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Appendix D

Noise and Vibration

URS

QUEENSLAND COKE & ENERGY

STANWELL CORPORATION LIMITED

Queensland Coke & Power Plant Project

Noise Aspects of Environmental Impact Study

(Stanwell)

3329R03V01.doc

30 June 2006

Prepared for

URS

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Contents

1 Introduction

ASK Consulting Engineers Pty Ltd (ASK) provided the acoustic report component of the EIS for the Queensland Coke & Power Plant Project (our ref: 3329R01V03.doc, dated 24/11/2005).

Since that report, the EPA has commented on the EIS, and has eleven (11) issues and recommendations with respect to the Noise & Vibration component of the EIS. Queensland Rail and Queensland Health have one issue each as well.

In addition a number of changes to the plant layout and noise control measures have been made.

This report is an update of the original EIS and deals with the above changes.

2 Existing Noise Levels

Additional noise monitoring has been carried out in and around Stanwell during March 2006 and June 2006 to provide an update to the August 2000 background noise levels reported in the EIS.

Since the critical time in terms of noise impact is the night-time period, the emphasis has been placed on the night-time period. In essence the results show that if the night-time noise limits are met, then the day and evening noise limits would also be met.

The night-time background noise levels refer to the L90 noise levels obtained between 10 pm and 7am. Additional data was collected at location B1, B2, V1 and V4 over a period of 7 days in March 2006 and 7 days in June 2006.

For each of these monitoring periods the L90 value was calculated as per the Ecoaccess guideline. The results are summarised in **Table 1** and also include results for August 2000, reported in the original EIS.

Figure 1 shows the noise monitoring locations.

Table 1: Night-time Background Noise Levels (L90) calculated as per Ecoaccess guideline

Location	Area Description	August 2000	March 2006	June 2006	Average March/ June 2006
B1	Several kilometres west of Stanwell. Representative of background noise levels away from the SPS, but near the highway.	27	31	25	28
B2	Several kilometres south of Stanwell. Representative of background noise levels away from the SPS and the highway.	28	28	24	26
V1	Stanwell township, north of highway.	32	32	32	32
V4	Stanwell township, south of highway.	--	33	34	33

The results indicate that the background noise levels at locations B1 and B2, which are several kilometres away from Stanwell township and the SPS have remained more or less constant with the passage of time, and are generally less than 30 dB(A).

At location V1 (see **Figure 1**) the background noise level on all three occasions was 32 dB(A).

At location V4, to the south of the highway in Stanwell, the noise levels are also quite constant at 33/34 dB(A).

The slightly higher background noise levels at location V4 compared to those at location V1 reflect the presence of the SPS to the southwest and closer proximity to road and rail.

In terms of setting noise limits the average of the background noise levels obtained in March 2006 and June 2006 have been used.

All of the Ecoaccess calculated background noise levels at locations B1, B2, V1 and V4 are shown in **Appendix A.**

The daytime refers to the period 7am to 6pm, and the evening refers to the period 6pm-10pm.

3 Noise Criteria

The noise limits according to Ecoaccess have been determined as follows.

For locations along the highway and at some distance from the township of Stanwell, as represented by noise monitoring location B1, the appropriate zoning would be residential area on a busy road. The Ecoaccess Leq noise limit at these locations is calculated to be 36 dB(A).

For locations away from the highway and at some distance from the township of Stanwell, as represented by noise monitoring location B2, the appropriate zoning would be purely residential (rural residential). The Ecoaccess Leq noise limit at these locations is calculated to be 31 dB(A).

Noise monitoring location V1 is located in Stanwell to the north of the highway. This location is somewhat affected by the SPS, but not to the same degree as residences to the south of the highway located near noise monitoring location V4.

The appropriate zoning for the localities around V1 and V4 is residential area on a busy road or near an industrial area or commercial area.

Application of the Ecoaccess guidelines means that the Leq noise limit at location V1 and nearby residences is 35 dB(A), and at location V4 and nearby residences 33 dB(A).

The Ecoaccess noise limits are summarised in **Table 2. Appendix A** shows the application of the method outlined in Ecoaccess to obtain the noise limits at each of these locations.

Table 2: Leq Ecoaccess noise limits

Location	Area Description	Noise limit $L_{Aeq,adj}$		
		day	evening	night
B1	Several kilometres west of Stanwell. Representative of background noise levels away from the SPS, but near the highway.	41	40	36
B2	Several kilometres south of Stanwell. Representative of background noise levels away from the SPS and the highway.	36	37	31
V1	Stanwell township, north of highway.	43	41	35
V4	Stanwell township, south of highway.	44	41	33

4 Project Noise Sources

Since the noise report for the EIS was prepared, ASK has been provided with additional information on the materials handling processes in the Project. This information has been used to reassess the noise emissions.

The materials handling aspect of the Project is considered to be the likely dominant noise source due to the processes involved and the closer proximity to Stanwell township. The noise data for the coke oven component of the development is based on theoretical calculations of sound power associated with expected noise sources. At this stage, no measured noise data has been obtained for the coke oven component of the development.

Some of the handling facilities have been relocated to the eastern part of the site in close proximity to Flagstaff Hill. The hill will provide some acoustic shielding for these noise sources.

5 Proposed Attenuation Measures

To reduce the noise emission levels from the project, the following noise mitigation measures are proposed and these have been incorporated in the latest modelling:

- Enclosure of the coal crusher and screen station. Construction may consist of a sheet metal wall lined internally with 100mm insulation and perforated metal/foil, mounted on vibration isolation mounts around the sides of the station: 10 dB(A) reduction; located on the N/NW part of the plant.
- Relocation of the crushing and screening station further west towards the stockpiles; located on the N/NW part of the plant.
- Enclosure of conveyors, aside from those required to be open for coke stacker/reclaimer and coal stacker: 5 dB(A) reduction; located on the N,W and E parts of the plant.
- Reduction of speed of coal conveyor from stockpiles to crusher/screener to coke ovens and use of super low noise idlers: 5 dB(A) reduction; located on the N,W and E parts of the plant.
- Stacker – Adoption of noise minimisation techniques such as (i) controlled trajectory chute at the tripper discharge, (ii) fully enclosed tripper discharge chute; (iii) low height tripper transfer discharge; (iv) fully enclosed boom conveyor load skirts; and (v) low noise electric motor on the boom conveyor drive (Mills, Bridges and Juillerat): 8 dB(A) reduction; located on the W part of the plant.
- Reclaimer – Adoption of noise minimisation techniques such as (i) ball bearing type chain guide rollers; (ii) vibration absorbing rubber plates attached to chain guide liners; (iii) large diameter chain sprockets and guide rollers and tumblers; (iv) low noise motors on harrow sled drive; and (v) fully enclosed impact loading table at discharge to yard conveyor (Mills, Bridges and Juillerat): 4 dB(A) reduction; located on the N part of the plant.

- Maintain a bed of coke in the breeze and nut bins such that new material is not falling onto bare metal (Mills, Bridges and Juillerat): 10 dB(A) reduction; located on the E part of the plant.
- Construction of enclosures leading into and out of the rail load-out facility, upgrade overall construction in terms of wall and roof transmission loss performance, and maintain bed of coke in rail-load out bin: 10 dB(A) reduction; located on the W part of the plant.
- Adoption of high performance attenuators on the cooling tower fans, and coke oven stack fans (small stacks have no fans but the large stacks have fans at the base of the stack): 15 dB(A) reduction; located on the SE part of the plant.
- Modification of dozer D11 with assistance of Caterpillar, using treatments to tracks and muffler: 5 dB(A) reduction; located on the E part of the plant.

The sound power data in terms of dB per octave band is listed in **Table B.1**. This data is taken from various sources and is considered indicative of the equipment proposed in this project based on the information available to ASK.

Another potentially annoying noise from industrial projects is reverse beepers from mobile equipment. This has not been assessed in detail at this stage, however, the following noise controls should be considered:

- Use of background noise detecting reverse beepers;
- Designing vehicle paths to minimise time spent reversing;
- Use of flashing lights in lieu of reverse beepers; and/or
- Noise barriers and/or bunding around areas where reverse beepers are used.

It should be noted that all of these noise sources are to the south or southwest of the township of Stanwell.

6 Noise Level Predictions

The noise level predictions have been carried out using the PEN (propagation of environmental noise) model. This model takes into account attenuation of noise due to distance, ground effects, barriers, and atmospheric attenuation. The noise source data is in terms of octave bands raning from 63 Hz to 8000 Hz.

The noise level predictions in terms of Leq (as required by Ecaccess) for two meteorological scenarios have been modelled. The first scenario represents a neutral atmosphere with no wind. These conditions are commonly experienced both during the day and during the night.

The second scenario represents temperature inversion atmospheric conditions. These conditions are conducive to enhancement of noise levels, since the noise rays tend to bend back towards the earth rather than bend upward as normally occurs. Temperature inversions only occur during the night in the cooler months when there is little or no wind under clear skies. It has been assumed that the wind speed is 1 m/s from the SW and that the strength of the temperature inversion is

3°C/100 m. This scenario was modelled to indicate typical worst-case noise impact conditions. Inversion conditions generally occur during light wind condition from the west or south west.

Figure 2 shows the predicted noise contours for neutral conditions, and **Figure 3** shows the predicted noise contours for temperature inversion conditions during the night. A comparison of these figures indicates that the predicted Leq noise levels under inversion conditions are somewhat higher than those predicted under neutral conditions, typically by 5 dB(A) in Stanwell, as expected.

Table 3 shows the predicted noise levels for the residences shown in **Figure 2** and **Figure 3**. The last two digits for each residence refer to the night-time noise limit.

Reference to **Appendix B** indicates that the noise limits during the day and evening would be readily met, with the exception of residence H33, where during the evening there is an exceedance of 1 dB(A).

The highlighted noise levels in **Table 3** indicate a predicted exceedance of the noise limit during the night.

For neutral conditions during the night exceedances are predicted for residences A33-D33 of between 1-4 dB(A). The main reason for this exceedance is the relatively low noise limit derived from the Ecoaccess guidelines which is based on the current somewhat elevated background noise levels.

At residence H33 the exceedance is quite large and is due to its relatively close proximity to the proposed Coke Plant. The noise impact at this residence would be significant.

For temperature inversion conditions during the night the predicted noise levels at all of the residences other than A31-D31 exceed the noise limit.

It is instructive to compare existing Leq noise levels with the Ecoaccess Leq noise limits. **Table 4** shows the average Leq noise levels at locations B1, B2, V1 and V4 during the day, evening and night obtained during June 2006.

Table 5 shows the difference between the existing Leq noise levels and the Ecoaccess Leq noise limits.

Location B2 is of little interest, because the Ecoaccess noise limit at residences A31-D31 are predicted to be met.

At location B1 the existing Leq's are rather high because of its proximity to the Capricorn Highway. Nevertheless the differences between the existing Leq noise levels and the Ecoaccess Leq noise limits at residences A36-F36 would be expected to be at least 15 dB(A). This means that the noise limit is some 15 dB(A) below the existing Leq noise levels at these residences.

The maximum excess beyond the Ecoaccess noise limit under inversion conditions is 6 dB(A) at residence F36 with a predicted noise level of 43 dB(A). This predicted noise levels is still some 8 dB(A) below the existing noise level.

Within the township of Stanwell itself the differences between the existing Leq noise levels and the Ecoaccess Leq noise limits are 6-10 dB(A) during the day, 11-16 dB(A) during the evening and 17-24 dB(A) during the night.

The highest predicted noise level under temperature inversion conditions in Stanwell is 43 dB(A) at residence A33. This is some 24 dB(A) below the average Leq noise level during the night.

Table 3: Predicted noise levels due to proposed operations

Residence	Noise limits dBA*			Predicted noise level dBA	
	Day	Evening	Night	Neutral day/evening/night	Inversion with SW wind night only
A31	36	37	31	31	30
B31	36	37	31	29	29
C31	36	37	31	29	28
D31	36	37	31	29	29
A33	44	41	33	**37**	**43**
B33	44	41	33	**36**	**42**
C33	44	41	33	**35**	**42**
D33	44	41	33	**34**	**41**
E33	44	41	33	33	**40**
F33	44	41	33	32	**39**
G33	44	41	33	32	**39**
H33	44	41	33	**42***	**45**
A36	41	40	36	36	**38**
B36	41	40	36	36	**39**
C36	41	40	36	36	**39**
D36	41	40	36	35	**38**
E36	41	40	36	**39**	**43**
F36	41	40	36	**37**	**43**

Bold noise level indicates exceedance during the night
Bold noise levels with one star indicates exceedance during the evening and night

* Noise limits derived from Ecoaccess Guidelines

Table 4: Existing Leq noise levels

Location	Area Description	Noise levels		
		day	evening	night
B1	Several kilometres west of Stanwell. Representative of background noise levels away from the SPS, but near the highway.	63	63	62
B2	Several kilometres south of Stanwell. Representative of background noise levels away from the SPS and the highway.	45	35	34
V1	Stanwell township, north of highway.	49	52	52
V4	Stanwell township, south of highway.	54	57	57

Table 5: Difference between existing Leq and Leq Ecoaccess noise limits

Location	Area Description	Noise level difference		
		day	evening	night
B1	Several kilometres west of Stanwell. Representative of background noise levels away from the SPS, but near the highway.	22	23	26
B2	Several kilometres south of Stanwell. Representative of background noise levels away from the SPS and the highway.	9	-2	3
V1	Stanwell township, north of highway.	6	11	17
V4	Stanwell township, south of highway.	10	16	24

7 Conclusion

This updated noise section of the EIS indicates that, subject to the incorporation of the noise control measures outlined in this report, under neutral conditions the Ecoaccess daytime noise limits are able to be complied with. During the evening the Ecoaccess noise limit would be exceeded at 1 residence (H33).

Under typical night-time temperature inversion conditions the Ecoaccess noise limits would be exceeded at most nearby residences to the northeast of the Project.

A comparison of existing Leq noise levels with Leq noise levels due to the proposed plant indicates that existing noise levels are significantly higher than those predicted due to the proposed plant.

8 References

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Environmental Proctection Agency

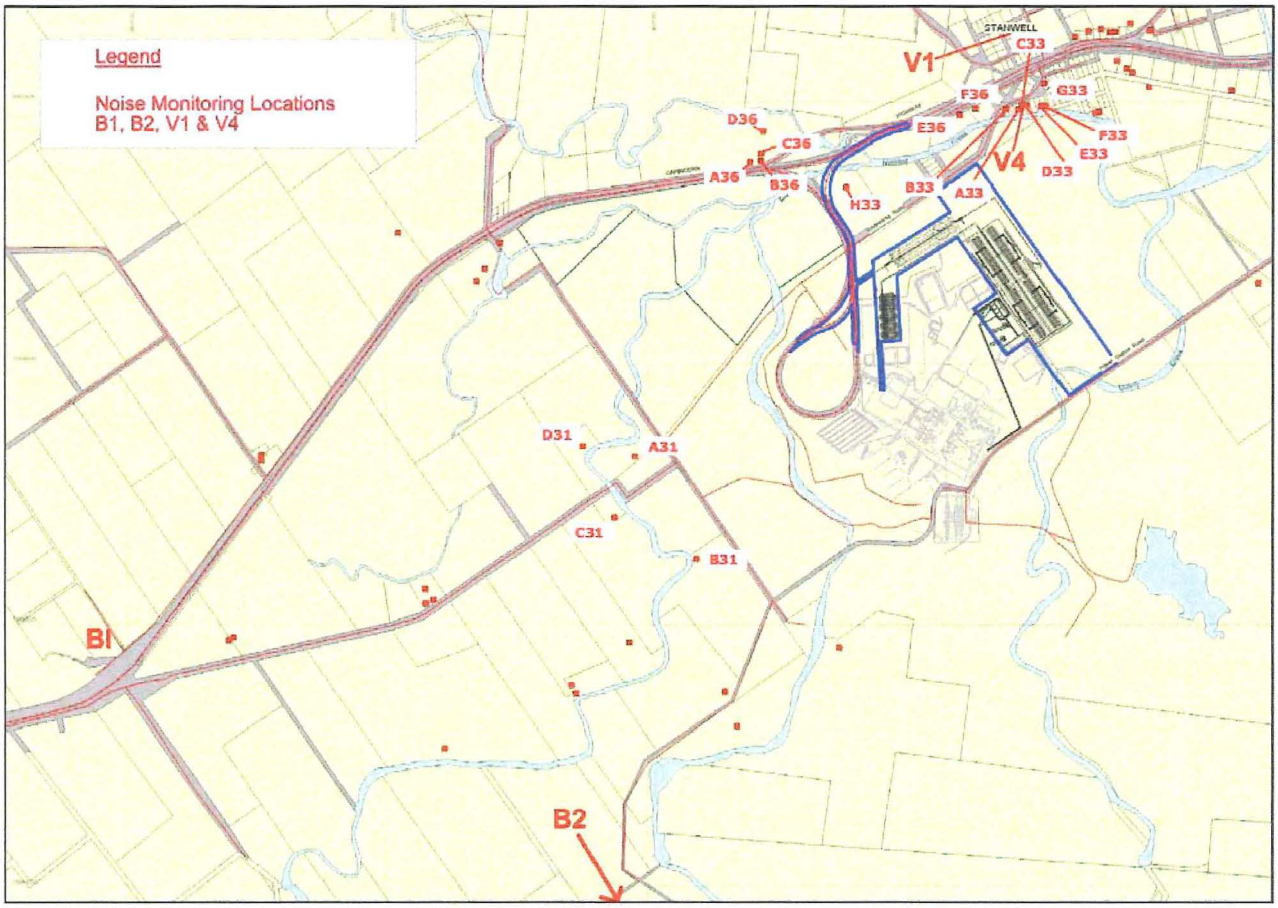

Figure 1 – Noise Monitoring Locations

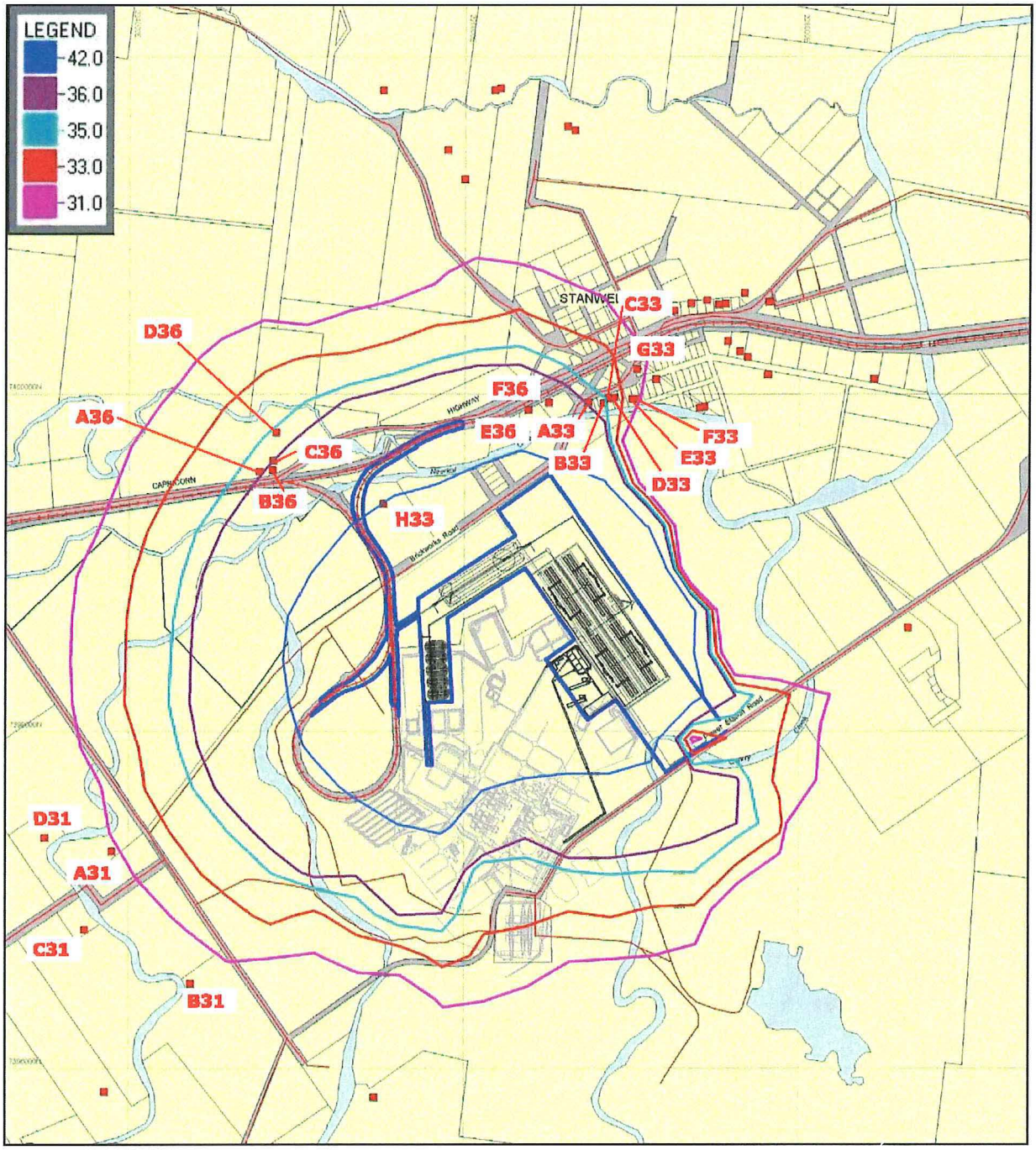

Figure 2 – Predicted Noise Contours For Neutral Conditions

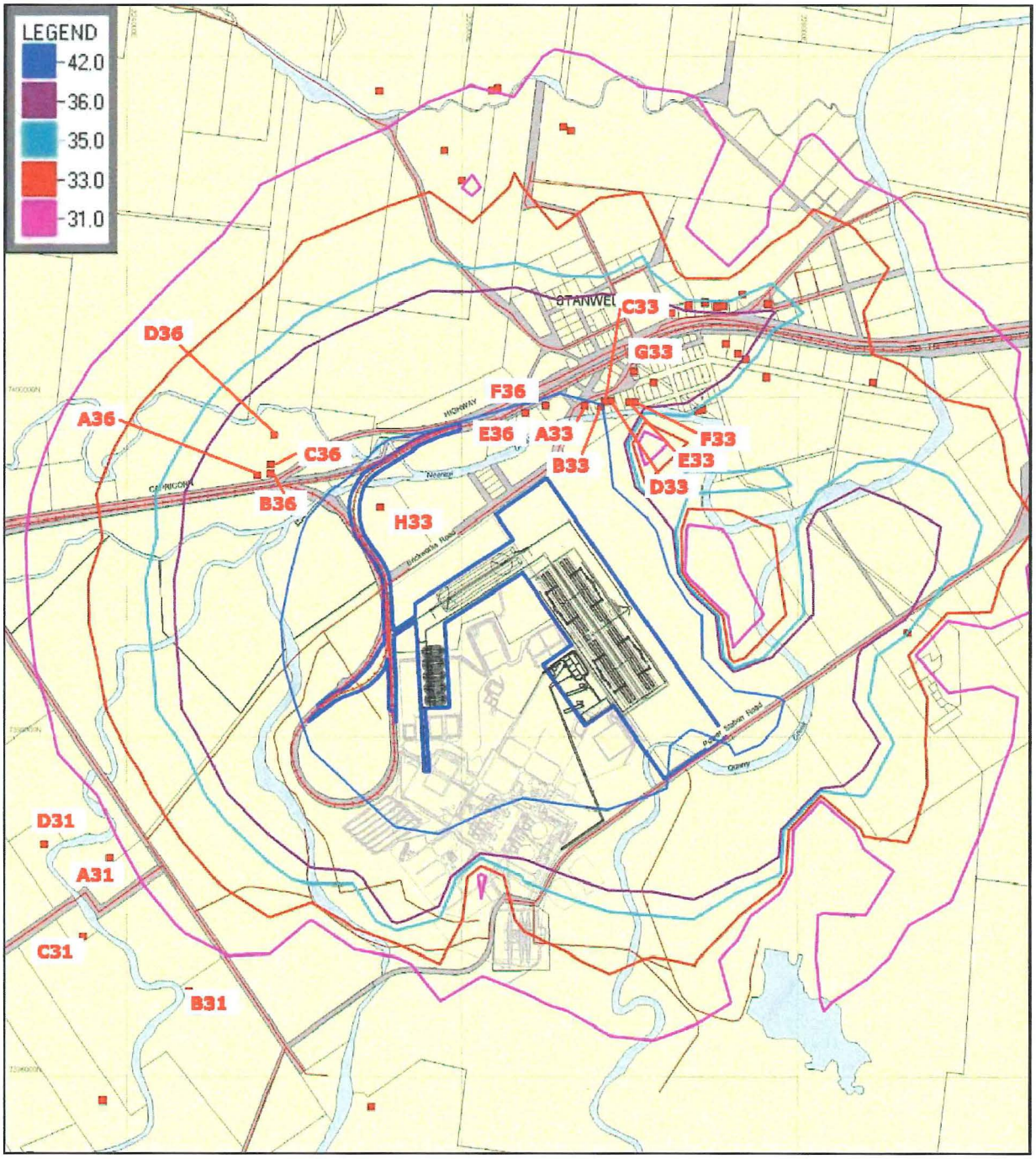

Figure 3 – Predicted Noise Contours For Temperature Inversion Conditions During The Night

Appendix A:

Derived Planning Noise Levels from Ecoaccess - Planning For Noise Control

Location: B1

Description	Noise Levels, dB(A)			Noise
	Day	Evening	Night	Parameter
Measured Background Noise Levels, from Logging Data (lowest 10th %)	33	32	28	L90
Acceptable Background Noise Levels, from Logging Data (lowest 10th %) - Minimum 25 dB(A)	33	32	28	L90
Recommended Background Noise Levels, Table 1	45	40	35	L90
Differences	12	8	7	L90
Adjustment to Background Noise Level (Table 2)	5	5	5	L90
Maximum Planning Level, L90	38	37	33	L90
Acceptable Existing Noise Levels, from Logging Data, Leq	51	50	43	Leq
Noise Area Category	z4			
Maximum Sound Pressure Level, Leq,1hr, dB(A)	60	55	50	Leq
Differences	9	5	7	Leq
Existing Noise Level Likely to Decrease in Future ? (y/n)	n			
Adjustment to Maximum PNL (Table 4)	0	-2	0	Leq
Maximum PNL, Leq	60	53	50	Leq
Lowest Criteria	38	37	33	L90/Leq
Specific Noise Limit (Equation 1), I.e. component noise limit, Leq, dB(A)	41	40	36	Leq

Location: B2

Description	Noise Levels, dB(A)			Noise
	Day	Evening	Night	Parameter
Measured Background Noise Levels, from Logging Data (lowest 10th %)	28	29	26	L90
Acceptable Background Noise Levels, from Logging Data (lowest 10th %) - Minimum 25 dB(A)	28	29	26	L90
Recommended Background Noise Levels, Table 1	40	35	30	L90
Differences	12	6	4	L90
Adjustment to Background Noise Level (Table 2)	5	5	-2	L90
Maximum Planning Level, L90	33	34	28	L90
Acceptable Existing Noise Levels, from Logging Data, Leq	51	50	43	Leq
Noise Area Category	z4			
Maximum Sound Pressure Level, Leq,1hr, dB(A)	60	55	50	Leq
Differences	9	5	7	Leq
Existing Noise Level Likely to Decrease in Future ? (y/n)	n			
Adjustment to Maximum PNL (Table 4)	0	-2	0	Leq
Maximum PNL, Leq	60	53	50	Leq
Lowest Criteria	33	34	28	L90/Leq
Specific Noise Limit (Equation 1), I.e. component noise limit, Leq, dB(A)	36	37	31	Leq

Location: V1

Description	Noise Levels, dB(A)			Noise
	Day	Evening	Night	Parameter
Measured Background Noise Levels, from Logging Data (lowest 10th %)	35	33	32	L90
Acceptable Background Noise Levels, from Logging Data (lowest 10th %) - Minimum 25 dB(A)	35	33	32	L90
Recommended Background Noise Levels, Table 1	45	40	35	L90
Differences	10	7	3	L90
Adjustment to Background Noise Level (Table 2)	5	5	3	L90
Maximum Planning Level, L90	40	38	32	L90
Acceptable Existing Noise Levels, from Logging Data, Leq	51	50	43	Leq
Noise Area Category	z4			
Maximum Sound Pressure Level, Leq,1hr, dB(A)	60	55	50	Leq
Differences	9	5	7	Leq
Existing Noise Level Likely to Decrease in Future ? (y/n)	n			
Adjustment to Maximum PNL (Table 4)	0	-2	0	Leq
Maximum PNL, Leq	60	53	50	Leq
Lowest Criteria	40	38	32	L90/Leq
Specific Noise Limit (Equation 1), I.e. component noise limit, Leq, dB(A)	43	41	35	Leq

Location: V4

Description	Noise Levels, dB(A)			Noise
	Day	Evening	Night	Parameter
Measured Background Noise Levels, from Logging Data (lowest 10th %)	36	36	33	L90
Acceptable Background Noise Levels, from Logging Data (lowest 10th %) - Minimum 25 dB(A)	36	36	33	L90
Recommended Background Noise Levels, Table 1	45	40	35	L90
Differences	9	4	2	L90
Adjustment to Background Noise Level (Table 2)	5	-2	-5	L90
Maximum Planning Level, L90	41	38	30	L90
Acceptable Existing Noise Levels, from Logging Data, Leq	51	50	43	Leq
Noise Area Category	z4			
Maximum Sound Pressure Level, Leq,1hr, dB(A)	60	55	50	Leq
Differences	9	5	7	Leq
Existing Noise Level Likely to Decrease in Future ? (y/n)	n			
Adjustment to Maximum PNL (Table 4)	0	-2	0	Leq
Maximum PNL, Leq	60	53	50	Leq
Lowest Criteria	41	38	30	L90/Leq
Specific Noise Limit (Equation 1), I.e. component noise limit, Leq, dB(A)	44	41	33	Leq

Appendix B: Noise Source Data Including Attenuation Measures

Table B.1: Sound Power Level of Equipment – Includes attenuation measures

Item	Number in Model	Sound Power Level in dB at Octave Band Centre Frequency (Hz)								Overall dB	Source of Data
		63	125	250	500	1000	2000	4000	8000		
Quench car	4	88	83	95	85	84	80	79	79	97	Electric motor rolling on tracks
Quench tower	4	98	94	91	90	90	87	77	67	101	Based on noise source of material falling into metal hopper, then attenuated to allow for coke being pushed onto concrete sloping wharf structure
Coal Conveyor from stockpiles stockpiles to crush/screen crush/screen to ovens	3	90	91	91	93	87	82	73	65	98	Data from published Clermont Coal EIS report for open coal conveyor. Based on other data sources, we recommend using low noise idlers to achieve this sound power level. The sound power level for the conveyor is on a per 100 m basis.
Coal Conveyor from rail	1	95	96	96	98	92	87	78	70	103	As above
Coke Conveyors	8	88	89	89	91	85	80	71	63	96	Data from published Clermont Coal EIS report for open coal conveyor less 7 dB(A) as coke conveyor run with significantly less tonnage at lower speed. The sound power level for the conveyor is on a per 100 m basis.
Coal transfer point – out of coke ovens	1	100	94	83	82	79	80	75	74	101	Based on noise measurement from transfer point at a limestone transfer station, and adjusted to account for expected reduced noise impact of coal. Assumes open plant without walls or enclosure
Coke screen	1	103	102	102	101	91	86	77	70	108	Based on noise measurements of similar items of plant
Nut bin/breeze	1	104	101	95	90	91	91	88	87	107	Based on noise measurement at another project, with material falling into a metal

Item	Number in Model	Sound Power Level in dB at Octave Band Centre Frequency (Hz)								Overall dB	Source of Data
		63	125	250	500	1000	2000	4000	8000		
bin											chute/hopper
Stacker reclaimer	1	103	99	99	101	97	93	91	90	108	Based on published data for a reclaimer at Wagerup
Coal crush & screen	1	103	102	102	101	91	86	77	70	108	Based on noise measurements of similar items of plant
Rail loader	1	118	109	99	98	95	94	92	85	119	Data from published Clermont Coal EIS report.
Cooling tower (4/8 fans running)	2	109	99	107	93	89	83	75	69	112	Fan noise calculation, using algorithms in Bies & Hansen textbook.
Air handling fan (main stacks)	4	103	93	96	77	68	57	47	38	104	Fan noise calculation, using algorithms in Bies & Hansen textbook. No attenuation downstream.
Turbine house	1	109	108	101	104	103	99	96	85	113	Based on noise measurement at Stanwell Power Station less 2 dB(A), as Coke Plant turbine house is half the size of Stanwell Power Station (i.e. 200MW v 350 MW)
Stacker	1	98	98	99	97	96	92	86	79	105	Based on published data for a stacker at Wagerup
Coal transfer point – into coke ovens	1	105	98	86	83	77	76	69	67	106	Based on noise measurements of similar items of plant
Coal transfer point – out of stockpiles	1	105	98	86	83	77	76	69	67	106	Based on noise measurements of similar items of plant