Noise Assessment – Summary of Key Outcomes

This chapter provides an overview of the potential noise impacts of the construction activities and operation of Project.

The noise assessment for operation of the Facility addressed general continuous operations, potential for sleep disturbance and low frequency and tonal noise. The noise assessment for construction addressed construction activities for the Facility, gas pipeline and access road, communications tower infrastructure (including access track) and off site traffic noise on public roads generated during construction. Vibration impacts of the proposed construction and operation have not been assessed in detail given the substantial distances from the Facility to the nearest residential receptors.

The predicted noise impacts of the proposed development upon the nearest potentially affected noise sensitive receptor locations have been assessed with consideration of the following guidelines:

- NSW Office of Environment and Heritage (OEH) *Industrial Noise Policy* (INP, EPA 1999) for the assessment of the operational noise of the proposed development;
- NSW OEH *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA 1999) for the assessment of the off-site traffic noise on public roads; and
- NSW OEH *Interim Construction Noise Guidelines* (ICNG, DECC, 2009) for the assessment of the noise from construction of the proposed development.

The adopted noise limits are the lowest permissible noise limits as specified in the NSW *Industrial Noise Policy*.

The study concluded that the noise criteria can be achieved with no further noise mitigation measures beyond those already proposed by AGL.

The following provides a summary of the outcomes of the assessment of potential acoustic impacts:

- Operation:
  - Noise levels generated by the proposed operation would be within the established noise limits at all receptor locations under neutral and the prevailing meteorological conditions at the Site.
- Sleep Disturbance:
  - Predicted noise levels are within the sleep disturbance noise limits established taking into consideration in accordance with the INP, ECRTN and WHO guidelines.
- Low Frequency and Tonal Noise:
  - The assessment indicates that low frequency noise may exceed the INP Low Frequency Noise criteria at three residences.
  - An alternative assessment of low frequency and tonal noise impacts undertaken in line with an alternative assessment model, and the application of which is supported by international research, suggests that the predicted low frequency noise would not be at a level to cause annoyance to any residential receptors. Consequently, no adjustment to the A-weighted predicted operational noise levels would be required under this model.

  - Notwithstanding this, AGL will commence discussions with receptors B, C and D (see **Table 12-3**) regarding this assessment, with a view to reaching agreement with them on noise management for the project consistent with other developments.

- Construction Noise:
  - No exceedance of the noise limit is expected at any residential locations during the proposed construction phase of the power station.
  - During pipeline construction, some exceedances may be experienced at Receptor D.
- Off-Site Traffic Noise:
  - Construction: The predicted increases in road traffic noise levels are up to 2 dB at the most potentially affected dwellings. The resulting levels remain within the off-site traffic noise criteria.

On the basis of this assessment, it is concluded that noise impacts of the proposed construction and operation of the plant and proposed gas pipeline and access road are not expected to degrade the existing acoustic environment nor create annoyance to the residential receptor locations surrounding the Facility.

12.1 Introduction

Potential noise impacts associated with the proposed construction and operational activities are assessed in accordance with the following NSW Office of Environment and Heritage (OEH) guidelines:

- NSW *Industrial Noise Policy* (INP, EPA 2000) for the assessment of the operational noise of the proposed development;
- NSW *Environmental Criteria for Road Traffic Noise* (ECRTN, EPA 1999) for the assessment of the off-site traffic noise on public roads; and
- NSW *Interim Construction Noise Guidelines* (ICNG, DECC 2009) for the assessment of the noise from construction of the proposed development.

Potential for sleep disturbance has also been assessed as the proposed development is a 'peaking' power station and could operate at any time.

12.2 Methodology

12.2.1 Assessment Process

The INP outlines processes to help strike a feasible and reasonable balance between the establishment and operation of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

In summary, noise management in accordance with the INP involves the following main steps:

1) Determining the project specific noise levels for intrusiveness and amenity that are relevant to the Project.
2) Measuring and determining existing background and ambient noise levels, using the method relevant to the expected level of impact.
3) Where the proposed development is expected to produce annoying noise characteristics, adjustments are to be applied to the noise levels produced by the development in question.
4) Predicting or measuring the noise levels produced by the development in question, having regard to meteorological effects (such as wind, temperature inversions).
5) Comparing the predicted or measured noise level with the project-specific noise levels and assessing impacts.
6) Considering feasible and reasonable noise mitigation strategies where the project-specific noise levels are exceeded.
7) Negotiation between the regulatory / consent authority and the proponent and between the community and the proponent to evaluate the economic, social and environmental costs and benefits from the proposed development against the noise impacts.
8) The regulatory / consent authority sets statutory compliance levels that reflect the achievable and agreed noise limits for the development.

9) Monitoring of environmental noise levels from the development to determine compliance with the consent / licence conditions.

Steps 1 to 6 were included as part of the noise assessment. Steps 7 to 9 will follow as part of the approvals process (if required).

12.2.2 Understanding Noise

Sound may be defined as any pressure variation that the human ear can detect. As the ear responds logarithmically to stimuli, it is more practical to express acoustic parameters as a logarithmic ratio of the measured value to a reference value. This logarithmic ratio is called a decibel or dB. The smallest perceptible change is about 1 dB.

The most common frequency weighting in current use is “A-weighting” providing results often denoted as dB(A), which conforms approximately to the response of the human ear.

For reference, **Table 12-1** presents the sound pressure levels of some common sources.

Table 12-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
140	Propeller aircraft; artillery fire, gunner’s position	Intolerable
120	Riveter; rock concert, close to speakers; ship’s engine room	
110	Grinding; sawing	
100	Punch press and wood planers, at operator’s position; pneumatic hammer or drilling (at 2 m)	Very noisy
80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
70	Kerbside of busy traffic	
60	Department store, restaurant, conversational speech	
50	General office	Moderate to quiet
40	Private office; Quiet residential area	Quiet
30	Theatre; quiet bedroom at night	
20	Unoccupied recording studio; Leaves rustling	Very quiet
10	Hearing threshold, good ears at frequency of maximum sensitivity	
0	Hearing threshold, excellent ears at frequency maximum response	

The most important factors affecting the way noise travels through the air and how it arrives at the receiver are:

- type of source (point or line);
- distance from source;
- atmospheric absorption;
- wind;
- temperature and temperature gradient;

- obstacles such as barriers and buildings;
- ground absorption;
- reflections;
- humidity; and
- precipitation.

12.2.3 Construction and Operational Noise Calculation

Noise levels due to the proposed construction and operation of the plant at the identified noise sensitive receptor locations have been predicted using an acoustic computer model created in SoundPLAN Version 6.5. This program is used and recognised internationally. It is also considered as a preferred computer noise model in NSW by OEH.

The noise model was developed to allow the prediction of cumulative noise levels from the plant and construction activities by calculating the contribution of each noise source. The noise model takes into account:

- sound power levels of each source;
- receptor locations;
- digital terrain map with 1m height interval;
- screening effects due to topography;
- meteorological effects and attenuation due to distance; and
- ground and atmospheric absorption.

The assessment considered the following operational scenarios:

- Stage 1: Power generation of 250 MW– 750 MW comprising:
  - two to four "E" class machines (125 MW to 180 MW each); or
  - two to three "F" class machines (200 MW to 250 MW each)
- Stage 2: Power generation of 750 MW – 1500 MW comprising additional E or F class turbines taking the maximum number of turbines to six.
  - six “E” class machines (125 MW to 180 MW each); or
  - six “F” class machines (200 MW to 250 MW each)

For the purposes of noise modelling, four operational scenarios were considered as presented in **Table 12-2**.

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Table 12-2 Operational Scenarios

Scenario	Stage	Machine Type	Quantity of Machine	Maximum Power Generation of Each Machine	Total Power Generation
A	1	13E2 Class	4	180 MW	720 MW
B		109FA Class	3	250 MW	750 MW
C	2	13E2 class	6	180 MW	1080 MW
D		109FA Class	6	250 MW	1500 MW

The sound power levels for both the E and F Class machines are presented within the Noise Assessment (**Appendix G**).

Attenuation of the sound power level due to the proposed noise mitigation measures for some primary components of the proposed gas turbines have been incorporated in the sound power levels and therefore the modelling of the impacts of the Facility. Noise mitigation measures for the primary components of the proposed gas turbines assumed include:

- acoustic enclosure of turbine compartments consists of single layer of 2 mm thick steel outer plate, 75 mm thick rockwool insulation and perforated steel inner plate;
- acoustic enclosure of exhaust diffusers consists of single layer of 4 mm thick steel outer plate, 150 mm thick rockwool insulation and 4 mm thick steel inner plate; and
- silencing on the inlet system via an 8 foot long parallel acoustic baffle.

The noise modelling was based on likely maximum operating conditions. All sources were conservatively positioned within designated operating areas. The following assumptions were made to assess the cumulative noise impacts of the proposed operation of the plant:

- each noise generating component operates continuously; and
- all the equipment operates continuously and simultaneously.

Adverse meteorological conditions have the potential to increase noise levels at a receptor. Such phenomena generally occur during temperature inversions and where there is a wind gradient with wind direction from the source to the receptor. It is known that these meteorological effects typically increase noise levels by 5 to 10 dB, and even higher than 10 dB in extreme conditions.

Temperature inversions generally occur during the night-time and early morning periods during the winter season, thus the most significant meteorological effect during the daytime period is wind.

The prevailing meteorological conditions for the site were assessed using historical meteorological data collected from a BOM weather station located in Goulburn Airport, and the results incorporated into the acoustic assessment. Further discussion is presented in Section 3.1 and 5.2 of the Acoustic Assessment (**Appendix G**).

12.2.4 Vibration

Vibration impacts of the proposed construction and operation have not been assessed in detail. Generally, the main activities that could create vibration during construction are driven piling and blasting. These activities are unlikely to be required for this project. Foundations for structures within the AGL site would likely be supported on bored piles. Essentially this is a drilling activity resulting in minimal vibration levels. The minimum distance between the nearest residences and the site is in the order of 2 km. Given the unlikelihood of vibration causing activities as well as the significant distance of the site from the closest residential receptors, the potential impact of vibration is considered negligible.

Vibration during operation could be associated with rotating equipment. Gas turbine plant operate at high rotational speed and are very sensitive to vibration and hence very well balanced preventing vibration at levels that could be intrusive to surrounding receptors.

12.3 Existing Environment

12.3.1 Residential Receivers

The nearest potentially affected noise sensitive receptor locations shown in **Table 12-3** have been identified from examination of aerial photographs using Google Earth and a site inspection. These locations are highlighted in **Figure 12-1**.

Table 12-3 Noise Sensitive Receptors

Receptor	Location	Approx Distance from Centre of Facility (km)	Indicative Noise Amenity Area[1]	Nearest Site Boundary
A	Rugby Road, Dalton (David Hallam)	4.2	Rural Residence	NNW
B	"Mt. Pleasant", 421 Walshs Road, Dalton	2.4	Rural Residence	NW
C	308 Rugby Road, Dalton	2.4	Rural Residence	SW
D	Cowper Street, Dalton	2.3	Rural Residence	SSW
E	Bushs Lane, Dalton	3.7	Rural Residence	S
F	Alton Hill Road, Dalton	5.7	Rural Residence	SE
G	Alton Hill Road, Dalton	4.9	Rural Residence	E
H	Castle Hill Road, Dalton	4.2	Rural Residence	NNE
I	Castle Hill Road, Dalton	3.3	Rural Residence	N
J	Alton Hill Road, Adj. Merrill Creek	3.0	Rural Residence	NNE

Notes: 1. According to the NSW Industrial Noise Policy.

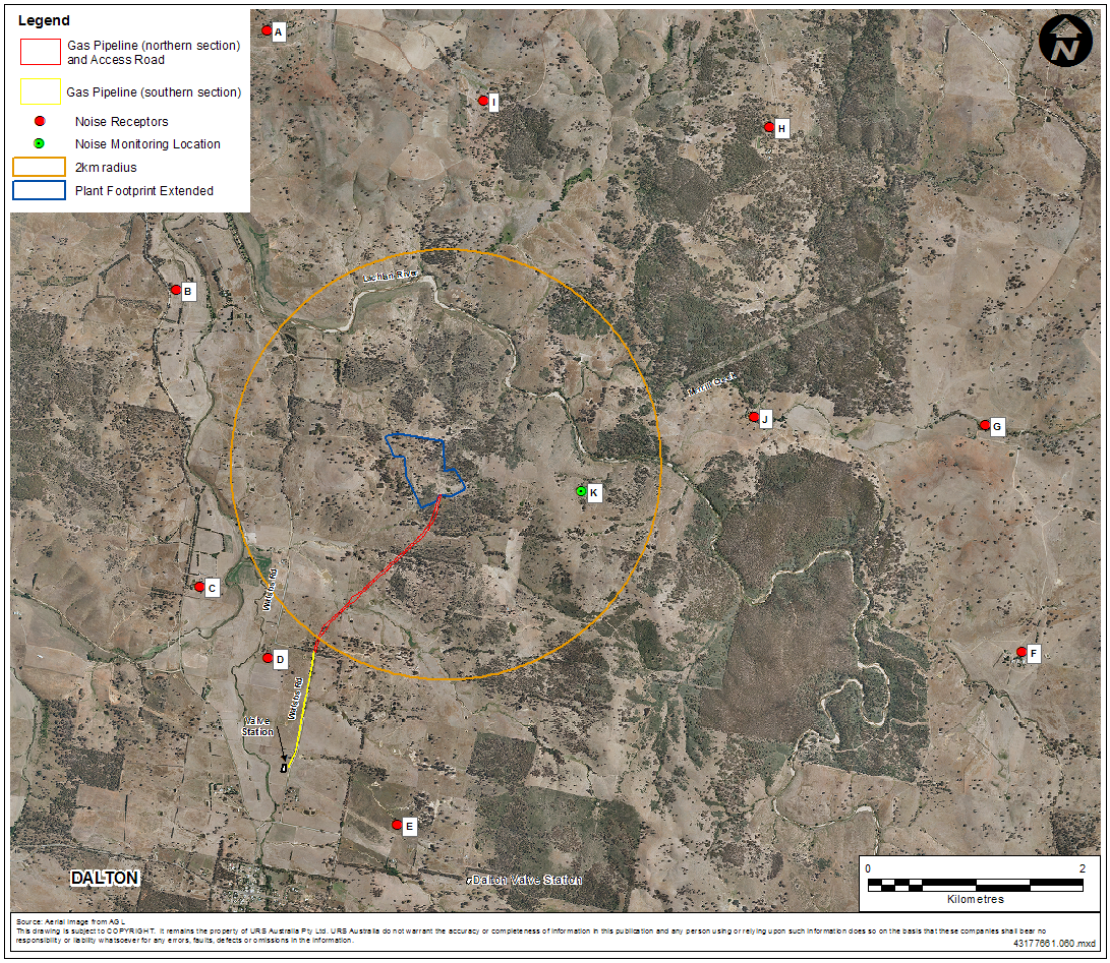
12.3.2 Traffic Noise

NSW Environmental Criteria for Road Traffic Noise (ECRTN)

Criteria for off site road traffic noise are specified in the NSW *Environmental Criteria for Road Traffic Noise* (ECRTN). The criteria applicable are summarised in **Table 12-4**. The location of the worst potentially affected receptor locations fall under the ECRTN category of:

- Land use developments with potential to create additional traffic on local road (Locations L and M); and
- Land use developments with potential to create additional traffic on collector road (Locations N and O).

Figure 12-1 Site and Noise Sensitive Receptor Locations



Regular vehicle movement within the Facility is considered as an industrial noise source and thus, is to be assessed in accordance with the INP.

Table 12-4 Environmental Criteria for Road Traffic Noise

Type of Development	Day $L_{Aeq,1hr}$ dB(A)	Night $L_{Aeq,1hr}$ dB(A)	Where criteria are already exceeded
Land use developments with potential to create additional traffic on local roads	55	50	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating time of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB.
Land use developments with potential to create additional traffic on collector roads	60	55	
Notes: • Day: 7.00 am – 10.00 pm / Night: 10.00 pm – 7.00 am.			

In accordance with the above guidelines, traffic noise criteria applicable for each receptor location within the study area are presented in **Table 12-5**.

Table 12-5 Traffic Noise Criteria for Receptors

Receptor	Address	Type of Road (Table 4-7)	Noise Criteria ($L_{Aeq,1hr}$) dB(A)	
			Day	Night
D	Walshs Road (Cowper Street)	Local Road	55	50
L	Dalton Road	Local Road	55	50
M	Warrataw Street	Local Road	55	50
N	Gundaroo Street	Collector Road	60	55
O	Collector Road	Collector Road	60	55

12.3.3 Background Monitoring

Noise monitoring locations were chosen after examination of satellite imagery of the locality and a site inspection. Consideration was given to selecting monitoring locations to establish the representative noise trend across the nearest receptors to the site. The locations were also chosen so that the noise loggers would not be affected by extraneous noise (e.g. cattle, pumps, etc) which could result in unrepresentative elevated background noise levels.

Two residential receptor locations were selected for the long-term noise monitoring in addition to one location near the site eastern boundary. Several short-term attended locations were also chosen to supplement the long-term noise monitoring. These locations are considered representative of the most potentially affected noise sensitive receptor locations near the Facility.

Table 12-6 provides a summary of the background monitoring locations representing each receiver.

Table 12-6 Background monitoring locations representing each receiver

Receptor	Location	Representative Background Monitoring Location
A	Rugby Road, Dalton	B (421 Walshs Road)
B	421 Walshs Road, Dalton	B
C	308 Rugby Road, Dalton	C (308 Rugby Road)
D	Walshs Road (Cowper Street), Dalton	C
E	Bushs Lane, Dalton	C
F	Alton Hill Road, Dalton	K (Site eastern boundary)
G	Alton Hill Road, Dalton	K (Site eastern boundary)
H	Castle Hill Road or Street, Dalton	B
I	Castle Hill Road or Street, Dalton	B
J	Alton Hill Road, Dalton (Merrill Ck)	K (Site eastern boundary)

It is noted that Location K (near site eastern boundary) was chosen as a representative location as AGL have not obtained permission to have the noise monitoring undertaken at Locations F, G or J. The noise monitoring at this location (Location K) would have provided conservative noise levels as the location was not exposed to noise sources other than local fauna such as birds, insects and cattle.

Table 12-7 presents a summary of overall ambient and background noise levels at each monitoring location.

Table 12-7 Summary of Measured Noise Levels – All Monitoring Locations

Location	Rating Background Level (RBL) L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
B: 421 Walshs Road	26	26	24	50	48	38
C: 308 Rugby Road	27	26	25	46	43	42
K: Site eastern boundary	25	27	25	45	44	39

The measured noise levels, or rating background levels (RBLs) presented were used to derive day, evening and night-time noise limits for this noise impact assessment of the proposed construction and operation of the plant.

The NSW INP states that where the rating background level is found to be less than 30 dB(A), then it is set to 30 dB(A). Therefore, the rating background levels for Locations B, C and K have been adjusted as shown in **Table 12-8** below.

Table 12-8 Rating Background Noise Levels – All Monitoring Locations

Location	Rating Background Level (RBL), L_{A90} dB(A)		
	Day	Evening	Night
B: 421 Walshs Road	30	30	30
C: 308 Rugby Road	30	30	30
K: Site eastern boundary	30	30	30

12.3.4 ECRTN Assessment

Additional noise monitoring locations were chosen after examination of the proposed traffic route and a site inspection. Consideration was given to selecting the monitoring locations to enable unattended long-term noise monitoring to establish the representative noise trend at the worst potentially affected receptor locations. The locations were also chosen so that the noise loggers would not have been affected by extraneous noise (e.g. cattle, pumps, etc) which could result in unrepresentative elevated background noise levels.

Two residential receptor locations were selected for the long-term traffic noise monitoring (Location M and N). Several short-term attended locations were also chosen to supplement the long-term noise monitoring (Locations L, M, N and O).

The worst potentially affected noise sensitive receptor locations are shown in **Table 12-9.**

Table 12-9 Summary of Noise Sensitive Receptors – ECRTN Assessment

Receptor	Location
D	Walshs Road (Cowper Street), Dalton
L	Dalton Road, Gunning
M	Warrataw Street, Gunning
N	Gundaroo Street, Gunning
O	Collector Road, Gunning

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Figure 12-2 Monitoring locations used to measure existing road traffic noise

The results of the long-term noise monitoring are summarised into representative traffic noise levels in **Table 12-10**. Further detail on the individual noise measurements at these locations is presented in **Appendix G**. For the purpose of the ECRTN assessment, the following time of day is defined:

- Day: 7.00 am – 10.00 pm, all days; and
- Night: 10.00 pm – 7.00 am, all days.

Table 12-10 Representative Traffic Noise Levels

Date	Average L_{Aeq} Levels, dB(A)		Highest $L_{Aeq,1hr}$ Levels, dB(A)	
	Day ($L_{Aeq,15hr}$)	Night ($L_{Aeq,9hr}$)	Day	Night
5 Warrataw Street, Gunning (Location L)[2]	54	48	58	54
1 Gundaroo Street, Gunning (Location M)[3]	55	48	58	51

Notes:
1. Represents logarithmic average of measured traffic levels. Further detail on individual measurements is provided in Appendix G.
2. Measured 1-5 April 2009
3. Measured 5-8 April 2009

12.3.5 Operational Noise - Continuous

NSW Industrial Noise Policy

The INP is designed to assess "industrial noise" using the more stringent of the following two approaches:

- intrusive noise impacts in the short term for residences; and
- amenity for particular land uses such as residences.

The INP's intrusive goal is set 5 dBA above the RBL for each time period (daytime, evening or night time) of interest. The RBL's are derived from the measured L_{A90} noise levels as per the OEH guidelines.

The amenity criterion is established to limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in the INP. **Table 12-11** is a summary of the noise levels from the INP showing amenity criteria applicable to the different types of receptors and areas within the study area.

Table 12-11 Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receptor	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable (ANL)	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45

Notes:
- Shaded levels represent the Amenity Criteria applicable to this assessment.

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For the receptor locations considered in this assessment, the amenity area of "Rural" has been adopted for the purpose of establishing the project-specific noise levels. "Rural" area means an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic.

In addition, the INP specifies that modification is to be implemented where the existing noise level from industrial noise sources is close to the acceptable noise level (ANL) or already exceeds the ANL for the area in question. However, modification to Acceptable Noise Level (ANL) is not required for the residential locations in this assessment as the L_{Aeq} noise levels obtained for these locations were dominated by natural sounds and not affected by industrial sources, as discussed in **Section 12.3.3** of this document.

The PSNL reflect the most stringent noise level requirement from the criteria derived from both the intrusive and amenity criteria to ensure that intrusive noise is limited and amenity is protected.

Table 12-12 summarises the noise criteria applicable to the operation of the Facility.

Table 12-12 Project-Specific Noise Levels (PSNL)

Receptor Location	Intrusive Criterion $L_{Aeq,15min}$ dB(A)			Amenity Criterion $L_{Aeq,period}$ dB(A)		
	Day	Evening	Night	Day	Evening	Night
All Receptor Locations	**35**	**35**	**35**	50	45	40
Notes: Shaded results represent the PSNL applicable to the assessment.						

It can been seen in the table above that the controlling noise criteria will be the intrusive criteria, which are based on the representative rating background levels for each assessment period. It should be noted that 35 dB(A) $L_{Aeq,15min}$ is the lowest permissible noise limit in accordance with the INP.

The PSNL is the noise contribution from the operation of the proposed power station only, i.e. excluding the contribution from the background noise level.

In assessing noise levels at residences, the noise level is to be assessed at the most affected point on or within the residential property boundary or, if this is more than 30 m from the residence, at the most affected point within 30 m of the residence.

As the proposed operations are up to 24 hours a day, the controlling noise criterion is the night-time criterion. For the purpose of this assessment, the night-time criterion is considered because compliance with that target leads to compliance at all other times.

Operational Noise Criteria - Sleep Disturbance

An assessment of sleep disturbance for the potentially affected noise sensitive receptors has also been considered in this study. Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (10.00pm – 7.00am), consideration should be given to the potential for the disturbance of sleep within residences.

Section 2.2 of the INP states that meeting the Acceptable Noise Limit (ANL) shown on **Table 12-11** will protect against sleep disturbance which recommends the acceptable external noise level for rural areas to be 40 dB(A) L_{Aeq} at night.

The World Health Organisation (WHO) suggests that the noise level inside bedrooms should be limited to 30 – 35 dB(A) L_{Aeq} and 45 dB(A) L_{Amax}. When considering internal noise levels from an external noise source, it is common practice to assume that windows are partially open to allow natural ventilation. The noise reduction through partially opened windows is estimated to be 10 dB(A), as specified in *AS 3671-1989: Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*.

The *Application Notes* to the INP state that:

- OEH reviewed research on sleep disturbance in the NSW Environmental Criteria for Traffic Noise (ECRTN), and the review concluded that the ECRTN sleep disturbance criterion of an $L_{A1,1min}$ not exceeding the $L_{A90,15min}$ by more than 15 dB(A) is not ideal.
- However, as there is insufficient evidence to determine what should replace it, OEH will continue to use this criterion as a guide to identify the likelihood of sleep disturbance. Where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.

To achieve the internal noise levels described above, the noise levels inside and outside bedroom windows, should be limited to 45 dB(A) $L_{A1,1min}$ and 55 dB(A) $L_{A1,1min}$ which is in line with the $L_{A90,15min}$ + 15 dB(A) criterion provided in the INP Application Notes.

Table 12-13 summarises the sleep disturbance criteria that are applied to the nominated residential receptors.

Table 12-13 Sleep Disturbance Criteria

Receptor	Internal Noise Level ($L_{A1,1min}$ or L_{Amax}) dB(A)	External Noise Level ($L_{A1,1min}$ or L_{Amax}) dB(A)
All receptors	30 + 15 = 45	45 + 10 = **55**

The external noise levels are assessed at the most exposed side of residential premises. Sleep disturbance thresholds are also determined by factors including noise character and pitch, perceived personal danger, degree of habituation, age, illness or fatigue and the point in time when the noise occurs during the sleep period. For example, noisy events are generally less disturbing to people if confined to the earlier period of the evening when it is still possible to retrieve deep sleep.

It is noted that the nominated sleep disturbance noise criterion is greater than the project-specific noise levels. Therefore, where the project-specific noise levels are not exceeded at residential receptor locations, the sleep disturbance criterion would also be satisfied, and no additional noise control measures would be required.

Low Frequency and Tonal Noise

The following guideline was used to assess potential low frequency noise impacts:

- NSW Industrial Noise Policy (INP, NSW EPA, 2000)

The INP recommendations for low frequency noise involve an assessment to be conducted on the difference between C and A weighting levels. The most common frequency weighting in current use is “A-weighting” providing results often denoted as dB(A), and approximate the response of the human ear at low sound levels. A “C-weighting” curve is also used, particularly when evaluating very loud or low-frequency sounds. In accordance with the INP:

- If a difference greater than 15 dB exists between the A and C weighted levels, a correction of 5 dB is to be applied to the measured or predicted levels.

This approach provides an assessment for potential for low frequency noise.

Low Frequency and Tonal Noise Alternative Assessment

Recent international research has shown that the use of the INP difference approach is not suitable when the noise levels are low, since the low frequencies may then be below the threshold of hearing levels (A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003).

The following documents have additionally been considered for an alternative assessment approach to low frequency noise in this assessment:

- World Health Organisation (WHO), *Guidelines for Community Noise*, 1999
- Proposed Criteria for the Assessment of Low Frequency Noise Disturbance, 2005, Prepared for DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams
- Procedure for the Assessment of Low Frequency Noise Complaints, 2005, Prepared for DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams.
- A Noise Limit on Low Frequency Noise Emission due to Power Plants, Dr. N. Broner, 2008
- NSW Leafs Gully Gas Turbine Power Station – Noise & Vibration Assessment, Wilkinson Murray, 2008
- NSW Leafs Gully Gas Turbine Power Station – Director General's Report and Project Approval issued by NSW Department of Planning

Construction Noise

The noise criteria set out in the *Interim Construction Noise Guideline* (DECC, July 2009) have been used to assess the potential construction noise impact. This guideline is not mandatory although it will be used to assist OEH in setting statutory conditions in licences or other regulatory instruments for construction noise.

The construction noise criteria guideline for noise at residences and other sensitive land uses is discussed further in **Appendix G**.

Table 12-14 summarises the criteria for construction noise which has been deemed appropriate for this particular investigation.

Table 12-14 Project-specific Construction Noise Management Levels

Receptor Location	Rating Background Level L_{A90} dB(A)	Noise Affected Level $L_{Aeq,15min}$ dB(A)	Highly Noise Affected Level $L_{Aeq,15min}$ dB(A)
All Receptors	30	30 + 10 = **40**	**75**

12.4 Assessment of Impacts

12.4.1 Operational Noise Assessment

The noise modelling using the CONCAWE and ISO calculation methods considering neutral (Stability Class of D with a wind speed of 0 m/s) and adverse meteorological conditions (Stability Class of C with a wind speed of 4 m/s for daytime and Stability Class of F and a wind speed of 2 m/s for evening and night-time) compared to the INP Noise Limits are presented in **Table 12-15, Table 12-16, Table 12-17, Table 12-18 and Table 12-19**.

Scenario A – Four 13E2 Class Machines

Table 12-15 Predicted Operational Noise Levels – Scenario A

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B	24	24	27	27	35	No
C	24	25	28	28	35	No
D	26	27	30	30	35	No
E	< 20	< 20	21	22	35	No
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	< 20	< 20	20	35	No
J	20	21	24	25	35	No

The results presented in **Table 12-15** show that the noise levels would be within the established noise limits at all receptor locations under all meteorological conditions.

Scenario B – Three 109FA Class Machines

Table 12-16 Predicted Operational Noise Levels – Scenario B

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B	25	26	28	28	35	No
C	24	25	27	28	35	No
D	26	27	30	30	35	No
E	< 20	< 20	< 20	< 20	35	No

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	< 20	< 20	21	35	No
J	< 20	20	23	24	35	No

The results presented in **Table 12-16** show that the noise levels would be within the established noise limits at all receptor locations under the considered meteorological conditions.

Scenario C – Six 13E2 Class Machines

Table 12-17 Predicted Operational Noise Levels – Scenario C

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B	25	26	28	29	35	No
C	26	27	29	30	35	No
D	27	28	31	31	35	No
E	< 20	< 20	23	23	35	No
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	21	21	22	35	No
J	21	22	25	26	35	No

The results presented in **Table 12-17** show that the noise levels would be within the established noise limits at all receptor locations under the considered meteorological conditions.

Scenario D – Six 109FA Class Machines

Table 12-18 Predicted Operational Noise Levels – Scenario D

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
A	< 20	< 20	< 20	< 20	35	No
B	27	28	31	31	35	No

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Neutral Met Conditions		Adverse Met Conditions		All Periods	
	Day	Evening / Night	Day	Evening / Night		
C	26	27	30	30	35	No
D	28	29	32	32	35	No
E	< 20	< 20	< 20	23	35	No
F	< 20	< 20	< 20	< 20	35	No
G	< 20	< 20	< 20	< 20	35	No
H	< 20	< 20	< 20	< 20	35	No
I	< 20	21	< 20	24	35	No
J	22	23	28	28	35	No

The results presented in **Table 12-18** show that the noise levels would be within the established noise limits at all receptor locations under the considered meteorological conditions.

ISO Calculation Method – All Scenarios

The highest predicted noise levels, using the ISO calculation method compared to the INP Noise Limits, are presented in **Table 12-19**.

Table 12-19 Predicted Operational Noise Levels – ISO Conditions

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Scenario A	Scenario B	Scenario C	Scenario D	All Periods	
	Night	Night	Night	Night		
A	< 20	< 20	< 20	< 20	35	No
B	30	30	32	33	35	No
C	30	30	32	33	35	No
D	31	31	33	34	35	No
E	26	25	28	28	35	No
F	20	19	22	22	35	No
G	< 20	20	23	24	35	No
H	< 20	15	18	19	35	No
I	23	23	24	26	35	No
J	26	25	28	29	35	No

The results presented in **Table 12-19** show that the noise levels would be within the established noise limits at all receptor locations under moderate meteorological conditions.

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The results shown in tables from **Table 12-15** to **Table 12-19** present A-weighted noise levels predicted using SoundPLAN.

Comparing the results using the CONCAWE calculation method (**Tables 12-15, 12-16, 12-17, 12-18**) with the ISO results (**Table 12-19**) they predict similar noise levels at all receptor locations. The minor variations are primarily due to down-wind setting used in each calculation method.

Figures 12-3 and **12-4** present the noise contours for Stage 2 (i.e maximum number of turbines). It is noted that the calculated (point to point) levels as presented in **Tables 12-15 to 12-19** are more accurate than contours.

Due to the commercially sensitive nature of this data, noise data provided to URS was only available in octave band frequencies, which did not allow URS to undertake a detailed assessment to foresee if the proposed operation would generate noise containing prominent tonal components.

Noise emanating from the proposed operation is not expected to contain tonality or impulsiveness, however, AGL is committed to ameliorating any tonal or impulsive noise issues if they arise, and propose a noise monitoring program during commissioning as discussed further in **Table 12-24**.

Figure 12-3 Noise Contours for Stage 2 – Operation of 6 "E" Class Machines

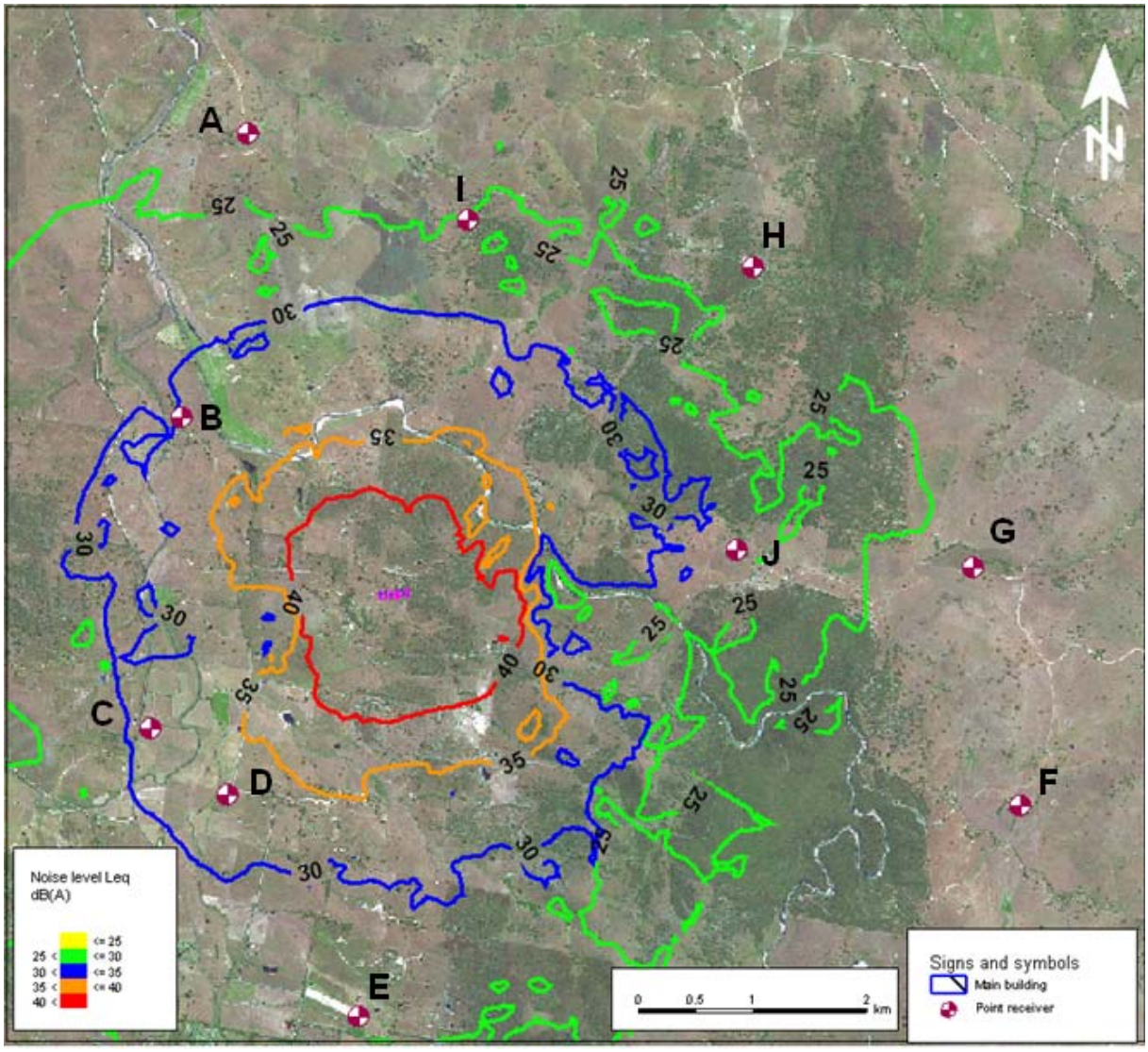

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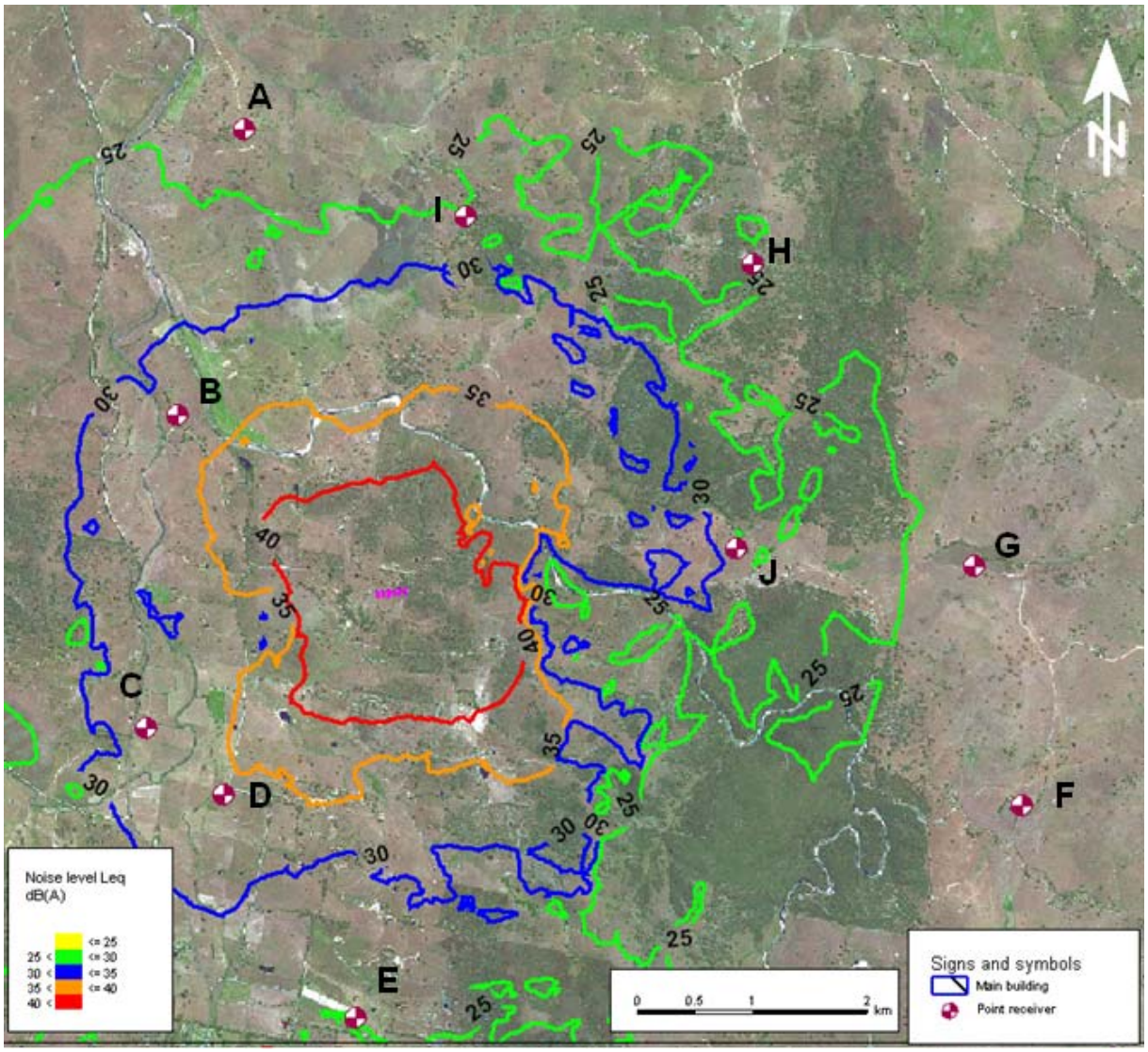
Figure 12-4 Noise Contours for Stage 2 – Operation of 6 “F” Class Machines



Assessment of Low-Frequency and Tonal Noise

To assess potential low frequency noise impacts, C-weighted noise levels of octave band frequency have been predicted by noise modelling using SoundPLAN. . The predicted C-weighted noise levels at the receptors were then compared with the predicted A-weighted noise levels to examine if the difference between the C and A-weighted noise levels is greater than or equal to 15 dB. The result of the comparison with the criteria identified in **Chapter 12.3.5** is presented in **Table 12-20**.

Table 12-20 presents C-weighted noise levels predicted using SoundPLAN based on indicative turbine spectra.

Table 12-20 Predicted Operational Noise Levels (A- and C-weighted) – Worst-case Scenario

Receptor Location	Difference between C- and A-weighted Predicted Noise Levels (L_{eq}), dB	
	Worst-case Scenario	Exceeds INP LFN[1] Criterion
A	52 – 20 > 15	Yes
B	56 – 33 > 15	Yes
C	56 – 33 > 15	Yes
D	57 – 34 > 15	Yes
E	53 – 28 > 15	Yes
F	49 – 22 > 15	Yes
G	50 – 24 > 15	Yes
H	52 – 20 > 15	Yes
I	54 – 26 > 15	Yes
J	52 – 29 > 15	Yes
Note: 1. Low Frequency Noise		

It can be seen in **Table 12-20** that the difference between C and A-weighted noise levels would exceed the INP Low Frequency Noise criterion. Using the INP approach, the A–weighted noise predictions at the receptors would require a 5 dB(A) adjustment. This impact and subsequent comparison to the Project-Specific Noise Level (PSNL) of 35 dB(A) is presented in **Table 12-21**. The results indicate that the predicted noise levels would exceed the PSNL at Receptors B, C and D.

Based on the information provided by AGL, it is considered that noise emanating from the proposed facility is not expected to contain tonality or impulsiveness.

Table 12-21 Predicted Operational Noise Levels (adjusted A-weighted) –Worst-case Scenario

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Scenario A	Scenario B	Scenario C	Scenario D	All Periods	
A	20 *(25)*	20 *(25)*	20 *(25)*	20 *(25)*	35	No

Receptor Location	Predicted Noise Levels (L_{Aeq}) dB(A)				Criterion (L_{Aeq}) dB(A)	Exceedance
	Scenario A	Scenario B	Scenario C	Scenario D	All Periods	
B	30 *(35)*	30 *(35)*	32 ***(37)***	33 ***(38)***	35	**Yes**
C	30 *(35)*	30 *(35)*	32 ***(37)***	33 ***(38)***	35	**Yes**
D	31 ***(36)***	31 ***(36)***	33 ***(38)***	34 ***(39)***	35	**Yes**
E	26 *(31)*	25 *(30)*	28 *(33)*	28 *(33)*	35	No
F	20 *(25)*	20 *(25)*	22 *(27)*	22 *(27)*	35	No
G	20 *(25)*	20 *(25)*	23 *(28)*	24 *(29)*	35	No
H	20 *(25)*	20 *(25)*	20 *(25)*	20 *(25)*	35	No
I	23 *(28)*	23 *(28)*	24 *(29)*	26 *(31)*	35	No
J	26 (31)	25 (30)	28 (33)	29 (34)	35	No

Notes:
- Adjustment shown in brackets in italics.
- Exceedance of the criterion shown in brackets in bold italics.

Alternative Approach to Low Frequency and Tonal Noise

Recent international research has shown that the use of the INP difference approach is not suitable for use in assessments when the noise levels are low, since the low frequencies may then be below the threshold of hearing levels (A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003).

URS has additionally reviewed the following noise policies and guidelines for an alternative assessment of potential low frequency noise impacts:

- A review of Published Research on Low Frequency Noise and its Effects, Report for Department for Environment, Food and Rural Affairs (UK) by Dr Geoff Leventhall, 2003
- Proposed criteria for the assessment of low frequency noise disturbance, prepared for UK DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams, 2005
- Procedure for the assessment of low frequency noise complaints, prepared for UK DEFRA by Dr. Andy Moorhouse, Dr. David Waddington, Dr. Mags Adams, 2005
- Proposed Criteria for Low Frequency Noise from Combustion Turbine Power Plants, Noise – Con 2004, Baltimore, Maryland, G. F. Hesseler Jr, 2005 (as referenced in Broner, 2008)
- Proposed Criteria for Low Frequency Industrial Noise in Residential Communities, Journal of Low Frequency Noise, Vibration and Active Control 24, No 2, G. F. Hessler Jr, 2005 (as referenced in Broner, 2008)
- ANSI S12.9 – 2005/ Part 4 Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response (as referenced in Broner, 2008)
- US Oregon Department of Environmental Quality, Noise Control Regulations for Industry and Commerce OAR 340-035-0035 (as referenced in Broner, 2008)

- A Noise Limit on Low Frequency Noise Emission due to Power Plants, Dr. N. Broner, 2008
- NSW Leafs Gully Gas Turbine Power Station – Noise & Vibration Assessment, Wilkinson Murray, 2008
- NSW Leafs Gully Gas Turbine Power Station – Director General's Report and Project Approval issued by NSW Department of Planning

Current research suggests that (dB(C) – dB(A)) difference should not be used as an annoyance predictor, but as a simple indicator of whether further investigation may be necessary (Low Frequency Noise and Annoyance, Noise & Health 2004, 6:23, 59-72).

For protecting residential areas against potential low frequency noise issues caused by combustion turbine open cycle plants, Broner (2008) makes reference to Hessler's research which proposed C-weighted levels supplementary to the A-weighted site criteria as follows:

- For intermittent daytime only or seasonal source operation:
  - 70 dB(C) for normal suburban / urban residential areas, where background level (L_{A90}) is higher than 40 dB(A),
  - 65 dB(C) for quiet suburban or rural residential areas, where background level (L_{A90}) is lower than 40 dB(A),
- For extensive or 24/7 source operation:
  - 65 dB(C) for normal suburban / urban residential areas, where background level (L_{A90}) is higher than 40 dB(A),
  - 60 dB(C) for very quiet suburban or rural residential areas, where background level (L_{A90}) is lower than 40 dB(A).

Following a review of the INP assessment method and the aforementioned papers, URS proposes the following to be the most appropriate criterion to adopt for a low frequency noise assessment for this project. It is based on a combination of the INP and Hessler (as referenced in Broner's paper [Broner, 2008]) approach.

The research indicates that the use of the approach provided in the NSW Industrial Noise Policy (INP) is not the best available assessment methodology when the predicted resultant noise levels are low.

The Dalton Power Project would operate intermittently. Additionally, there will be a seasonal component (associated with peak electricity demand) to its operation, and the Project is proposed to be located in a rural area with background noise levels below 40 dB(A). For this situation, the Hessler/Broner studies cited above suggest a criterion of 65 dB(C).

- Measure / assess C and A weighted levels over same time period.
- If the difference between the C and A weighted levels is 15 dB or more:
  - Apply **5 dB correction** to the measured/predicted levels, if the overall noise level is **greater than L_{eq} 65 dB(C)**.
  - Apply **no correction** to the measured/predicted levels, if the overall noise level is **less than L_{eq} 65 dB(C)**.

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It is noted that this low frequency noise criterion is consistent with that imposed for AGL's recently approved power station development in Leafs Gully, NSW. The Leafs Gully power station is to be located in a rural area where background noise levels are similar to those of Dalton.

As with the Leafs Gully Project, the impact assessment process undertaken for the Dalton Project involved the review of relevant overseas research related to assessment of the potential for low frequency noise.

The NSW Department of Planning and Infrastructure accepted the approach on the Leafs Gully Project. That approach considers a noise level not greater than 65 dB(C) as unlikely to cause low frequency noise annoyance impacts at sensitive receptors. For the Leafs Gully Project, the Department concluded that the 5 dB(A) adjustment to the noise criteria should only to be applied if the difference between the C and A-weighted noise levels is greater than or equal to 15 dB when the measured noise levels is greater than 65 dB(C).

Discussion of Low Frequency and Tonal Noise

The results shown in **Table 12-20** and **Table 12-21** indicate that the predicted noise levels would exceed the PSNL at Receptors B, C and D. However international research suggests that the predicted low frequency noise would not be at a level to cause annoyance to residential receptors as the overall C-weighted noise levels would not exceed 65 dB(C) at any receptor locations (Hessler/Broner method [Broner, 2008]).

Accordingly, and based on the approach to this assessment of the combination of the INP and international methods, no adjustment to the A-weighted predicted operational noise levels would be required.

Notwithstanding this, AGL will commence discussions with receptors B, C and D (see **Table 12-3**) regarding this assessment, with a view to reaching agreement with them on noise management for the project as consistent with other developments.

Assessment of Sleep Disturbance

The potential for sleep disturbance within the residences would potentially be greatest during the early morning hours (notionally, 2.00 am-4.00 am) when background noise levels are at their lowest. It should be noted that this time period is not when the demand for a peaking power plant is likely to occur and as such operation of plant is unlikely. However, the potential for sleep disturbance has been assessed for completeness.

AGL has confirmed that there are no sources that would produce instantaneous or short-duration high noise level events. If a turbine begins or ceases operation in the early hours of the morning, this would occur in a gradual process. If operation occurs during night or early morning period, the process is relatively steady state and free of instantaneous events. The main pressure from the gas line would be adequate and therefore no gas compressor is required for this operation.

Any repairs or maintenance works would be scheduled during the daytime period.

Given that the noise from the proposed operation would be steady rather than fluctuating, it was considered that the difference between L_{Aeq} and L_{Amax} noise levels would be less than 10 dB. Based on this, the ECRTN and INP sleep disturbance criterion of 45 dB(A) $L_{A1,1min}$ or L_{Amax}, when measured inside bedroom, is not expected to be exceeded.

Therefore, the proposed operation is not predicted to give rise to sleep disturbance.

12.4.2 Construction Noise

The Stage 1 construction phase is anticipated to take around 24 months and will involve the construction of concrete footings for the generator units, the formation of unsealed site roads, installation of turbine units, construction of a switchyard and transmission connection, installation of the gas pipeline and gas receiving station, fencing, commissioning and other minor works.

The construction program for the second stage would comprise construction activities to achieve the residual generating capacity for a completed maximum of six turbines on site. Although it is assumed that the construction would be generally similar to the first stage, the intensity is likely to be lower as the majority of site preparation works and infrastructure would be established in the first stage.

Based on similar sized projects, the construction period for each stage is expected to take around 24 months with a peak period of up to 6 months.

The main construction activities would involve the following activities:

- Removing the layer of vegetation and levelling,
- Bulk earthworks including site grading and excavation work,
- Establishing concrete foundations for plant and buildings,
- Construction of buildings and installation of equipment and machinery, and
- Pipe line construction.

The noise levels generated by the indicative construction activities listed above have been predicted at each receptor location. Noise emissions would vary as construction progresses. The noise modelling has been carried out considering the adverse meteorological conditions. The results are presented in **Table 12-22**.

Table 12-22 Predicted Construction Noise Levels

Receptor	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Noise Criterion $L_{Aeq,15min}$ dB(A)		Exceedance
		Daytime	Evening/Night	
A	< 20	Noise Affected: 40 Highly Noise Affected: 75	35	No
B	24 – 27			No
C	23 – 26			No
D	24 – 27			No
J	Up to 22			No
E, F, G, H and I	< 20			No

The predicted construction noise levels presented in **Table 12-22** show that no exceedance of the noise limit is expected at any receptor locations.

Table 12-23 Predicted Noise Levels during Pipeline Construction

Receptor	Approx Distance from Pipeline (km)	Predicted Noise Level, $L_{Aeq,15min}$ dB(A)	Noise Criterion $L_{Aeq,15min}$ dB(A)		Exceedance
			Daytime	Evening/Night	
A	4.2	< 20	40	35	No
B	2.5	22 – 28			No
C	1.3	32 – 40			No
D	0.5	**43 – 52**			Up to 12 dB (day) and 17 dB (evening and night)
E	1.3	31 – 39			Up to 4 dB (evening and night only)
F	6	< 20			No
G	6.5	< 20			No
H	3.6	< 20			No
I	3.6	< 20			No
J	2.8	20 – 26			No

Note: * Although the corresponding predicted noise level (lower end of the range) exceeds the evening/night noise criteria, the construction scenario modelled would be considered a reasonable "worst case" daytime construction scenario. It would be still be feasible to conduct some selected construction activities at night whilst still achieving the noise criteria.

The predicted daytime construction noise levels presented in **Table 12-23** show that no exceedance of the "Noise Affected" noise level is predicted at all residential locations except for Receptor D, but no exceedances of the "Highly Affected" noise level at all residential locations.

The "Noise Affected" level would be exceeded if the standard daytime construction were to occur during the evening and night-time however, construction activities would be scheduled to be undertaken at an appropriate time of the day for the activity in question. The construction activities generating the most noise would be conducted during the day.

12.5 Off-Site Traffic Noise

The potential off-site traffic noise impact associated with the proposed construction and operation has been assessed based on the URS Traffic Study undertaken for the development.

To predict the increase in traffic noise levels, potentially caused by the proposed construction and operation of the facility, the United States' Federal Highway Administration Model (FHWA Model) was used. The model was verified and calibrated using the short-term noise monitoring results obtained for this assessment.

The assessment concluded that the increased road traffic noise levels due to the proposed construction of the facility would be within the ECRTN noise criteria. There would be some increase in noise levels (2 dB) at receptor locations, however this is not predicted to cause a noise impact on residences.

It is assumed that off-site traffic noise associated with the proposed construction would be minimised as much as is practically possible by limitations on construction hours, and Australian Design Rules which apply to road-registered vehicles.

The ongoing operation of the Facility would generate significantly less traffic than the construction phase of the Project. The operational phase is likely to generate up to 14 vehicle trips within the peak hour periods. This assumes 10 vehicle trips for operation and 4 vehicle trips for water truck deliveries based on a worst case assuming water supply is by truck delivery and peak summer requirement for Stage 2 (assuming total generation capacity of up to 1500 MW) and that 10 % of these movements would occur during the AM Peak Hour. The increase in traffic from the daily operation of the power station is accounted for in the general growth in traffic for the region. An increase in traffic volumes is expected during maintenance which would take place every 3 years at the most.

Therefore the operational traffic generated by the proposed operation is expected to be similar to traffic currently generated in the assessment area, and a further detailed assessment is not deemed necessary.

12.6 Mitigation Measures

12.6.1 Construction

While the proposed construction activities have limited potential for impact on the local ambient noise environment, noise management strategies can be applied which would further reduce the potential for noise issues during the construction period. A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary. The Construction Noise Management Plan should consider measures such as:

- Carrying out all noisy construction works during the standard daytime construction hours.
- Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors.
- Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors, where possible.
- Awareness training for staff and contractors in environmental noise issues.
- Minimising the use of horn signals and maintaining to a low volume and consideration of alternative methods of communication.
- Switching off any equipment not in use for extended periods during construction work.
- Minimising heavy vehicles' entry to site and departure from site outside the nominated construction hours.
- Use of temporary barriers (if required).
- Consideration of the positioning of construction plant / processes.
- Retrofitting reversing alarms that are quieter and display less annoying characteristics.

- Where noise level exceedances cannot be avoided, consideration should be given to applying time restrictions and/or providing quiet periods for nearby residents.
- Community consultation with local residents to assist in the alleviation of community concerns.
- Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts

12.6.2 Operation

The exhaust stack is required to be designed to comply with the INP requirements.

The noise mitigation measures for the primary components of the proposed gas turbines which have already been incorporated in the noise modelling for this assessment include:

- acoustic enclosure of turbine compartments consists of single layer of 2 mm thick steel outer plate, 75 mm thick rockwool insulation and perforated steel inner plate;
- acoustic enclosure of exhaust diffusers consists of single layer of 4 mm thick steel outer plate, 150 mm thick rockwool insulation and 4 mm thick steel inner plate; and
- silencing on the inlet system via an 2.4 m long parallel acoustic baffle.

Beyond these measures, the noise assessment did not identify a requirement for further mitigation.

Noise emissions from the plant operation would be verified during commissioning stage to confirm compliance with the project noise criteria. An Environmental Management Plan (EMP) is expected to be prepared with a noise monitoring and management programme included.

The proposed development would require licensing under the provisions of the POEO Act. This Environment Protection Licence administered by OEH is likely to include operation noise limits for the plant and requirements for compliance noise monitoring.

Table 12-24 presents a summary of mitigation measures as a result of the noise assessment.

Table 12-24 Summary of Mitigation Measures

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
A Construction Noise Management Plan is to be developed as part of the CEMP to confirm assumptions made in the assessment and to investigate reasonable and feasible noise mitigation measures if necessary.		✓	
Carrying out all noisy construction works during the standard daytime construction hours.		✓	
Scheduling construction to minimise multiple use of the noisiest equipment or plant items near noise sensitive receptors.		✓	
Strategic positioning of plant items to reduce the noise emission to noise sensitive receptors, where possible.	✓	✓	

Mitigation Measures	Implementation of mitigation measures		
	Design	Construction	Operation
Carrying out maintenance work away from noise sensitive receptors, where practicable.		✓	
Ensuring engine covers are closed, maintenance of silencers and mechanical condition. Regular maintenance and noise testing for major items of construction equipment that are significant contributors to construction noise levels.		✓	
Awareness training for staff and contractors in environmental noise issues including.		✓	
Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered.		✓	
Avoiding any unnecessary noise when carrying out manual operations and when operating plant.		✓	
Switching off any equipment not in use for extended periods during construction work.		✓	
Minimising heavy vehicles' entry to site and departure from site outside the nominated construction hours.	✓	✓	
Where noise level exceedances cannot be avoided during construction, consideration should be given to applying time restrictions and/or providing quiet periods for nearby residents.		✓	
Community consultation with local residents and building owners to assist in the alleviation of community concerns.		✓	
Maintaining a suitable complaint register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts.		✓	
Noise emissions from the plant operation to be verified during commissioning stage to confirm assumptions made regarding noise attenuation and compliance with the project noise criteria.			✓
The exhaust stack is required to be designed to comply with the INP requirements.	✓		✓
AGL will commence discussions with receptors B, C and D (see Table 12-3) regarding this assessment, with a view to reaching agreement with them on noise management for the project as consistent with other developments.	✓		