Appendix G Noise Impact Assessment

GTS-590-RP-EV-002

HORSLEY PARK GAS METERING STATION

Noise Impact Assessment

Rp 001 2014338SY

01 October 2014

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Project: **HORSLEY PARK GAS METERING STATION**

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Report No.: **Rp 001 2014341SY**

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1.0 INTRODUCTION

The Eastern Gas Pipeline (EGP) is a DN450, class 900 gas transmission pipeline which runs from the Longford Compressor Station in South Gippsland, Victoria to Horsley Park in New South Wales. An opportunity has arisen to construct a new gas delivery facility within the existing Jemena facility in Horsley Park.

Jemena Asset Management Pty Ltd has engaged Marshall Day Acoustics to investigate potential noise impacts due to the construction and operation of the new facility and, if necessary, propose an operational noise mitigation strategy.

Acoustic terminology used in this report is described in Appendix A.

2.0 SITE AND PROJECT DESCRIPTION

The proposed development site is within an existing Jemena facility on Chandos Road. The land surrounding the site is predominantly bush with widely spaced residential properties in the immediate environs. The nearest residential dwelling is understood to be 187-201 Chandos Road which is approximately 90m from the existing site boundary.

The location of the site in relation to the nearest residential receptor is presented in Figure 1.

Figure 1: Site location relative to nearest residential receptor

2.1 Site plan

A layout of the proposed gas delivery facility is shown below in Figure 2.

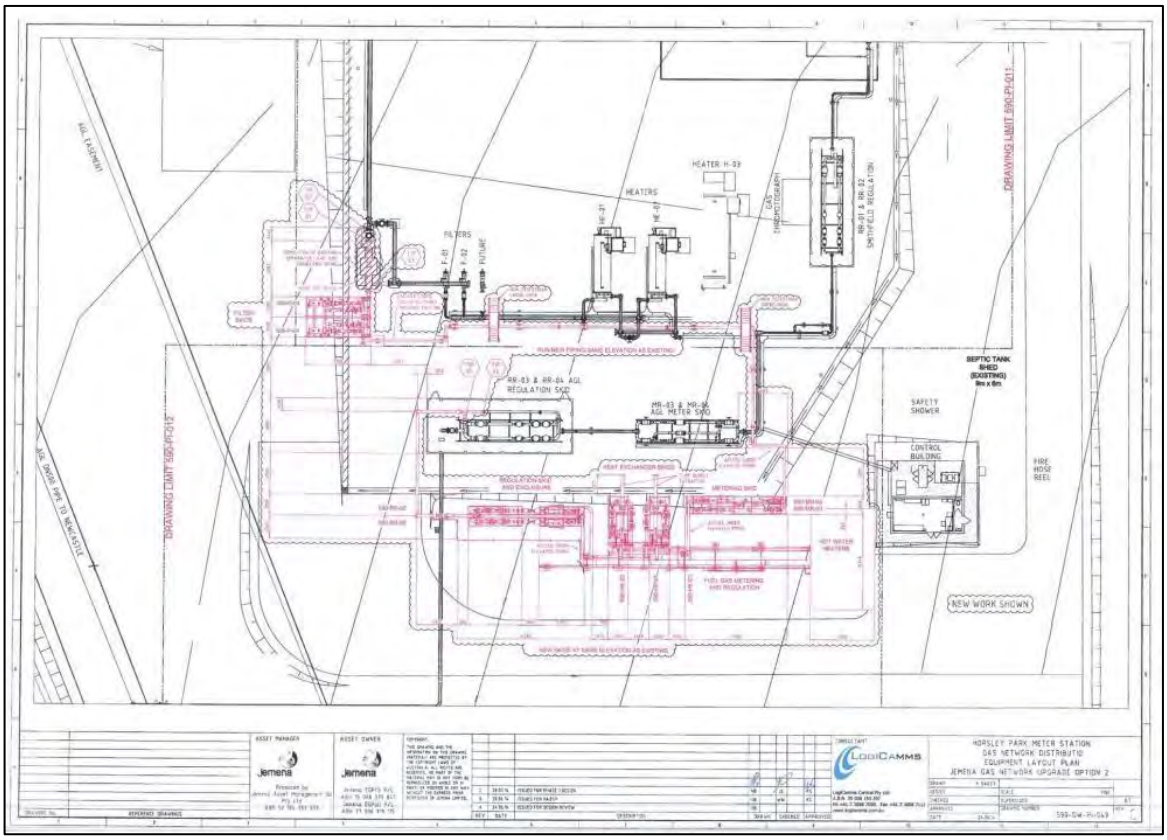


Figure 2: Site Plan

2.2 Noise sources

It is understood, from a preliminary Jemena noise investigation (Document No. GTS-563-RP-EV-001, dated 19 August 2014) which was undertaken for a similar site in NSW, that the following items of noisy equipment are anticipated to be required as part of the proposed gas delivery facility:

- Active Pressure Control Valves (PCVs) on the Pressure Reduction Skid
- One duty Boiler on the Heater Package
- Two duty Water Pumps on the Heater Package

2.3 Working hours – Construction

It is understood that construction of the facility will be undertaken as follows:

- 0700 – 1800hrs Monday – Friday
- 0800 – 1300hrs Saturday

3.0 UNATTENDED NOISE MEASUREMENTS

Ambient and background noise levels at the site were measured using ARL EL - 316 precision integrating sound level meters fitted with weatherproof windshields.

The microphones were mounted on poles at a height of approximately 1.5m above local ground level under freefield conditions. The measurement locations are shown in Appendix D.

Measurements were obtained using the 'F' response time and A-weighting frequency network. The equipment was calibrated before and after the survey and no significant calibration drifts were observed.

3.1 Southern site boundary

Consecutive 15 minute measurements of background and ambient noise levels were obtained at the southern boundary of the existing site between 1215hrs on Wednesday 27 August and 1800hrs on Sunday 9 September 2014.

It was observed that the prevailing noise environment was typical of a rural location with occasional distant road traffic audible along with intermittent road traffic on Chandos Road. A photograph of the noise monitor in situ is presented as Figure 3. Measured background and ambient noise levels are presented in Table 1 and Table 2.

Table 1: Measured background noise levels – Southern site boundary

Period	Average Background Noise Level, $L_{A90\ 15mins}$ dB		
	Day	Evening	Night
Wednesday, 27 Aug 2014	-**	52*	49*
Thursday, 28 Aug 2014	52*	53*	53*
Friday, 29 Aug 2014	52	51	47*
Saturday, 30 Aug 2014	50*	49*	46*
Sunday, 31 Aug 2014	47	50	49
Monday, 01 Sep 2014	51	53	49
Tuesday, 02 Sep 2014	52	52	49*
Wednesday, 03 Sep 2014	53*	52	50
Thursday, 04 Sep 2014	52	52	52
Friday, 05 Sep 2014	51*	51*	48*
Saturday, 06 Sep 2014	49*	49*	46*
Sunday, 07 Sep 2014	48*	-	-
Minimum	47	49	46

*- Weather affected measurement (rain or strong winds) or no weather data available

** - Incomplete period

Table 2: Measured ambient noise levels – Southern site boundary

Period	Average Ambient Noise Level, $L_{Aeq\ 15mins}$ dB		
	Day	Evening	Night
Wednesday, 27 Aug 2014	-**	54*	54*
Thursday, 28 Aug 2014	57*	55*	54*
Friday, 29 Aug 2014	56	54	50*
Saturday, 30 Aug 2014	53*	51*	49*
Sunday, 31 Aug 2014	51	52	52
Monday, 01 Sep 2014	56	55	53
Tuesday, 02 Sep 2014	56	54	53*
Wednesday, 03 Sep 2014	57*	54	54
Thursday, 04 Sep 2014	57	54	53*
Friday, 05 Sep 2014	56*	54*	51*
Saturday, 06 Sep 2014	53*	51*	48*
Sunday, 07 Sep 2014	53*	-	-
Minimum	51	51	48

* - Weather affected measurement (rain or strong winds) or no weather data available

** - Incomplete period

Figure 3: Noise monitoring location – Southern site boundary

3.2 Chandos Road

Consecutive 15 minute measurements of background and ambient noise levels were obtained on Chandos Road between 1345hrs on Wednesday 27 August and 1845hrs on Sunday 9 September 2014.

The measurement location was selected, in the absence of available access to local residential properties, so as to be representative of the prevailing noise environment in the area.

It was observed that the prevailing noise environment was typical of a rural location with occasional distant road traffic audible along with intermittent road traffic on Chandos Road. A photograph of the noise monitor in situ is presented as Figure 4. Measured background and ambient noise levels are presented in Table 1.

Table 3: Measured background noise levels – Chandos Road

Period	Average Background Noise Level, $L_{A90\ 15mins}$ dB		
	Day	Evening	Night
Wednesday, 27 Aug 2014	-**	58*	59*
Thursday, 28 Aug 2014	54*	59*	65*
Friday, 29 Aug 2014	53	54	53*
Saturday, 30 Aug 2014	50*	51*	53*
Sunday, 31 Aug 2014	45*	49	48
Monday, 01 Sep 2014	48	50	45
Tuesday, 02 Sep 2014	52	50	48*
Wednesday, 03 Sep 2014	54*	49	46
Thursday, 04 Sep 2014	52	49	60*
Friday, 05 Sep 2014	52*	49*	44*
Saturday, 06 Sep 2014	47*	44*	40*
Sunday, 07 Sep 2014	42*	-	-
Minimum	45	44	40

* - Weather affected measurement (rain or strong winds) or no weather data available

** - Incomplete period

Table 4: Measured ambient noise levels – Chandos Road

Period	Average Ambient Noise Level, $L_{Aeq\ 15mins}$ dB		
	Day	Evening	Night
Wednesday, 27 Aug 2014	-**	67*	66*
Thursday, 28 Aug 2014	69*	67*	65*
Friday, 29 Aug 2014	68	66	63*
Saturday, 30 Aug 2014	64*	63*	62*
Sunday, 31 Aug 2014	61*	62	63
Monday, 01 Sep 2014	68	64	62
Tuesday, 02 Sep 2014	68	64	63*
Wednesday, 03 Sep 2014	68*	64	62
Thursday, 04 Sep 2014	68	64	62
Friday, 05 Sep 2014	68*	65*	60*
Saturday, 06 Sep 2014	64*	61*	56*
Sunday, 07 Sep 2014	61*	-	-
Minimum	61	61	56

* - Weather affected measurement (rain or strong winds) or no weather data available

** - Incomplete period

Figure 4: Noise monitoring location – Chandos Road

3.3 Weather conditions

All measured noise levels have been correlated to weather data taken from the Horsley Park Equestrian Centre Bureau of Meteorology (BOM) weather station which is located approximately 5km to the south of the subject site.

Significant periods of the measurement survey were affected by rainfall or strong winds and therefore any noise data collected during these periods are highlighted in the Tables. Noise measurements taken during periods in which weather data was not available from the BOM have been discarded.

The periods of inclement weather, or absent weather data, are highlighted in the graphical representations of the noise measurements which are presented in Appendix C and Appendix D.

It should be noted that BOM weather data is supplied in 30 minute intervals. Therefore the noise measurements presented in Appendix C and Appendix D have been re-calculated into the same for the purposes of correlating the two data sets.

3.4 Discussion

Analysis of the measured noise data at the Chandos Road noise monitor, which is presented graphically in Appendix D, seems to indicate the presence of a cyclical noise source in close proximity to the monitoring location.

This can be seen by the shape of the time trace which displays a similar pattern each day. It is considered that this is unusual for a rural setting such as this.

However, observations made on-site when the noise monitor was installed and collected did not highlight any obvious noise sources and therefore the source of the pattern is unknown.

Furthermore, the noise levels measured at Chandos Road are generally higher than those taken at the site boundary which would tend to indicate that the pattern to the noise levels is not influenced by the existing industrial installation.

It can also be seen that the pattern does not occur over the first measurement weekend and that the noise levels over night-time during this period did not fall to levels that would be expected in a rural location. Night-time noise levels during the week and over the second measurement weekend do display a pattern that would be representative of a rural location.

For these reasons, the decision has been taken to discard the measurement data taken at the Chandos Road noise monitor and undertake the assessment based upon the data taken at the southern site boundary.

Therefore, subsequent sections of this report do not reference the Chandos Road data.

4.0 NSW INDUSTRIAL NOISE POLICY

In NSW, the EPA *Industrial Noise Policy* (INP) is the standard for assessing noise emissions from industrial facilities and other developments with noise sources that may be considered to be industrial in nature. The INP sets out a procedure where an industrial facility can be assessed against a series of noise level criteria. In the INP, these criteria are called the project specific noise levels and are derived from an involved analysis of the ambient noise environment and zoning information. The derivation of the project specific noise levels for this development is summarised in Table 5, Table 6 and Table 7 with full description set out in Figure 5 below.

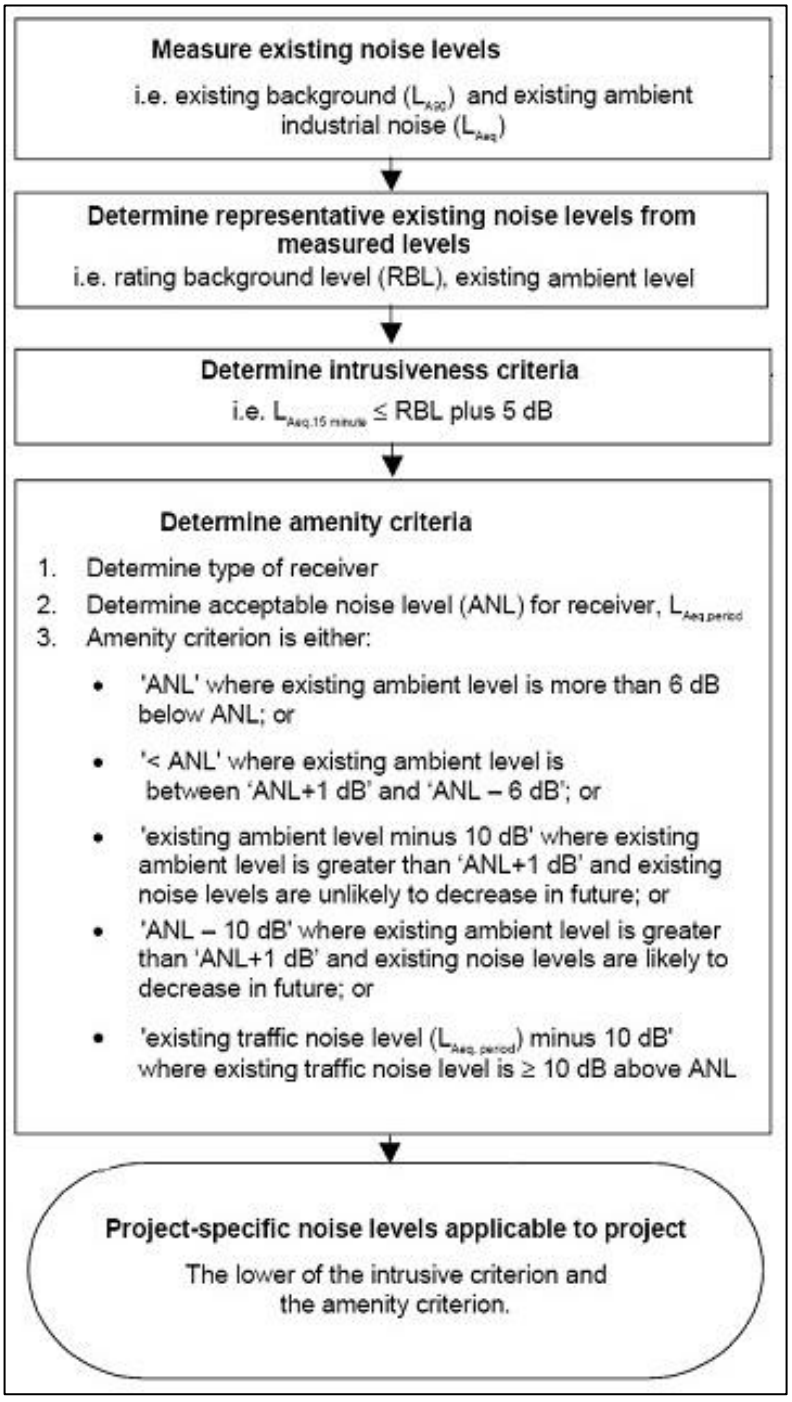


Figure 5: Industrial noise policy process

4.1 Intrusiveness Criteria

The intrusiveness noise assessment is based on knowledge of the background noise level at the receiver locations. The intrusiveness criterion is the background noise level at the nearest noise sensitive location plus 5 dB. Therefore the noise emissions from the industrial premises are considered to be intrusive if the A-weighted source noise level ($L_{Aeq,15mins}$) is greater than the background noise level (L_{A90}) plus 5 dB. In the INP the background noise level is referred to as the Rating Background Level (RBL).

Table 5: INP time periods against measured background and ambient noise levels

		Southern site boundary	
Period	**Time period**	**RBL L_{A90} dB**	**L_{Aeq} dB**
Day	0700-1800hrs	47	51
Evening	1800-2200hrs	49	51
Night	2200-0700hrs	46	48

It should be noted that on Sundays and public holidays, daytime is considered to be from 0800hrs 1800hrs.

Based upon the data summarised in Table 5, noise limits for intrusiveness have been calculated in accordance with the INP and are presented in Table 6.

Table 6: Calculated Intrusiveness Criteria

	Southern site boundary	
Period	**RBL L_{A90} dB**	**Intrusiveness Criteria (RBL +5dB)**
Day	47	52
Evening	49	54
Night	46	51

4.2 Amenity Criteria

The Amenity Criteria are designed to prevent industrial noise continually increasing above an acceptable level. The initial stage in determining the Amenity Criteria is to correct the acceptable noise levels provided for the appropriate amenity area with the baseline noise monitoring. The area surrounding the proposed development is considered Rural. The acceptable and recommended maximum levels for residences in a rural area are detailed in Table 7 below.

Table 7: Recommended noise levels from industrial noise sources in a rural area

Time of Day	**Recommended Noise Level L_{Aeq} dBA**	
	Acceptable	**Recommended Maximum**
Day	50	55
Evening	45	50
Night	40	45

Based on the acceptable level presented in Table 7 the L_{Aeq} values from Table 5 are adjusted using INP Table 2.2 to determine the Amenity Criteria.

The derivation of the Amenity Criteria is a function of the measured existing ambient noise conditions on-site. The corrections which are applicable to the measured ambient noise levels (taken from INP Table2.2) are detailed below in Table 8.

Table 8: Corrections to Acceptable noise level based on the measured ambient noise level

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

The Amenity Criteria for each time period are presented below.

Table 9: Calculated Amenity Criteria

	Southern site boundary	
Period	**L_{Aeq} dB**	**Amenity Criteria**
Day	51	41
Evening	51	41
Night	48	38

4.3 Determination of Project Specific Noise Levels

The final process in determining the operational noise limits for the development, called the project specific noise levels, is to take the more stringent of either the Intrusiveness or Amenity Criteria that have been calculated.

Therefore, the appropriate noise limits for this development are both the amenity and intrusiveness noise levels.

Table 10 summarises the noise level criteria for Southern site boundary.

Table 10: Noise level criteria for Southern site boundary

Time of day	Intrusiveness Criteria, $L_{Aeq,15mins}$ dB	Amenity Criteria, $L_{Aeq,\ period}$ dB	Criteria selected, $L_{Aeq,\ period}$ dB
Day	52	41	41
Evening	54	41	41
Night	51	38	38

In this case the Intrusiveness Criteria is not considered to be applicable and therefore the Amenity Criteria has been taken for all periods.

5.0 NSW INTERIM CONSTRUCTION NOISE GUIDELINE

The NSW Interim Construction Noise Guideline (CNG) provides guidance for assessing noise associated with construction activities. The CNG sets out noise management levels above which there may be community reaction to construction noise. The management levels are applied during the standard hours of construction set out in the CNG, which are as follows:

- Monday to Friday 0700-1800hrs
- Saturday 0800-1300hrs

The noise management levels for residential receivers affected by construction noise are derived from the Rating Background Level (as determined by the requirements of the NSW INP) and adding 10dB, for construction that will take place during the recommended hours set out in the CNG. For construction taking place outside of the recommended standard hours, 5dB is added to the Rating Background Level (RBL) to determine the noise management level.

The construction noise management levels for the residential receivers affected by this development are provided in Table 11 below.

Table 11: Construction noise management levels for residential receivers

Day of week	Time period	RBL, L_{A90} dB	Management level, $L_{Aeq, 15mins}$ dB
Chandos Road - Residential			
Monday to Friday	0700-1800hrs	47	57
Saturday	0800-1300hrs	47	57

In applying the management level, the CNG requires that all feasible and reasonable work practices be employed. Where the management level is exceeded, all potentially impacted residents should be informed. The CNG also sets out that where noise levels exceed 75dBA at residential receivers, there will be a requirement for community consultation and negotiation.

6.0 NOISE MODELLING PROCEDURE

To predict the noise level from the proposed facility to the adjacent residential areas, the following items must be considered:

- The amount of noise being generated by the various noise sources, expressed in terms of the sound power level
- The distance between the sources and receivers
- The presence of obstacles such as hills, buildings, screens or barriers in the propagation path
- The hardness of the ground between the source and receiver
- Absorption of sound by the air over long distances
- Meteorological influences such as wind or temperature gradients.

A 3-dimensional computer model has been created in the environmental noise emission modelling program, *SoundPlan V7.2*, which utilises the methodology defined in International Standard *ISO 9613-2: 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*.

With regard to calculation conditions, ISO 9613 states that:

"The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation from sources of known sound emission."

The conditions used by the standard that are favourable to sound propagation are as follows:

- wind blowing from source to receiver within an angle of ±45° of the direction connecting the dominant sound source to the specified receiver region
- wind speed between 1m/s and 5m/s.

This environmental noise prediction method is an internationally recognised standard that has been used extensively throughout Australia, New Zealand, and Europe since its publication in 1996. This model is considered to provide a suitable methodology for the purposes of predicting environmental noise levels from industry and other sources and has been adopted for this assessment.

6.1 Locations modelled

187-201 Chandos Road is considered to be the nearest residential location to the proposed facility. Therefore compliance with the INP noise limits is likely to be driven by the predicted noise levels at this location and it is considered that compliance at the nearest affected receiver implies compliance at other receiver locations.

6.2 Receptor location

With regard to receptor locations in the noise model, page 14 of the INP states the following:

"This is to be assessed at the most-affected point on or within the residential property boundary - or, if that is more than 30m from the residence, at the most-affected point within 30m of the residence."

The distance between the nearest boundary fence of 187-201 Chandos Road and the dwelling itself is less than 30m. Therefore the receptor location in the noise model has been placed at the nearest point on the fence line at a distance of approximately 30m from the façade of the dwelling. The noise modelling location is illustrated in Figure 6.

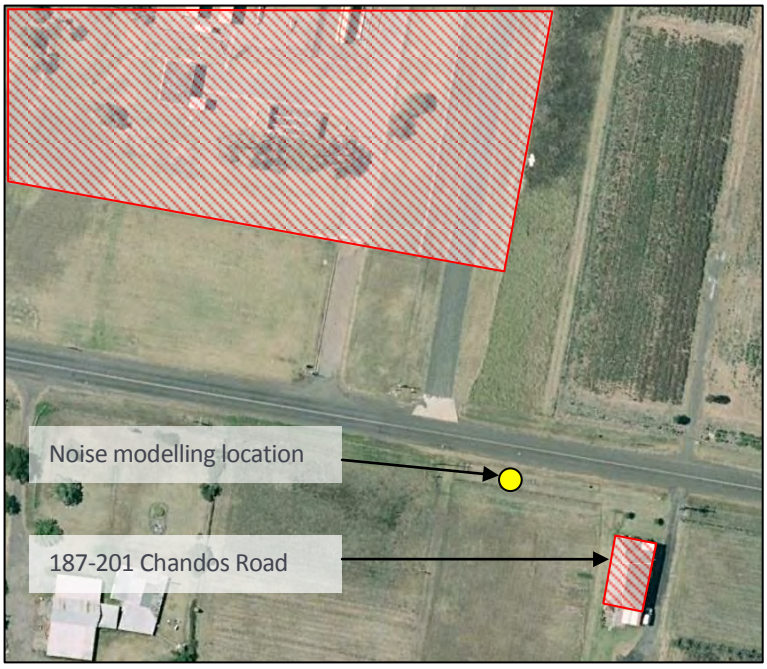


Figure 6: Noise modelling location

6.3 Noise level data sources

Table A1 of Australian Standard 2436 – 2010 "*Guide to Noise Control on Construction, Maintenance and Demolition Sites*" presents single figure sound power levels for some typical equipment items.

This data is sourced from octave band noise level data given in Tables C.1 – C.11 of BS 5228-1:2009 "*Code of practice for noise and vibration control on construction and open sites – Part 1: noise*".

The proposed facility will operate during the night-time period and as such it is considered that the frequency content of the noise sources on site is an important component of the assessment. Furthermore, the design of noise mitigation measures will be highly dependent on the frequency content of the noise received at the nearest noise sensitive receptor.

6.4 Operational noise sources

Input noise levels for the operation of the facility have been taken from BS 5228, information from past MDA projects and information held within our in-house noise database.

Anticipated overall noise levels for various equipment items were detailed in previous work undertaken by Jemena (Document No. GTS-563-RP-EV-001, dated 19 August 2014). The report was prepared for a similar site in NSW and the anticipated equipment for the Horsley site is understood to be comparable. Therefore octave band data taken from BS5228 and previous MDA projects has been adjusted to match the overall noise levels presented previously.

Overall input noise levels are presented in Table 12 and the octave band data is presented in Appendix E.

Table 12: Input Sound Power level data

Location	No(s)	Equipment	Source Reference	Activity L_w dB
Inside walled enclosure	1	Active PCV on APA PRS	MDA database (4257)	93
Inside building	1	Boiler	MDA database	91
Inside building	1	Water pump	BS 5228-1:2009 Table C.2:45	93

6.5 Construction noise sources

Input noise levels for the construction of the facility have been taken from BS 5228.

The extent of plant that is likely to be required for the construction of the facility was provided by Jemena.

Overall input noise levels are presented in Table 12 and the octave band data is presented in Appendix E.

Table 13: Input Sound Power level data

Activity	No(s)	Equipment	Source Reference	Activity L_w dB
Site excavation	2	Tracked excavator (20t)	BS 5228-1:2009 Table C.6:11	103
	1	Tipper lorry	BS 5228-1:2009 Table C.8:20	107
	1	Wheeled backhoe loader	BS 5228-1:2009 Table C.4:66	97
Concrete pours	1	Concrete mixer truck (discharging) & concrete pump (pumping)	BS 5228-1:2009 Table C.4:28	103
Site deliveries	1	Semi-trailer	BS 5228-1:2009 Table C.11:11	114
	1	Telescopic crane (10t)	BS 5228-1:2009 Table C.2:35	99
	1	Telescopic handler (4t)	BS 5228-1:2009 Table C.4:54	107

Table 13: Input Sound Power level data

Activity	No(s)	Equipment	Source Reference	Activity L_w dB
Mechanical installation	1	Mobile telescopic crane (100t)	BS 5228-1:2009 Table C.4:41	99
	1	Telescopic handler (4t)	BS 5228-1:2009 Table C.4:54	107
	1	Tracked excavator (20t)	BS 5228-1:2009 Table C.6:11	103
	1	Compressor	BS 5228-1:2009 Table C.3:19	103

6.6 Assumptions

The following assumptions have been made in the course of the noise modelling:

- Receptor heights have been set at 1.5m
- Building heights have been taken from aerial photographs
- Noise radiating from doors of buildings has been modelled as area sources
- The sound power level of the area sources has been derived from the sources detailed above in Table 12
- Buildings have been assumed to be of masonry construction with light-weight roofs
- External equipment has been modelled as point sources
- The sound power level of the point sources has been derived from the sources detailed above in Table 12

6.7 Building construction

Information provided by Jemena indicates that the majority of equipment to the proposed site will be housed within structures.

It is understood that the pressure reduction skid will be housed within a walled enclosure. The enclosure will not have a roof.

The building in which the boiler will be housed has been modelled based on the construction presented in Jemena drawing 552-CS-010_3 which shows a similar building on a previous project. The construction is summarised as follows:

- Masonry walls
- 2 layers of 9mm Villa board, 300mm air gap and 0.48mm BMT Trimdeck sheeting to the roof
- Two roller shutter doors to the north façade of the boiler house.

Calculations of the likely sound insulation performance of the above structure have been carried out using Insul and indicate that the structure is likely to provide a weighted sound insulation performance of 42dB R_w.

This performance is likely to be undermined, in the boiler house, by the presence of a pair of roller shutter doors. Previous MDA project data indicates that roller shutter doors can reliably provide a sound insulation performance of up to 13dB $R_{w.}$

Therefore it has been assumed that the roller shutters will be B&D Envir-a-shutters, or similar. MDA has tested these door sets in situ and found that they provide a sound insulation performance of up to 20dB $R_{w.}$ In particular these up rated roller door sets provide a higher performance at low frequency.

6.8 Summary of modelled activities - Operation

The noise modelling has assumed a worst case for the operation of the proposed facility over a 15 minute period, as follows:

- All duty equipment operating at full capacity
- All stand-by equipment operating at full capacity.

6.9 Summary of modelled activities – Construction

The noise modelling has assumed a worst case for the construction of the proposed facility over a 15 minute period, as follows:

- All specified equipment for an activity will operate simultaneously and at full capacity
- Each activity has been assumed to be carried out discretely and sequentially.

7.0 NOISE IMPACT ASSESSMENT

7.1 Operational noise

Predictions of the typical noise emission from the site have been calculated based on the assumptions outlined in Section 6.5 and are presented below in Table 14.

Table 14: Predicted operational noise levels – 187-201 Chandos Road

Activity	Predicted noise level, L_{Aeq} dB	INP noise limit			Compliance
		Day	Evening	Night	
Operation	29	41	31	38	✓

The predicted noise levels show that the proposed facility will be compliant with the applicable noise limit during all periods of the day.

7.2 Construction noise

Predictions of the typical noise emission from the site have been calculated based on the assumptions outlined in Section 6.5 and are presented below in Table 14.

Table 15: Predicted construction noise levels – 187-201 Chandos Road

Receiver	Predicted noise level, L_{Aeq} dB	Construction noise limit			Compliance
		Day	Evening	Night	
Site Excavation	43	56	N/a	N/a	✓
Concrete pours	39	56	N/a	N/a	✓
Deliveries	63	56	N/a	N/a	×
Mechanical Installation	47	56	N/a	N/a	✓

The predicted noise levels show that, with the exception of deliveries, construction of the proposed facility will be compliant with the applicable noise limit during all of the proposed activities.

8.0 CONCLUSION

Jemena Asset Management Pty Ltd has engaged Marshall Day Acoustics to investigate potential noise impacts due to the development of a gas metering facility within an existing site at Chandos Road in Horsley Park NSW.

A series of unattended noise monitoring surveys have been undertaken at residential dwellings in the vicinity of the facility and a proposed gas pipeline.

Two monitoring locations were selected, however there was significant uncertainty surrounding one of the locations, and the data taken for this position was therefore discarded.

Operational and construction noise limits have been calculated at four residential dwellings in the area.

The nearest residential dwelling to the proposed site is located at 187-201 Chandos Road. A noise model of the site has been created in order to predict noise levels from the construction and operational phases of the project.

Calculations have shown that, based on the construction assumptions detailed in Section 6.7, the operation of the facility can comply with the relevant INP noise limit during every period of the day.

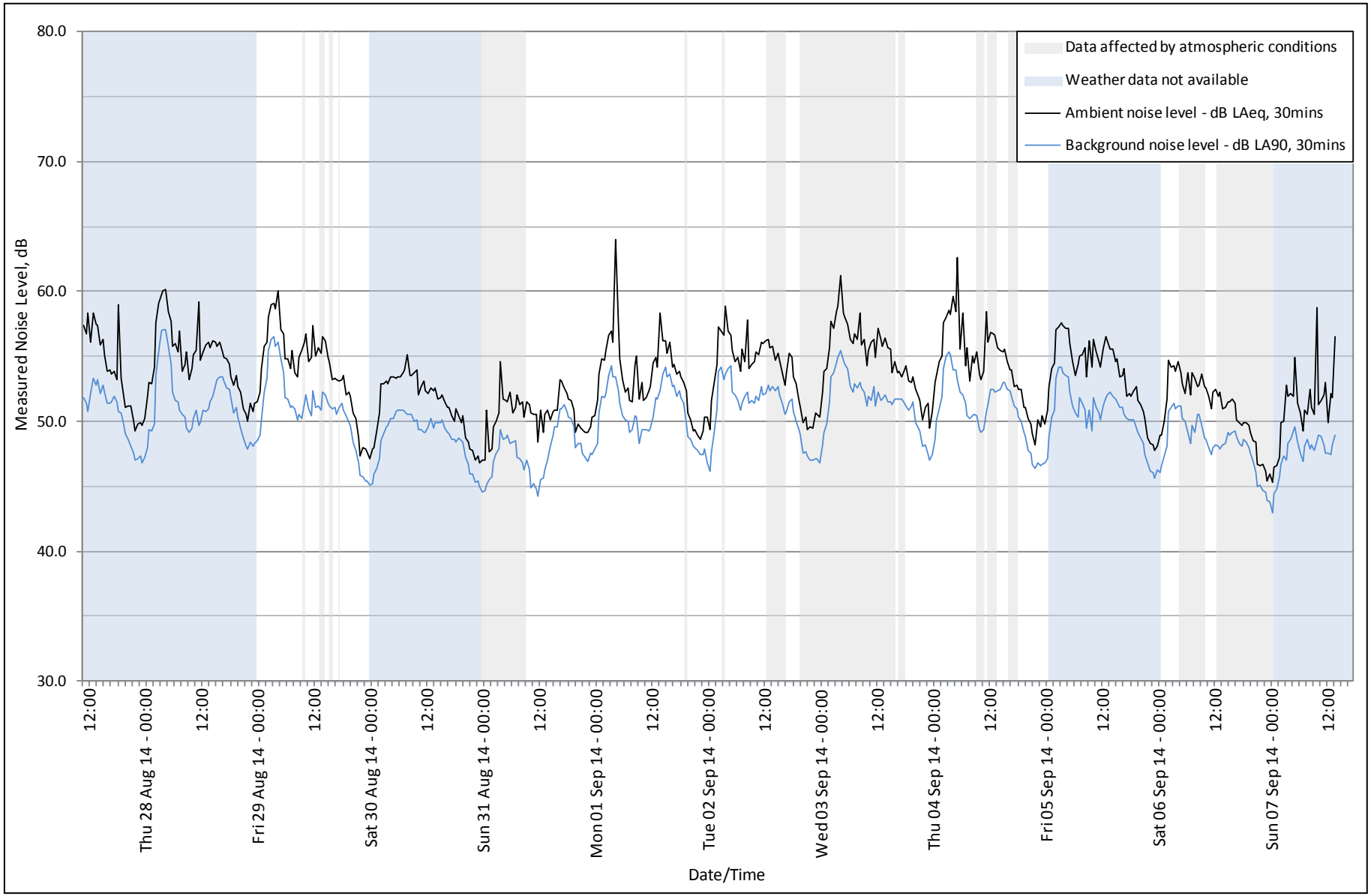
Further calculations have shown that the construction activities detailed in Section 6.5, with the exception of deliveries, can comply with the relevant noise limit.

APPENDIX A GLOSSARY OF TERMINOLOGY

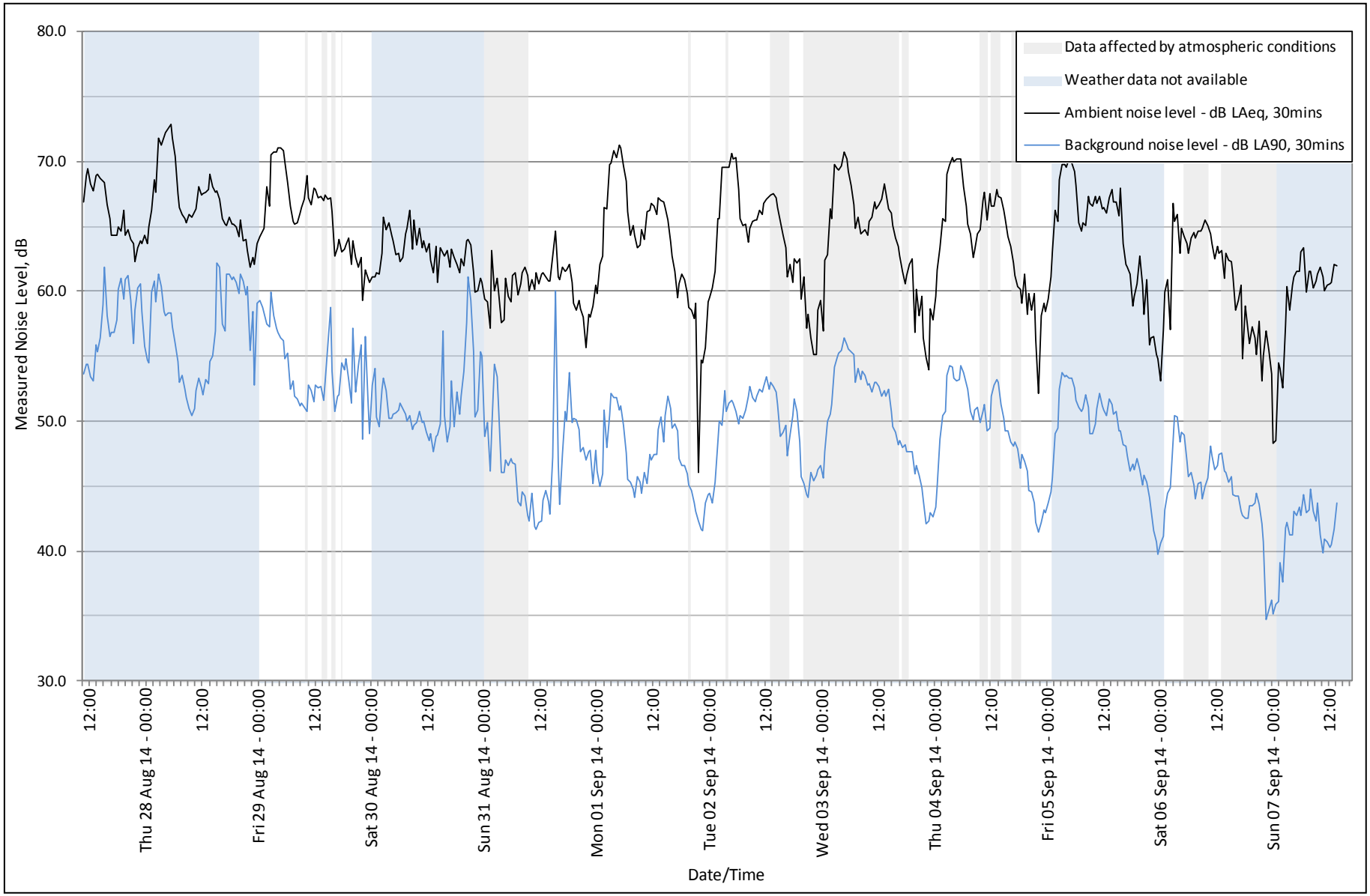
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dB	Decibel The unit of sound level.
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
L_{Aeq}	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level.
L_{A90}	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
L_w (or SWL)	Sound Power Level. The level of total sound power radiated by a sound source
Octave Band	A range of frequencies where the highest frequency included is twice the lowest frequency. Octave bands are referred to by their logarithmic centre frequencies, these being 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz for the audible range of sound.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
Sound Insulation	When sound hits a surface, some of the sound energy travels through the material. 'Sound insulation' refers to ability of a material to stop sound travelling through it.
R_w	Weighted Sound Reduction Index A single number rating of the sound insulation performance of a specific building element. 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.

APPENDIX B UNATTENDED NOISE MONITORING LOCATIONS

APPENDIX C UNATTENDED NOISE MONITORING RESULTS – SOUTHERN SITE BOUNDARY


Data affected by atmospheric conditions
Weather data not available
Ambient noise level - dB LAeq, 30mins
Background noise level - dB LA90, 30mins
Measured Noise Level, dB
80.0
70.0
60.0
50.0
40.0
30.0
12:00
Thu 28 Aug 14 - 00:00
Fri 29 Aug 14 - 00:00
Sat 30 Aug 14 - 00:00
Sun 31 Aug 14 - 00:00
Mon 01 Sep 14 - 00:00
Tue 02 Sep 14 - 00:00
Wed 03 Sep 14 - 00:00
Thu 04 Sep 14 - 00:00
Fri 05 Sep 14 - 00:00
Sat 06 Sep 14 - 00:00
Sun 07 Sep 14 - 00:00
Date/Time

APPENDIX D UNATTENDED NOISE MONITORING RESULTS – CHANDOS ROAD


Data affected by atmospheric conditions
Weather data not available
Ambient noise level - dB LAeq, 30mins
Background noise level - dB LA90, 30mins
Measured Noise Level, dB
80.0
70.0
60.0
50.0
40.0
30.0
12:00
Thu 28 Aug 14 - 00:00
Fri 29 Aug 14 - 00:00
Sat 30 Aug 14 - 00:00
Sun 31 Aug 14 - 00:00
Mon 01 Sep 14 - 00:00
Tue 02 Sep 14 - 00:00
Wed 03 Sep 14 - 00:00
Thu 04 Sep 14 - 00:00
Fri 05 Sep 14 - 00:00
Sat 06 Sep 14 - 00:00
Sun 07 Sep 14 - 00:00
Date/Time

APPENDIX E OCTAVE BAND INPUT NOISE DATA

Table H.1: Octave band input sound power level data - Operation

Category	Notes	Source	f63	f125	f250	f500	f1k	f2k	f4k	f8k	Calculated Lw dB
Active PCV on PRS		MDA database (4257)	-	83	81	86	85	87	86	86	93
Boiler	Data taken from Longford GCP	MDA database	91	91	92	90	82	81	81	79	91
Water pump		BS 5228-1:2009 Table C.2:45	101	96	90	90	89	84	81	69	93

Table H.2: Octave band input sound power level data – Construction

Activity	Equipment	Source	f63	f125	f250	f500	f1k	f2k	f4k	f8k	Calculated Lw dB
Site excavation	Tracked excavator (20t)	BS 5228-1:2009 Table C.6:11	110	112	103	97	97	95	90	85	103
	Tipper lorry	BS 5228-1:2009 Table C.8:20	116	110	102	102	102	101	98	95	107
	Wheeled backhoe loader	BS 5228-1:2009 Table C.4:66	100	91	95	95	91	90	84	78	97
Concrete pours	Concrete mixer truck (discharging) & concrete pump (pumping)	BS 5228-1:2009 Table C.4:28	107	108	101	100	97	96	87	81	103
Site deliveries	Lorry ж	BS 5228-1:2009 Table C.11:11	124	107	103	107	110	108	100	95	114
	Telescopic crane (10t)	BS 5228-1:2009 Table C.2:35	113	107	97	95	92	90	84	75	99
	Telescopic handler (4t)	BS 5228-1:2009 Table C.4:54	107	101	94	93	106	94	82	75	107
Mechanical installation	Mobile telescopic crane (100t)	BS 5228-1:2009 Table C.4:41	101	99	96	98	94	91	82	77	99
	Telescopic handler (4t)	BS 5228-1:2009 Table C.4:54	107	101	94	93	106	94	82	75	107
	Tracked excavator (20t)	BS 5228-1:2009 Table C.6:11	110	112	103	97	97	95	90	85	103
	Compressor	BS 5228-1:2009 Table C.3:19	103	99	93	98	99	97	90	85	103