 10th percentile (lowest 10 percent) background level (LA90) for each period.
Adverse meteorological conditions	Meteorological conditions under which noise propagation is enhanced. This typically includes the presence of wind and temperature inversions.
Ambient Noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
A-weighting	Refers to an adjustment made to noise levels to take into account the frequency composition of an acoustic signal relative to the ear's response to the various frequencies that make up the noise. A-weighting is applied to approximate the perception of noise by an "average" human ear response.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
C-weighting	Refers to an adjustment made to noise levels to take into account the frequency composition of an acoustic signal relative to the ear's response to various frequencies with added sensitivity in the low frequencies compared with the A-weighting.
dB(A)	Decibel level with an applied A-weighting.
dB(C)	Decibel level with an applied C-weighting
dB(Lin)	Decibel level with a Linear weighting i.e. no frequency weighting applied.
Decibel, dB	Decibel is a logarithmic unit used to describe the ratio of a signal level relative to a reference level and is used to describe sound pressure and sound power magnitudes.
L_1	The L_1 level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_1 level for 99% of the time.
L_{10}	The L_{10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{10} level for 90% of the time. The L_{10} is a common noise descriptor for environmental noise and road traffic noise.
L_{50}	The L_{50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{50} level for 50% of the time.
L_{90}	The L_{90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{90} level for 10% of the time. This measure is commonly referred to as the background noise level.
L_{eq}	The equivalent continuous sound level (L_{eq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
L_{max}	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
L_n	The level exceeded for N% of the monitoring time.
Neutral meteorological conditions	Meteorological conditions under which no enhancements to noise propagation are present, i.e. temperature inversions and windy conditions.
Peak Particle Velocity (PPV)	The peak particle velocity is a measure of the maximum instantaneous velocity of a particle during a given time period.
RBL	The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night-time.
Rw	Weighted sound reduction index. Rw is measured in a laboratory. Rw is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.
Sound Power Level (SWL)	A logarithmic measure of source acoustic power expressed in dB. The sound power level is fixed and inherent to the source similar to how electric power is inherent to an electrical device. The resulting sound pressure level due to a given sound power level is dependent on various environmental factors such as distance, acoustic shielding, meteorological factors etc.
Stability Class	The system of classifying atmospheric stability using considerations of solar radiation, surface wind speed, cloud cover and temperature lapse rate. The scale ranges from A (strongly unstable) to F (moderately stable). Typically Stability Class D is considered to represent moderately unstable atmospheric conditions and the conventional temperature gradient, typical of daytime conditions. Stability Class F is considered to represent moderately stable atmospheric conditions when a temperature inversion is present.
Temperature Inversion	An atmospheric condition when the temperature gradient in the air is inverted so that sound waves are refracted in the air back towards the ground, enhancing the distance over which noise propagates.
Vibration Dose Value (VDV)	The vibration does value defines a relationship that provides a consistent assessment of vibration which correlates well with receivers responses taking into account the magnitude and duration of vibration exposure as defined in *BS6472 2008 Guide to evaluation of human exposure to vibration in buildings.*

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1 INTRODUCTION

The Next Generation NSW Pty Ltd (TNG) proposes to construct and operate an Energy from Waste (EFW) facility on land adjacent to the Genesis Xero Waste Facility, located at Honeycomb Drive, Eastern Creek, NSW.

Pacific Environment was engaged by TNG to prepare an Noise Impact Assessment as part of an Environmental Impact Statement (EIS), required under State Significant Development provisions under Section 78A(8A) of the *Environmental Planning and Assessment Act* 1979 (EP&A Act). This assessment has been completed based on the assumption of maximum operational throughput of the plant (i.e. 1.35 Mtpa).

This document presented the consolidated outcomes of the original report, *Energy from Waste Facility, Eastern Creek (SSD6236) – Noise Impact Assessment Report* (ACO-NW-004-08526) (Pacific Environment, March 2015), and additional works completed in response to submissions received, as part of the *Response to Submissions: SD_6236 TNG Energy from Waste Facility, Eastern Creek* (ACO 08526H) (Pacific Environment, October 2015)

1.1 Objectives of the Study

The objective of this study is to undertake an operational noise, construction noise and vibration and road traffic noise impact assessment for the proposed EFW facility.

The Director General's Requirements (DGRs) (SSD 6236) issued in December 2013 included the following requirements for the assessment of noise:

- Description of all potential noise sources such as construction, operational, on and off-site traffic noise;
- Quantitative noise impact assessment including a cumulative noise impact assessment in accordance with relevant Environment Protection Authority guidelines; and
- Details of noise mitigation, management and monitoring measures.

The assessment was performed with reference to the following guidelines, policies and standards:

- AS1055.1 Acoustics – Description and measurement of environmental noise – Part1: General procedures.
- AS 2436 Guide to noise and vibration control on construction, demolition and maintenance sites.
- Interim Construction Noise Guideline (ICNG), EPA, 2008.
- Industrial Noise Policy (INP), EPA, 2000.
- INP Application Notes, EPA 2006.
- Road Noise Policy (RNP), EPA, 2011.
- Assessing Vibration: A Technical Guideline, EPA, 2004.
- Environmental Noise Management Manual (ENMM), RMS, 2001.

2 PROJECT DESCRIPTION

2.1 Site and Surrounding Land Use

The site is located at the end of Honeycomb Drive, within the Eastern Creek Business Park, Eastern Creek, NSW.

The site is currently undeveloped and is bounded by the existing Genesis Xero Waste Facility to the north, the proposed Hanson Asphalt and Concrete Facility to the east, and electricity infrastructure easement to the west and undeveloped land to the south.

Therefore, the closest receivers to the site are Genesis Xero Waste Facility and the Hanson Asphalt and Concrete Facility which are both classed as industrial receivers.

The closest residential receivers to the proposed facility are located in and around McFarlane Drive and Cobbler Crescent in Minchinbury, approximately 1km north of the site. The intervening land use is a waste processing facility and the M4 motorway. Sensitive residential receivers in Erskine Park, are located approximately 1km west of the site and the intervening land use is an electricity infrastructure easement and a nature strip. Within Minchinbury there is one school and there are two schools within Erskine Park. The next nearest residential receivers are in Colyton, located approximately 1.6km from the site, adjacent to the M4 motorway.

The closest commercial receivers are located to the east and south east of the site within the Eastern Creek Business Park in addition to a Woolworths, Aldi and Startrack distribution centres located on Sargents Road to approximately 1km north of the site.

Figure 2-1 shows the surrounding land use.

2.2 Proposed Development

2.2.1 Overview

The proposed development involves the construction of an Energy from Waste (EFW) Electricity Generation Plant for The Next Generation NSW Pty Ltd (TNG) in Eastern Creek, approximately 36km west of the Sydney CBD. Layouts are presented in **Appendix A.**

The development involves the construction and operation of an Electricity Generation Plant, which will allow for unsalvageable and uneconomic residual waste from the Genesis Xero Material Processing Centre (MPC) and external Waste Transfer Station (WTS) to be used for generation of electrical power. The EFW facility is proposed to be located on Lots 2 and 3, DP 1145808.

The Facility will operate 24 hours a day, 7 days a week, with occasional offline periods for maintenance. Over the entire year, it is assumed that the facility would be operational for 8,000 hours as an annual average.

The technology of the Facility will have a design capacity to process up to 1,350,000 tonnes of residual waste material per annum. TNG NSW's proposed implementation will be to process up to 1,105,000 tonnes per annum, using a two phased approach:

- Phase 1 (lines 1 and 2) which will require 552,500 tpa as waste.
- Phase 2 (lines 1, 2, 3 and 4) which will require 1,105,000 tpa as waste.

The first phase will include the complete construction of the Tipping Hall and Waste Bunker and combustion Lines 1 and 2 comprising of two independent boilers, Flue Gas Treatment (FGT) systems, stack as well as one turbine and one Air Cooled Condenser (ACC) and all other auxiliary equipment. The second phase will comprise of installation of combustion lines 3 and 4 with again two independent

boilers, FGT systems, stack as well as one turbine and one ACC and all other auxiliary equipment. This assessment addresses the EfW facility when all four lines are operational. Some wastes would be delivered directly to the facility (by truck) with the remaining transferred from the existing Genesis Facility either via a covered electrically powered conveyor or by truck. The following waste fuel types are considered as the main sources of fuel for the facility:

- Chute Residual Waste (CRW) from the Genesis MPC
- Commercial and Industrial (C&I)
- Construction and Demolition(C&D)
- Floc waste from car and metal shredding
- Paper pulp
- Glass Recovery
- Garden Organics (GO)
- Alternative Waste Treatment (AWT)
- Material Recovery Facility waste (MRF waste) residual.

The proposed EFW facility will provide employment for a total of up to 55 staff upon operation, working over three shifts (i.e. not on site at any one time).

The project is identified as State Significant Development (SSD) under Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011 being:

Cl. 20 Electricity generating works and heat or co-generation:

Development for the purpose of electricity generating works or heat or their co-generation (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:

a) *has a capital investment value of more than $30 million, or*
b) *has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance*

The proposal has a capital investment value of greater than $30 million and therefore is classified as a State Significant Development.

The site which is accessed off Honeycomb Drive at Eastern Creek is surrounded by land owned by the Corporate Group Alexandria Landfill Pty Ltd, ThaQuarry Pty Ltd, Australand, Hanson, Jacfin, the Department of Planning and Infrastructure and Sargents. The site and surrounding land is identified as part of the '*State Environmental Planning Policy (Western Sydney Employment Area) 2009 (WSEA SEPP)*' to be redeveloped for higher end industrial and employment uses over the next decade. The site has a total area of approximately 56 Ha including the Riparian Corridor, with a specific development area circa 9 Ha.

The proposed works will, in addition to the EFW facility, include the adoption of a plan of subdivision and the following ancillary works:

- Earthworks associated with the balance of the site;
- Internal roadways;
- Provision of a direct underpass connection (Precast Arch and Conveyor Culvert) between TNG Facility and the Genesis Xero Waste Facility;
- Staff amenities and ablutions;
- Staff carparking facilities;
- Water detention and treatment basins;
- Services (Sewerage, Water Supply, Communications, Power Supply).

2.2.2 Proposed Operations

The proposed facility is a conventional EFW facility. It will take residual waste fuel and convert it to electricity. By-products and waste gases are treated before being released to atmosphere or taken off site for further processing.

The facility will operate a well-established technology known as a moving grate furnace. Residual waste fuel is delivered via truck into the tipping hall where it is then transferred to the waste bunker. Residual waste fuel is then gravity fed onto the grate. The grate is continually moving thus promoting continuous mixing of the residual waste fuel with the combustion air.

Ash from the grate is discharged into a water filled quench bath from where it is moved by conveyor to the enclosed ash storage bunkers prior to being transported off site. All bottom ash is sent to the adjoining Genesis facility or other licensed facilities for aggregate and road-base production. APC residue ash is collected into sealed storage tanks and transporter off site for further treatment or disposal via sealed tanker vehicle.

Hot gases from the combustion of the waste pass through a heat recovery boiler. The energy from the hot gases is transferred to the boiler to produce high pressure steam. This steam is fed to the steam turbine driven generator capable of generating around 137 MWe, which after supplying the site electrical load is exported to the Grid.

The facility will operate 24 hours a day, seven days a week, with occasional offline periods for maintenance. Over the entire year, it is assumed that the facility would be operational for 8,000 hours.

Residual waste fuel will be delivered to the site by road and via conveyor from the Genesis Facility. Capacity for approximately four days storage of fuel will be provided by the facility.

The EFW facility is expected to consist of two streams of energy conversion (four processing lines), supplied from one tipping hall and one solid fuel bunker. The streams are expected to come online in stages, however for the purposes of conservatism, this assessment has considered the facility at full operating capacity.

The facility is expected to consist of a number of buildings which house different equipment. These buildings are expected be:

- Tipping Hall – Waste is delivered by truck in the tipping hall.
- Solid Fuel Bunker –Storage and supply of fuel to the burners.
- Two Energy Recovery and Fuel Gas Treatment buildings– Energy recovered from combustion of fuel and the associated gases treated.
- Two Residue Handling and Treatment facilities – Treatment of flue gases prior to release to atmosphere and handling of combustion by-products.
- Two Turbine Halls – Houses turbine for the conversion of fuel gas to electricity.

The site will be landscaped and concrete pads and laydown areas will be established across the site in order to facilitate the assembly of the facility.

The main noise sources associated with the facility are expected to be:

- Heavy vehicles - Vehicle movements within the site boundary for the delivery of waste, removal of ash and other combustion by-products and supply of consumables.
- Breakout noise from buildings – Internal noise generating plant, equipment and activities propagate through the building envelope into the surrounding environment.
- Exhaust stacks – Stacks releasing treated flue gas into the atmosphere.
- Cooling equipment – Air cooled condensers that cool gas supplied from boilers to turbine.
- ID fans – Fans required to supply air flow to the flue gas treatment processes.

- Sub-station – Sub-station required to supply electricity to the grid.
- Ancillary equipment – Including silo blowers and ash bunker exhaust fan.

The facility is proposed to be constructed over 36 months across a number of stages. The construction is expected to involve earthworks and site establishment, building and structure construction and equipment installation. Generally the works are to be carried out during the day, however some activities require continuous construction and therefore may take place outside of standard working hours. Detail regarding construction methods and impacts are presented in Section 5 of this report.

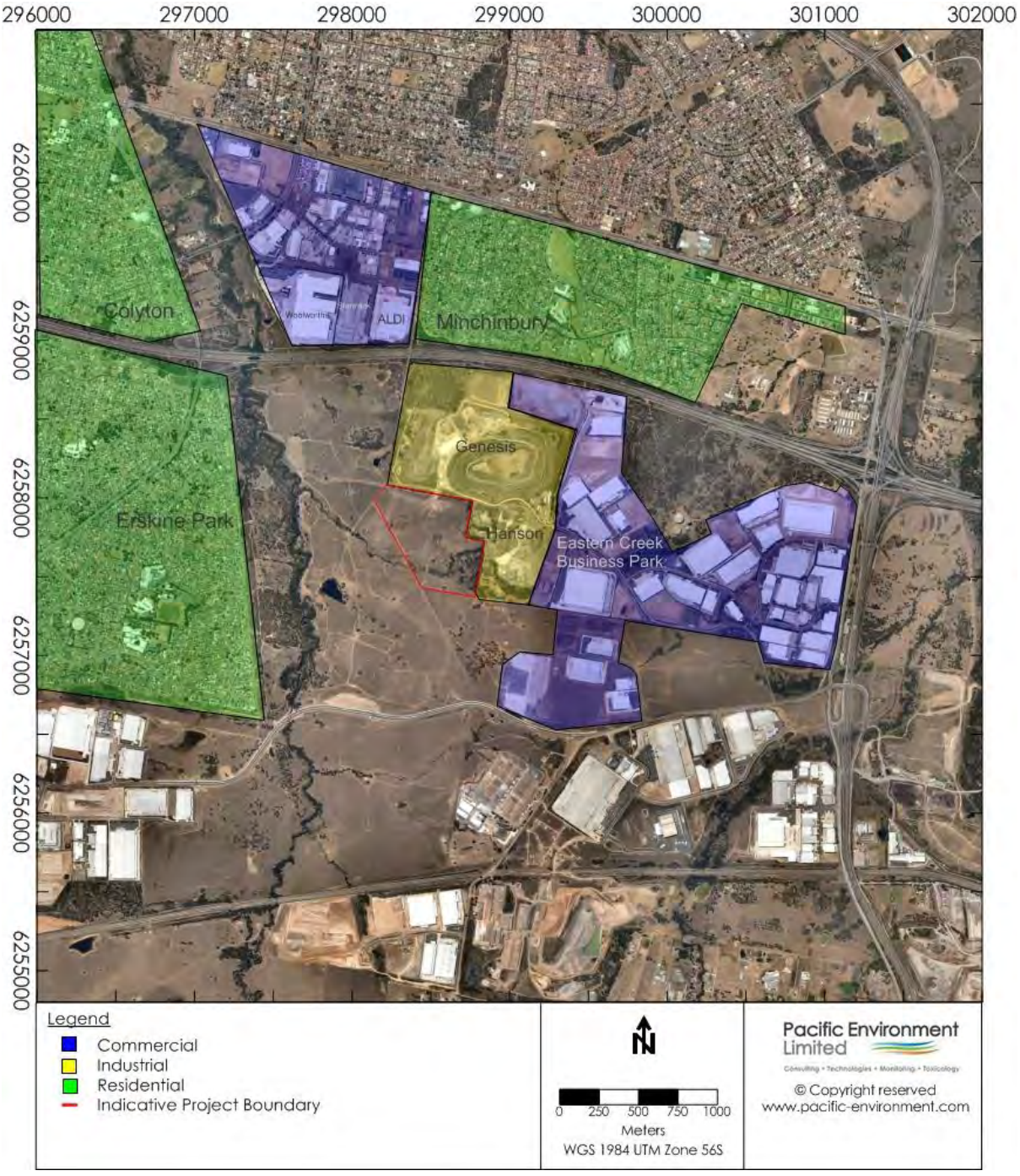

Figure 2-1: Regional Setting

2.3 Sensitive Receivers

Based on information supplied by the client, on site observations and satellite imagery, the closest residential receivers were identified in the vicinity of the site.

The closest areas of sensitive receivers are located to the north and west of the project area, approximately 1km away in Minchinbury and Erskine Park.

As the two areas contain a number of residential receptors, representative locations were chosen to represent the potentially most affected receivers in these areas.

On site observations revealed that the majority of housing is primarily single storey in both suburbs, with the occasional double storey house.

Three schools were identified in the surrounding area. Minchinbury Public School is located at 202 McFarlane Drive, Minchinbury, James Erskine Primary School is located at 53 Peppertree Drive, Erskine Park and Erskine Park High School is located at 78-82 Swallow Drive, Erskine Park.

In addition, commercial and industrial receivers are located immediately to the north, and east of the site within the Eastern Creek Business Park.

The current road access to the site is along Honeycomb Drive and Wonderland Drive from Wallgrove Road which links the M4, M7 and Great Western Highway. The receivers along Wallgrove Road, Honeycomb Drive and Wonderland Drive are commercial, industrial or light industrial.

3 EXISTING ENVIRONMENT

3.1 Noise Environment

Unattended noise monitoring was carried out at two locations representative of the nearest sensitive receivers in Minchinbury and Erskine Park. The first location was at 24 Cobbler Crescent, Minchinbury (BG1). The second was at 4 Blackbird Glen, Erskine Park (BG2). The noise monitoring locations were chosen to represent the existing ambient and background noise environments in the two closest and potentially most affected sensitive receiver areas to the project, without being unduly affected by road traffic noise from the M4. **Figure 3-1** shows the noise monitoring locations.

Unattended monitoring was undertaken between 18 March and 27 March 2014 at both locations. Due to a fault at BG1, the monitoring was repeated between 8 April 2014 and 16 April 2014. Noise monitoring was carried out using two NTi Audio XL2 Type 1 Sound Level Meters. The meters have been calibrated in the last two years and calibration was checked before and after the measurement period and no significant drift (±0.5 dB) was noted.

During the monitoring period, it was noted that insect and frog calls were prominent during the evening and night periods at BG2. A review of the monitoring data reveals that the most significant insect and frog noise was in the 3.15 and 4 kHz third octaves bands. These frequency bands were filtered to remove the effects of the insect noise, prior to further analysis.

Meteorological data during the monitoring periods were recorded at the Bureau of Meteorology's Horsley Park automatic weather station (AWS) (station ID 067119), located approximately 7km south west from the monitoring locations.

Where monitoring data were identified to be adversely affected by extraneous noise or during periods of adverse weather (significant rainfall or wind speeds greater than 5 m/s), these periods were removed from the monitoring.

The noise levels obtained are expressed in terms of, $L_{A90,15min}$ and $L_{Aeq,15min}$.

- $L_{A90,15min}$ is the A-weighted noise level that is exceeded for 90% of the monitoring time period (15 minutes).
- The $L_{Aeq,15min}$ is the 15 minute equivalent continuous noise level containing the same acoustic energy as the actual fluctuating noise level.

The $L_{A90,15min}$ is commonly referred to as the background noise level and the lowest 10^{th} percentile $L_{A90,15min}$ over a period (day, evening, night) is referred to as the period assessment background level (ABL). The Rating Background Level (RBL) for each day, evening and night period of the monitoring occurrence is then calculated by taking the median of the ABLs.

Table 3-1 presents a summary of the noise monitoring results. Raw noise monitoring results are presented graphically in **Appendix B**.

Table 3-1: Summary of Unattended Noise Monitoring Results

Location	Measured RBL dB(A)			Measured Ambient Noise Level $L_{eq,15min}$ dB(A)		
	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
BG1	43	48	41	55	54	51
BG2	37	44	35	53	57	46

Notes: 1.Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays.
2. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays.
3. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.

A review of **Table 3-1** indicates that measured RBLs at BG1 and BG2 are higher during the evening than during the day. The INP Application Notes (EPA, 2006) state that where this occurs, the expectation of the community that noise controls are greater during more sensitive evening and night periods is considered. The INP Application Notes recommend that where the measured evening level is higher than the day, the RBL should be set no higher than the day level. Therefore in determining project specific noise levels from the measured RBLs, this approach will be adopted.

Attended noise measurements were also carried out over 15 minutes during each period to characterise the existing noise environment and identify existing industrial and other types of noise sources. **Table 3-2** presents a summary of the measurements. Significant insect noise was noted during the measurements at BG2 during the evening and night periods in the 3.15 kHz and 4 kHz third octave bands.

Table 3-2: Attended Measurement Results

Location	Date and Time	Measured Noise Level dB(A)		Notes
		L_{eq}	L_{90}	
BG1	18/3/14 11.57am	50	47	Noise environment was dominated by road traffic from M4 motorway (48-52 dB(A)). Other noise sources included some community noise (hammering and dog barking) and occasional bird calls (L_{max} 60 dB(A). Industrial noise was not noted.
BG1	18/3/14 8.20pm	47	45	Noise environment dominated by road traffic noise from M4 motorway, distant traffic from the Great Western Highway and insect noise (noted in the 4, 6.3 and 8kHz third octave bands). Industrial noise was not noted.
BG1	19/3/14 12.37am	51	48	Noise environment generally dominated by road traffic noise from M4 motorway. Some distant industrial noise from directly west of monitoring location estimated at <41 dB(A). Insect noise was also audible at this location.
BG2	18/3/14 1.03pm	47	40	Noise environment consisted of constant distant road traffic noise from M4, occasional community noise and birds, frogs and insects and cicadas (noted in 3.15, 4 and 5kHz one third octave bands). Industrial noise was not noted.
BG2	18/3/14 7.34pm	55	53	Noise environment dominated by frogs and insects (2-16kHz third octave bands) road traffic noise (L_{max} 51 dB(A). Other sources noted included community noise and one occurrence of a just audible tonal reversing alarm estimated <47 dB(A).
BG2	19/3/14 12.05am	50	49	Noise environment dominated by frogs and insects (2-4kHz third octave bands) road traffic noise (46-47 dB(A). Other sources noted included community noise. Industrial noise was not noted.

Figure 3-1: Noise Monitoring Locations

3.2 Meteorological Environment

The existing meteorological environment was determined using data from the nearest Bureau of Meteorology (BoM) site at Horsley Park (site no. 067119).

The climate statistics for the region are summarised in **Table 3-3**.

Table 3-3: Rainfall Statistics for Horsley Park AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year average
Mean rainfall (mm)	66.9	116.2	76.4	70.6	50.2	69.8	40.3	32.3	37.3	57.1	84.9	58.8	765.7

Source: **BoM (2014)**

Wind in the direction of source to receiver has the potential to enhance noise levels at the receiver. The INP states that where winds less than 3 m/s at 10 m height are present for more than 30% of the time in any assessment period (day, evening, night) during any season, they are to be considered as a feature of the area and should be considered when predicting noise impacts. The INP considers 3 m/s as the upper limit of wind speed that can noticeably increase source noise levels without increasing ambient noise levels so that they mask noise from the source.

Meteorological data supplied by the Air Quality Consultants (Pacific Environment) were used to generate the wind statistics. **Table 3-4** presents a summary of the percentage of occurrence of winds less than 3 m/s. As can be seen from the table, there are no feature winds in the area. However in order to provide a conservative assessment, the potential for source to receiver gradient winds has been considered in the noise modelling.

Table 3-4: Percentage of Winds less than 3m/s

Percentage Occurrence of Winds less than 3m/s												
	Summer			Autumn			Winter			Spring		
	Day	Eve.	Night	Day	Eve.	Night	Day	Eve.	Night	Day	Eve.	Night
N	6%	4%	3%	7%	6%	4%	8%	7%	11%	8%	3%	6%
NNE	2%	3%	1%	2%	1%	2%	1%	2%	3%	2%	2%	1%
NE	2%	4%	1%	1%	2%	1%	2%	2%	3%	1%	2%	0%
ENE	3%	7%	1%	2%	5%	0%	0%	1%	1%	2%	2%	1%
E	4%	9%	1%	4%	3%	1%	1%	1%	1%	4%	2%	1%
ESE	11%	8%	1%	6%	2%	1%	1%	1%	2%	8%	3%	0%
SE	10%	7%	3%	5%	4%	3%	2%	4%	3%	6%	5%	2%
SSE	5%	5%	8%	3%	8%	7%	3%	5%	7%	5%	5%	8%
S	6%	7%	22%	8%	14%	21%	8%	16%	18%	10%	10%	22%
SSW	3%	9%	24%	9%	24%	25%	11%	20%	18%	6%	16%	29%
SW	2%	3%	12%	4%	12%	8%	8%	8%	6%	4%	9%	10%
WSW	1%	1%	3%	3%	3%	3%	4%	4%	2%	3%	3%	4%
W	1%	1%	2%	2%	1%	1%	4%	4%	2%	5%	3%	1%
WNW	2%	0%	1%	3%	1%	1%	8%	4%	1%	8%	3%	1%
NW	4%	1%	3%	3%	3%	2%	10%	8%	3%	7%	5%	2%
NNW	8%	3%	4%	9%	6%	4%	13%	8%	6%	9%	8%	4%

The potential for temperature inversions has also been considered. The INP states that where temperature inversions (both F and G stability class – see Glossary of Terms) occur for more than 30% of the time during winter nights (6.00pm to 7.00am) then they should be considered a feature and accounted for in an assessment.

The default temperature inversion conditions for a non-arid area (more than 500mm rainfall per year) is to consider a moderate temperature inversion equivalent to Pasquil stability class F (3°C/100m). **Table 3-3** shows that the area is non-arid and therefore the default conditions from the INP for non-arid areas will be used for a conservative assessment.

Receivers in Minchinbury are at a higher elevation than the project, therefore drainage flow winds have not been considered for these receivers. Receivers located in Erskine Park are nearly level with the project and therefore the potential for drainage flow winds has not been included for temperature inversion conditions.

4 NOISE CRITERIA

4.1 Construction Noise

Appropriate construction noise management levels are given in the *NSW Interim Construction Noise Guideline* (DECCW 2009). Construction noise management levels for residential receivers are given in full in **Table 4-1**. The management levels represent the level at which when exceeded, the measures outlined in **Table 4-1** would apply.

Table 4-1: Construction Noise Management Levels at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,15min}$	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(A)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,(15min)}$ 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 works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	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: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. 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 + 5dBA	• A strong justification would typically be required for works 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 dB(A) above the noise affected level, the proponent should negotiate with the community.

A summary of the project specific construction noise management levels for residential receivers and other receiver types is presented in **Table 4-2**. The unattended measured background noise levels summarised in **Table 3-1** has been used for residential receivers.

Table 4-2: Project Specific Construction Noise Management Level, dB(A)

Land Use	Construction Noise Management Level, $L_{Aeq,15min}$ dB(A)			
	Standard Hours	Outside of Standard Hours		
	Monday to Friday 7am to 6pm Saturday 8am to 1pm	Day Saturday 7am-8am, 1pm to 6pm, Sunday 8am-4pm	Evening Monday to Sunday 6pm to 10pm	Night time Monday to Saturday 10pm to 7am Sunday & Public Holidays 10pm to 8am
Minchinbury (BG1)[1]	53	48	48	46
Erskine Park (BG2)[1]	47	42	42	40
Commercial	65	65	65	65
Industrial	70	70	70	70
School[2]	55	-	-	-

Notes: 1. The measured evening RBL was higher than the day. In this case, the evening RBL has been set equal to the day, in accordance with the INP Application Notes.

2. External noise level based on an outside to inside correction of 10 dB(A), in accordance with the INP.

4.2 Operational Noise

4.2.1 Eastern Creek Precinct Plan

Blacktown City Council produced the Stage 3 Eastern Creek Precinct Plan (BCC, 2005) under the State Environmental Planning Policy 59 (SEPP 59). The SEPP includes advisory noise emission levels for different precinct zones at the nearest sensitive receivers in Minchinbury and Erskine Park. As shown in **Figure 4-1**, the proposed development is planned in Zone 4.

The Precinct plan addresses noise and vibration issues with the following controls:

- Development Applications should provide an assessment, and identify necessary mitigation measures, to minimise the potential environmental impacts from noise and vibration generated by the proposed development.
- Development Applications must comply with relevant Council, and government authority guidelines, to ensure no adverse environmental impacts occur both during and after development of the Precinct.
- Where appropriate, development may need to be treated to minimise the impact from noise generated both on and off site.
- Consideration shall be given to:
  - the appropriate spatial arrangement of sensitive land uses;
  - the sensitive location of buildings on lots; and
  - the design of buildings to attenuate noise inside the building.
- The optimised noise level goals for the Precinct are outlined in **Table 4-3**. These goals will provide adequate protection to the noise amenity of residential areas surrounding the Precinct without unduly restricting the operation of development.

Operational noise from the proposed development will be assessed with reference to the noise level goals for the precinct to determine potential impact on surrounding land uses within the Precinct.

Table 4-3: Precinct Noise Emission Zone Goals

Period	Noise Emission Goal at Nearest Residential Areas, $L_{eq,period}$ dB(A)					
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Day	57	54	56	54	49	52
Evening	47	44	46	44	39	42
Night	42	40	40	39	34	37

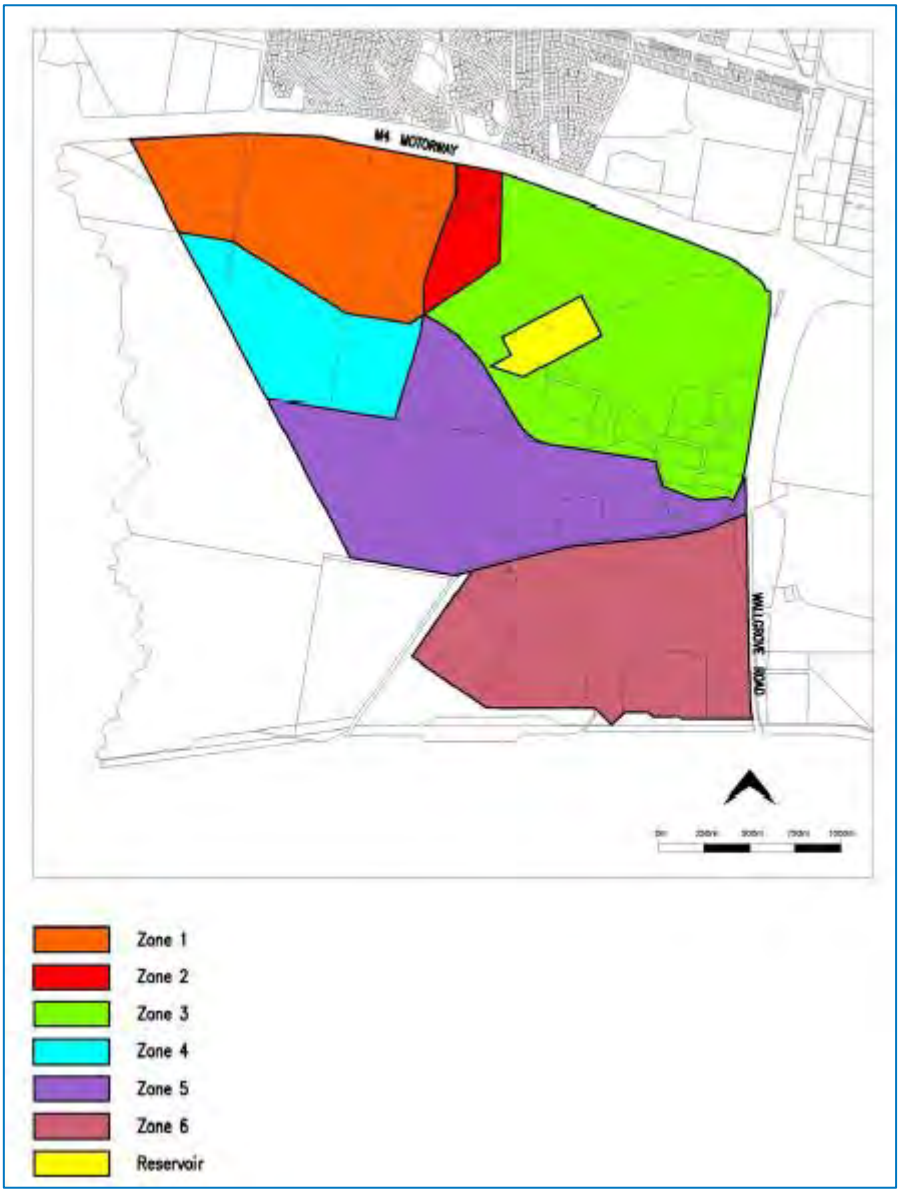

Figure 4-1: Precinct Noise Emission Zones

4.2.2 Industrial Noise Policy

In accordance with EPA requirements and the precinct plan's suggested controls, the project will be assessed according to the *Industrial Noise Policy* (INP).

The INP recommends two criteria to meet environmental noise objectives. The Intrusiveness Criteria for residential receivers to address the potential for intrusive noise and Amenity Criteria to maintain acoustic amenity appropriate to the relevant land use category of the area.

Intrusiveness Noise Criterion – The $L_{Aeq,15min}$ noise level within the day (7.00am to 6.00pm, 8.00am to 6.00pm Sundays and Public Holidays), evening (6.00pm to 10.00pm) or night time (10.00pm to 7.00am, 10.00pm to 8.00am Sundays and Public Holidays) assessment periods should not exceed the Rating Background Level (RBL), as defined by the INP, within that period by more than 5 dB(A). The purpose of this noise goal is to minimise the likelihood of intrusive noise.

Amenity Noise Criterion – The maximum ambient L_{Aeq} noise level within the day, evening and night assessment period should not exceed the "acceptable noise levels" (ANL) published in the INP and reproduced in **Table 4-4** for applicable land uses.

The ANL is dependent on the relevant receiver type and area category for the residential receiver. The purpose of this noise goal is to provide an upper limit to industry related noise emissions and prevent industrial noise levels from creeping higher with each new successive industrial development.

Where the existing industrial noise level is close to the relevant deemed ANL, the project specific amenity noise criterion is then set lower than ANL so that the total level of industrial noise (i.e. new plus existing) does not exceed the deemed INP acceptable level. Adjustments to the ANL are presented in **Table 4-5**. On the other hand, where the existing level of industrial noise is higher than the INP acceptable level, then the project specific noise criterion is set 10dB(A) lower than the prevailing noise level if it is unlikely that the prevailing industrial noise level will reduce in the future. If it is likely that the overall noise level will reduce, then the project specific amenity criterion is set 10 dB(A) below the INP acceptable noise level.

Table 4-4: Recommended L_{Aeq} Noise Levels from Industrial Noise Sources, dB(A)

Type of Receiver	Indicative Noise Amenity Area	Time of Day[1]	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residential	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
School Classroom	All	Noisiest 1 hour period (when in use)	45 (external)	50 (external)
Commercial	All	When in use	65	70
Industrial	All	When in use	70	75

Note: 1. This table taken from Table 2.1 of the INP. It should be read in conjunction with the notes from Section 2.2.1 of the INP. Time periods are defined as: Day (7.00am-6.00pm Monday to Saturday and 8.00am-6.00pm Sundays and Public Holidays), Evening (6.00pm-10.00pm), Night (10.00pm-7.00am, unless preceding a Sunday or Public Holiday).
2. External noise criteria based on internal criteria + 10 dB, as recommended in the INP.

Table 4-5: Modification to ANL to Account for Existing Level of Industrial Noise

Total existing L_{Aeq} noise level from industrial sources dB(A)	Maximum L_{Aeq} noise level for noise from new sources alone, dB(A)
≥ Acceptable noise level plus 2	If existing noise level is *likely to decrease* in future: acceptable noise level minus 10 If existing noise level is *unlikely to decrease* in future: existing level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level

Note: This table is a reproduction of Table 2.2 of the INP.

The INP includes provisions for certain characteristics of the noise emitted from an industrial premises. The characteristics include tonality, impulsiveness, intermittency or dominant low frequency content.

4.2.3 Project Specific Operational Noise Levels

The operational noise criteria for the project are presented in **Table 4-6**, for the receiver type within the project area. The intrusive noise criteria are based on the RBLs in **Table 3-1**. The amenity criteria have been derived using the unattended and attended noise measurements. The existing level of industrial noise was determined from the attended monitoring and used to inform the modification of the ANLs.

The INP defines an urban receiver as an area with an acoustical environment that is dominated by "urban hum" or industrial source noise, has through traffic with characteristically heavy and continuous traffic flows during peak periods, is near commercial districts or industrial districts or has any combination of the above. Urban hum is defined as the aggregate sound of many unidentifiable mostly traffic related sound sources.

Minchinbury has been classified as an urban type receiver as noise measurements and on site observations indicated the presence of 'urban hum' which includes continuous traffic noise from the M4 motorway and Great Western Highway.

A suburban receiver is defined in the INP as an area that has local traffic flows or some limited commerce or industry. This area often has the decreasing noise levels in the evening period or evening ambient noise levels defined by the natural environment and infrequent human activity.

Traffic in Erskine Park is local traffic and influence from the M4 decreases towards the south of the suburb. The area generally experiences low ambient and background noise levels and no significant industrial noise was observed. As a result, Erskine Park has been classified as a suburban receiver area.

The INP requires the comparison of the derived intrusive and amenity criteria and the most stringent criteria are selected to be assessed against. From **Table 4-6** it can be seen that the controlling criteria for residential receivers is the intrusive criteria during the day, evening and night, except during the night at Minchinbury where the amenity criterion is 3 dB lower than the intrusive criterion.

The project specific noise levels will be assessed over 15 minutes. The operation of the facility is then assessed as a worst case 15 minutes. The amenity criterion is assessed over a period of eleven, four or nine hours and one hour for schools. For the criterion at Minchinbury during the night, the amenity criterion is the most stringent. However, it is conservatively considered that if compliance is achieved over a worst-case 15 minutes, it would also be achieved over the nine hour period, in the unlikely event that the modelled level of noise was continuous for that period.

Further to this is it is implied that where compliance with the intrusive criteria is achieved, compliance would also be achieved with the amenity criteria.

Table 4-6: Project Specific Noise Criteria, dB(A)

Receiver Area	Type	Period[1]	Amenity			Intrusive		
			ANL	Existing Industrial Noise[2] $L_{eq,industrial}$	Adjusted ANL $L_{Aeq,period}$	RBL	Intrusiveness Criteria RBL+5 $L_{Aeq15min}$	Project Specific Criteria
Minchinbury	Residential	Day	60	<41	60	43	48	$L_{Aeq,15min}$ 48
		Evening	50	<41	50	43	48	$L_{Aeq,15min}$ 48
		Night	45	<41	43	41	46	$L_{Aeq,period}$ 43
Erskine Park	Residential	Day	55	-	55	37	42	$L_{Aeq,15min}$ 42
		Evening	45	-	45	37	42	$L_{Aeq,15min}$ 42
		Night	40	-	40	35	40	$L_{Aeq,15min}$ 40
Minchinbury Primary School	School	When in use	45	-	-	-	-	$L_{Aeq,1hr}$ 45
Erskine Park Primary School	School	When in use	45	-	-	-	-	$L_{Aeq,1hr}$ 45
Industrial	Industrial	When in use	70	-	-	-	-	$L_{Aeq,period}$ 70
Commercial	Commercial	When in use	65	-	-	-	-	$L_{Aeq,period}$ 65

Notes: 1. Day (7.00am-6.00pm Monday to Saturday and 8.00am-6.00pm Sundays and Public Holidays), Evening (6.00pm-10.00pm), Night (10.00pm-7.00am, unless preceding a Sunday or Public Holiday).

4.2.4 Low Frequency Noise

The INP provides guidance on 'modifying factors' which should be applied to predicted or measured noise levels when a dominant low frequency noise characteristic is present. Table 4.1 of the INP states that low frequency noise is considered dominant where the difference between the A-weighted and C-weighted noise levels is 15 dB or greater. Where this difference occurs the INP recommends a modifying factor of 5 dB is added to the predicted noise level.

4.3 Cumulative Noise Impacts

Cumulative noise impacts affecting receivers from all industrial noise sources are assessed according to the INP's amenity criteria. The combined impact of all industrial noise sources at a receiver point should be considered, where industrial facilities are either operating or have been approved for development. The cumulative noise criteria that apply for the residential receivers within the project area are the acceptable noise levels shown in **Table 4-6**.

In addition, the Eastern Creek Precinct Plan provided noise levels at the nearest residential receivers to the specified zones. As a result, where predicted noise levels are compliant with these zone emission goals, adverse cumulative noise impacts would be not be expected.

4.4 Sleep Disturbance

The EPA does not currently have an explicit policy regarding sleep disturbance caused by noise from construction or industrial operation activities. However there is some guidance mentioned in the INP application notes, which states *"The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development."*

Where research exists, such as that reported in the INP and Environmental Criteria for Road Traffic Noise (ECRTN), the results are diverse and EPA has therefore not set a specific criterion. However, in lieu of further and more definite research a screening criterion of RBL + 15 dB $L_{A1,1min}$ dB(A) is adopted as suggested in the INP Application Notes. This screening criterion indicates that if the criterion is met, sleep disturbance is unlikely. Where the criterion is exceeded, further analysis is required.

Project specific screening criteria are presented in **Table 4-7**.

Table 4-7: Sleep Disturbance Screening Criteria, dB(A)

Residential Receiver Area	Sleep Disturbance Screening Criteria $L_{1,1min}$ dB(A)
Minchinbury	56
Erskine Park	50

4.5 Road Traffic Noise

The *NSW Road Noise Policy (EPA, 2011)* provides guidance, criteria and procedures for assessing noise impacts from existing, new and redeveloped roads and traffic generating developments. The assessment of road traffic noise impacts on public roads is assessed under the RNP.

The RNP provides several assessment criteria for traffic generating developments. The criteria are expressed as absolute levels and relative increase criteria for different land uses.

The noise assessment criteria for residential land uses affected by additional traffic generated by land uses developments are presented in **Table 4-8**.

Table 4-8: Road Traffic Noise Assessment Criteria for Residential Land Uses

Road Category	Type of Project/Land use	Assessment Criteria – dB(A)[1]	
		Day (7.00am to 10.00pm)	Night (10.00pm to 7.00am)
Freeway/arterial/sub-arterial	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hr}$ 55 (external)	$L_{Aeq,1hr}$ 50 (external)

Note: 1. Noise level criteria are façade-corrected noise levels.

The RNP specifies relative increase criteria for the increase in total traffic noise level due to a traffic generating project where the existing traffic noise level is significantly below the criteria in **Table 4-8**. Where this occurs an increase must be limited to 12 dB above the existing day or night noise level and not exceed the traffic noise criteria.

Additional specific relative increase criteria apply to traffic generating developments affecting existing sensitive land uses. The Road Noise Policy Application Notes (EPA, 2013) states the following:

"any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds the relevant day or night noise assessment criterion."

4.6 Vibration

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

No significant operational vibration sources were identified and subsequently the impacts are considered to be negligible, therefore operational vibration has not been assessed. Only potential impacts from vibration arising from construction activities have been assessed.

4.6.1 Human Comfort

The EPA administered guideline entitled *Assessing Vibration: A Technical Guideline* provides acceptable values for continuous and impulsive vibration in the range 1-80Hz. Both preferred and maximum vibration limits are defined for various locations and are provided in **Table 4-9**.

Table 4-9: Preferred and Maximum Peak Particle Velocity (PPV) Values for Continuous and Impulsive Vibration

Location	Assessment Period[1]	Preferred Values	Maximum Values
Continuous Vibration			
Critical areas [2]	Day or night time	0.14	0.28
Residences	Daytime	0.28	0.56
	Night time	0.20	0.40
Offices, schools, educational institutions and places of worship	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2
Impulsive Vibration			
Critical areas [2]	Day or night time	0.14	0.28
Residences	Daytime	8.6	17.0
	Night time	2.8	5.6
Offices, schools, educational institutions and places of worship	Day or night time	18.0	36.0
Workshops	Day or night time	18.0	36.0

Notes: 1 Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source BS 6472-1992.

These limits relate to a long-term (16 hours for daytime), continuous exposure to vibration sources. Where vibration is intermittent, a vibration dose is calculated and acceptable values are shown in **Table 4-10** below.

Table 4-10: Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime[1]		Night Time[1]	
	Preferred Value	Maximum Values	Preferred Value	Maximum Value
Critical areas [2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: 1 Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.
2 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas. Source BS 6472-1992.

4.6.2 Building Damage

Australian Standard *AS 2187: Part 2-2006 Explosives – Storage and Use – Part 2: Use of Explosives* recommends the frequency dependent guideline values and assessment methods given in *BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2* as they "are applicable to Australian conditions".

The British Standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The recommended limits (guide values) from BS 7385 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in **Table 4-11**.

Table 4-11: Transient Vibration Guide Values for Minimum Risk of Cosmetic Damage

Type of Building	Peak Component particle velocity in frequency range of predominant pulse 4 Hz to 15 Hz	 15 Hz and above
Reinforced or framed structures, Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	N/A
Unreinforced or light framed structures, Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

The standard states that the guide values in **Table 4-11** relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings.

Rockbreaking/hammering, vibratory rolling and sheet piling activities are considered to have the potential to cause dynamic loading in some structures (e.g. residences) and it may therefore be appropriate to reduce the transient values by 50%.

The British Standard goes on to state that "Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity". In addition, a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.

5 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

5.1 Introduction

The construction of the facility is expected to occur in stages for a total duration of 36 months . The construction works are expected to occur during standard hours 7.00am to 6.00pm Monday to Friday and 8.00am to 1.00pm Saturdays. Some construction activities would be required to work outside of standard hours. Where work is proposed outside of standard hours, the ICNG requires that the proponent provides suitable justification for this to occur other than for convenience.

Justification for the following activities is provided for works identified by the proponent as requiring work outside of standard hours:

- Delivery of oversized plant and equipment such as mobile plant, indivisible equipment or large structural sections. These items may require special permits to travel on the roads and would therefore be required to travel and arrive on site outside of standard hours.
- Emergency works may be required outside of standard hours in order to avoid loss of life, property damage or environmental harm in the event of an emergency.
- Safety inspections are required prior to and after construction works each day. An inspection of the site is carried out and where required, minor works may be required to make items safe.
- The project will require interfacing, connections to, maintenance and upgrading of utility services. In order to sustain the operational integrity of public infrastructure some works will need to be done outside of standard hours. The hours of work will be nominated by the utility stakeholder.
- Servicing of construction plant that occurs outside of standard hours. Due to the specialist nature of the plant and to achieve efficiency in its use, this plant is normally maintained outside normal operating hours.
- There are structural elements in the project such as the waste and ash bunkers that require the use of a "slip form" formwork system for vertical wall elements, to ensure the integrity of the finished product. The waste and ash bunkers will contain hazardous materials and need to be treated as a water tight tank. The slip form method is the only type of formwork system that will produce one solid tank. To achieve this casting continuously over periods of 24 hour operation over several days at a time is required.
- Out of hours work is also sought on Saturday from 7.00am to 8.00am and 1.00pm to 6.00pm for structure and concrete works as advice from the construction contractor indicates that working hours between 8.00am and 1.00pm may not allow enough time for sections to be completed to a sufficient standard.
- The installation of the EFW plant and equipment may be required to occur outside of standard hours. For installing large or complex items, lifts and placement could be expected to take longer to set up and complete than standard hours allows. Where plant or equipment is required to be delivered outside of standard hours for road safety reasons, in some instances equipment would be required to be manoeuvred into place immediately where it cannot be set down and installed at a later date.

Where construction is expected to occur outside of Standard Hours different criteria apply. The assessable time periods where these criteria apply are defined in **Table 5-1**. The significant stages are summarised in **Table 5-2**.

Table 5-1: Construction Assessment Time Periods

Construction Period		Time
Standard Hours (SH)		7.00am to 6.00pm Monday to Friday 8.00am to 1.00pm Saturdays
Outside of Standard Hours (OSH)		
OSH 1	Evenings	6.00pm to 10.00pm Monday to Sunday
OSH 2	Weekday Nights	10.00pm to 7.00am Monday to Friday
OSH 3	Saturday Night[1]	10.00pm (Saturday) to 8.00am (Sunday/Public Holiday)
OSH 4	Saturdays	7.00am to 8.00am and 1.00pm to 6.00pm Saturdays
OSH 5	Sundays/Public Holidays	8.00am to 6.00pm Sundays

Note: 1. Saturday Night may be replaced by the day preceding a Public Holiday

Table 5-2: Construction Schedule

Stage	Description	Duration of Works	Expected Hours of Operation[1]
Site establishment and clearance	Excavation machinery will be used to clear the site envelope and clear any unwanted vegetation. Setting up of site fences and erosion control measures.	2 weeks	SH
Bulk Excavation/Detailed Excavation/Services Lead In works	Machinery will be used to commence the cut/fill requirement for the future building structure, as well as completing the bulk excavation of the waste bunker. Removal of top soil will be required using trucks. Utilities required to be brought into the site will be undertaken by excavators. This period should be around 10months.	6-10 months	SH
Structure and Concrete Works	The structure will require two methods of construction. The slip form method, requires concrete to be poured continuously over a period of 16 days. The second method is standard concrete placing methods, which will occur regularly throughout the structure period during standard hours.	5 months	SH, (Slip form OSH 1, 2, 3,4 & 5)
EFW Technology Provider plant installation and façade/roofing installation	During this period, the main plant and equipment used to install all the required elements to the EFW plant are cranes, EWP, mobile cranes, manitous, forklifts and the like. This occurrence will be daily for a period of 16-18 months. Out of hours construction may occur on up to 45 days during the stage.	16-18 months	SH, OSH 1, 2, 3,4 & 5
Landscaping	Nearing completion of the project the final fit out and landscaping stages will acquire minimal plant such as bob cats, backhoes, and smaller excavators. Trucks importing soil may also be required.	5 months	SH, (SH, OSH 4 for concrete pour days)

Note: 1. Refer to **Table 5-1** for definition of time periods.

5.2 Construction Scenarios and Sound Power Levels

The significant construction stages and their associated significant items of equipment are summarised in **Table 5-3**.

Out of hours construction stages for safety inspections and equipment servicing have not been assessed as these scenarios are not expected to use significant noise sources. Emergency works would be necessary by definition and the extent of emergency works would vary depending on the situation and subsequently have not been assessed.

Out of hours utility works are expected to be minor in nature using hand tools and EWPs only. As they do not represent a significant construction scenario, they have not been assessed further.

Sound power levels were sourced from Australian *Standard AS 2436-2010 Guide to noise and vibration control on construction, demolition and maintenance sites* and Department of Environment, Food and Rural Affairs (DEFRA), UK (2005) *Update of Noise Database for Prediction of Noise on Construction and Open Sites.*

Table 5-3: Construction Stages and Noise Sources

Stage	Plant	No. Off	Activity Use	Times of Use[1]	SWL per unit dB(A)
Site Clearing and Preparation	4WD	4	Staff site vehicle movements	SH	97
	Dozer	1	Clearing and vegetation removal	SH	115
	Excavator	3	Clearing, stripping and stockpiling	SH	110
	Water Cart	1	Dust suppression	SH	110
	Tipper	2	Relocation of spoil to stockpile	SH	116
	Mulcher	1	Vegetation Mulching	SH	116
Excavation/ Services Lead In[2]	Generators	2	Site power	SH	106
	Excavator	6	Preparation of grade materials	SH	110
	Roller	2	Compaction of grade materials	SH	108
	Water Cart	1	Dust suppression	SH	110
	Dozer	2	Stripping, stockpiling and relocating	SH	115
	Bobcats	2	Stockpiling	SH	104
	Rock Crusher	1	Crush rock for compaction	SH	112
	Trucks	6	Movement of spoil	SH	107
Structure	Concrete Pump (Mobile)	2	Pumping of Concrete	Concrete Pour Days (SH, OSH 1, 2, 3,4 & 5)	106
	Concrete Trucks	30	Supply of concrete	Concrete Pour Days (SH, OSH 1, 2, 3,4 & 5)	108
	Mobile Crane	2	Material handling for structural components.	SH, OSH 4	98
	Tower Crane	1	Material handling for structural components.	SH, OSH 4	104
	Generators	2	Site power	SH, OSH 4	106
	Vibrators	5	Placement of concrete	Concrete Pour Days (SH, OSH 1, 2, 3,4 & 5)	97
Technology Provider Plant Installation /Structural Steel	Mobile Crane	4	Material handling for structural components.	SH, OSH 1, 2, 3,4 & 5	98
	Tower Crane	2	Material handling for structural components.	SH, OSH 1, 2, 3,4 & 5	104
	Scissor Lifts	8	Access to various elements during steel erection.	SH, OSH 1, 2, 3,4 & 5	106
	Boom Lifts	8	Access to various elements during steel erection.	SH, OSH 1, 2, 3,4 & 5	105
	Generators	2	Site power	SH, OSH 1, 2, 3,4 & 5	106

Stage	Plant	No. Off	Activity Use	Times of Use[1]	SWL per unit dB(A)
	Franna	2	Material handling for structural components.	SH, OSH 1, 2, 3,4 & 5	107
Landscaping	Bobcat	2	Movement of spoil/soil	SH	104
	Excavator	1	Preparation of grade	SH	110
	Asphalt Layer	1	Installation of asphalt	SH	105
	Compactor	1	Preparation of grade	SH	106
	Concrete Pump (Mobile)	2	Pumping of Concrete	Concrete Pour Days (SH, OSH, 4)	106
	Concrete Trucks	30	Supply of concrete	Concrete Pour Days (SH, OSH, 4)	108
	Vibrators	5	Placement of concrete	Concrete Pour Days (SH, OSH, 4)	97

Note: 1. Refer to **Table 5-1** for definition of time periods.
2. Out of hours utility and services work would be required, however the equipment proposed does not represent a significant construction scenario and therefore has not been assessed.

The most significant construction works are organised into seven scenarios, summarised in **Table 5-4**.

Table 5-4: Construction Noise Modelling Scenarios

Scenario	Description	Hours of Operation[1]					
		SH	OSH 1	OSH 2	OSH 3	OSH 4	OSH 5
1	Site Clearing and Preparation	x					
2	Excavation/Services Lead In	x					
3	Structure – non concrete pour days	x				x	
4	Structure – concrete pour days	x	x	x	x	x	x
5	Technology Provider Plant Installation /Structural Steel	x	x	x	x	x	x
6	Landscaping – non concrete pour days	x					
7	Landscaping – concrete pour days	x				x	

Note: 1. Refer to **Table 5-1** for definition of time periods.

5.3 Noise Assessment

5.3.1 Methodology

Noise modelling was undertaken using the ISO9613 algorithm, as implemented within the CadnaA acoustic modelling package. The noise modelling takes into consideration the sound power level of the proposed site operations, activities and equipment, and applies adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography and barriers, ground effect and atmospheric absorption.

The ICNG states that recommended construction hours are Monday to Friday 7.00am to 6.00pm and Saturdays 8.00am to 1.00pm. All work outside of these times is considered outside of standard hours.

5.3.2 Predicted Noise Levels

The predicted construction noise levels are presented in **Table 5-5** and **Table 5-6**. The predicted noise levels are presented as a range where activities occur at the closest and furthest point from the receiver.

Table 5-5: Construction Noise Level Prediction during Standard Hours

Receiver	Criteria	Scenario Predicted Noise Level $L_{eq,15min}$ dB(A)						
		1	2	3	4	5	6	7
Erskine Park Residential	47	41-47	41-47	31-33	35-37	38-41	31-37	30-39
Erskine Park School	55	38-45	38-45	28-33	31-36	28-41	28-36	29-38
Woolworths Distribution Centre	65	20-48	20-48	29-31	32-34	34-38	<20-38	<20-40
Startrack Centre	65	21-49	21-49	28-31	31-34	33-38	<20-39	<20-41
Aldi	65	22-46	22-46	28-31	31-34	33-39	<20-36	<20-38
Minchinbury Residential	53	22-44	22-44	30-31	33-34	37-39	<20-34	<20-36
Minchinbury School	55	<20-35	<20-35	25-27	27-29	28-33	<20-25	<20-27
Genesis	70	38-56	38-56	44-46	46-48	46-51	28-46	30-48
Hanson	70	44-83	44-83	45-50	49-53	48-58	31-73	33-75

Table 5-6: Construction Noise Level Prediction Outside of Standard Hours

Receiver	Criteria[1]				Scenario Predicted Noise Level $L_{eq,15min}$ dB(A)						
	OSH 1/2	OSH 3	OSH 4	OSH 5			3	4	5	6	7
Erskine Park Residential	42/40	40	42	42			31-33	35-37	38-41		30-39
Erskine Park School	55	55	55	55			28-33	31-36	28-41		29-38
Woolworths Distribution Centre	65	65	65	65			29-31	32-34	34-38		<20-40
Startrack Centre	65	65	65	65			28-31	31-34	33-38		<20-41
Aldi	65	65	65	65			28-31	31-34	33-39		<20-38
Minchinbury Residential	48/46	46	48	48			30-31	33-34	37-39		<20-36
Minchinbury School	55	55	55	55			25-27	27-29	28-33		<20-27
Genesis	70	70	70	70			44-46	46-48	46-51		30-48
Hanson	70	70	70	70			45-50	49-53	48-58		33-75

Notes: 1. Refer to **Table 5-1** for definition of time periods.

5.3.3 Assessment

The predicted construction noise levels indicate compliance would be achieved at all sensitive receiver locations during Standard Hours and for all construction scenarios.

Scenarios three, four, five and seven are expected to occur on weekends outside of standard hours between 7.00am to 8.00am and 1.00pm to 6.00pm on Saturdays. Scenarios four, five and seven could also to occur during the evening and night on weekends and weekdays. Scenarios four and five could occur on Sundays during continuous operations.

Construction noise is predicted to be within the construction noise management goals outside of standard hours at residential and other sensitive land uses, with the exception of Erskine Park residential properties. The predicted exceedances of the construction noise management goals at the nearest Erskine Park residential properties are as follows:

- Scenario 5 during OSH 2 and 3

In light of these predicted exceedances, noise mitigation and management is recommended.

Compliance is expected at the commercial receivers Woolworths, Startrack and Aldi and the industrial Genesis site for all construction scenarios.

Exceedance of the criteria is predicted at the Hanson Facility for scenarios one, two, six and seven when works are at their closest to the site boundary. It should be noted that when works are at the furthest from the Hanson Facility, compliance is predicted. The construction noise modelling is representative of a conservative scenario that considers all plant working simultaneously. Furthermore, the Hanson Site is currently vacant, however management measures are recommended where compliance and noise control are required.

The noise predictions take into account all plant working simultaneously at their closest point to the receiver, therefore where plant do not work simultaneously and are not at their closet point, lower noise levels would be expected.

5.4 Sleep Disturbance

The potential for sleep disturbance is considered from short-duration, high level noise events. In this case, significant maximum noise level events that could occur from the following activities that occur during the night are considered as follows:

- Truck brakes
- Dropping or striking tools or materials
- Loading material into trucks
- Engine starts
- Reversing alarms

A conservative maximum noise sound power level of L_{max}125 dB(A) is considered the level of the maximum short duration noise event. The predicted noise levels are shown in **Table 5-7**. From this table it can be seen that compliance is met with the sleep disturbance screening criteria and therefore sleep disturbance awakenings are considered unlikely.

Table 5-7: Predicted Maximum Noise Levels

Receiver	Sleep Disturbance Criteria $L_{1,1min}$ dB(A)	Predicted Maximum Noise Level L_{max} dB(A)
Minchinbury	56	46
Erskine Park	50	49

5.5 Construction Noise Management

In light of the predicted exceedances at the Hanson Facility and residential receivers in Erskine Park for selected scenarios, noise mitigation and management measures will be implemented where reasonable and feasible. A construction noise management plan will be developed and implemented once further details and schedules are confirmed. The plan is to be completed prior commencement of construction, and will include the following:

- Communication with the potentially affected receiver locations to inform of the proposed works, durations and potential for noise.
- Identification of key noise impacts
- Noise management measures
- Noise monitoring on site and at sensitive receivers
- Training and awareness of on site personnel.
- Incident and emergency response.
- Non-conformance, preventative and corrective action.

Noise monitoring will be conducted as part of the construction noise management plan. It will follow the principles for noise monitoring outlined in **Appendix D** and be made up of a combination of continuous long term unattended and short term attended noise monitoring. Attended monitoring will also be conducted at appropriate intervals during each major construction stage, and in response to complaints, where appropriate.

During out of hours work or work continuing for 24 hours a day, continuous unattended noise monitoring will be carried out supported by periodic attended noise monitoring.

Education and training of site staff is necessary for satisfactory implementation of noise mitigation measures. Education and training strategies would focus on:

- Site awareness training / environmental inductions that include a section on noise mitigation techniques / measures to be implemented throughout the project.
- Ensuring work occurs within approved hours.
- Locating noisy equipment away from sensitive receivers.
- Using noise screens for mobile plant and equipment.
- Ensuring plant and equipment is well maintained and not making excessive noise.
- Turning off machinery when not in use.

Where appropriate, noise mitigation measures will include:

- Not operating equipment simultaneously, where possible. This has the potential to substantially reduce noise emissions.
- Mitigation of specific noise sources may be possible by using portable temporary screens or site structures.
- Maximising the offset distance between noisy plant items and receivers where possible, especially during more sensitive periods (evening and night).
- Orientating directional noise emitting equipment away from receivers.
- Operating excavators and other mobile plant in a manner that would reduce the likelihood of maximum noise level events occurring such as:
    - Sudden changes in vehicle direction/engine load.
    - Shaking excavator buckets.
    - Excavator buckets or similar contacting the ground or other solid structures.
- Carrying out loading and unloading away from sensitive receivers.
- Selecting plant and equipment based on noise emission levels.
- Use of residential class mufflers to reduce noise emission from mobile plant such as dozers, cranes, graders and excavators.
- Using alternative construction methods.
- Using spotters, closed circuit television monitors, "smart" reversing alarms, or "squawker" type reversing alarms in place of traditional reversing alarms.

An incident and complaints handling protocol should be implemented. This should follow the principles detailed in **Appendix D**.

5.6 Vibration Assessment

5.6.1 Methodology

The most significant source of construction vibration has been identified as dozers.

The assessment takes into account the distance between the sensitive receivers and the activities and applies the distance attenuation according to the method in the USA's Federal Transit Administration *Transit Noise and Vibration Impact Assessment Guideline* (FTA 2006). It is noted that the attenuation of ground vibration can vary from site to site depending on the specific geological and operating conditions.

The closest receiver is the Hanson Facility located adjacent to the EFW site. It was identified from site layouts (Hanson, 2012) that the closest human comfort receiver is an office, located approximately 75m from the nearest boundary with the EFW site.

5.6.2 Vibration Source Levels

Vibration source levels were taken from the Environmental Noise Management Manual (RMS, 2001) and are summarised in **Table 5-8**.

Table 5-8: Vibration Source Levels

Equipment	Peak Particle Velocity (PPV) at 10m (mm/s)
Dozer	4

5.6.3 Predicted Vibration Levels

Table 5-9 provides indicative vibration levels for the dozer at a range of distance. The most stringent criterion for building damage is 15 mm/s and for human comfort in offices is 0.56 mm/s.

Table 5-9: Predicted Vibration Levels

Distance (m)	Predicted PPV (mm/s)
10	4.0
20	1.4
30	0.8
40	0.5
50	0.4

5.6.4 Assessment

A review of **Table 5-9** indicates that vibration levels from construction will be well below the most stringent building damage criterion at 10m and the human comfort criterion at 40m. Therefore adverse impacts are not expected.

6 OPERATIONAL NOISE ASSESSMENT

6.1 Noise Model

Noise modelling was undertaken using the ISO9613 and CONCAWE algorithms, as implemented within the CadnaA acoustic modelling package. The noise modelling takes into consideration the sound power level of the proposed site operations, activities and equipment, and applies adjustments for attenuation from geometric spreading, acoustic shielding from intervening ground topography and barriers, ground effect and atmospheric absorption.

Ground absorption conditions were modelled according to the land type as identified by observations made on site, project plans and aerial photography.

A number of sensitive receiver locations were selected to be indicative of the potentially worst affected receivers in Minchinbury and Erskine Park. Single storey receivers were modelled at a receiver height of 1.5m and double storey receivers at 4m. The greatest predicted noise level in each sensitive receiver area is presented. Industrial and commercial receivers were assessed at the potentially most affected location on the site boundary.

6.2 Meteorological Conditions

The default meteorological conditions as specified in the INP have been used in the modelling. Based on the meteorological parameters determined in Section 3.2, the meteorological parameters used in the modelling are as follows:

- Neutral – Stability Class D, no wind (day, evening, night)
- Adverse 1 – Stability Class D, 3 m/s source to receiver wind (day, evening, night)
- Adverse 2 – Stability Class F, no wind (night)

6.3 Modelling Scenario

A modelling scenario was established to provide a conservative assessment for operations at the facility over a 15 minute period.

The scenario considers the following assumptions, as agreed with the client:

- A peak number of fuel trucks entering the facility of 17 per hour. In order to be conservative, it has been assumed that 75% of the trucks enter the facility within 15 minutes.
- The peak number of ash collection trucks is 5 per 15 minutes, APC trucks 1 per 15 minutes and consumable trucks is 1 per 15 minutes.
- Trucks travel around the site at 30km/h.
- Access doors to the tipping hall are left open.
- Within the tipping hall, the activities that are assumed are trucks entering hall, dumping material, idling and then exiting the tipping hall.
- Building break out noise was calculated based on façade details provided in the concept drawings and transmission loss data was taken from manufacturer's data or products of equivalent performance. It is assumed that building facades are continuous and contain no gaps between panels and sections.
- Air cooled condensers are housed in an open top enclosure.
- The modelling considered significant noise sources based on information provided by the facility designers (Ramboll) and assessment of similar facilities (Ferrybridge, UK).
- Building walls and roofs are clad according to the specification supplied by the project architect. They include the following materials:
    - HiKlip 630 profiled steel sheeting,
    - Alucobond 3mm panelling
    - Danapalon 16mm panelling

- Low level concrete walling.
- Steel sheeting roofing with one layer of insulation with an acoustic performance of Rw 25.

➢ All equipment is operating simultaneously.

Additional modelling assumptions are detailed in **Appendix E**.

6.4 Sound Power Levels

Sound power levels were sourced from information provided by the client from the facilities designer and are based on noise levels measured at a similar plant in Ferrybridge, UK. Additional detail is provided in **Appendix E.** Indicative sound power levels are presented in **Table 6-1**.

Table 6-1: Indicative Sound Power Levels for Site Equipment, dB(A)

Item	Description	Number off	Height (m)	Descriptor	Noise Level, dB(A)
Tipping Hall[1]	Building	1	-	Internal Sound Pressure Level	85
Waste Bunker[1]	Building	1	-	Internal Sound Pressure Level	82
Boiler House[1]	Building	2	-	Internal Sound Pressure Level	85
Flue Gas Treatment[1]	Fixed Plant	4	-	Sound Power Level	98
Turbine Hall[1]	Building	2	-	Internal Sound Pressure Level	88
Ash Bunker Extraction fan[1]	Fixed Plant	2		Sound Power Level	93
ID Fans[1]	Fixed Plant	4	4	Sound Power Level	100
ID Fan duct[1]	Fixed Plant	4	9	Sound Power Level	79/m
Stack tip[1]	Fixed Plant	4	100	Sound Power Level	91
Lime Blowers[1]	Fixed Plant	2	1.5	Sound Power Level	92
Silo Air Compressors[1]	Fixed Plant	2	1.5	Sound Power Level	97
PAC Blowers[1]	Fixed Plant	2	1.5	Sound Power Level	92
Air Cooled Condensers[1]	Fixed Plant	24	11	Sound Power Level per section of 6 units	102
Transformer[1]	Fixed Plant	2	2	Sound Power Level	102
High Pressure Steam Line[1]	Fixed Plant	2	9	Sound Power Level	96
Heavy Vehicles[2]	Vehicle at 30 km/h	13	1.5	Sound Power Level per vehicle	107

Notes: 1. Sourced from facility designer's specification and based on similar facility at Ferrybridge, UK
2. Sourced from the USA's Federal Highway Administration Traffic Noise Model

6.5 Predicted Noise Levels

The predicted noise levels are presented in **Table 6-2**. The predicted noise levels represent the greatest predicted noise level within the receiving area. **Table 6-3** presents the predicted C-weighted noise levels for adverse night time conditions, when the highest predicted noise levels are expected to occur, and a comparison against INP low frequency noise criteria.

Operational noise contours for neutral, adverse (wind) and adverse (temperature inversion) are presented in **Appendix C**. Contours plots are produced using a 25m grid spacing and therefore are indicative only.

Table 6-2: Predicted Operational Noise Levels

Receiver	Criteria $L_{eq,15min}$ dB(A)			Predicted Noise Level, $L_{eq,15min}$ dB(A)		
	Day	Evening	Night	Neutral	Adverse 1	Adverse 2
Minchinbury Residential	48	48	43	33	38	38
Minchinbury School	45	-	-	28	33	33
Erskine Park Residential	42	42	40	35	40	40
Erskine Park Schools	45	-	-	34	38	39
Woolworths	65			32	37	37
Startrack	65			33	37	38
ALDI	65			33	38	38
GENESIS	70			55	56	56
HANSON	70			54	54	56

Table 6-3: Predicted C-Weighted Noise Levels

Receiver	Predicted Noise Level, $L_{eq,15min}$ dB(C)	Difference	INP Criteria $L_{eq,15min}$ dB(C)
	Adverse 2	C-A dB	C-A, dB
Minchinbury Residential	50	12	15
Minchinbury School	46	13	15
Erskine Park Residential	54	14	15
Erskine Park Schools	53	14	15

Noise levels are predicted to be below the commercial and industrial criteria outlined in the NSW EPA INP under all prevailing meteorological wind conditions.

The noise contours provided in Appendix C demonstrate that worst case predicted noise levels (under night time inversion conditions) would be between 50 - 55 dB(A) at the southern boundary of the facility, well below the criteria for commercial or industrial land uses. Therefore noise levels at the nearby Eastern Creek Business Park are predicted to comply with relevant INP criteria.

6.6 Operational Noise Assessment

A review of the predicted noise levels in **Table 6-2** and **Table 6-3** indicates that compliance is achieved with the project specific noise level criteria during both neutral and adverse meteorological conditions.

The assessment indicated that adjustments for modifying factors is not required as the project is not expected to include tonal, intermittent, impulsive or low frequency noise characteristics as defined in the INP.

6.7 Sleep Disturbance Assessment

The following noise sources have been identified with the potential to cause high level instantaneous noise events:

- Loading Ash into trucks
- Truck Park Brake
- Pressure Release Safety Valve

The maximum sound power levels for these sources are presented in **Table 6-4**.

Table 6-4: Maximum Sound Power Levels

Item	Sound Power Level, L_{max} dB(A)
Loading trucks	120
Truck park brake	112
Safety Valve	126

Noise Level predictions were made to the surrounding residential receivers and a summary of the greatest predicted result for each nearest residential area is presented in **Table 6-5**. As indicated in the predicted noise levels in Table 6-5, sleep disturbance impacts are not expected.

Table 6-5: Predicted Maximum Noise Levels

Receiver	Criteria $L_{1,1min}$ dB(A)	Predicted Maximum Noise Level L_{max} dB(A)	
		Neutral	Adverse 2
Minchinbury	56	42	46
Erskine Park	50	45	50

6.8 Cumulative Impact Assessment

The potential for cumulative noise impacts to occur as a result of several noise emitting developments at a noise sensitive receiver is considered by the amenity criteria within the INP. The amenity criteria considers the cumulative impact of industrial noise sources and applies penalties to permitted levels of noise emission from any new development based on the level of the existing industrial noise. Cumulative impacts within Zone 4 are also assessed in the context of the Eastern Creek Stage 3 Precinct Plan and relevant noise limits, for existing and approved developments.

The existing industrial noise environment was quantified by measurement and described in **Section 3.1**. It is noted that the proposed Hanson development in the adjacent lot has been approved, however is not yet operational. The Hanson development was approved with noise limits at Erskine Park of $L_{Aeq,15min}$ 35 dB(A) during the day, evening and night (Hanson, 2012).

The INP amenity criteria and Precinct Plan goals are assessed over 9 hours. The EFW project specific noise levels and the Hanson noise limits are assessed over 15 minutes. The assessment over 15 minutes has not taken into account periods of lower noise emission which would be expected over a 9 hour period from the types of activities under assessment. Therefore noise emission levels from both facilities would be expected to be lower over 9 hours compared with over 15 minutes.

Noise modelling of the EFW facility was performed using the model described in **Section 6.1** for a conservative nine hour scenario. The nine hour scenario considered the same conservative assumptions except that the number of trucks arriving are spread evenly over a 24 hour period, resulting in 5 trucks per hour (one-way).

The greatest predicted noise level at Erskine Park residential receivers from the EFW Facility is $L_{Aeq,9hr}$ 39 dB(A) under adverse conditions during the night. Assuming a similar reduction for the Hanson development, the resultant $L_{Aeq,9hr}$ cumulative noise level would be $L_{Aeq,9hr}$ 40 dB(A).

Where the Hanson development is operational prior to the EFW facility, the presence of the existing industrial noise at $L_{Aeq,9hr}$ 34 dB(A) would require the night time amenity criteria at Erskine Park to be decreased by 1 dB to $L_{Aeq,9hr}$ 39 dB(A). This would mean that the cumulative noise of the EFW facility and the Hanson development would exceed the amenity criteria by 1 dB and the Precinct Plan goal by 2 dB.

A 1-2 dB exceedance of the night time goals is considered marginal as typically a 3-5 dB increase in noise level represents a change in noise level noticeable by most people. Furthermore the exceedance is only predicted to apply during the night under temperature inversion conditions. As these conditions are not present all of the time, it is expected to reduce the chance of adverse noise impacts occurring.

Therefore in consideration of conservative modelling, the marginal degree of exceedance and the conditions under which the exceedance is predicted to occur, additional mitigation is not considered reasonable.

Further, developments within Zone 5 of the precinct plan are limited to a lower noise goal than Zone 3 and Zone 1. As such noise emission from Zone 1 and Zone 3 will control noise levels at noise receivers in Erskine Park. Meaning a reduction in noise emissions from Zone 5 below the precinct plan goal would not benefit noise levels at the receiver. The mitigation burden is carried by the Zone 1 and Zone 3 activities as they have a controlling influence on receiver noise levels.

Cumulative noise impacts on Eastern Creek Business Park were considered as part of the Response to Submissions (October 2015). The cumulative impact of the proposed development in conjunction with operation of the Genesis Xero Waste Facility (ERM, 2008) and Hanson Asphalt Batching Plant (Heggies 2006) were referenced from noise contour plots. Worse case noise levels of approximately 56 dB(A) are expected at the southern site boundary of the proposed EFW facility.

6.9 Health Impacts

The health impacts of the proposed facility were considered as part of the Response to Submissions (October 2015).

This report has demonstrated that the noise impacts from the project will comply with relevant NSW EPA noise criteria, and cumulative noise goals under the majority of conditions. These goals have been developed to protect the amenity of nearby land uses, and ensure there are no adverse or unacceptable impacts on nearby sensitive receivers. Compliance with these noise goals ensures that noise levels are within acceptable planning limits and environmental noise criteria for industrial premises. The predicted noise levels are within typical impact ranges for this type of urban land use.

In terms of medical impacts of acoustic exposure, the World Health Organisation (WHO) says the following with regard to noise-induced hearing impairment as a result of continuous, intermittent, impulse noise:

"At L_{Aeq},8h levels of 75 dBA and lower, even prolonged occupational noise exposure will not result in noise-induced hearing impairment (ISO 1990). This value is equal to that specified in 1980 by the World Health Organization (WHO 1980a)."

The WHO guidelines also state that, in terms of annoyance related to noise exposure, "noise above 80 dBA is associated with increased aggressive behaviour" and has noted that annoyance is generally

linked to noise exposure characteristics, with "stronger reactions have been observed when noise is accompanied by vibrations and contains low frequency components".

Noise exposure from the project is predicted to comply with regulatory guideline values for the majority of conditions, with minor (<1 dB(A)) exceedances predicted when assessed cumulatively with other noise sources. Site noise will be significantly below the guideline values for medical health impacts as defined by the World Health Organisation (WHO) Guidelines for Community Noise (WHO 1980a).

6.10 Recommendations

It is recommended that noise measurements be carried out to confirm compliance upon commissioning of the facility.

An operational noise management plan should be developed for the site to assist in maintaining good practice in noise management.

The noise source emissions used in this report are indicative only and based on data obtained from a similar facility. Where further details or changes relating to noise emissions become available, it should be confirmed that the project is able to meet the environmental noise goals.

The environmental noise goals of the project should be considered when selecting plant and equipment.

All building envelope materials should have the same or better performance than those used in this assessment.

Building facades should be constructed so that they are continuous and contain no gaps between panels and sections.

Buildings should have openings orientated away from receivers, where possible. The opening should be designed where possible so as to not compromise the acoustic performance of the building and remain closed where possible.

Where possible, broadband or smart reversing alarms should be fitted to all vehicles on site, in order to reduce the potential impacts caused by tonal style reversing alarms.

6.11 Operational Noise Management

This assessment has predicted compliance with the operational noise criteria. Nevertheless, in accordance with the DGRs, noise management principles have been included to assist the facility in maintaining good practice in noise management, presented in **Appendix D**.

7 ROAD TRAFFIC NOISE ASSESSMENT

7.1 Methodology

Project generated traffic has the potential to increase noise levels on existing public roads. Traffic noise impacts are assessed according to the relative increase predicted on the project related roads, therefore complying with the RNP criteria where existing roads affected by traffic generating developments do not cause an increase in overall traffic noise levels of more than 2dB.

Inputs to the assessment were sourced from the EIS traffic assessment component completed by Traffix and publicly available data.

Consistent with the traffic assessment, the project related roads are assumed to be:

- Wonderland Drive
- Honeycomb Drive
- Wallgrove Road
- M7 motorway
- M4 Motorway

Sensitive residential receivers were identified along the M4, M7 and Wallgrove Road and the potential for project generated traffic to result in noise levels above those prescribed in the RNP is considered.

Wonderland Drive and Honeycomb Drive are located within the Eastern Creek Business Park and as such there are no sensitive receivers located along these roads and therefore will not be assessed further.

A road traffic noise assessment was performed for the Genesis project as part of the approval process (ERM, 2008). The report concluded that on Wallgrove Road and the M4 motorway, the additional traffic generated by the Genesis development would not cause noise levels to increase above the guideline levels.

The majority of heavy vehicle traffic into the project site is expected to come from the Genesis facility, approximately 63% via the connecting road between the sites. These traffic movements are incorporated into the existing Genesis generated traffic volumes. However approximately 37% of fuel deliveries are expected to come from sources other than Genesis and result in an additional 57 heavy vehicle movements a day.

Other traffic movements in and out of the site is expected to include up to 4 movements a day for heavy vehicle traffic associated with consumable deliveries and removal of combustion by products and light vehicle traffic from staff movements. In response to comments by the EPA with regard to traffic volumes, this assessment includes additional traffic resulting from offsite disposal of ash residue produced at the facility. Ash residue waste from the facility will be in the order of 451,700 tonnes per annum, equating to approximately 14 vehicle movements per hour.

There are expected to be 55 staff working on a three shift pattern. It is assumed that staff will use one car each to arrive and depart from the site.

7.2 Traffic Volumes

Traffic volumes for the project were sourced from data provided by the applicant, and publicly available data. **Table 7-1** provides a summary of the project generated traffic.

Table 7-1: Project Generated Traffic

Activity	Vehicle Type	Movements (two way)	
		Daily	Hourly

Staff	Light	110	37
Input Waste/ Fuel Deliveries	Heavy	336	14
Ash residue Removal	Heavy	161	14
Miscellaneous Deliveries	Heavy	8	2
Total	All	615	67

Existing traffic volumes expressed as annual average daily traffic (AADT) on the project related roads are summarised as follows:

- Wallgrove Road (RMS, 2005) AADT 25,754
- M4 (RMS, 2012) AADT 93,000
- M7 December 2013 Quarter (Transurban, 2014) 154,157 Average Daily Trips.

7.3 Assessment

Existing project related roads already carry large volumes of traffic, including a large percentage of heavy vehicles on Wallgrove Road, M4 and M7 generated by existing industrial and commercial land uses. As a result of the project, the traffic volumes would be expected to increase on these road by less than 2% of AADT and therefore no significant increase (2 dB or more) is expected on these roads.

As a general rule overall traffic noise increases by 3 dB with a doubling of traffic flows. Traffic from the project is expected to be low in the context of existing traffic volumes, with overall volumes predicted to increase by less than 1% compared to annual average daily flows and not expected to result in a change to overall traffic noise.

Typically an increase in traffic noise level above the 2 dB increase criteria is expected where traffic volumes increase by 20% or more. Since the project is expected to increase traffic much less than this, it is considered to comply with the RNP relative increase criteria.

In addition, it is expected that since the latest publicly available counts on Wallgrove Road are from 2005, traffic would have likely increased since then, which would cause the project's relative contribution to decrease.

Traffic will travel directly between the site and the arterial road network. There are no residential receivers located along project affected roads.

8 CONCLUSION

Pacific Environment has conducted a noise impact assessment for the proposed Energy from Waste facility at Eastern Creek, NSW.

This document presented the consolidated outcomes of the original report, *Energy from Waste Facility, Eastern Creek (SSD6236) – Noise Impact Assessment Report* (ACO-NW-004-08526) (Pacific Environment, March 2015), and additional works completed in response to submissions received, as part of the *Response to Submissions: SD_6236 TNG Energy from Waste Facility, Eastern Creek* (ACO 08526H) (Pacific Environment, October 2015).

The assessment was conducted for operations, construction and road traffic in accordance with the relevant guidelines, standards and policies. Assessment was made using a number of conservative assumptions as outlined in the report.

The construction noise assessment indicated the following:

- Predicted noise levels indicate that compliance would be achieved during standard hours at residential receiver locations.
- Exceedance of the noise management levels is expected at the closest industrial receiver for certain construction scenarios.
- Where work occurs outside of standard hours, exceedances of the construction noise management goals were predicted for residential receivers in Erskine Park on weekends and during night works.
- Noise management measures are recommended to assist in the prevention of impacts.

The construction vibration assessment indicated that the most significant vibration generating activities would comply with the most stringent criteria at the closest receivers.

The operational noise assessment indicated that noise emissions from the operating facility would comply with the most stringent criteria under both neutral and adverse meteorological conditions.

The cumulative noise assessment for operational noise indicated that adverse cumulative noise impacts would not be expected.

Operational noise management principles have been recommended to assist in the prevention of adverse impacts.

The road traffic noise assessment indicated that the predicted increase in road traffic noise from both construction and operational traffic would not be above the limiting criteria.

9 REFERENCES

Australian Standard, 1997, *AS1055.1 Acoustics – Description and measurement of environmental noise – Part1: General procedures.*

Australian Standard, 2006, *AS 2187.2 Explosives – Storage and Use – Part 2: Use of Explosives.*

Australian Standard, 2010, *AS 2436 Guide to noise and vibration control on construction, demolition and maintenance sites*.

Bies and Hansen, 2009*, Engineering Noise Control - Theory and Practice - 4th Edition.*

British Standard, 2008, BS*6472-1 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*.

British Standard, 1993, *BS7385-2 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.*

CONCAWE Report No. 4/81, Manning C.J., 1981, *The propagation of noise from petroleum and petrochemical complexes to neighbouring communities.*

Department of Environment, Food and Rural Affairs, UK (2005) "Update of Noise Database for Prediction of Noise on Construction and Open Sites"

Department of Transport and the Welsh Office, UK, 1988, *Calculation of Road Traffic Noise*

Environment Protection Authority (former Department of Environment, Climate Change and Water), 2009, *Interim Construction Noise Guideline*.

Environment Protection Authority (former Department of Environment, Conservation and Climate Change), 2000, *Industrial Noise Policy*.

Environment Protection Authority, 1999, *Environmental Criteria for Road Traffic Noise*.

Environment Protection Authority, 2013, *NSW Road Noise Policy*.

Environment Protection Authority (former Department of Environment and Climate Change), 2004, *Assessing Vibration: A technical Guideline*.

ERM, 2008, *Light Horse Business Centre Noise Impact Assessment*, 0071234 Noise

FHWA, 1998, *Traffic Noise Model – Technical Manual.* US Department of Transportation, Federal Highway Administration, Washington USA.

Federal Transit Administration, 2006, *Transit Noise and Vibration Impact Assessment Guideline*

Hanson, 2012, *Noise, Dust and Vibration Management Plan – Wallgrove Redevelopment*

Pacific Environment, March 2015, *Energy from Waste Facility, Eastern Creek (SSD6236) – Noise Impact Assessment Report* (ACO-NW-004-08526).

Pacific Environment, October 2015, *Response to Submissions: SD_6236 TNG Energy from Waste Facility, Eastern Creek* (ACO 08526H).

Roads and Maritime Services (formerly Roads and Traffic Authority), 2001, *Environmental Noise Management Manual*

Roads and Maritime Services, *Annual Average Daily Traffic Volumes 2012*

Roads and Maritime Services, *AADT Data 1995 - 2006*

Transurban, 2014, *ASX Release – Traffic and Revenue Data – December 2013, 13 January 2014*.

URS, 2013, *Ferrybridge Multifuel 2 Preliminary Environmental Information Report*, October 2013, Ref: Pa-D1

World Health Organization (WHO), 1980a, *Guidelines for Community Noise*.

Appendix A SITE LAYOUT

THE NEXT GENERATION- ENERGY FROM WASTE FACILITY

EASTERN CREEK, SYDNEY

PROPOSED SITE MASTERPLAN

PRELIMINARY

DATE 20.02.2015
SCALE 1:1500 @ A1

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PROJECT NO. 2015 | DRAWING NO. PS07 | ISSUE DRAFT

A1

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PROPRIETOR

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Energise Your Future

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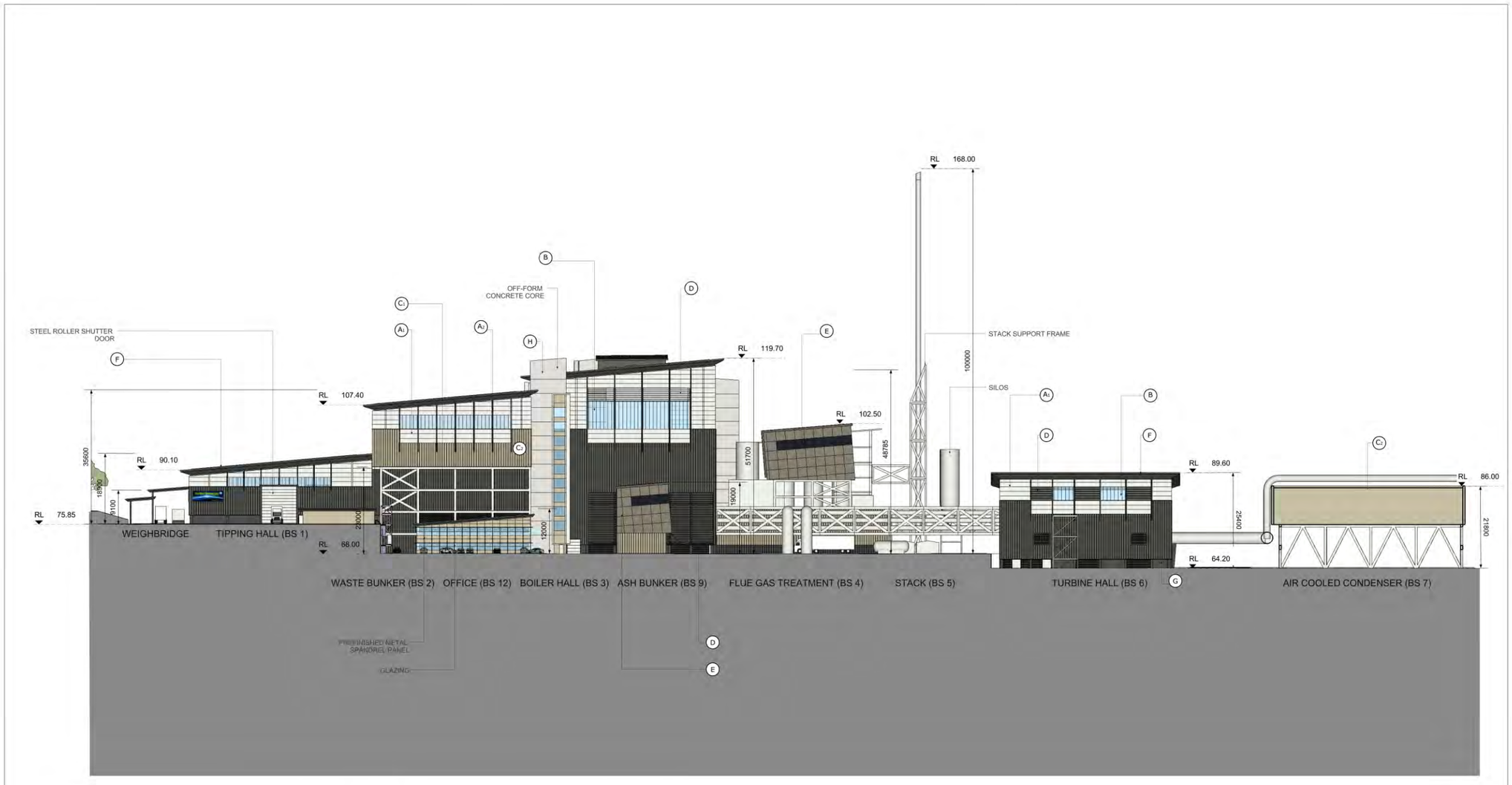
krikis tayler architects

100mm | 200mm | 300mm ON ORIGINAL



LEGEND

- A1 SILVER METALLIC 'ALUCOBOND' COMPOSITE METAL PANELS
- A2 DARK GREY METALLIC 'ALUCOBOND' SOFFIT LINING, FASCIA AND PROJECTING BLADES
- B BLUE 'DANPALON DP16' 16mm MULTICELL POLYCARBONATE GLAZING
- C VERTICAL PRE-FINISHED PROFILED METAL CLADDING COLORBOND COLOUR;
- C1 COLOUR: 'WOODLAND GREY'
- C2 COLOUR: 'COVE'
- C3 COLOUR: 'MONUMENT'
- D PRE-FINISHED METAL LOUVRES. SPECIFICATION IN ACCORDANCE WITH MECHANICAL AND ACOUSTIC ENGINEERING CRITERIA. POWDERCOAT FINISH TO MATCH COLORBOND 'WOODLAND GREY'
- E 'VITRA' PANEL OR SIMILAR. COLOUR: 'EARTH K115' WITH ACCENT COLOUR 'CHARRED FOREST M167'. POWDER-COATED AL. BOX SECTION BATTEN OVERLAY
- F FIELDERS HIKLIP 630 COLOUR: 'WOODLAND GREY' OR SIMILAR PREFINISHED ROOF DECKING ON FOIL-BACKED MINERAL WOOL INSULATION WITH SAFETY MESH SUPPORT
- G CONCRETE PUSH-WALL EXTERIOR PAINT FINISH TO MATCH COLORBOND 'MONUMENT'
- H 'KEIM' PAINT; 'ROYALAN' COLOUR 9590 @30% FINISH TO OFF-FORM CONCRETE CORE

THE NEXT GENERATION - ENERGY FROM WASTE FACILITY

EASTERN CREEK, SYDNEY

WEST ELEVATION

PRELIMINARY

DATE 20.02.2015
SCALE 1:500 @ A1

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PROJECT NO.	DRAWING NO.	ISSUE
2015	PS01	DRAFT

A1

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LEGEND

- (A1) SILVER METALLIC 'ALUCOBOND' COMPOSITE METAL PANELS
- (A2) DARK GREY METALLIC 'ALUCOBOND' SOFFIT LINING, FASCIA AND PROJECTING BLADES
- (B) BLUE 'DANPALON DP16' 16mm MULTICELL POLYCARBONATE GLAZING
- (C) VERTICAL PRE-FINISHED PROFILED METAL CLADDING COLORBOND COLOUR;
- (C1) COLOUR: 'WOODLAND GREY'
- (C2) COLOUR: 'COVE'
- (C3) COLOUR: 'MONUMENT'
- (D) PRE-FINISHED METAL LOUVRES. SPECIFICATION IN ACCORDANCE WITH MECHANICAL AND ACOUSTIC ENGINEERING CRITERIA. POWDERCOAT FINISH TO MATCH COLORBOND 'WOODLAND GREY'
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- (F) FIELDERS HIKLIP 630 COLOUR: 'WOODLAND GREY' OR SIMILAR PREFINISHED ROOF DECKING ON FOIL-BACKED MINERAL WOOL INSULATION WITH SAFETY MESH SUPPORT
- (G) CONCRETE PUSH-WALL EXTERIOR PAINT FINISH TO MATCH COLORBOND 'MONUMENT'
- (H) 'KEIM' PAINT: 'ROYALAN' COLOUR 9590 @30% FINISH TO OFF-FORM CONCRETE CORE

THE NEXT GENERATION - ENERGY FROM WASTE FACILITY

EASTERN CREEK, SYDNEY

EAST ELEVATION

PRELIMINARY

DATE 20.02.2015
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PROJECT NO.	DRAWING NO.	ISSUE
2015	PS02	DRAFT

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THE NEXT GENERATION

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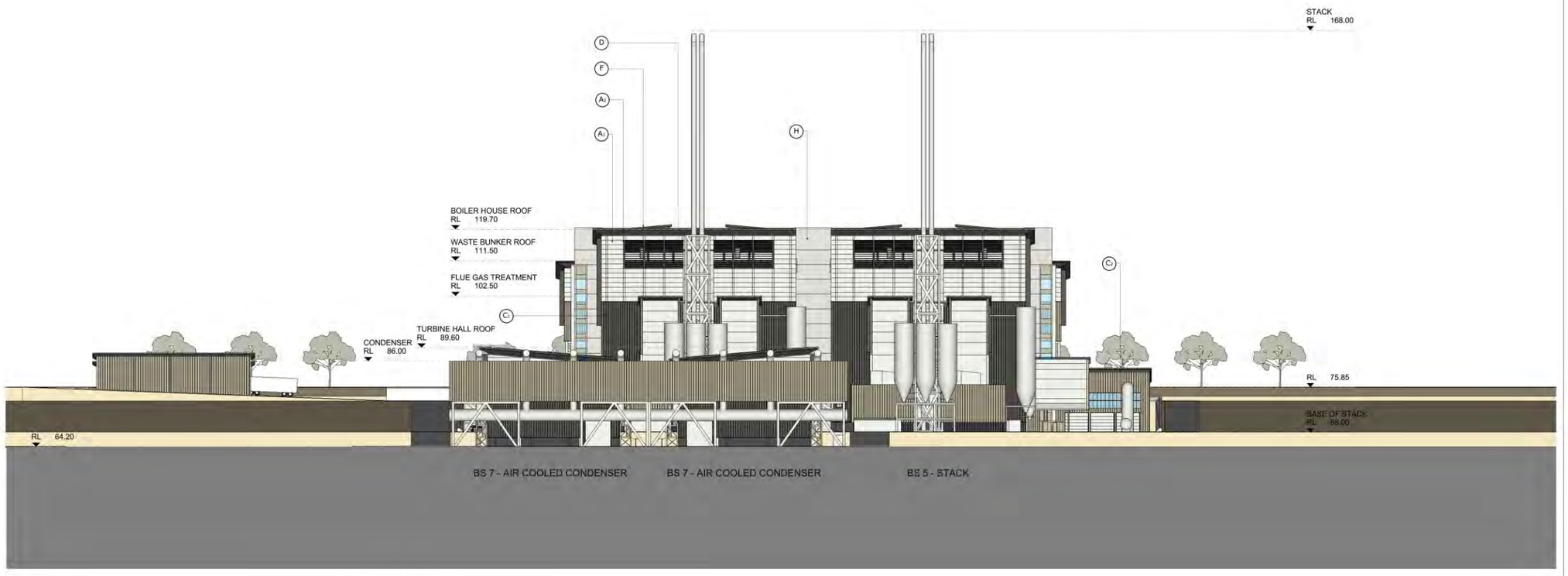

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THE NEXT GENERATION - ENERGY FROM WASTE FACILITY

EASTERN CREEK, SYDNEY

PRELIMINARY

DATE 20.02.2015
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PROPRIETOR

THE NEXT GENERATION

SOUTH ELEVATION

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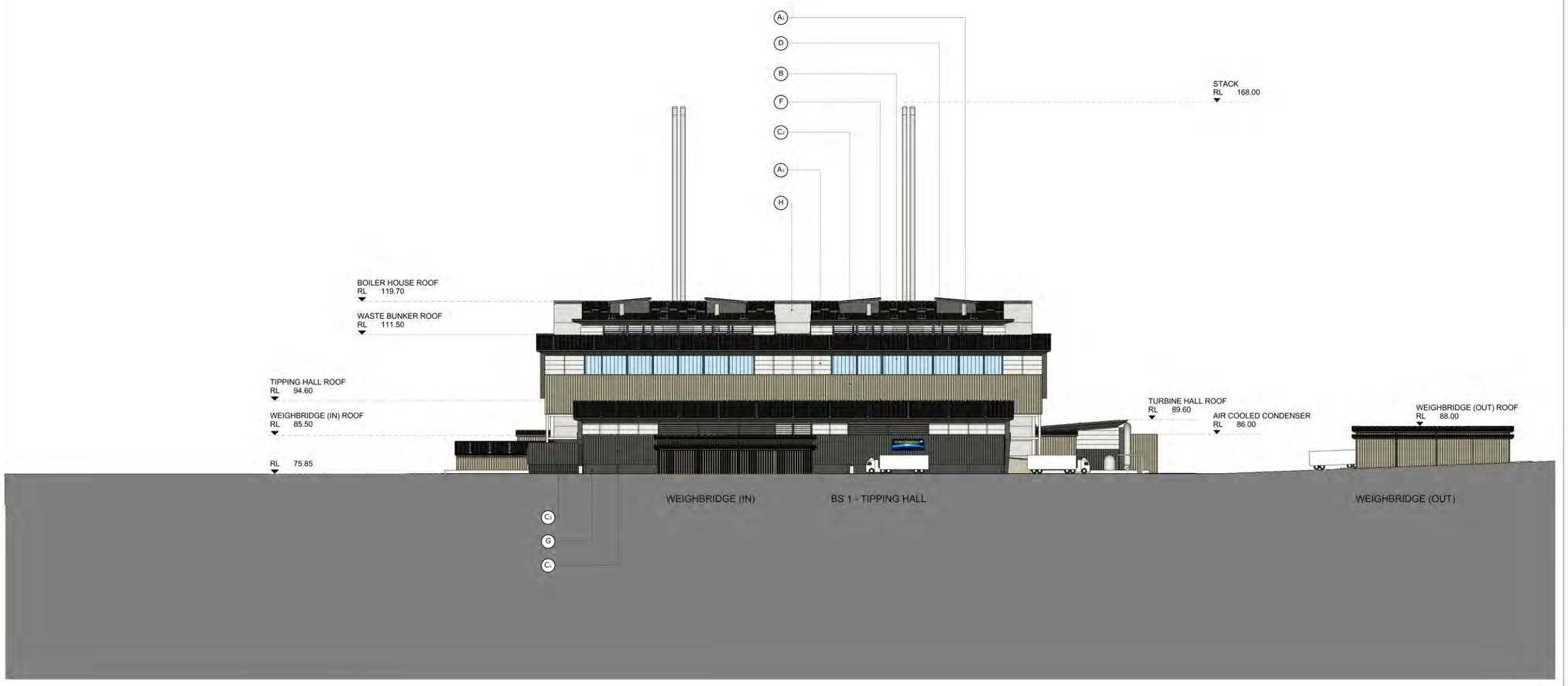

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THE NEXT GENERATION - ENERGY FROM WASTE FACILITY

EASTERN CREEK, SYDNEY

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DATE 20.02.2015
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NORTH ELEVATION

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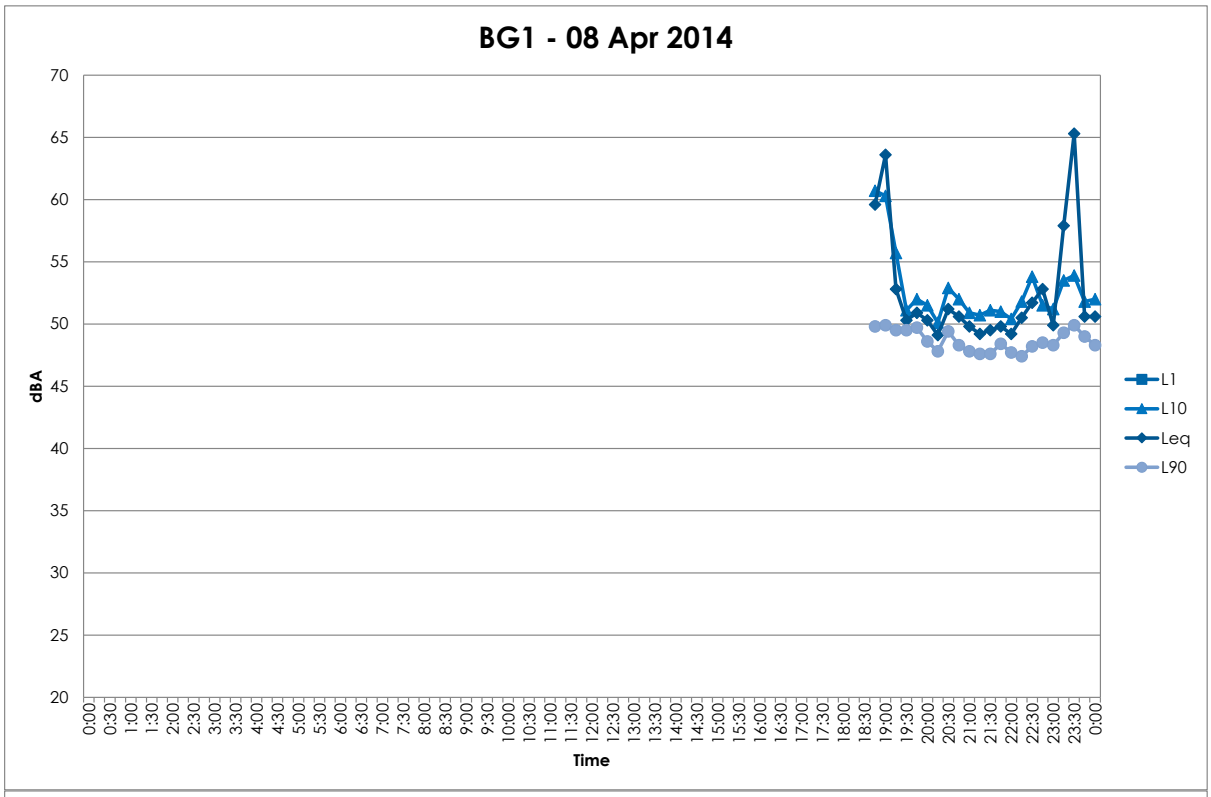
Appendix B NOISE MONITORING GRAPHS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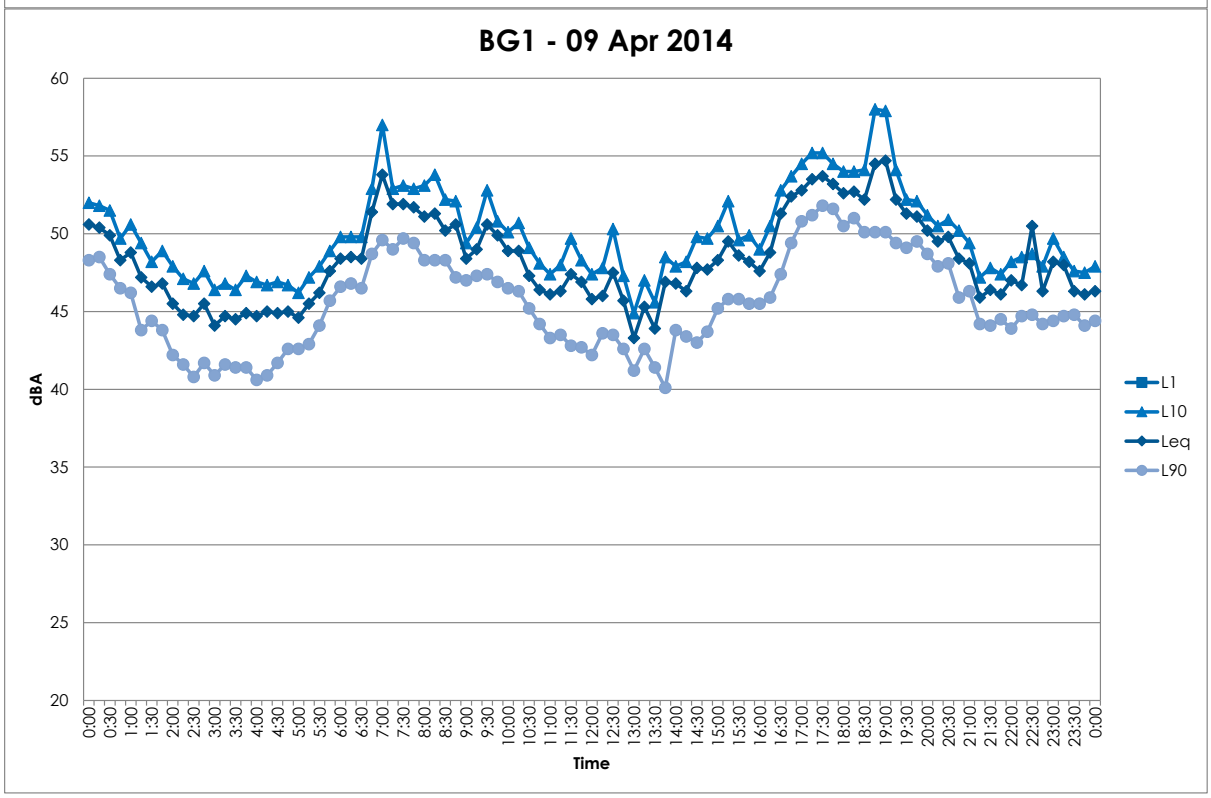
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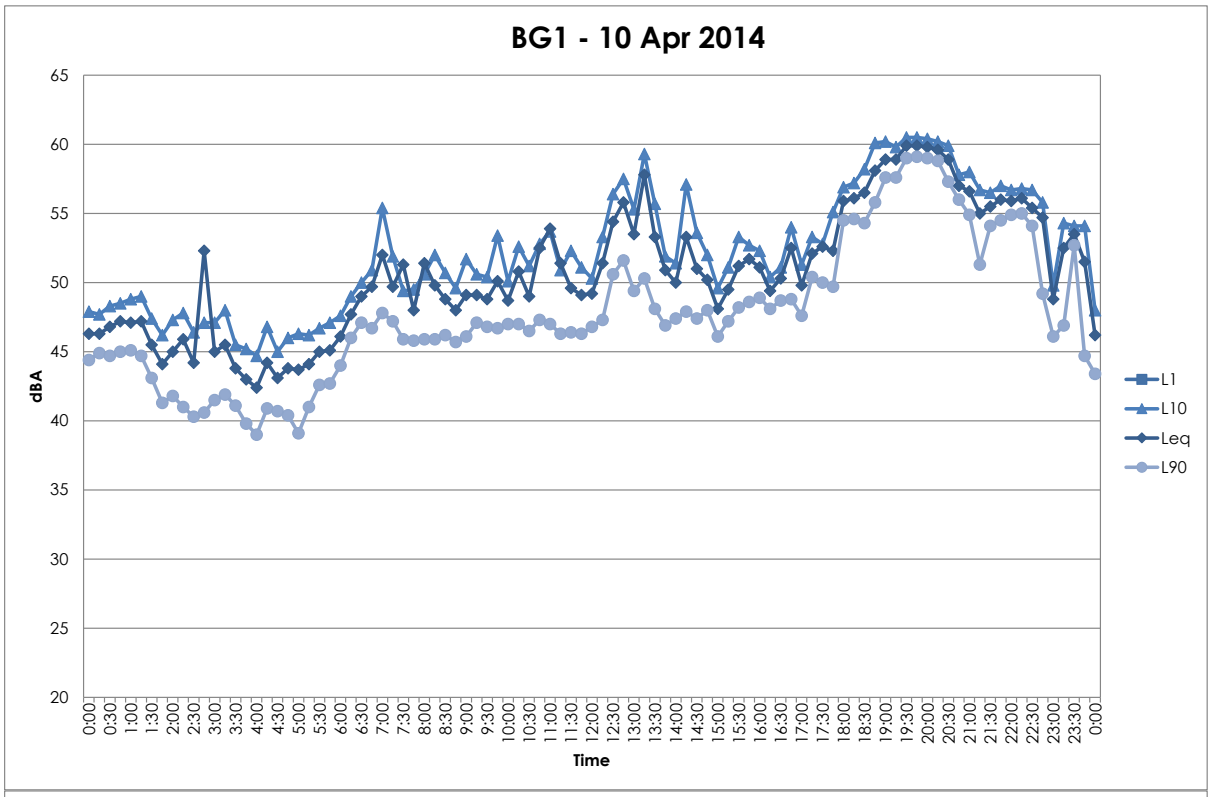
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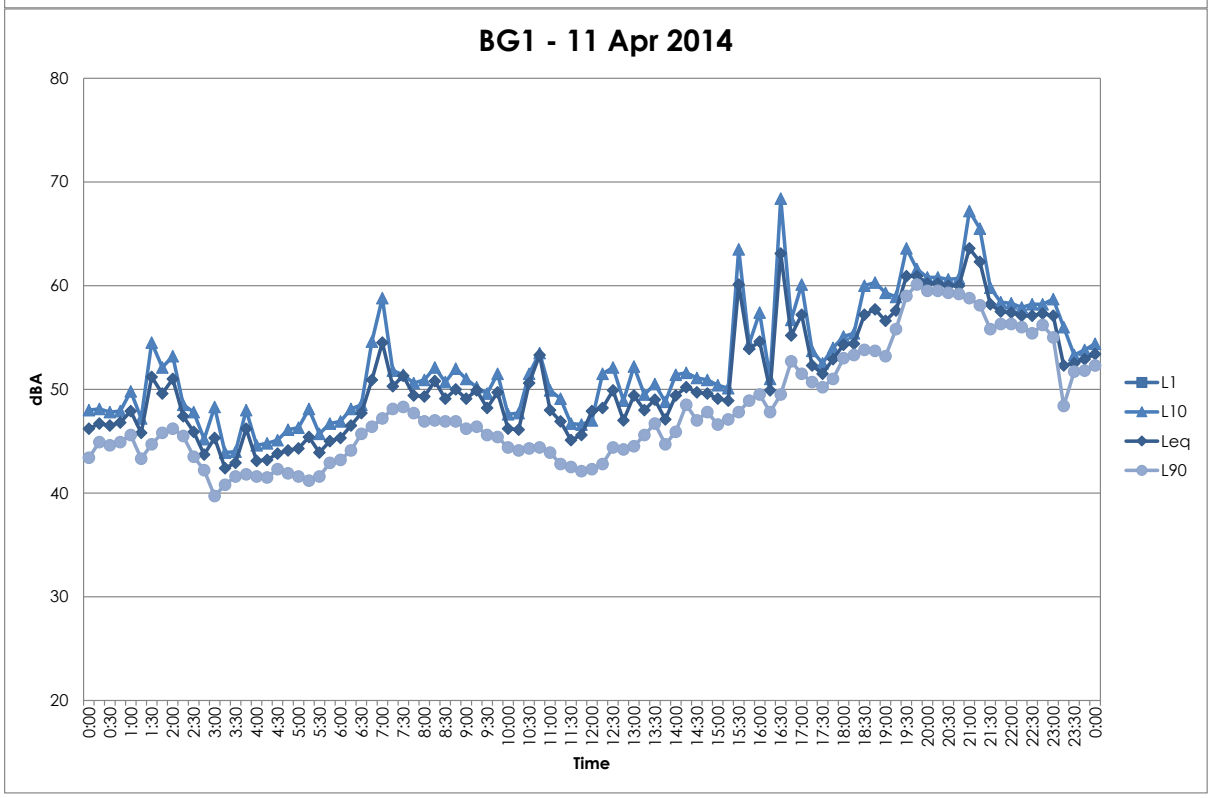
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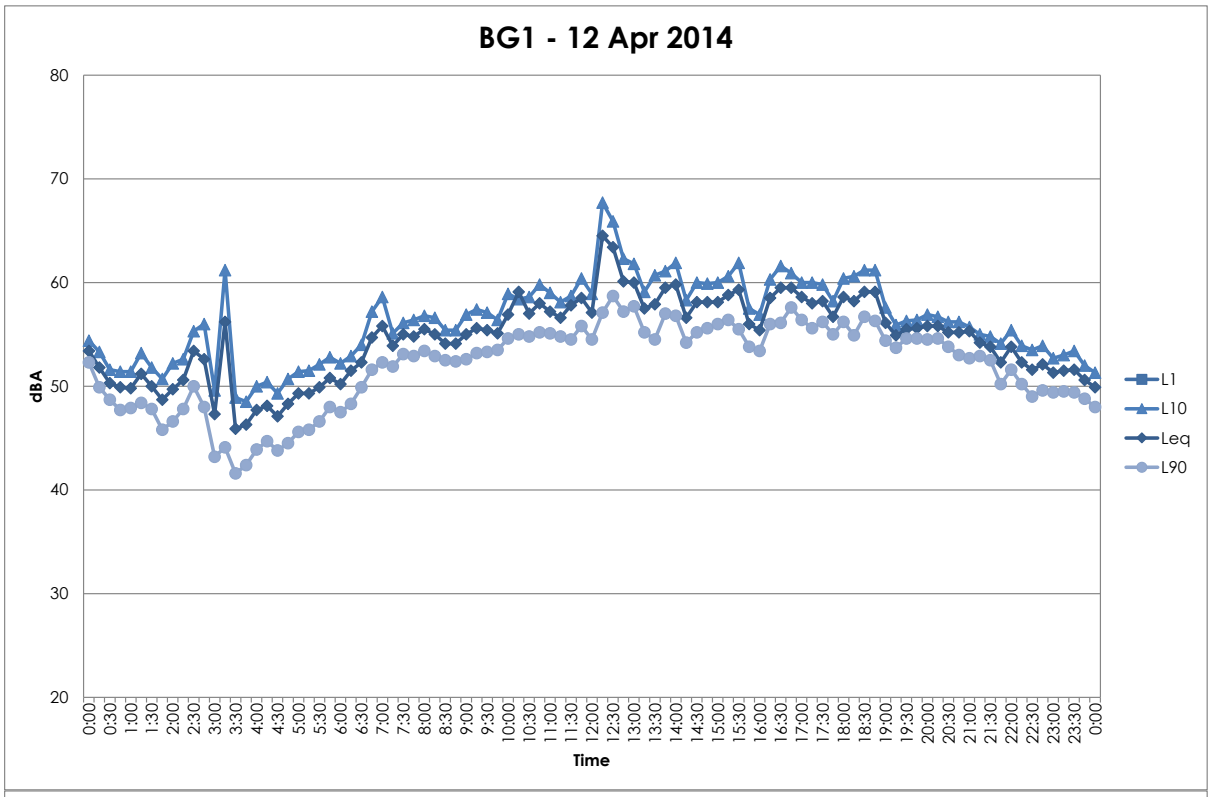
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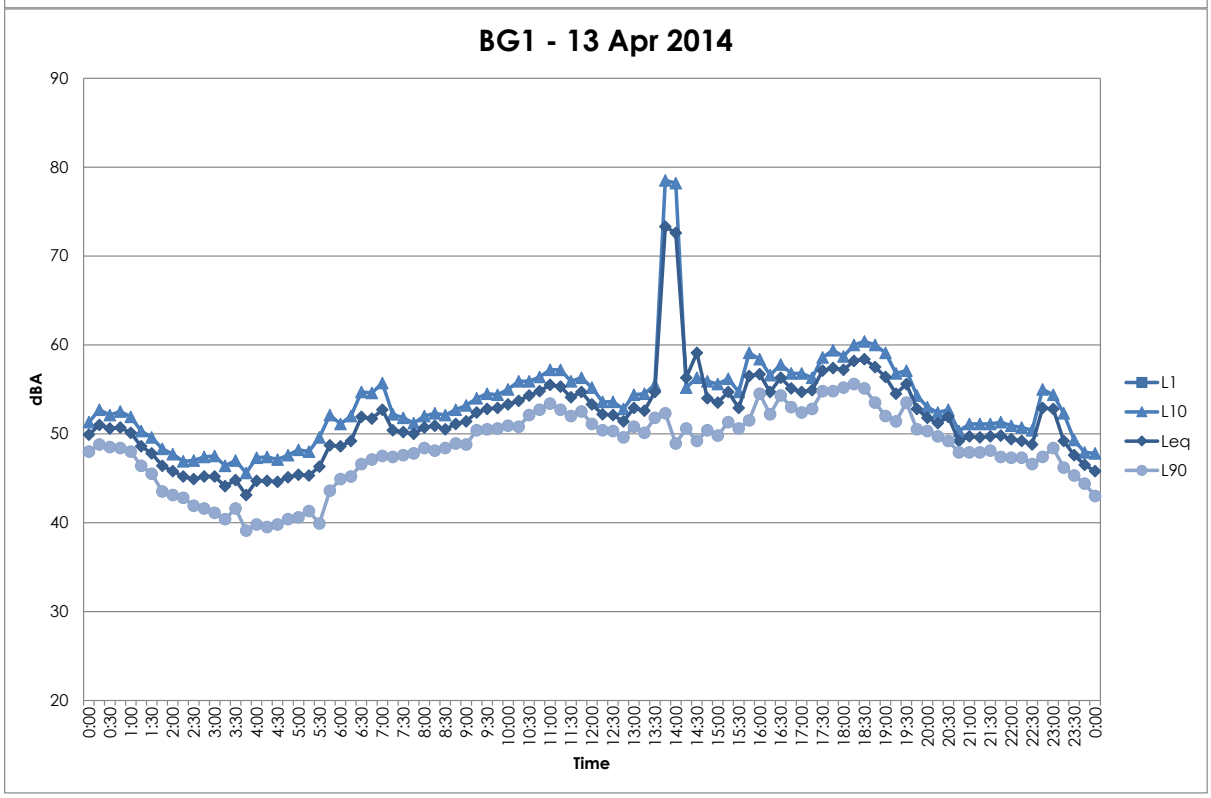
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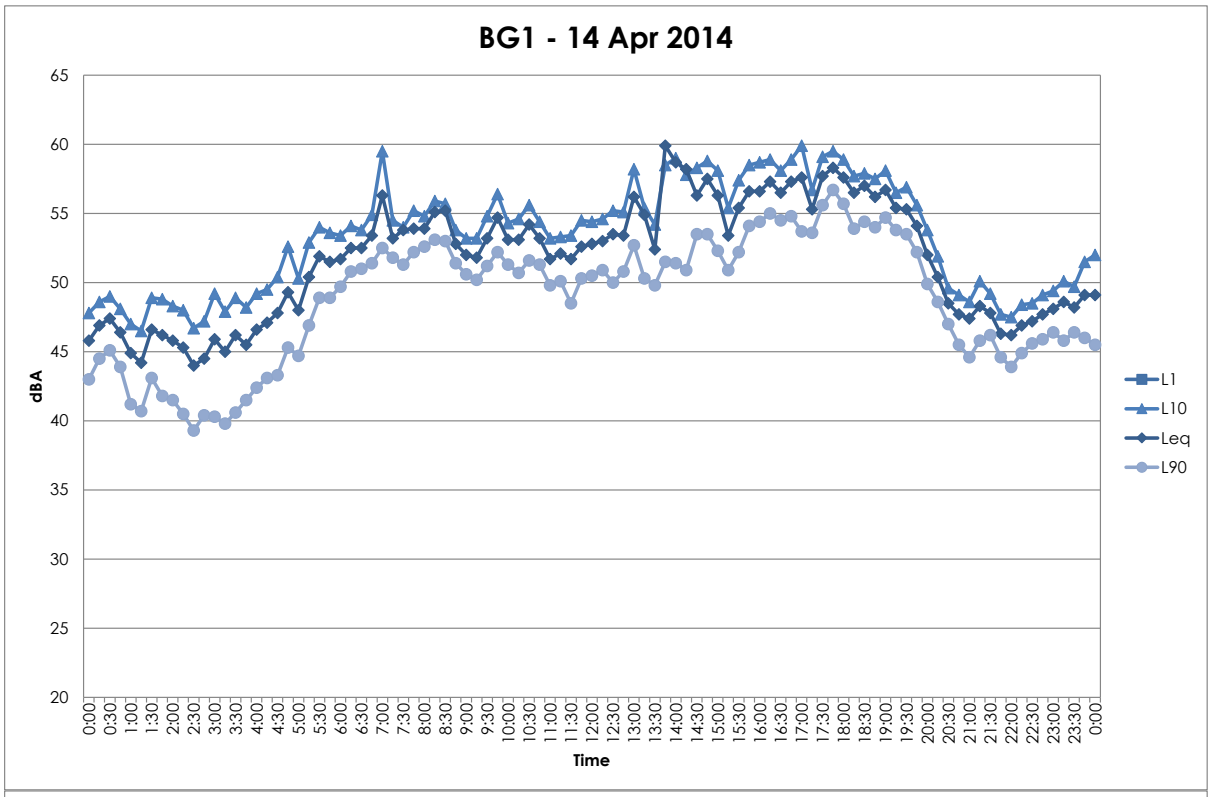
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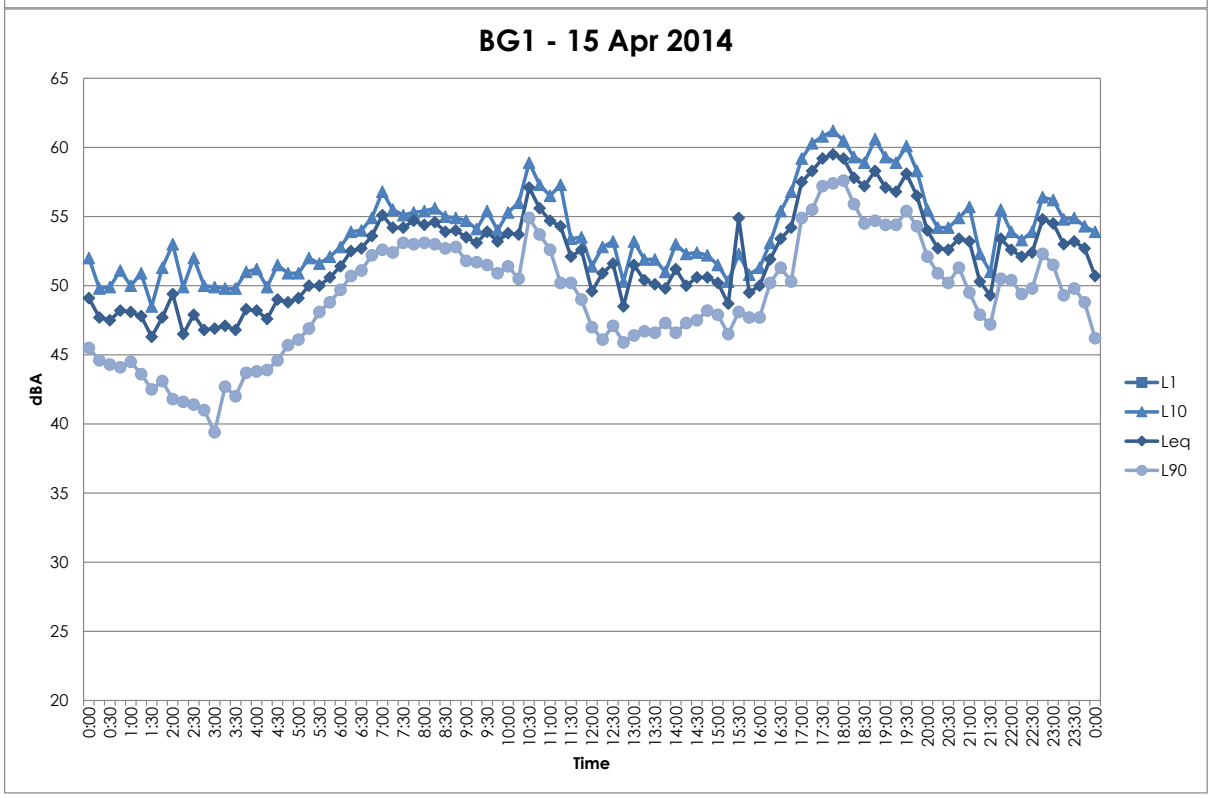
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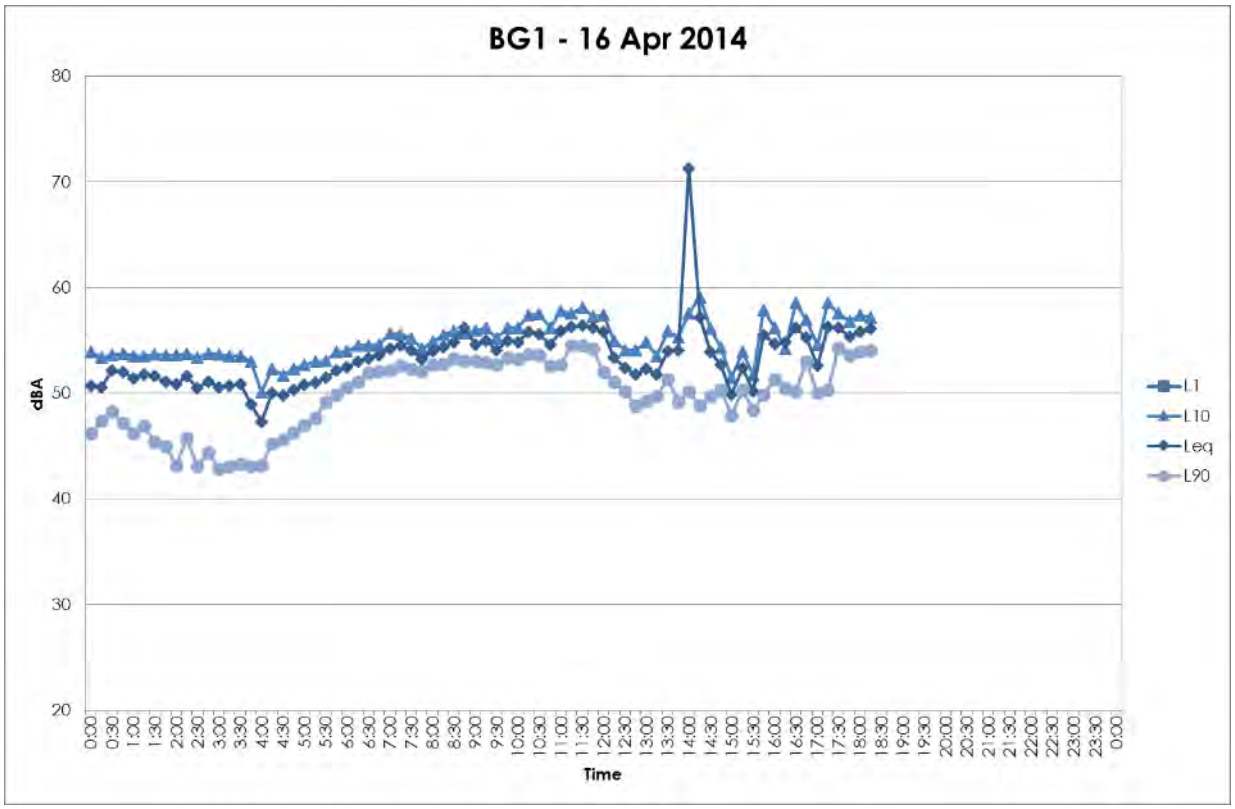

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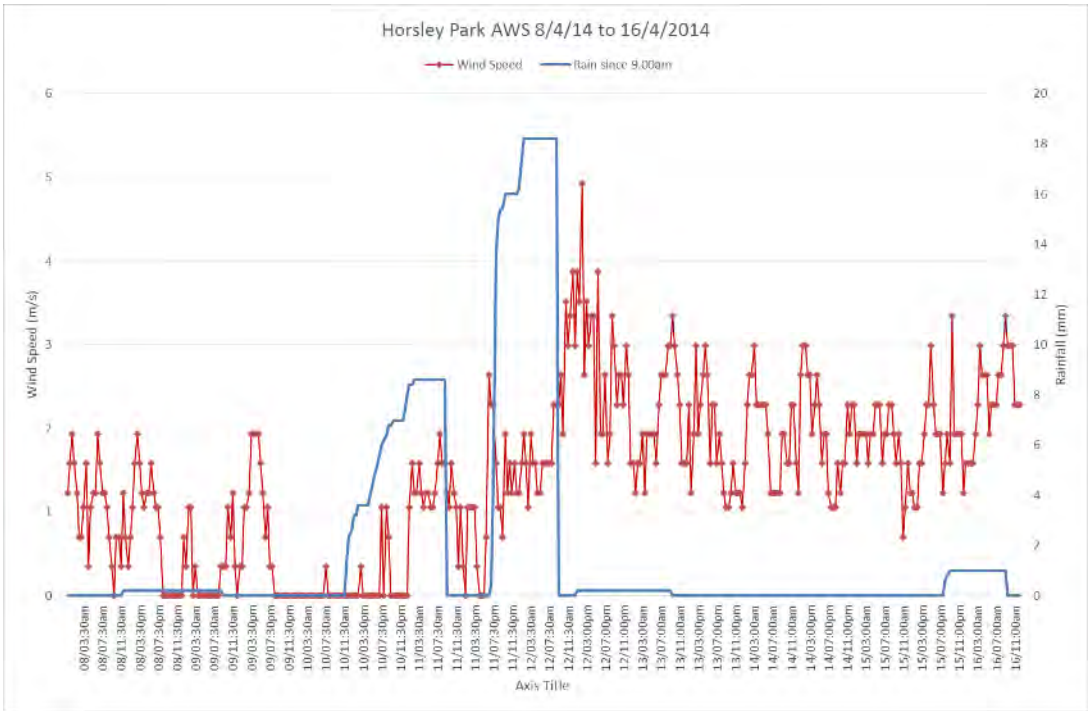
Period	RBL	7	8	9	10	11	12	13	14	15	16
Day	43	-	-	43	-	43	-	48	-	-	-
Evening	48	-	48	44	-	-	-	48	-	-	-
Night	41	-	41	40	41	44	40	41	-	-	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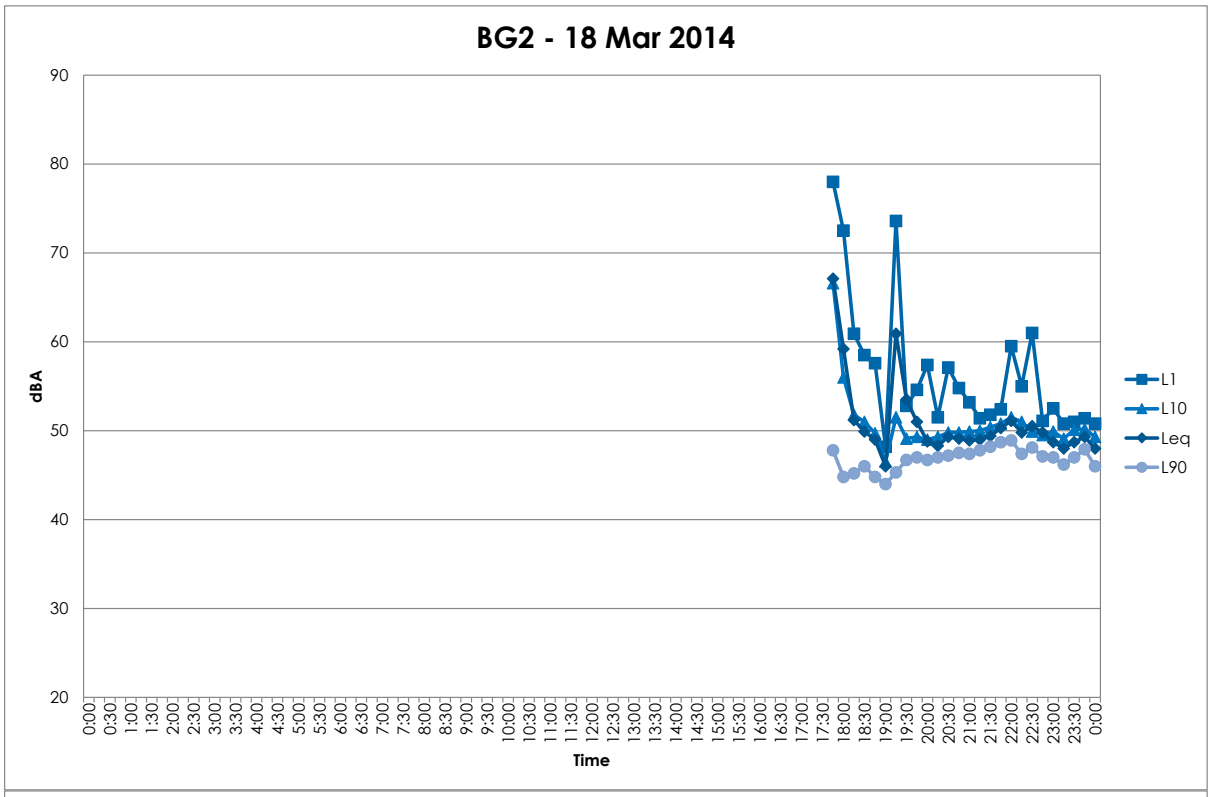
Wind Speed
Rain since 9.00am
Wind Speed (m/s)
Rainfall (mm)
Axis Title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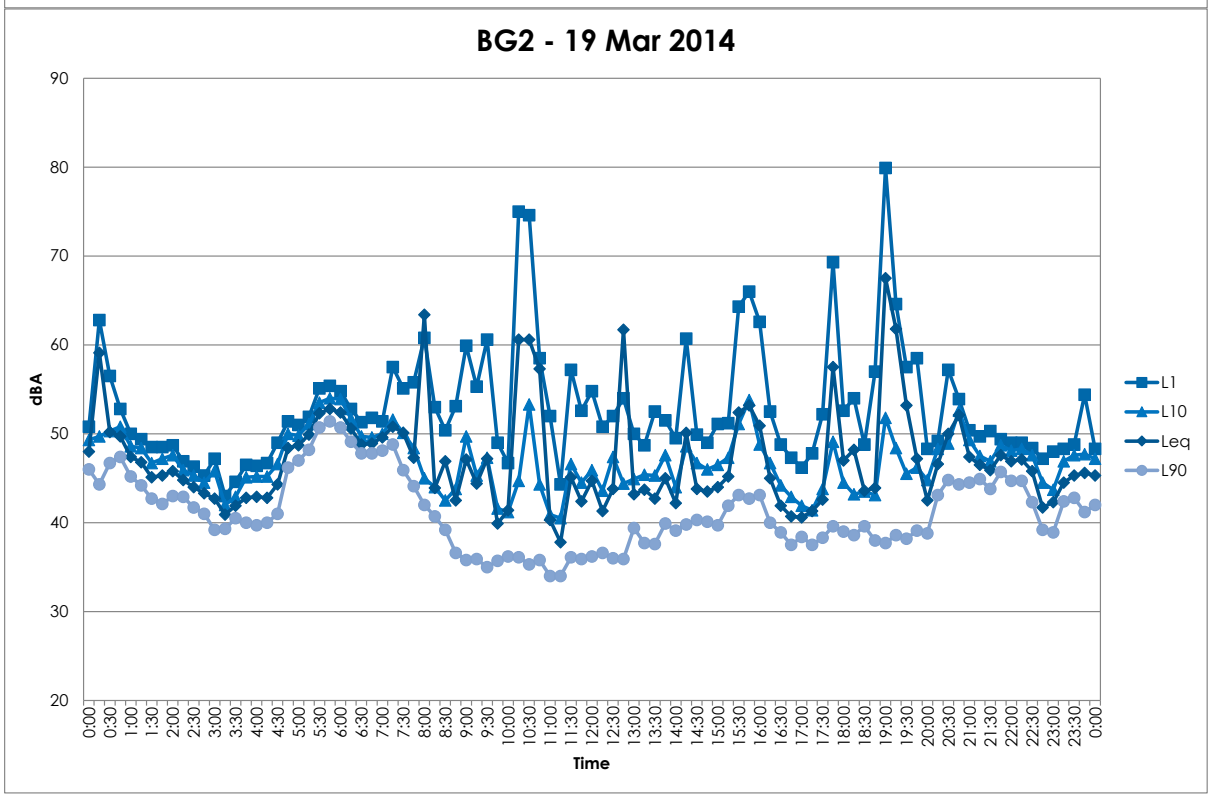
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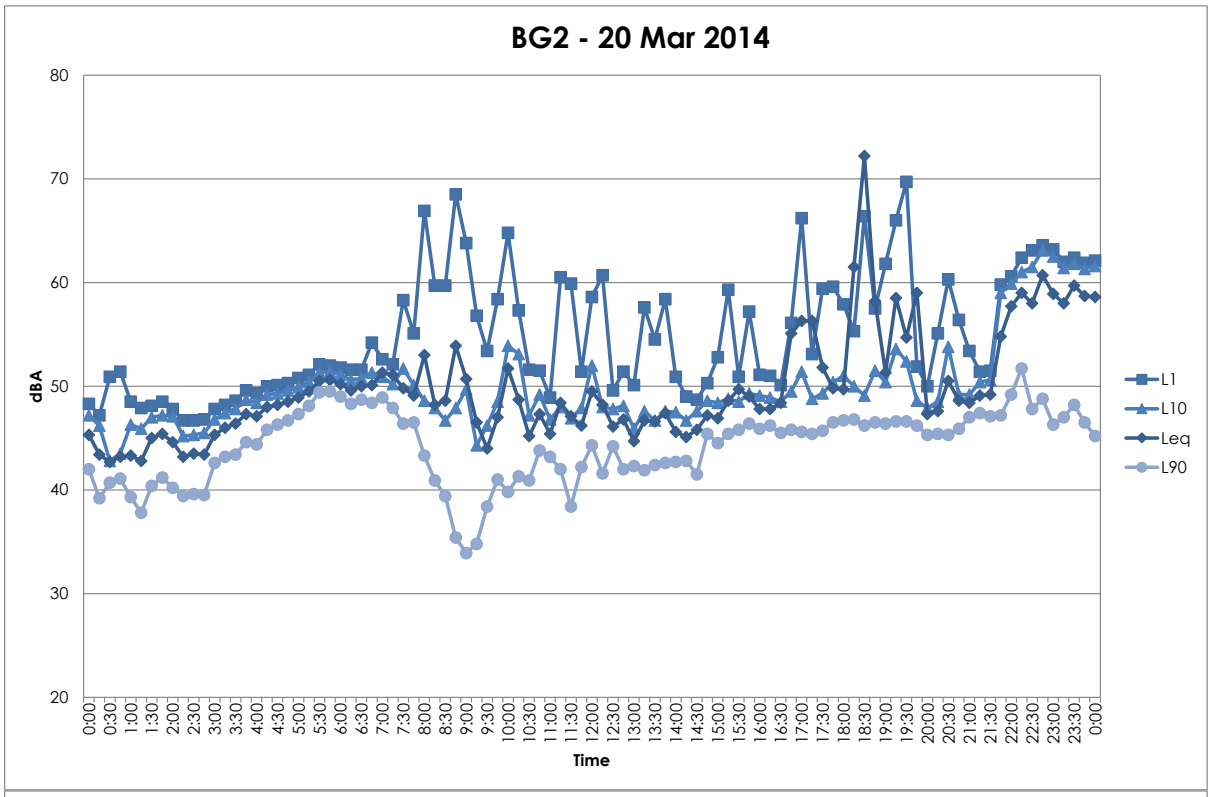
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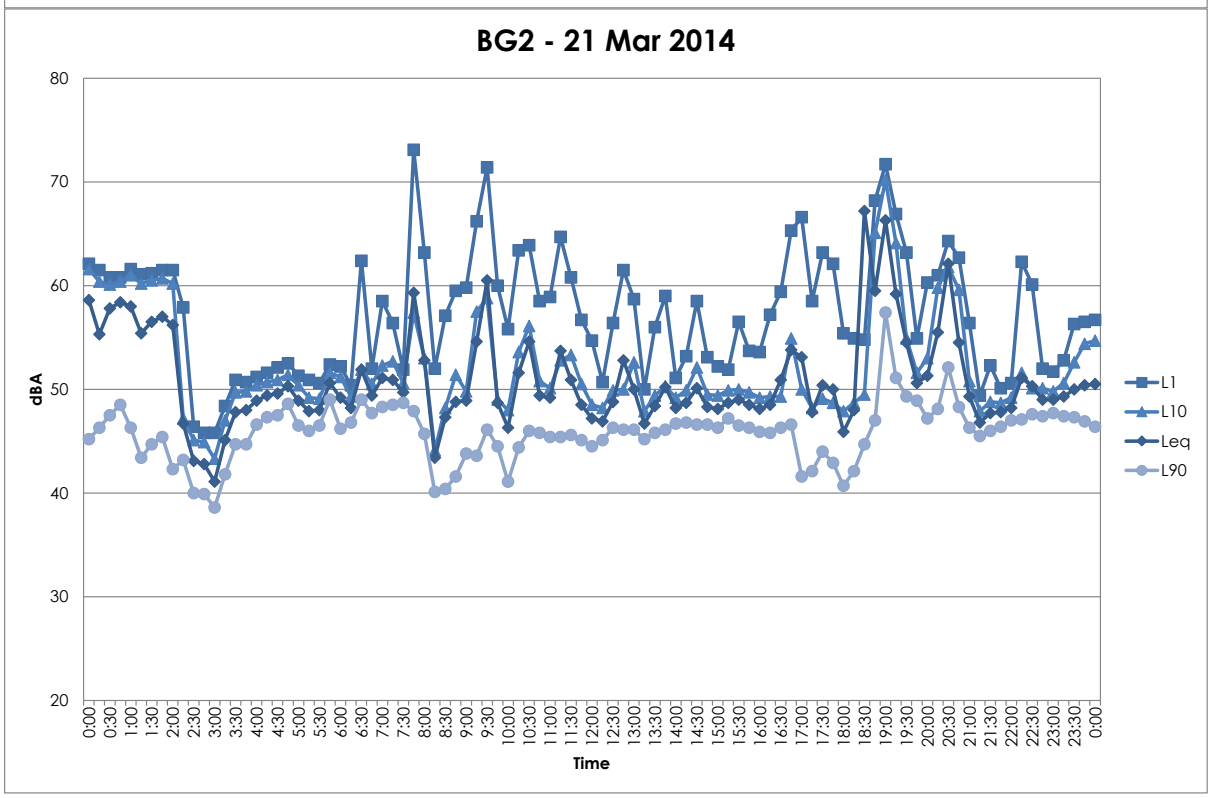
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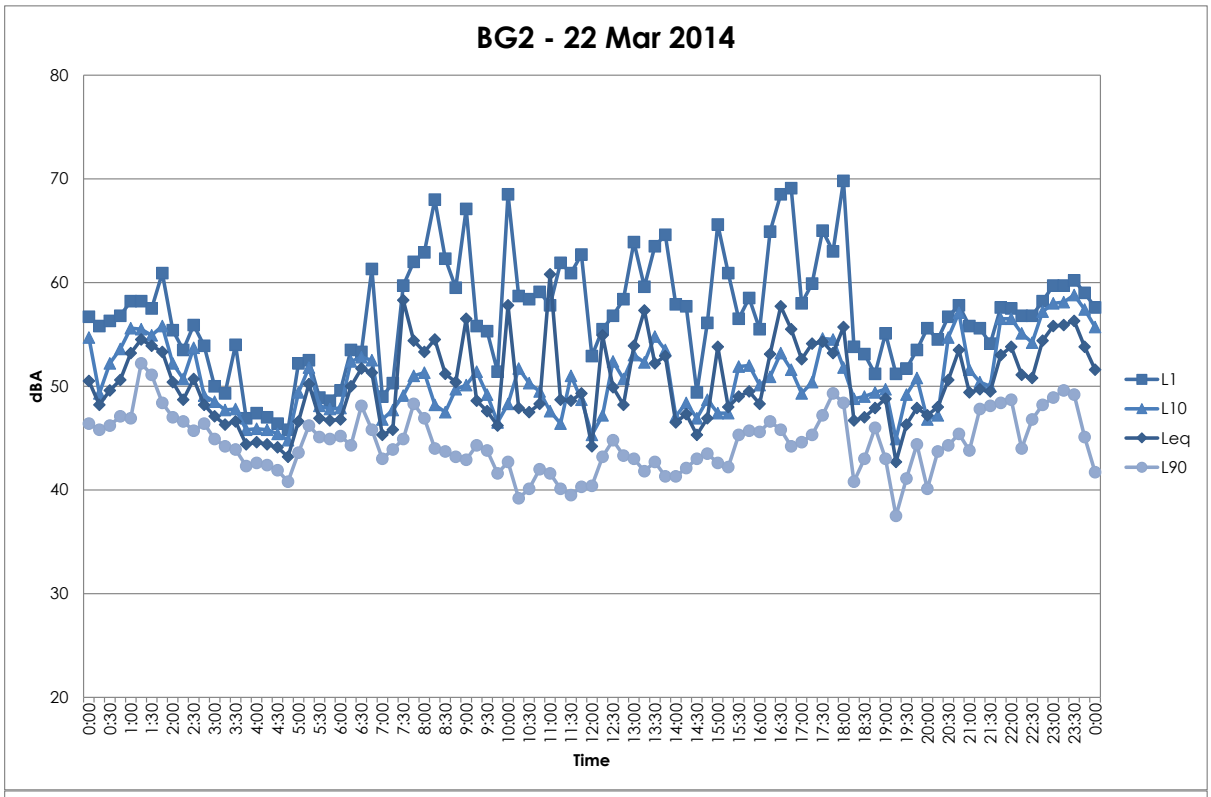
BG2 - 22 Mar 2014
dBA
Time
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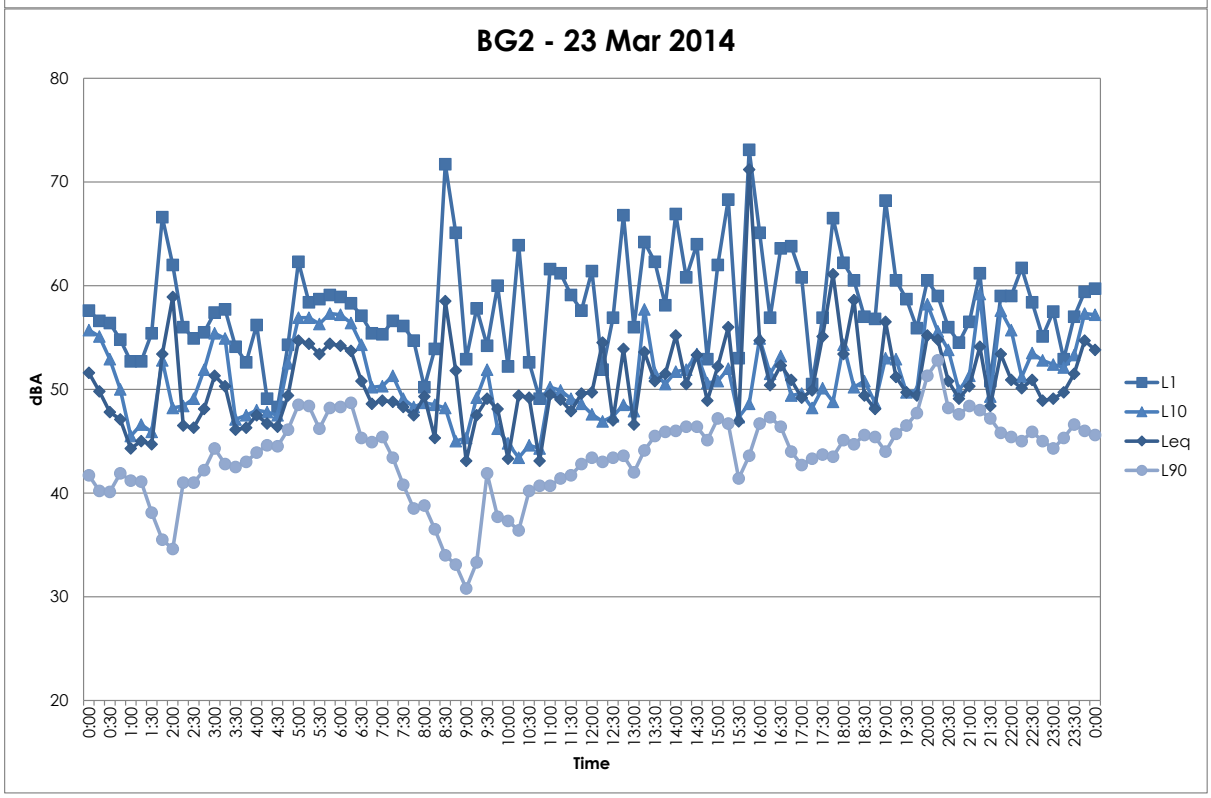
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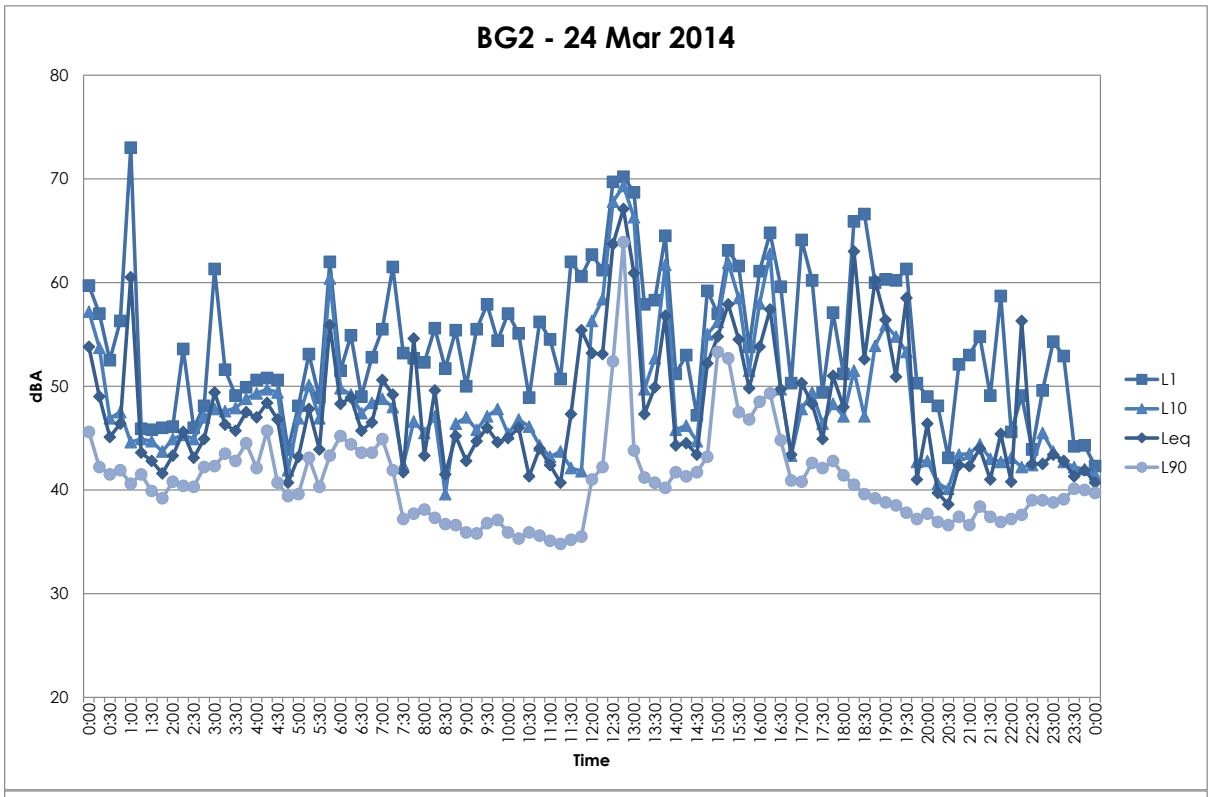
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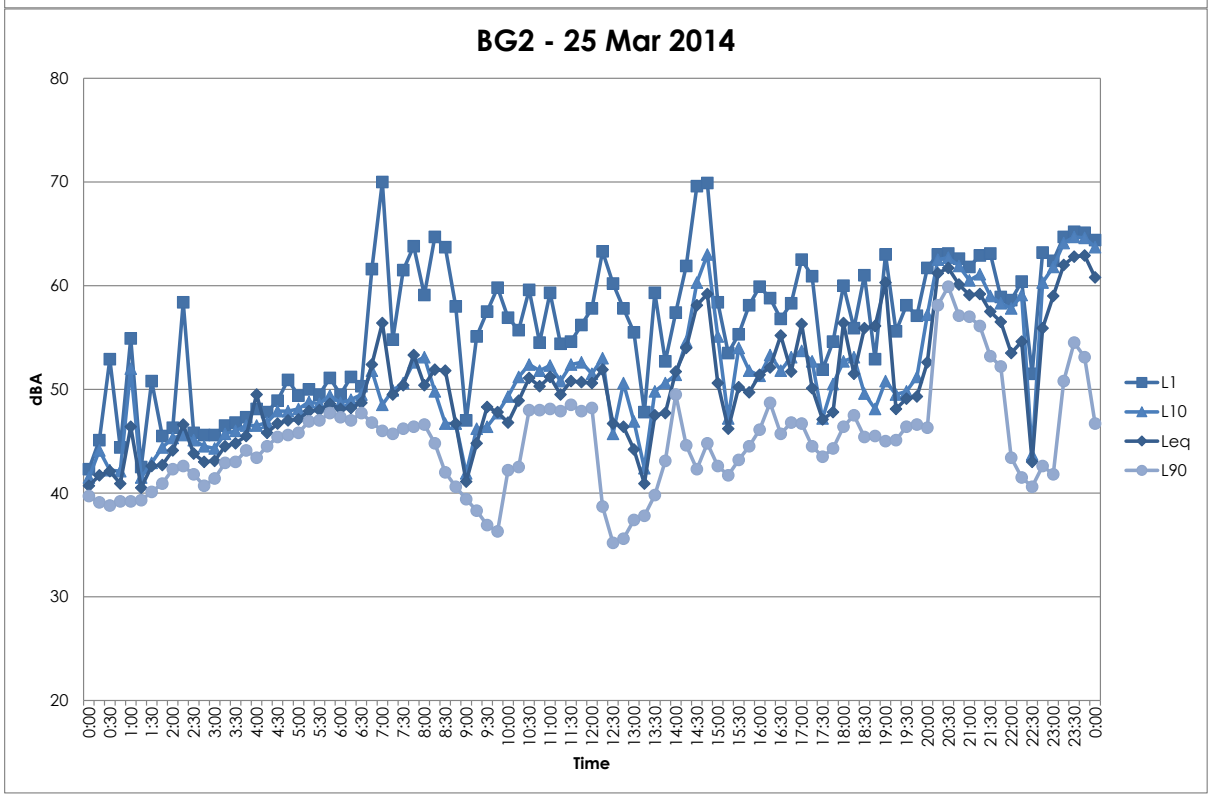
BG2 - 25 Mar 2014
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Time
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L10
Leq
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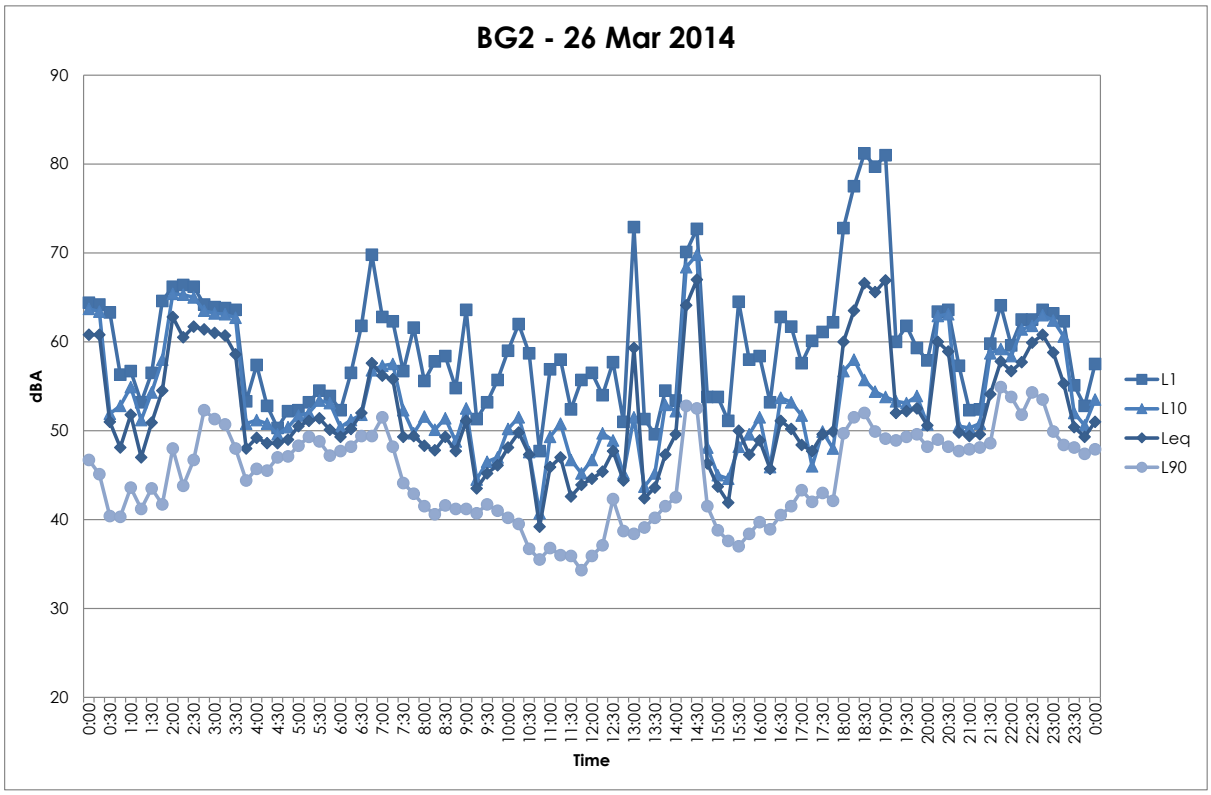
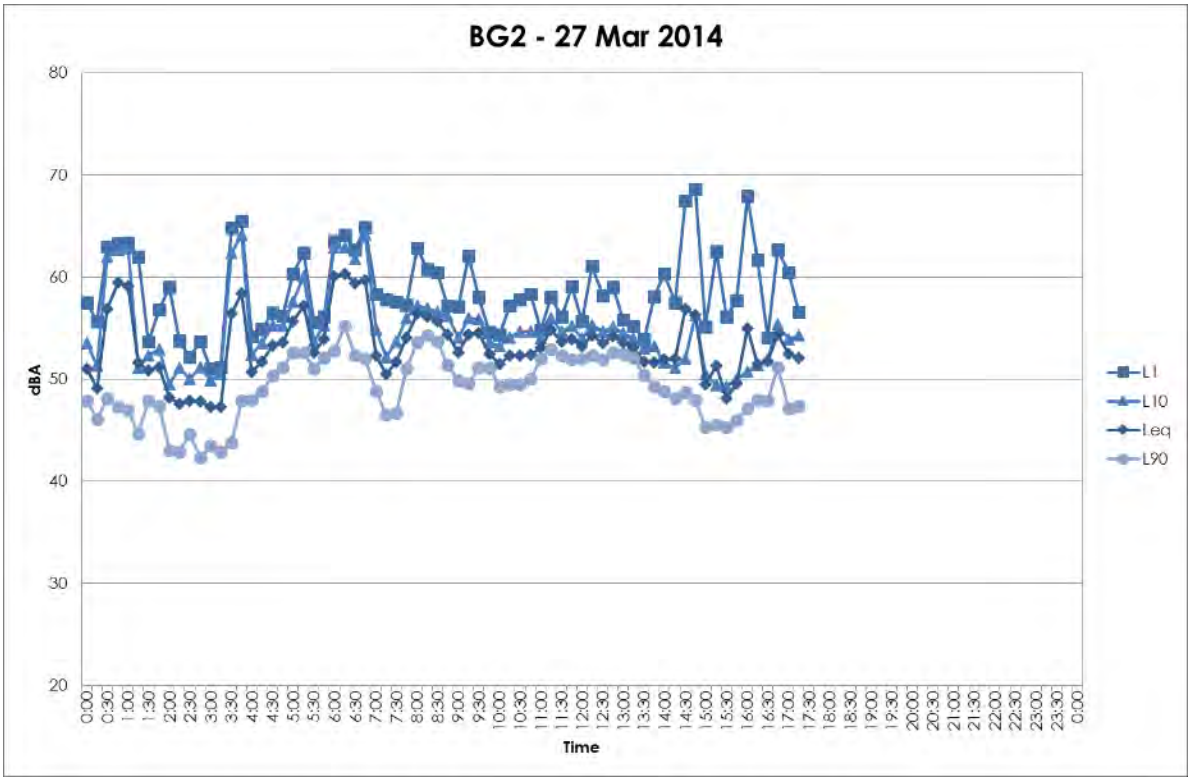
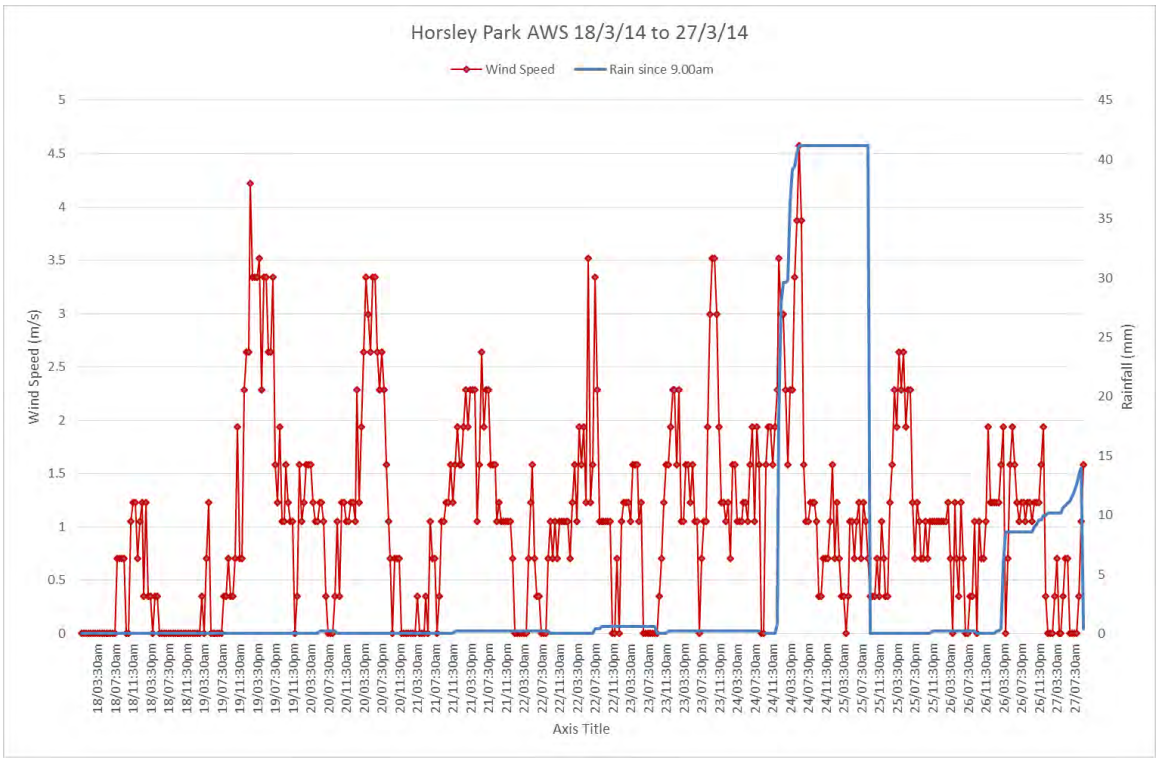
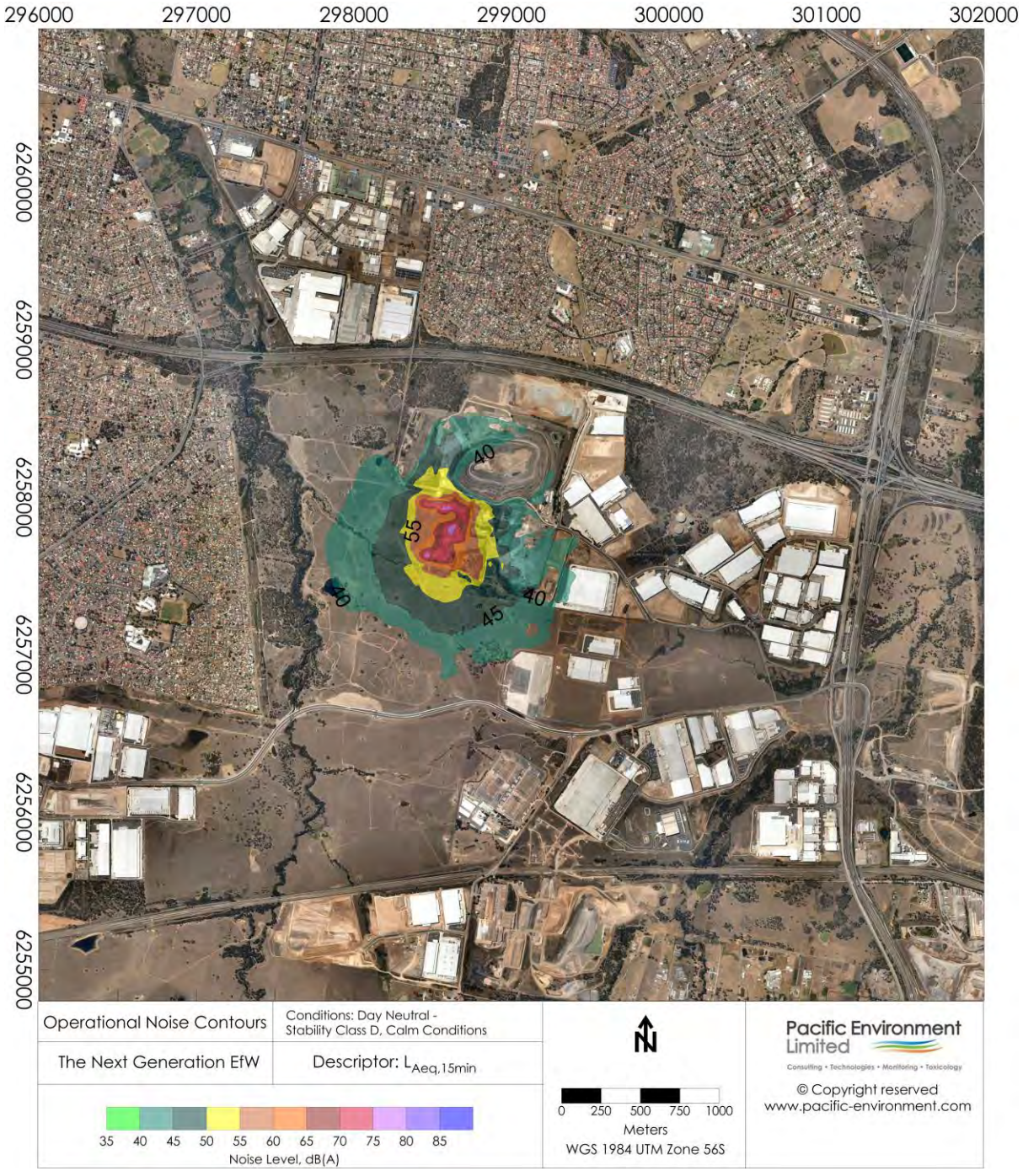

BG2 - 26 Mar 2014
dBA
Time
L1
L10
Leq
L90


BG2 - 27 Mar 2014
dBA
Time
L1
L10
Leq
L90

BG2		ABL by Day `(March 2014) dB(A)										
Period	RBL	17	18	19	20	21	22	23	24	25	26	27
Day	37	-	-	35	39	41	40	35	-	37	36	-
Evening	44	-	45	35	44	45	37	45	36	40	48	
Night	35	-	37	35	34	33	29	33	37	36	-	



Appendix C OPERATIONAL NOISE CONTOURS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Operational Noise Contours
Conditions: Day Neutral - Stability Class D, Calm Conditions
The Next Generation EfW
Descriptor: $L_{Aeq,15min}$
35 40 45 50 55 60 65 70 75 80 85
Noise Level, dB(A)
N
0 250 500 750 1000
Meters
WGS 1984 UTM Zone 56S
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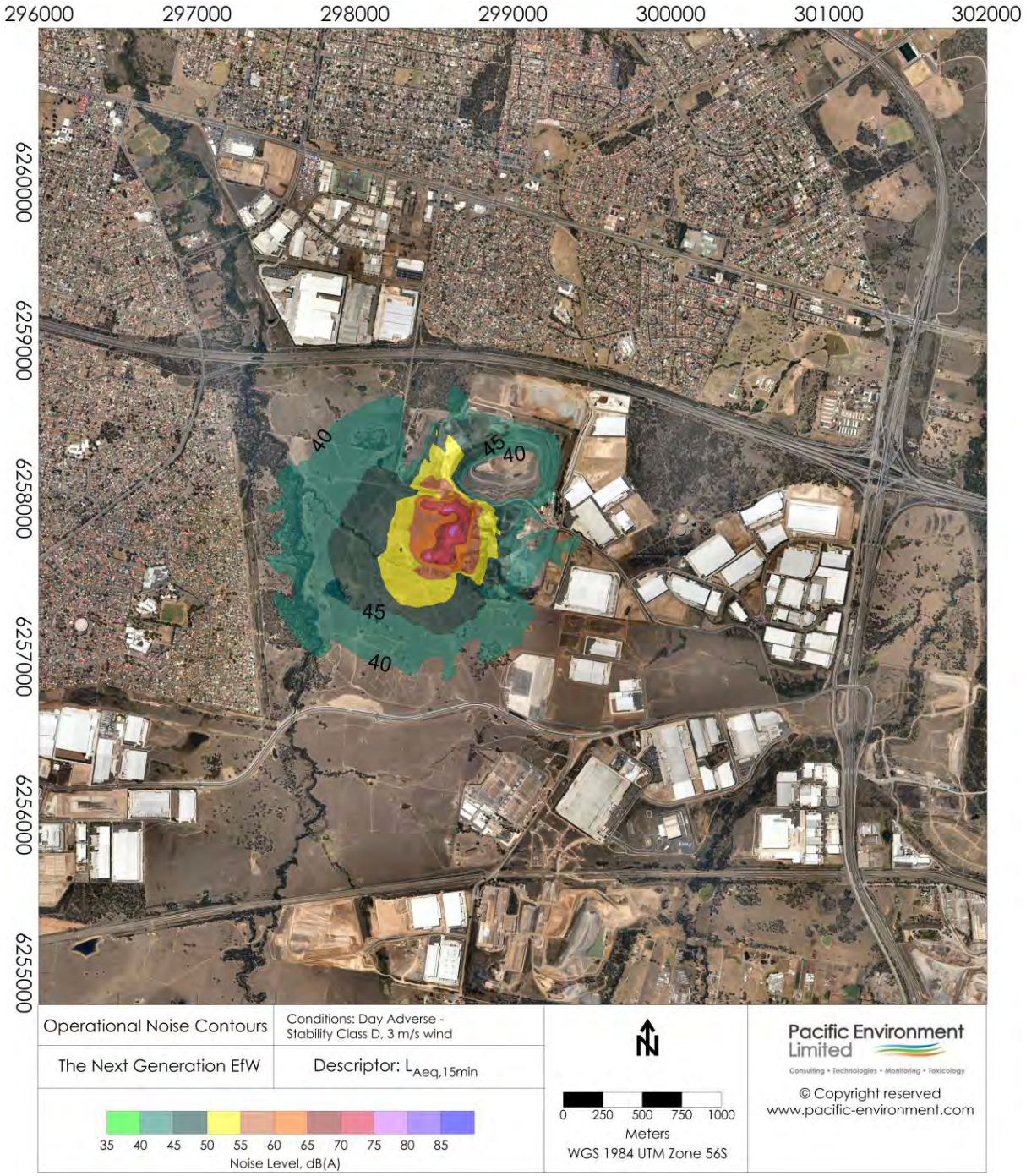
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Operational Noise Contours
Conditions: Day Adverse - Stability Class D, 3 m/s wind
The Next Generation EfW
Descriptor: $L_{Aeq,15min}$
35 40 45 50 55 60 65 70 75 80 85
Noise Level, dB(A)
N
0 250 500 750 1000
Meters
WGS 1984 UTM Zone 56S
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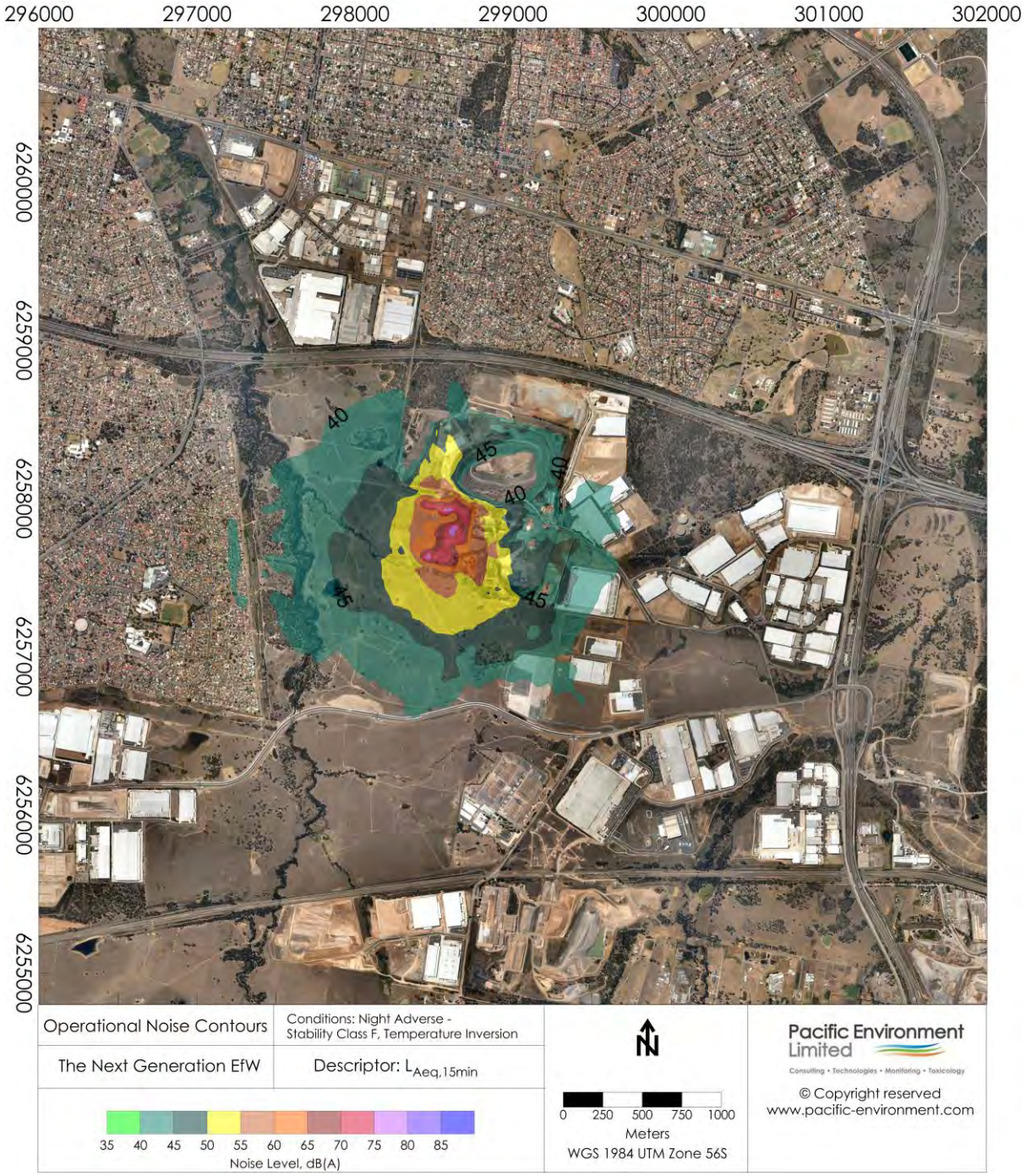
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45
Operational Noise Contours
Conditions: Night Adverse - Stability Class F, Temperature Inversion
The Next Generation EfW
Descriptor: $L_{Aeq,15min}$
35 40 45 50 55 60 65 70 75 80 85
Noise Level, dB(A)
N
0 250 500 750 1000
Meters
WGS 1984 UTM Zone 56S
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Appendix D OPERATIONAL NOISE MANAGEMENT

1 OBJECTIVES

The objective of this management plan is to provide a framework and protocols to minimise the risk of adverse noise impacts during the operation of the Eastern Creek EFW Facility.

This framework is to be updated following further details and confirmation of operational details once the development is finalised.

2 GUIDELINES AND STANDARDS

The following guidelines and standards should be used to support the implementation of a noise management plan.

- AS 1055 Acoustics – Description and measurement of environmental noise.
- Industrial Noise Policy (INP), EPA, 2000.
- INP Application Notes, EPA 2006.

3 POTENTIAL NOISE ISSUES

The significant noise sources with potential to cause issues during the normal operation of the facility are as follows:

- Operation of vehicles and mobile plant including:
  - Fuel delivery trucks
  - Fuel delivery trucks dumping material
  - Loading of ash residues
  - Manual handling of materials (dropping and dragging)
  - Reversing alarms
- Breakout noise from buildings
- Fixed plant noise emission, including:
  - Air cooled condensers
  - Transformers
  - Safety valves
  - Compressors
  - ID and exhaust fans
  - High pressure steam lines

4 NOISE CONTROL PRACTICES

Noise control practices can be categorised into three areas of control: control at source, path or receiver. This hierarchy of control states that the most effective method of control is at the source, followed by interruption of the noise transmission path, while controls at the receiver are the least effective approach.

The three control types can involve using both engineering and administrative methods. The most appropriate control method should be determined based on site specific constraints.

Feasible and practical noise control measures should be implemented where noise levels are determined to be above the criteria. In this case, it is predicted that noise levels are not expected to exceed the operational noise criteria.

To ensure noise levels do not exceed the predicted levels, the following noise management principles are proposed:

- All equipment should be properly maintained in accordance with the manufacturer's specifications.
- All equipment should be operated in the appropriate manner.
- Maintaining site roads in good order to minimise the risk of rattling and other attributes associated with heavy vehicles on uneven roads.
- Where possible, the tipping hall doors should be closed when access is not required.
- All on site mobile plant and trucks should be fitted with broadband or smart reversing alarms, where practical.
- Where possible, arranging loading of ash residues to times where the community is less sensitive including during the day time.
- Where practical arrange for trucks to access the site during times when the community is less sensitive.
- Minimise the use of engine/compression brakes on site.
- Carry out materials handling and processing within buildings where possible.
    - Where this is not possible, minimise dropping and scraping of materials on the ground.
- Buildings openings such as doors or shutters should remain closed when not in use.
- All buildings and enclosures are to be maintained to preserve their acoustic performance.
- All equipment should be designed and tested to meet the required internal or external noise levels to satisfy environmental noise goals.
- Carrying out maintenance work on noisy plant with the potential to generate noise impacts to be carried out away from sensitive receivers or to use buildings to shield noise.
- Where noisy maintenance is required, it should be scheduled to occur during periods when receivers are less sensitive, such as during the daytime.

For heavy vehicles accessing the site, the following measures are recommended:

- Ensure all trucks are in good working order and comply with the relevant noise emissions standards by checks and regular inspection.
- Operations should be designed to minimise reversing on site.
- Keep to speed limits on public roads and onsite.
- Where possible, driving of trucks should minimise:
    - Heavy acceleration and braking.
    - Engine/compression braking (especially during the evening and night).
    - Reversing using tonal alarms, where feasible.

5 TRAINING AND AWARENESS

Education and training of site staff is necessary for satisfactory implementation of noise management principles. Education and training strategies should focus on:

- Site awareness training / environmental inductions that include a section on noise management awareness.
- Ensuring plant and equipment is well maintained and not making excessive noise by checks and regular inspections.
- Ensuring that loading and unloading operations are conducted in a proper manner by periodic inspection and education of appropriate loading techniques and locations.
- Turning off machinery when not in use.
- Awareness of noise sensitive driving techniques.

6 COMPLAINTS HANDLING PROTOCOL

Response procedures will be activated by adverse noise impacts at a neighbouring property. The knowledge of noise problems will normally arrive from two sources:

- Community complaints from neighbouring landholders who contact the site when a perception of high noise levels exists.
- Observations from staff and management.

In situations where noise emission levels are perceived by neighbouring landholders or site personnel to be a problem, the following procedure must be undertaken when receiving, handling, responding to and reporting community complaints:

- An onsite manager is to investigate the situation to determine the possible source of the noise.
- Where a problem source is found, the method of operation is to be altered, or controlled, or if possible the source is to be modified to reduce the impact.
- Monitoring of noise levels at the complainant's property may be required if a noise source cannot be readily identified, or if the complainant is not satisfied with the corrective action.
- Any corrective action is to be recorded and reported to the onsite manager, who is to keep a record of all significant actions.
- The onsite manager must be informed of any complaint and details must be recorded in the complaint register.
- The onsite manager must notify potentially affected receivers if observations from staff and management indicate that the noise criteria are likely being exceeded due to the activities carried out on site. Affected receiver will be notified of exceedances and the source of the impact in writing within 48 hours of detection and verification.

A phone line should be maintained off-site during the hours of operation. All complaints will be logged, noting the nature of the complaint and the time and date of the complaint. Prompt response to the community's concerns is imperative to maintaining good relations with the community. Also, it is important to maintain community relations by informing neighbours of on-site activities, especially in times of extra ordinary activities.

7 NOISE MONITORING

7.1 Purpose

Noise monitoring is to be carried out to establish the noise emission level of the facility at sensitive receptors and determine compliance.

In the event of a noise complaint received from the community and during the initial stage of the development's operation, compliance noise monitoring is to be conducted. Noise will be monitored at the most critical time of day near the complainant and near the identified source of the impact.

7.2 Personnel

All attended noise monitoring is to be carried out by an independent and appropriately qualified noise specialist. Records of routine equipment calibration and testing are to be maintained by the qualified noise specialist undertaking the monitoring.

7.3 Frequency

It is recommended that noise monitoring is carried out every quarter during the facility's first year of operation, to confirm compliance and verify noise emissions. On completion of this year, the frequency of noise monitoring should be reviewed.

Monitoring should also be carried out in response to a complaint and should be completed as soon as practically possible after the complaint. Where applicable, following any corrective action, monitoring should be repeated to confirm the effectiveness of any control measure implemented.

7.4 Procedure

7.4.1 Introduction

The noise monitoring procedure should follow the methods and principles specified in Chapter 11 of the INP and AS1055: Acoustics – Description and measurement of environmental noise.

Instrumentation should comply with the requirements of AS1055: Acoustics – Description and measurement of environmental noise.

7.4.2 Site Access

In order to undertake noise monitoring on private property, approval must be gained from property owners for site access. In accordance with the agreement between the property owner and site management, all agreed protocols will be followed when accessing privately owned land for the purposed of noise monitoring. Noise monitoring results will be made available directly to the landowner if requested.

7.4.3 Monitoring Records

When any monitoring is undertaken a clear record of the sampling will be recorded and kept on file, to include:

- Name of the person undertaking the survey.
- Check of calibration at the start and at the end of the survey using a calibrator.
- The date of the last NATA calibration of the equipment.
- Location of the noise measurements.
- Prevailing weather conditions including comment on wind direction and speed, degree of cloud cover, temperature and humidity. Meteorological data can be obtained from the nearest BoM weather station at Horsley Park or using observations based on techniques in AS 1055.
- Instrumentation details including serial number.
- Comments on the various noise sources comprising the prevailing noise environment, dominant noise sources, identification of construction or temporary noise sources, whether the facility is audible or inaudible and the noise characteristics (e.g. tonal, impulsive, intermittent or low frequency dominance).
- Details of the activities being carried out on site.
- An estimation by the specialist of the noise emission level from the facility.
- Where noise levels from the facility cannot be measured at the receivers due to other noise sources, alternative methods for determining compliance as detailed in Chapter 11 of the INP.
- The noise meter will be set to A-weighting, "fast" response. Noise parameters to be measured and recorded are at a minimum L_{Amax}, L_{A1}, L_{A10}, L_{A90} and L_{Aeq} noise levels. Where additional analysis is required octave or third octave band frequency data and audio recordings may be required.

The keeping of clear records for sampling is important to ensure the reliability of the data collected.

7.4.4 Investigation of non-compliance

Where a non-compliance is measured and recorded by the monitoring, an investigation should be launched to identify the causes and control measures required. A non-compliance should be reported to site management as soon as possible after verification.

The investigation should occur as soon as practically possible after a non-compliance is measured. It should follow the procedures outlined in the INP. A noise specialist may be engaged to carry out the investigation. The investigation as a minimum should detail the following:

- Date and time of exceedance.
- The location where the exceedance was identified.
- The meteorological conditions during the identification of the exceedance.
- The identified cause of the exceedance from the project.
- Identification of other non-project related noise sources.
- Recommendations for corrective action.

Any corrective action recommended should be made in consultation with the relevant regulatory authorities where appropriate.

7.4.5 Data Quality Control

The noise levels will be recorded for each 15-minute interval during the monitoring period. Intervals for which the mean wind speed exceeds 5 m/s, or during which rain is recorded and identified to adversely affect the monitoring, will be discarded in further analysis. Data exclusion should be carried out in accordance with the procedure in Appendix B of the INP. All data should be collated and be held in a central repository.

8 PERFORMANCE INDICATORS

The effectiveness of any noise management plan will be reviewed against the following performance indicators:

- Compliance with noise goals and criteria.
- Any noise incidents reported internally and effectively managed.
- Noise complaints from nearby receptors.

9 ROLES AND RESPONSIBILITIES

The Environment Manager is responsible for ensuring that the requirements of the management plan are implemented.

10 PERIODIC REVIEW

The noise management plan should be periodically reviewed and where required, updated to incorporate changes that may have occurred in noise management measures, procedures, on site or external factors.

Appendix E NOISE MODELLING ASSUMPTIONS

Operational noise source levels were developed based on information provided by the manufacturers, suppliers and designers (Ramboll), noise measurements taken at similar plants including Ferrybridge and Greatmoor EFW plants located in the UK. Where octave band noise levels were not available, reference spectra from measurements carried out at similar facilities and published data sources were used and adjusted to the required level. **Table 10-1** presents indicative internal sound pressure levels used for the building break out calculations and **Table 10-2** presents the indicative sound power levels for fixed plant. All industrial buildings were modelled using dimensions from supplied drawings and assumed an internal absorption coefficient of 0.15.

Table 10-1: Indicative Internal Sound Pressure Levels

Item	Octave Band Sound Level, Hz dB(A)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Tipping Hall	64	71	76	79	79	78	75	69	85
Waste Bunker	58	68	74	76	76	76	74	68	82
Boiler House	69	74	80	80	78	76	70	65	85
Turbine Hall	69	75	74	76	84	81	81	82	88

Table 10-2: Indicative Plant Sound Power Levels

Item	Octave Band Sound Level, Hz dB(A)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Stack[1]	85	87	86	76	60	59	58	63	91
Transformer	79	91	93	99	96	92	87	78	102
ACC (per section of 6 units)	67	80	90	94	98	98	92	87	102
ID Fan	68	76	89	95	95	93	86	87	100
Ash Extraction Fan	58	79	87	87	87	84	82	75	93
Lime Pack Blower	57	78	86	86	86	83	81	74	92
Compressor	87	86	84	84	86	90	89	85	96
High Pressure Steam Line	56	70	78	84	89	91	91	87	96
Truck	86	94	98	101	101	100	97	91	107
Pressure Release Safety Valve	86	100	108	114	119	121	121	117	126

Note: 1. No directivity loss was assigned to the stack.

Building break out noise was calculated using internal noise levels provided by the equipment supplier and noise levels from similar facilities. Building façade compositions were determined from the project's concept drawings. Transmission loss data for façade materials was sourced from manufacturer's data and published sources. **Table 10-3** presents the transmission loss data for different façade materials. Doors and openings were assumed to have no acoustic attenuation.

Wall facades are constructed of a combination of HiKlip 630 profiled steel sheeting, Alucobond 3mm panelling, concrete and Danapalon 16mm panelling. Roofs are constructed of 0.4 BMT steel sheeting over insulation. Where data was unavailable for the 63 Hz band, it was inferred from the panel's performance and other published sources.

Louvres were assumed to provide no attenuation unless specified as acoustic louvre. The following louvres were assumed to be acoustically treated using a 400mm acoustic louvre.

- Boiler House 1 – High level louvres on western façade, all louvres on eastern façade
- Boiler House 2 – High level louvres on eastern façade, all louvres on western façade
- Turbine Hall – All louvres were acoustically treated.

Table 10-3: Transmission Loss of Building Facade Materials

Material	Octave Band Transmission Loss, Hz dB							
	63	125	250	500	1k	2k	4k	8k
Fielders HiKlip 630 steel sheet, 0.48 BMT	9	13	16	16	19	25	29	29
Alucobond Panel 3mm	9	14	15	21	27	30	29	29
Danapalon Panel 16mm	11	13	16	20	25	28	24	24
200m concrete	29	34	39	46	53	59	64	65
Sonic Series 400 Chevron 400mm Acoustic Louvre	0	5	10	19	23	27	24	24
0.4 BMT steel sheeting over insulation	11	15	15	19	25	35	35	35