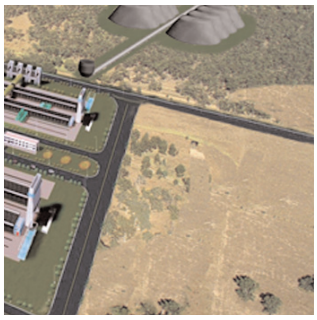
9 Noise and Vibration





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Summary

ASK Consulting Engineers was commissioned to assess the potential noise impacts of the Queensland Coke and Power Plant Project (the Project) to be located adjacent to the existing Stanwell Power Station (SPS). This section of the EIS presents a brief description of the area surrounding the project site and existing environmental values, details of existing noise levels at noise sensitive receptors and the Stanwell Power Station, sound power levels and mapped noise contours for the fully-developed Project and assessment of the noise impacts.

In terms of background creep, the calculated noise levels comply with the specific noise level criteria at the closest residential area to the proposed Project. Noise contours under adverse conditions show that the 31 dB(A) night criterion is exceeded at two residences located at the north-eastern corner of the project site. The noise level at these locations is up to 36 dB(A), up to 5 dB(A) higher than at the residential area to the north of Neerkol Creek. Using the Environmental Protection Agency (EPA) Ecoaccess noise guidelines and proposing that these receivers are residential land uses in an area dominated by light industry, the calculated noise levels comply with the relevant criterion. On occasions it is possible that noise levels may be higher than predicted due to plant start-up or upset conditions. These events are transient in nature and are not considered to impact the long-term background noise level.

In terms of sleep disturbance, noise levels from the operation of heavy equipment (e.g. front-end loaders and bobcats) may be up to 43 dB(A) if multiple pieces of equipment are operating at maximum load conditions under adverse meteorological conditions. Sleep disturbance goals are met at all noise sensitive receptors within Stanwell and in the surrounding rural community, with proposed attenuation measures applied.

The calculated noise level readily complies with the low frequency noise criterion at the closest residences within Stanwell and in the surrounding rural community, with attenuation measures in place.

Increases in road traffic noise would be acceptable with only minor increases in noise levels along the service road to the project site. Increases in rail traffic on the main east-west line are acceptable with only minor increases in noise levels. On the rail loop, based on an expectation of four train movements per night, the allowable sleep disturbance criterion is approximately 56 dB(A). The predicted noise level of 47 dB(A), at residences to the west of the rail loop, complies with this sleep disturbance criterion. The predicted noise level at the nearest residences to the west and south-west of the rail loop due to shunting, is 38 dB(A). This noise level will be easily audible, as would be the existing shunting operations, however, it is not likely to cause sleep disturbance, and is therefore considered acceptable.

The ship loading facility will be situated at the Fisherman's Landing wharf, in a developing industrial area. The closest residences are located approximately 1.8 km to the south. The noise sources at the ship loading facility are relatively minor compared with other manufacturing facilities in the area and it is not considered necessary to further investigate noise impacts of this aspect of the Project.

The Project is not a source of vibration to the surrounding community, with operation and construction activities being limited to vibration sources that will produce only localised impacts. The proposed activities do not involve vibration type sources such as heavy vehicles operating close to residences,

falling weights or hammers, compressed gases, explosions or pile driving. The combined effect of minimal vibration sources, relatively soft soils and the considerable distance to potential receivers results in the conclusion that vibration will not cause any significant impact.

9.1 Description of Environmental Values

9.1.1 Study Area

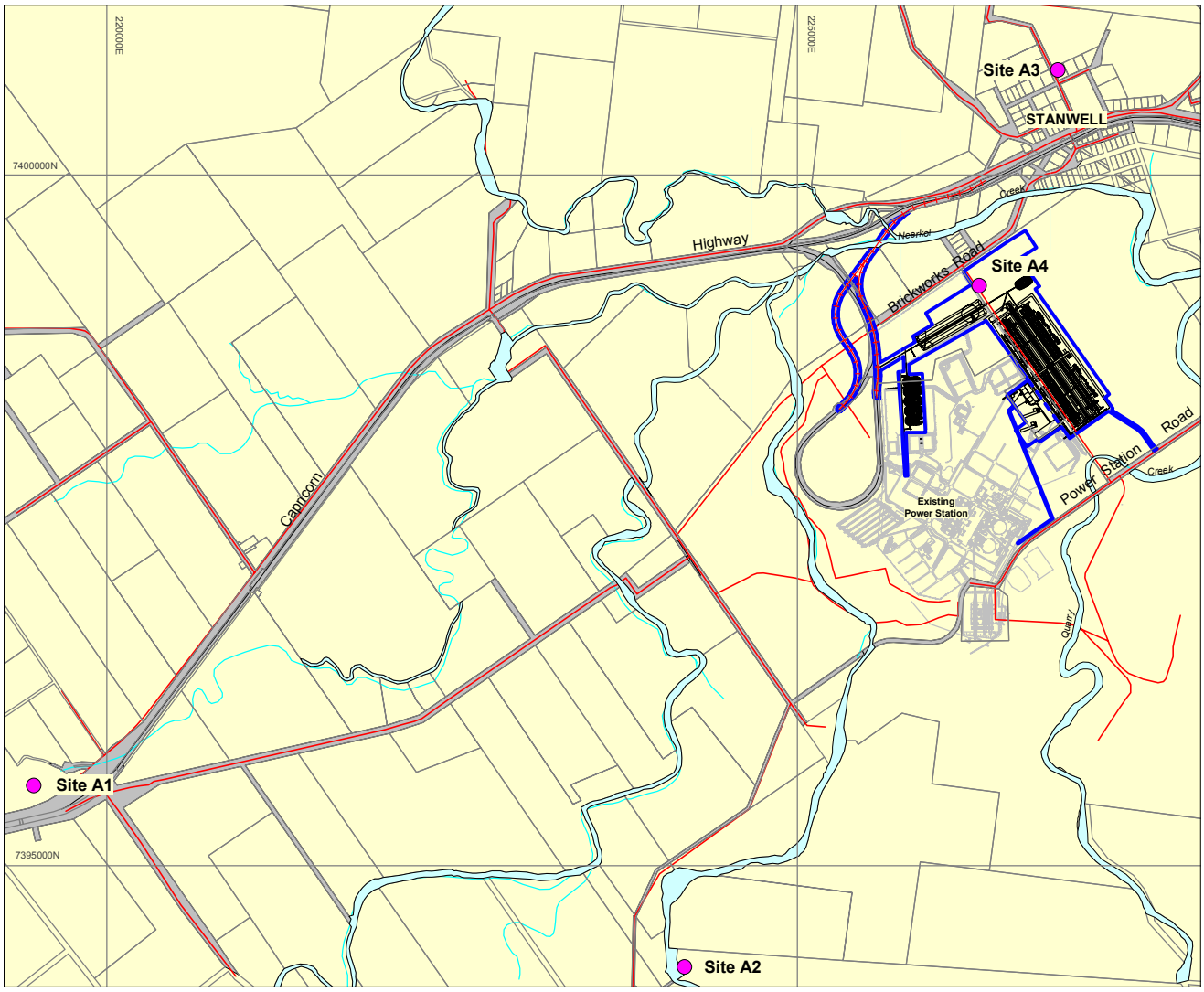
The proposed project site is situated within the Stanwell Energy Park (SEP), which is a designated industrial development area. The project site lies to the north-east of SPS and to the south of the Stanwell township. The subject site is bounded by Brickworks Road to the north, Power Station Road to the south, Flagstaff Hill to the east and the SPS rail loop to the west. The main features of the area are shown on Figure 3.7, described in detail in Section 3 – Land Characteristics, and include the following:

- The proposed site is situated between SPS and Stanwell village;
- The area comprises a mix of rural, rural residential, industrial and urban uses;
- The proposed site has an elevation between 44 m and 56 m AHD;
- Stanwell village is situated approximately 1 km to the north of the site and has an elevation of approximately 40 m AHD;
- There is a large hill (Flagstaff Hill) to the immediate north-east of the proposed site, with a maximum elevation of 130 m AHD. The hill obscures Stanwell village from much of the project site;
- There are a number of isolated residences, particularly to the west and north of the proposed site;
- The hills, watercourses and undeveloped parts of the SEP are lightly timbered; and
- The rural land is mostly cleared and irrigation occurs on the properties close to Neerkol Creek.

9.1.2 Survey Methodology

The methodology employed in this survey was in accordance with the *Environmental Protection (Noise) Policy 1997* (*EPP (Noise)*) and based on Australian Standard 1055.1 1997 "Acoustics: Description and Measurement of Environmental Noise; Part 1: General Procedures". Appendix J comprises the baseline noise monitoring program described below.

Two ambient noise monitoring sites (A1 and A2) and two sites closer to SPS that are likely to be affected by noise from SPS operations (A3 and A4) were assessed, as shown on Figure 9.1. Site A1 is located near the Capricorn Highway and is taken to be representative of the noise levels at A3 without the SPS. Site



N

0 750 1500m

Scale 1:50 000 (A4)

Horizontal Datum GDA94 Zone 55

LEGEND

- Noise Monitoring Locations
- Proposed Development Footprint
- Proposed Coke and Power Plant
- Existing Stanwell Power Station

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QUEENSLAND COKE
AND POWER PLANT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

NOISE MONITORING LOCATIONS

Drawn: VH	Approved: JMcD	Date: 06-01-06	Figure: **9.1** Rev:C
Job No: **42625626**	File No: 42625626-g-027c.wor		**A4**

A2 is located in a rural area well away from the Capricorn Highway and is taken to be representative of the noise levels at A4 without the SPS.

Measurements were also taken at a number of locations inside the SPS compound to provide information on the noise levels directly attributable to the SPS. These noise levels were used in the noise modelling process. Site A3 was selected to provide direct measurements of the noise levels in the most sensitive area in the township of Stanwell. Site A4 was selected as it is located close enough to SPS to be strongly influenced by SPS noise. It is somewhat closer to the SPS than the nearest residence.

At monitoring locations A1 to A4, attended monitoring was carried out at varying times of day and observations of the range of noise sources were recorded throughout each measurement. Meteorological readings were obtained from the SPS meteorological station (located to the west of SPS) for the entire monitoring period. The meteorological station recorded wind speed, wind direction and relative humidity at 10 m and 30 m. Temperature was measured at ground level and at 30 m.

In general, ambient noise levels are likely to have increased since the year 2000, however, noise data from the year 2000 has been used, as it is likely that background noise levels are the same or similar to current background noise levels. The noise survey was conducted in winter, and it is expected that background noise levels would be lower at this time of year due to the lack of insect noise, resulting in a more conservative analysis of potential impacts from the Project. Insect noise can raise background noise levels significantly for large periods of the day during warmer months of the year.

9.1.3 Baseline Noise Monitoring Results

Long-term measured background noise levels have not been recorded in the area. Baseline monitoring was carried out in accordance with the *EPP (Noise)* using four calibrated ARL environmental noise loggers to record noise levels over 15-minute periods for the two-week period between 8 and 24 August 2000 at locations A1 to A4. Short-duration attended monitoring was carried out using a Rion NA27 sound level meter.

Ambient Monitoring Results

Monitoring was carried out using an environmental noise logger at monitoring locations A1 to A4 for a period of approximately two weeks between the 8 and 24 August 2000. The summary of results of this monitoring is shown in Table 9.1, which illustrates the noise levels at the four sites during the day, evening and night-time periods. Day, evening and night periods are as defined in the *EPP (Noise).* Appendix J contains charts of the noise monitoring survey. The noise levels are expressed in terms of the L_{Aeq} [1], L_{A10} [2] and the L_{A90} [2] and are the arithmetic average of all 15-minute periods during the time period in question.

[1] The L_{Aeq} is the energy average noise level for each specified time period.
[2] The L_{A10} and L_{A90} are the 'A' weighted noise levels exceeded 10% and 90% of the time respectively. The L_{A90} is commonly taken to be the background noise level.

Table 9.1 Ambient Noise Level Survey, August 2000

Site	Noise Levels in Time Periods (dB(A))								
	Day (6am to 6 pm)			Evening (6pm to 10pm)			Night (10pm to 6am)		
	L_{Aeq}	L_{A10}	L_{A90}	L_{Aeq}	L_{A10}	L_{A90}	L_{Aeq}	L_{A10}	L_{A90}
A1	52	55	32	55	59	29 [1]	53	54	27 [1]
A2	40	41	28 [1]	36	37	28 [1]	33	34	27 [1]
A3	50	53	36	47	51	28 [1]	46	49	27 [1]
A4	44	46	34	43	46	34	43	45	34

Notes: [1] These values are, in the main, a measure of the electronic noise of the instrumentation and do not fully represent the prevailing ambient noise level. The electronic noise of the instrumentation determines the lowest measurable noise level of the instrument, often called the 'noise floor'. It is not possible for the instrument to measure levels lower than the 'noise floor'. Higher quality hand-held sound level meters (e.g. NA27 used for attended measurements) have a lower 'noise floor' but are not suitable for long-term monitoring due to their limited weather protection.

[2] The L_{A90} is the median of the daily 10 percentile value as defined in EPA Ecoaccess Guideline "Planning for Noise Control" 2004.

9.1.4 Attended Noise Level Survey

Short duration octave band noise level measurements at sites A3 and A4 were obtained at various times of the day.

Measured Noise Levels at Site A3

Table 9.2 presents the measured noise levels (L_{A10}) at location A3 in each octave band. The results are expressed in terms of the 'A' weighted noise level (dB(A)). This equates to how the human ear hears noise. Traffic noise and noise from birds and insects were the predominant noise sources at A3 during the day and evening period. During the evening period, noise from the SPS became audible when noise from other sources reduced. Between 12 am and 5 am the SPS was audible in the Stanwell township. The last measurement obtained at A3 (11/8/2000 at 2:15 am) was predominantly due to the SPS. While a higher frequency noise was evident, it did not strongly influence the overall noise level. The dominant frequency at this time was 125 Hz, primarily due to industrial noise sources.

Measured Noise Levels at Site A4

Table 9.3 shows the attended noise level measurements at site A4 in each octave band. Noise from the SPS dominated at A4 during all measurements. During the day traffic noise, insects, and the rustle of leaves in the trees were also heard.

Table 9.2 Measured Noise Levels at Site A3

Date and Time	L_{A10} Noise Level in dB(A) in Octave Band Centre Frequency (Hz)							Overall dB(A)	Comment/Meteorology
	63	125	250	500	1000	2000	4000		
9/8/2000 14:26	36.9	42.2	39.3	33.2	37.2	41.3	37.0	48.2	Traffic, bird noise, 1.4 m/s northerly breeze
9/8/2000 16:54	31.5	38.5	31.6	29.5	40.6	43.4	40.1	49.7	Traffic, bird noise, 1 train pass, dog barking, 1.5 m/s northerly breeze
9/8/2000 20:00	37.7	40.8	32.8	33.4	42.9	43.7	34.3	48.4	Traffic, 1 train pass, insects and crickets, 1 m/s north-easterly breeze
10/8/2000 05:06	38.5	42.1	41.6	41.9	46.5	48.0	35.4	52.9	Traffic, 1 train pass, lower octave band noise from SPS (also audible in higher octave bands), rooster crowing, still conditions 0.3 m/s southerly breeze
10/8/2000 08:02	37.3	41.7	39.9	39.0	44.5	46.6	41.4	52.0	Light traffic, 1 train pass, bird noise, lower octave band noise from SPS audible in quiet spells (also audible in higher octave bands), calm conditions, 0.4 m/s westerly breeze
11/8/2000 00:25	24.6	31.6	29.8	23.1	24.4	18.3	16.8	34.7	Lower octave band noise from SPS (also audible in higher octave bands), insect noise, calm conditions, 0.5 m/s southerly breeze
11/8/2000 02:15	24.6	33.7	29.2	23.9	21.9	18.7	16.5	35.1	Lower octave band noise from SPS (also audible in higher octave bands), calm conditions, 0.3 m/s southerly breeze

Table 9.3 Measured Noise Levels at Site A4

Date and Time	L_{A10} Noise Level in dB(A) in Octave Band Centre Frequency (Hz)							Total dB(A)	Comment/Meteorology
	63	125	250	500	1000	2000	4000		
9/8/2000 14:45	28.5	37.0	31.4	27.6	31.9	36.0	26.2	41.4	Lower octave band noise from SPS audible, traffic, bird noise, rustle of leaves in trees, calm conditions, 0.7 m/s westerly breeze
9/8/2000 20:20	25.2	31.4	32.0	37.5	37.7	30.4	32.1	42.7	Lower octave band noise from SPS audible, traffic, insects and crickets, calm conditions, 0.8 m/s north-easterly breeze
10/8/2000 5:30	33.0	37.1	35.8	44.4	43.3	34.1	24.9	47.3	Lower octave band noise from SPS obvious (also audible in higher octave bands), traffic, conditions very calm, 0.3 m/s south-westerly breeze
10/8/2000 8:20	29.1	32.4	32.4	36.8	37.8	37.9	29.7	43.6	Lower octave band noise from SPS obvious (also audible in higher octave bands), light traffic, bird noise, very calm conditions, 0.3 m/s westerly breeze
11/8/2000 2:34	35.3	37.0	38.3	41.0	39.1	33.6	20.8	45.4	Lower octave band noise from SPS obvious (also audible in higher octave bands), very calm conditions, 0.3 m/s south-easterly breeze
11/8/2000 11:30	32.1	35.8	36.1	37.0	34.1	32.4	33.6	42.9	Lower octave band noise from SPS obvious (also audible in higher octave bands), insects and birds, rustle of leaves, 1 train pass, calm conditions, 0.9 m/s south-westerly breeze

9.2 Potential Impacts and Mitigation Measures

9.2.1 Project Noise Sources

To determine the likely noise level emissions from the proposed Project, the operations have been compartmentalised and noise levels for each component based on reference to published material or experience with similar operations.

Construction Noise

The level of construction noise (including traffic noise) would not be expected to exceed operational noise levels. Construction equipment is expected to be similar to that required for operations (e.g. loaders). It is not anticipated that drilling, rock-breaking or other noisy equipment will be required during construction, however, such equipment may be required should the foundation for the Power Plant be required to be re-aligned. In addition, there will be no use of rail transport for construction, and road traffic volumes would be higher during operation than construction due to the majority of construction workers travelling to site by bus. Therefore, operational noise has been modeled in this assessment as being the greater. Construction noise is discussed further in Section 9.2.4.

Coke Oven Noise

It has not been possible to source information regarding noise emission data for coke ovens. Data is available for furnaces and it is recognised that furnace noise is a combination of a number of noise producing mechanisms, namely the jet noise of fuel and gas entering the combustion chamber and the noise of the combustion process.

However, the production of coke is somewhat different from the operation of a furnace. In the production of coke the air entering the oven is strictly controlled. The production of coke is carried out in an oxygen controlled combustion chamber. The coke production process to be adopted operates on a regenerative principle that separates coal into carbon in solid state and transforms volatile matter into gases. These gases are combusted to maintain the temperature of the coal bed. The coke production process is unlikely to generate a "jet" noise since both the velocity through the openings and the air mass flows are very low. Combustion noise is generally not as significant as that produced by air and gas flow (Bies and Hansen, 1988). Since the combustion process is contained within the coke which is encased in steel and refractory materials to strictly control airflow, it is unlikely that any significant noise generated by the combustion process will occur.

Quench Tower

After the coking is complete, the coke in the oven is removed and loaded onto a quench car using hydraulic rams or similar. The still-hot material is then taken by quench car on rails to the quench tower where the coke is quenched in water, approximately 1,100 L/t of coke. For the 320 coke ovens in Stage 1 and 640 coke ovens in Stages 1 and 2 combined, quenching will take place approximately every five

minutes during full production. It is likely that much of the steam produced by this process will be condensed within the quench towers for reuse.

The main noise sources associated with the quenching process will be the movement and operation of the quench car from the coke oven to the quench tower and the operation of the quench tower. For the purpose of this assessment the major noise source on the quench car is the operation of the dust scrubber system and for the quench tower the major noise is associated with the dropping of the quenched coke onto the hopper/conveyor system. It is assumed that the noise from quenching coke would be of similar magnitude.

The sound power levels for the quench towers were obtained from typical levels associated with the dropping of coal material onto a hopper conveyor system, and are shown in Table 9.4. For the purposes of modeling it is assumed that, at any one time, two quench cars and two quench towers will contribute to the environmental noise level. It is recognised that there are four of each of these units at full production, however, the batch style operation of the quench tower means that noise emissions are equivalent to the operation of two quench cars and two quench towers at any one time.

Table 9.4 Sound Power Levels for the Quench Tower System

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall dB(A)
		63	125	250	500	1000	2000	4000	8000	
Quench car	4 (2 in model)	62	67	81	72	69	61	58	53	82
Quench tower	4 (2 in model)	77	83	87	92	95	93	83	71	99

Materials Handling Equipment

The coal to be processed into coke is unloaded via the loadout bin from trains at the rail loop and carried by overland conveyor and stacker equipment onto the coal stockpiles, where it is then transported to the coke production facility using conveyors. The coal will be loaded onto the conveyors using front-end loaders and similar equipment. The coal will initially be stored in one of four surge bins for blending prior placement in the coke ovens. There are also several transfer points within the coal conveyor system. The coke ovens are loaded using a pusher system linked to the coal supply through a tripper conveyor. The pusher system is mounted on rails and is able to supply coal in batches to each of the coke ovens. On completion of the coke batch production process, the pusher system has hydraulic rams to force the material onto the quench cars.

The coke will be transported from the quench tower through a vibrating screen located within the coke sizing station and then on to the coke stacker/reclaimer via a conveyor. There is a surge bin, crusher and transfer point within the proposed coke conveyor system. Bobcats will operate around the quench tower and elsewhere over the site. The main noise sources associated with the materials handling system are the front-end loaders, conveyors, transfer points, crusher, surge and blending bins, stacker/reclaimer, rail

loader and the pusher system. The sound power levels for the materials handling equipment are shown in Table 9.5.

Table 9.5 Sound Power Levels for the Materials Handling System

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall
		63	125	250	500	1000	2000	4000	8000	dB(A)
Conveyors[1]	5.4 km	68	76	76	79	82	83	82	79	89
Transfer points	4	84	88	84	89	89	91	86	83	96
Surge bins	1	88	95	96	97	101	102	99	96	107
Blend bins	1	88	95	96	97	101	102	99	96	107
Coke crusher	1	88	95	96	97	101	102	99	96	107
Stacker reclaimer	1	70	77	77	80	83	84	83	80	90
Front-end loaders	2	84	96	101	107	107	106	99	90	112
Rail loader	1	89	98	102	107	109	107	100	88	113
Bobcats	2	74	86	91	97	97	96	89	80	103

Note: [1] The sound power level for the conveyor is on a per 100 m basis.

Steam and Power Generation

Initially the flue gas to be generated through the coke production process is to be discharged into the atmosphere through stacks. The stacks do not have any fans to assist the discharge of combustion products.

The energy in the excess heat from the coke production will be used to generate steam using heat recovery steam generators (HRSGs). The steam will be used to generate electricity. There will be one HRSG for every 40 coke ovens. In this mode there are fans and an air handling system to discharge the air to one of two stacks. The sound power level for the air handling fans is based on the airflow required for the heat recovery system and a pressure drop over the fan.

The power generation system is likely to comprise a steam turbine in a turbine building and cooling towers. The construction of the turbine house is likely to be similar to the existing SPS. The sound power level for the turbine house is based on that measured for the SPS turbine house. The noise level for cooling towers is similar to that obtained at other power generation facilities having similar cooling towers. It is proposed there be two cooling towers, each with eight fans for a total of 16 fans. It has been assumed that 50% of the fans will be operating at any one time. The sound power levels for the air handling fans, turbine house and the cooling tower is shown in Table 9.6.

Transient noise levels during plant start-up and upset conditions can be significantly higher than normal operating conditions. These noise sources include the steam bypass valve on the power plant turbine, and the operation of the safety valve on the coke plant HRSGs

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Table 9.6 Sound Power Levels for the Steam and Power Generation Systems

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall
		63	125	250	500	1000	2000	4000	8000	dB(A)
Cooling tower with 50% fans operating	2	89	93	111	106	107	103	101	98	114
Air handling fans	4	83	87	100	90	86	77	73	67	101
Turbine house	1	86	94	94	104	105	103	99	86	109

Road Traffic

The majority of road traffic to the project site will be along Power Station Road and the Capricorn Highway. The traffic data used for the noise assessment has been extracted from Section 14 – Transport Infrastructure, as determined for the Capricorn Highway near Power Station Road and measured as annual average daily traffic (AADT) (Table 9.7).

Table 9.7 Traffic Volumes for Capricorn Highway near to Power Station Road

Scenario	Year	Background Traffic		Project Generated Traffic	
		Total Vehicles AADT	Heavy Vehicles AADT (% Total)	Total Vehicles AADT	Heavy Vehicles AADT (% Total)
Existing	2003	3137	16.6	N/A	N/A
Stage 1 Construction	2006	3428	16.6	204	27
Stage 2 Construction	2008	3637	16.6	177	25
Stage 1 Operations	2008	3637	16.6	570	25
Stage 2 Operations	2010	3858	16.6	960	30

Rail Traffic

There will be additional rail traffic on the rail loop within SEP to supply the feedstock and deliver the final product coke for export through the Port of Gladstone. The additional train generation is expected to be approximately 16 trains per week for deliveries of coal and 16 trains per week for transportation of final coke product to the port.

Fisherman's Landing Wharf

The facility at Fisherman's Landing, Port of Gladstone will comprise a rail unloader, coke stockpiles a stacker reclaimer and conveyors to the shiploader. The ship loader will be situated on an extension of the existing wharf facility.

Future Industrial Development

It is not possible to predict potential future land uses that may develop in the vicinity of the Project. Therefore, assessment of potential noise impacts on such land uses will require assessment during the planning stages of any such developments.

9.2.2 Assessment Criteria

The EPA's Ecoaccess Guideline "Planning for Noise Control" (2004a) specifies the procedures and methods for setting conditions relating to noise emitted from industrial premises for planning purposes. The guideline is applicable to noises from all sources, individually and in combination, which contribute to the total noise from a site. Tables 9.8 to 9.11 are sourced from this guideline. The procedure takes into account the following three factors:

- Control and prevention of background noise creep in the case of a steady noise level from equipment such as caused by ventilation fans and other continuously operating machinery;
- Containment of variable noise levels and short-term noise events such as those caused by forklifts and isolated hand tools, to an acceptable level above the background noise level; and
- Setting of noise levels that should not be exceeded, to avoid sleep disturbance.

In addition, the EPA Ecoaccess Guideline "Assessment of Low Frequency Noise" (draft) (2004b) also contains procedures and methods for setting conditions relating to noise emitted from industrial premises for planning purposes. The guideline specifically relates to noise in the 10 Hz to 200 Hz frequency range.

Control and Prevention of Background Creep

To prevent background noise levels from progressively creeping higher and higher over time with the establishment of new developments in an area, the EPA recommend that the '$\min L_{A90,1\ hour}$' outdoor background noise planning levels given in Table 9.8 not be exceeded.

Table 9.8 Recommended Outdoor Background Noise Planning Levels ($minL_{A90,1\ hour}$)

Receiver Land Use	Receiver Area Dominant Land Use (Description of Neighborhood) [1]	Background Noise Level, $minL_{A90,1\ hour}$ dB(A) [2]		
		Day	Evening	Night
Purely residential	Very rural	35	30	25
	Rural residential, church, hospital	40	35	30
	Shop or commercial office	45	40	35
	Light industry	50	45	40
Residential area on a busy road or near an industrial area or commercial area	Residential, church, hospital, school	45	40	35
	Shop or commercial office	50	45	40
	Light industry	55	50	45
Industrial areas	Residential, church, hospital school	50	45	40
	Shop or commercial office	55	50	45
	Factory office or factory	60	60	60
Passive recreation area	Picnic grounds, public beaches, bush walks, public gardens, etc.	35	35	35

Notes: [1] The dominant land use is defined by a radius of 200 m from the receiver location under consideration.
[2] $minL_{A90}$ is defined as the rating background noise level.

The existing $minL_{A90}$ is measured and compared with the recommended background noise level. If the measured $minL_{A90}$ varies from the recommended $minL_{A90}$, then the guideline recommends a planning $minL_{A90}$. Table 9.9 shows the planning $minL_{A90}$.

Table 9.9 Recommended Noise Immission Planning Levels ($L_{A90,1\ hour}$) for Developments

Existing Background Noise Level at the Most Sensitive Point in an Affected Residential Area	Recommended L_{A90}, 1 Hour Maximum Noise Level Contribution for Planning Approval Purposes, at that Point as a Result of a Proposed New Source
Background noise level is above relevant recommended level (Table 9.8)	Preferably, set maximum planning level 10 dB(A) or more below relevant recommended level (Table 9.8). At least set maximum planning level 10 dB(A) below the existing background level.
Background noise level is equal to recommended level	Set maximum planning level relevant recommended level (Table 9.8)
Background noise level is below recommended level by 1 dB(A) 2 dB(A) 3 dB(A) 4 dB(A) 5 dB(A) 6 dB(A)	Set maximum planning level: 9 dB(A) below recommended level 5 dB(A) below recommended level 3 dB(A) below recommended level 2 dB(A) below recommended level 2 dB(A) below recommended level 5 dB(A) above background level

Note: It may not be possible to maintain background noise levels in very rural areas below 25 dB(A) as developments occur. In such cases a threshold background noise level of 25 dB(A) is to be used.

The guideline recommends that the L_{Aeq} noise descriptor be used to define the long-term noise criteria. For this purpose, it is termed the 'rating level' of the noise source under consideration and designated

$L_{Ar,Tr}$. The estimated maximum hourly values of planning noise levels (PNL) for different areas containing residences are given in Table 9.10 and these values are used as a guideline**.**

Table 9.10 Estimated Maximum Values of Planning Noise Levels (PNL) for Proposed Noise Sources for Different Areas Containing Residences

Noise Area Category	Description of Neighborhood	Maximum Hourly Sound Pressure Level, $L_{Aeq,1\ hour}$ (PNL)		
		Monday to Saturday, Sunday/Public Holidays		
		Day (6am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 6am)
Z1	Very rural, purely residential, Less than 40 vehicles per hour	40	35	30
Z2	Negligible transportation. Less than 80 vehicles per hour	50	45	40
Z3	Low-density transportation. Less than 200 vehicles per hour	55	50	45
Z4	Medium-density transportation. Less than 600 vehicles per hour	60	55	50
Z5	Dense transportation. Less than 1,400 vehicles per hour or some commerce or industry	65	60	55
Z6	Very dense transportation. Less than 3,000 vehicles per hour or in commercial or bordering industry districts	70	65	60
Z7	Extremely dense transportation. Less than 3,000 vehicles per hour or in commercial or bordering industry districts	75	70	65

Notes: Some industrial and commercial sites are not predominantly sources of high ambient noise levels.
Where transportation noise is present, the minimum of the hourly L_{Aeq} values for transportation noise in the appropriate time period is taken or the corresponding value from Table 9.10, whichever is the greater.
The criteria should not be exceeded in any hour of the appropriate time period.
Planning Noise Levels apply at a location 4.0 m from the façade of a building.

Where existing noise levels from specific noise sources are close to the maximum PNL, the noise level from any new source(s) must be controlled to preserve the amenity of an area. If the total noise level from specific noise sources already exceeds the maximum PNL for the area in question, the L_{Aeq}, 1 hour noise level from any new source should not be greater than:

- 10 dB(A) below the maximum planning level (Table 9.10) if there is a possibility that the existing levels will be reduced in the future; or
- 10 dB(A) below the existing noise level if there is no such possibility that the existing levels will fall and no significant changes to the land use are expected.

Table 9.11 sets out the implications of this requirement for noise from new sources. The specific noise level or component noise level criteria for a new development is L_{Aeq}, 1 hour = minL_{A90}, 1 hour + 3.

Table 9.11 Modification to Recommended Maximum Planning Noise Level (PNL) to Account for Existing Level of Specific Noise

Total Existing Noise Level from Specific Sources L_{Aeq} (dB(A))	Maximum Planning Noise Level for Noise from New Sources Alone L_{Aeq} (dB(A))
≥ PNL+2	If existing noise level is likely to decrease in the future PNL – 10 If existing noise level is unlikely to decrease in the future Existing Level - 10
PNL + 1	PNL - 9
PNL	PNL - 8
PNL - 1	PNL - 6
PNL - 2	PNL - 4
PNL - 3	PNL - 3
PNL - 4	PNL - 2
PNL - 5	PNL - 2
PNL - 6	PNL - 1
< PNL - 6	PNL

For each noise monitoring site not affected by noise from SPS the acceptable noise level criterion for the monitoring locations has been determined in Tables 9.12 and 9.13 in accordance with the Ecoaccess guidelines. Location A1 is considered to be representative of residences in Stanwell village and along the Capricorn Highway. Location A2 is considered to be representative of rural residences remote from the Capricorn Highway and Stanwell Village. From Table 9.12 it can be seen that the Specific Level criteria (41, 36 and 31 dB(A)) are lower than the Maximum Planning Noise Level (PNL) criteria (60, 47 and 47 dB(A)), and therefore the Specific Level criteria should be applied at this location.

Table 9.12 Calculation of Noise Limits for Location A1

No.	Description	Day	Evening	Night
1	Initial survey L_{A90}	32	29	27
2	Acceptable (measured) LA_{90}	32	25	25
3	Recommended L_{A90} (Table 9.8)	40	35	30
4	Differences (equal to No.3 minus No.2)	8	10	5
5	Adjustments to background (Table 9.9)	5	5	-2
6	**Maximum planning level, L_{A90} (Table 9.9)**	**37**	**30**	**28**
7	Existing L_{Aeq} (Table 9.1)	52	55	53
8	PNL, $L_{Aeq,1\ hour}$ (Table 9.10, Cat Z4)	60	55	50
9	Differences (equal to No.8 minus No.7)	8	0	-3
10	**Max PNL, $L_{Aeq,1\ hour}$ (Table 9.11)**	**60**	**47**	**43**
11	**Specific Level (equal to No.6 plus 3 dB(A))**	**40**	**33**	**31**

Table 9.13 Calculation of Noise Limits for Location A2

No.	Description	Day	Evening	Night
1	Initial survey L_{A90}	28	28	27
2	Acceptable (measured) LA_{90}	25	25	25
3	Recommended L_{A90} (Table 9.8)	40	35	30
4	Differences (equal to No.3 minus No.2)	15	10	5
5	Adjustments to background (Table 9.9)	5	5	-2
6	**Maximum planning level, L_{A90} (Table 9.9)**	**30**	**30**	**28**
7	Existing L_{Aeq} (Table 9.1)	40	36	33
8	PNL, $L_{Aeq,1\ hour}$ (Table 9.10, Cat Z4)	50	45	40
9	Differences (equal to No.8 minus No.7)	10	9	7
10	**Max PNL, $L_{Aeq,1\ hour}$ (Table 9.11)**	**50**	**45**	**40**
11	**Specific Level (equal to No.6 plus 3 dB(A))**	**33**	**33**	**31**

From Table 9.13 it can be seen that the Specific Level criteria (33, 33 and 31 dB(A)) are lower than the Maximum Planning Level (PNL) criteria (50, 45 and 40 dB(A)), and therefore the Specific Level criteria should be applied at this location. The specific noise level criteria are shown in Table 9.14 for two distinct regions:

- All noise sensitive receptors along the Capricorn Highway and within Stanwell; and
- All noise sensitive receptors remote from the Capricorn Highway and not within Stanwell village.

Table 9.14 Specific Noise Level Criteria

Region	Specific/Component Noise Level Goal $L_{Aeq,1\ hour}$ in dB(A)		
	Day	Evening	Night
Stanwell and close to Capricorn Highway	40	33	31
Remote from Stanwell and Capricorn Highway	33	33	31

As the plant will generally operate continuously 24 hours per day, the design noise level goal is 31 dB(A) $L_{Aeq,1\ hour}$ at sensitive receivers (i.e. houses, hospitals, retirement villages etc). These noise criteria are considered to apply to typical operational conditions. It is likely that there will be short-term changes in operational conditions during start-up or upset conditions. Due to the short-term duration of these events, it is not considered appropriate to compare the resulting noise levels against the criteria in Table 9.14. Instead, it is proposed that these events be assessed using sleep disturbance criteria (below) as the noise events may occur at night, but are not expected to occur frequently.

Single Event Noise Levels Criteria

The EPA Guidelines address the situation where there are noise events with relatively high noise levels and large fluctuations in sound pressure levels. It is unlikely that these types of events form part of the normal or atypical operation and construction of the Project. The design of the Coke Plant is such that this type of noise event has been avoided. As a result, assessment of this type of noise event will not be considered further.

Sleep Disturbance Criteria

The Ecoaccess Guideline "Planning for Noise Control" (EPA, 2004a), in referring to the World Health Organisation guidelines, makes the following general recommendation:

"As a rule in planning for short-term or transient noise events, for good sleep over eight hours, the indoor sound pressure level measured as a maximum instantaneous value should not exceed approximately 45 dB(A) maxLpA more than 10 to 15 times per night. The corresponding external noise level, assuming partially closed windows, is 52 dB(A) maxLpA measured in the free field."

For less regular night events, the allowable external noise level is higher, as follows:

- Approximately 3 events per night: 57 dB(A) maxLpA; and
- Approximately 1 event per night: 62 dB(A) maxLpA.

Low Frequency Noise

The Ecoaccess Guideline "Assessment of Low Frequency Noise" (EPA, 2004b) categorises items such as boilers, pumps, transformers, cooling fans, compressors, oil and gas burners, foundries, wind farms, electrical installations, diesel engines, ventilation and air-conditioning equipment, wind turbulence and large chimney resonance as sources of high level noise having frequency content less than 200 Hz.

These sources exhibit a spectrum that characteristically shows a general increase in sound pressure level with decrease in frequency. Annoyance due to low frequency noise can be high, even though the dB(A) level measured is relatively low. Typically, annoyance is experienced in the otherwise quiet environs of residences, offices and factories adjacent to, or near, low frequency noise sources. Generally, low level/low frequency noises become annoying when the masking effect of higher frequencies is absent. This loss of high frequency components may occur as a result of transmission through the fabric of a building, or in propagation over long distances. Where a noise emission occurs exhibiting an unbalanced frequency spectra, the overall sound pressure level inside residences should not exceed 50 dB(Linear) to avoid complaints of low frequency noise annoyance.

Traffic Noise

There are no guidelines in Queensland relating to the assessment of impact from increased traffic, due to an industrial development, on public roads. However, it is usual to adopt a maximum increase of 3 dB(A) based on a 24-hour average, as an acceptable maximum increase in noise levels. A 3dB(A) increase

corresponds to a doubling of traffic volume, assuming the same type of vehicles. The basis for this opinion may be seen in various criteria including those described above.

9.2.3 Noise Model Predictions

Model Description

Noise modelling was carried out using the digital terrain noise model (i.e. the calculations of the propagation are ground aware) PEN computer program. The noise modelling employed an environmental noise module, in accordance with methodology contained in "Engineering Noise Control" (Bies and Hansen, 1988). The model includes the propagation effects of air absorption, ground reflection, meteorology, barriers and forest.

The digital terrain noise model of the project site and surroundings was set up with terrain data supplied by the proponent. Terrain maps were digitised into the model and form the topographic basis for the investigation. The computer model also required identification of ground types, tree zones, surface roughness estimates and meteorological data. The default ground type is rough grass for the map. Although tree zones are present, for the purposes of this modelling, no part of the map has been defined as tree zones. The surface roughness assumed for this model is dependent on the type of terrain, quantity and density of vegetation and other factors. For all cases a surface roughness for grasslands of 0.023 m was used. There are some areas of trees between the site and surrounding land uses, and these will tend to provide additional noise attenuation. In this respect, the model could be considered conservative.

The roughness of the surface influences the vertical wind speed profile. A rough surface means that the wind does not reach full speed until quite some distance from the ground. However, a smooth surface means that full wind speed is achieved much closer to the ground. The selected surface roughness is representative of the cleared farmland.

For the purposes of modelling, the noise sources in Table 9.15 were included in the model. The front-end loaders and bobcats were not included in this model as they were not considered steady noise sources, but are assessed against sleep disturbance criteria.

Table 9.15 Noise Sources used in Computer Model

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall
		63	125	250	500	1000	2000	4000	8000	dB(A)
Quench car	2	62	67	81	72	69	61	58	53	82
Quench tower	2	77	83	87	92	95	93	83	71	99
Conveyors[1]	5.4 km	94	92	85	82	82	82	81	80	90
Transfer points	4	84	88	84	89	89	91	86	83	96
Surge Bin	1	88	95	96	97	101	102	99	96	107
Blend Bin	1	88	95	96	97	101	102	99	96	107
Coke Crusher	1	88	95	96	97	101	102	99	96	107

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall
		63	125	250	500	1000	2000	4000	8000	dB(A)
Stacker Reclaimer	1	70	77	77	80	83	84	83	80	90
Rail loader	1	89	98	102	107	109	107	100	88	113
Cooling Tower	2	89	93	111	106	107	103	101	98	114
Air handling fans	4	83	87	100	90	86	77	73	67	101
Turbine House	1	86	94	94	104	105	103	99	86	109

Note: [1]The sound power level for the conveyor is on a per 100 m basis.

Predicted Noise Levels from Operations

The predicted noise levels for the Project operation have been calculated for a distance up to almost 5 km from the project site for neutral atmosphere, mild inversion and typical daytime. Drainage-flow wind would occur generally from west to east. The inversion case incorporates a 3 °/100 m vertical temperature gradient (starting at ground level) and a 1 m/s west to east drainage-flow wind. A drainage-flow wind of greater than this magnitude is unlikely in this situation. This would be representative of typical adverse case evening meteorological conditions. A typical day-time case has been assessed. For this a vertical temperature gradient of –3 °/100 m has been assumed, without any wind. The neutral model scenario does not include a temperature gradient or any wind.

Table 9.16 contains the calculated noise levels from the Project for the three meteorological conditions on the nearest residence which is approximately 0.5 km north of the Project. As it is likely that the Power Plant may not be constructed initially, the noise levels for this situation are likely to be lower since the ID fans, Power Plant and cooling towers would not be in operation. The noise levels in Table 9.16 have been calculated for a receiver located in Stanwell township, on the southern side of the Capricorn Highway, near the intersection of Brickworks Road and Sackville Street.

From Table 9.16, it can be seen that the predicted noise levels exceed the specific noise level criteria in Table 9.14, and also exceed the low frequency noise criteria. Therefore, it is likely that if the Project is designed without consideration for noise emissions, there will be exceedences of noise criteria in the community. Noise attenuation measures will be considered in the design of the proposed plant.

Table 9.16 Calculated Noise Levels from the Project at the Closest Residence in Stanwell – No Attenuation Measures

Meteorological Condition	Assessment Criterion	
	Background Creep and Sleep Disturbance, Noise Level in dB(A)	Low Frequency Noise, Noise Level in dB(Lin)
Neutral (Day/Evening)	37	52
Inversion (Night)	46	59
Daytime	36	51

Noise Attenuation Measures

The reduced sound power levels due to modified plant were obtained from modelling (Table 9.17). The sound power levels are considered 'sound power limits' for the plant, and these can be achieved using an appropriate design solution. The attenuation measures incorporated into the model are as follows:

- Quench cars – upgraded building construction or enclosure of major noise source components (9 dB(A) reduction);
- Quench towers – upgraded building construction or enclosure of major noise source components (20 dB(A) reduction);
- Transfer points on conveyors – upgraded building construction or enclosure of major noise source components (15 dB(A) reduction);
- Surge bin(s), blend bin(s) and coke crusher – enclosure of major sources (23 dB(A) reduction);
- Stacker reclaimer – shielded by stockpiles (11 dB(A) reduction);
- Rail Loader – enclosure of major sources (25 dB(A) reduction);
- Cooling towers – fan attenuators (14 dB(A) reduction);
- Air handling fans – fan attenuators (12 dB(A) reduction);
- Turbine house – upgraded building construction (11 dB(A) reduction);
- Conveyors – conveyors may need to be enclosed to achieve the sound power level in Tables 9.15 and 9.17; and
- Northern coke conveyor running approximately east-west – shielding on the northern side of the conveyor (11 dB(A) reduction).

Table 9.17 Noise Sources in Computer Model including Attenuation Measures

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall dB(A)
		63	125	250	500	1000	2000	4000	8000	
Quench car	4	59	61	72	62	57	49	46	43	73
Quench tower	4	71	73	72	72	70	68	58	51	79
Conveyors[1]	5.4 km	65	70	67	69	70	71	70	69	78
Transfer points	4	78	78	69	69	64	66	61	63	81
Surge Bin	1	78	80	76	72	71	67	64	66	83
Blend Bin	1	78	80	76	72	71	67	64	66	83
Coke Crusher	1	78	80	76	72	71	67	64	66	83
Stacker Reclaimer	1	67	71	68	70	71	72	71	70	79

Item	Number	Sound Power Level in dB(A) at Octave Band Centre Frequency (Hz)								Overall dB(A)
		63	125	250	500	1000	2000	4000	8000	
Rail loader	1	79	83	82	82	79	72	65	58	88
Cooling Tower	2	81	84	96	86	90	93	92	90	100
Air handling fans	4	79	81	88	75	61	57	58	55	89
Turbine House	1	83	88	85	94	93	91	87	76	99

Notes: [1] The sound power level for the conveyor is on a per 100 m basis. Reduced sound power level is only applied to northern-most conveyor. Other conveyors use the sound power level in Table 9.15.

It should be noted that the noise attenuation measures proposed are considered indicative only. Noise attenuation measures are expected to be required for the plant to achieve the sound power levels in Table 9.17. Alternatively, if plant sound power levels are higher than the levels in Table 9.15, then a greater level of noise reduction will be required, and more expansive attenuation measures would be required.

Predicted Noise Levels from Operations with Attenuation Measures

The calculated noise level from the Project for the three meteorological conditions with the attenuation measures included in the model, are presented in Table 9.18. The predicted noise levels under neutral, inversion and day-time conditions are shown in Figures 9.2, 9.3 and 9.4 respectively. The predicted noise levels comply with the specific noise level criteria in Table 9.14, and the low frequency noise criteria. Therefore, with the proposed design of noise attenuation measures applied, the proposed plant is able to meet the noise criteria.

Table 9.18 Calculated Noise levels from the Project at Closest Residence in Stanwell with Attenuation Measures

Meteorological Condition	Assessment Criteria	
	Background Creep and Sleep Disturbance (dB(A)	Low Frequency Noise (dB(Lin))
Neutral (Day/Evening)	27	46
Inversion (Night)	31	50
Daytime	26	45

Predicted Noise Levels from Mobile Plant

As noted previously, the front-end loaders and bobcats were not included in the above model, as they are not considered steady noise sources. Modelling has indicated that the noise level in Stanwell from these noise sources is approximately 20 to 34 dB(A) under average load conditions (or when averaged over a period of 15 minutes, for example), and possible 5 dB(A) higher under maximum load conditions. The model has been run under adverse (inversion) conditions. When these noise levels are combined with the steady plant noise levels in Table 9.18, there is the likelihood that the noise level will be up to 43 dB(A) on occasions, if multiple loaders and bobcats are operating at maximum load conditions under adverse meteorological conditions.

N

0 500m 1000m

Scale 1:25 000 (A4)

Horizontal Datum GDA94 Zone 55

LEGEND

45 Noise Contour and Value (dB(A))

Proposed Development Footprint

Proposed Coke and Power Plant

Creek

STANWELL CORPORATION LIMITED

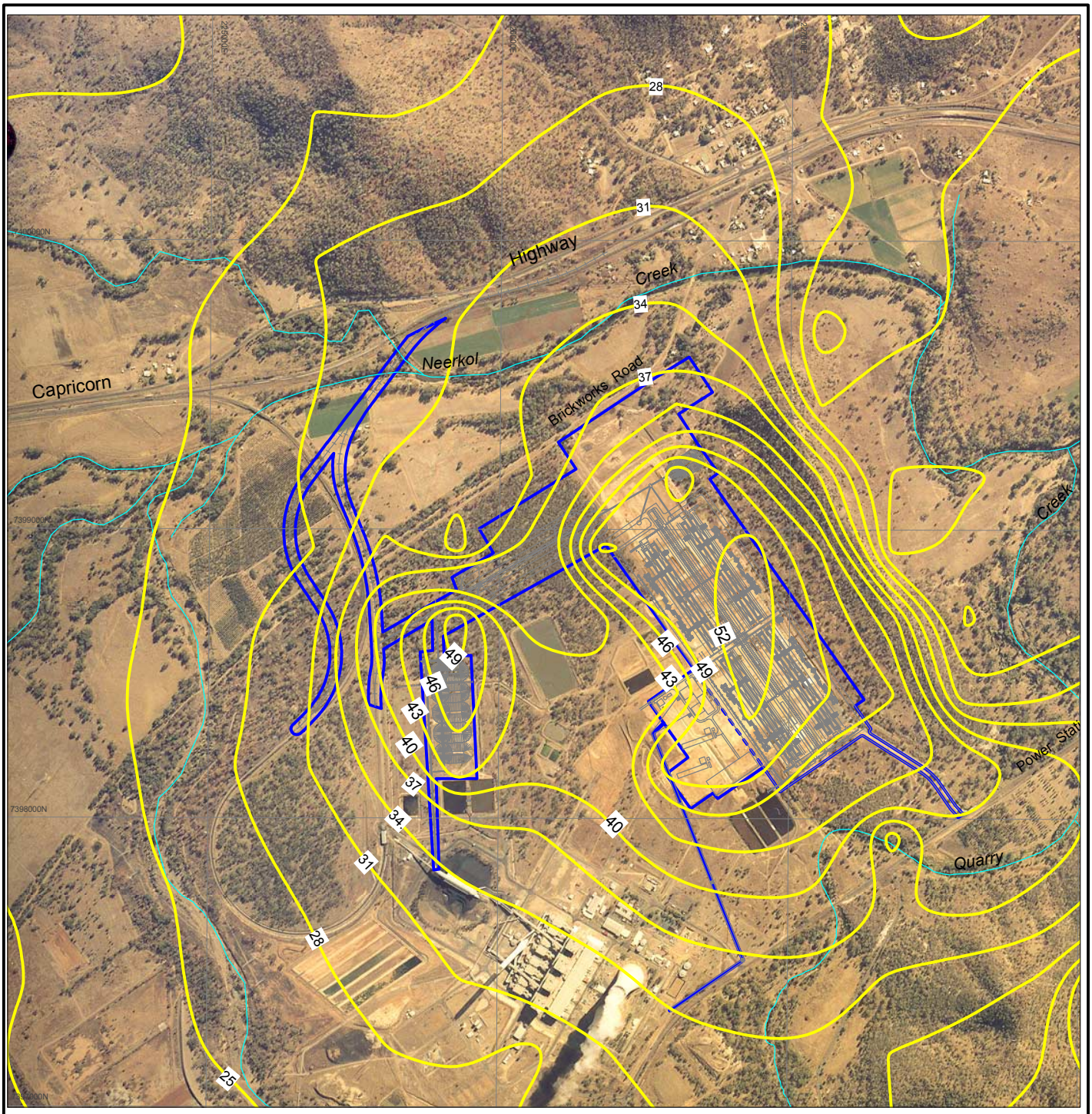
QUEENSLAND COKE & ENERGY

URS

QUEENSLAND COKE AND POWER PLANT PROJECT ENVIRONMENTAL IMPACT STATEMENT

NOISE CONTOUR - NEUTRAL (WITH ATTENUATION MEASURES)

Drawn: VH	Approved: JMcD	Date: 06-01-06	Figure: **9.2**	Rev:D
Job No: **42625626**	File No: 42625626-g-028d.wor			**A4**



N

0 500m 1000m

Scale 1:25 000 (A4)

Horizontal Datum GDA94 Zone 55

LEGEND

45 Noise Contour and Value (dB/a)

Proposed Development Footprint

Proposed Coke and Power Plant

Creek

STANWELL CORPORATION LIMITED

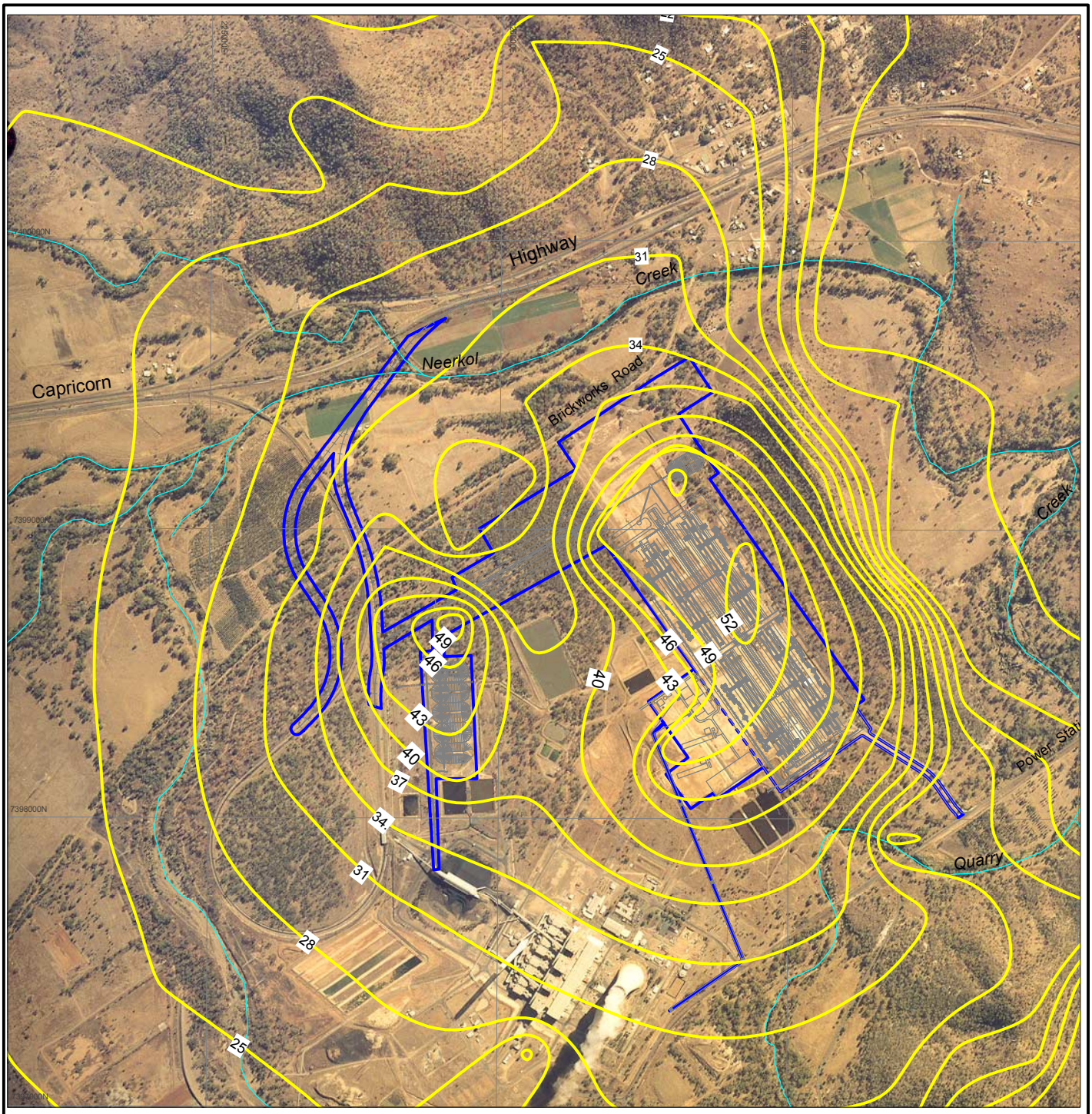
QUEENSLAND COKE & ENERGY

URS

QUEENSLAND COKE AND POWER PLANT PROJECT ENVIRONMENTAL IMPACT STATEMENT

NOISE CONTOUR - ADVERSE (INVERSION) (WITH ATTENUATION MEASURES)

Drawn: VH	Approved: JMcD	Date: 06-01-06	
Job No: **42625626**	File No: 42625626-g-029d.wor	Figure: **9.3**	Rev:D **A4**



N

0 500m 1000m

Scale 1:25 000 (A4)

Horizontal Datum GDA94 Zone 55

LEGEND

45 Noise Contour and Value (dB(A))

Proposed Development Footprint

Proposed Coke and Power Plant

Creek

STANWELL CORPORATION LIMITED

QUEENSLAND COKE & ENERGY

URS

QUEENSLAND COKE AND POWER PLANT PROJECT
ENVIRONMENTAL IMPACT STATEMENT

NOISE CONTOUR - DAYTIME (WITH ATTENUATION MEASURES)

Drawn: VH	Approved: JMcD	Date: 06-01-06	Figure: **9.4**	Rev:D
Job No: **42625626**	File No: 42625626-g-030d.wor			**A4**

Predicted Noise Levels from Other Plant Items

The proposed development will include other smaller plant items, including pumps and motors. These items have not been included in the model as they are typically not the dominant source of noise emissions. As they are typically located at ground level, they are generally screened by buildings, stockpiles and other topographical features. Nevertheless, consideration will be given to all noise sources in the design of the plant. The detailed design of the plant will consider screening noise sources from Stanwell township, and other residential dwellings near the site. Any other major plant items not included in this assessment will also be reviewed in terms of noise emissions, as it is likely that they will require noise attenuation measures to be incorporated into their design (i.e. attenuators, screening, enclosures, upgraded construction etc).

Predicted Traffic Noise

Road Traffic

From Table 9.7 it can be seen that the project-generated road traffic is up to 25% of the background road traffic volume during Stage 2 operations. The increase in road traffic noise levels along the Capricorn Highway due to the increased traffic volume, and the increased percentage of heavy vehicles, is expected to be approximately 1.4 dB(A). This is considerably less than 3 dB(A) and unlikely to lead to adverse impacts.

Rail Traffic

Based on data from QR National, the expected rail usage on the main east-west line is up to 230 trains per week by 2009/2010. The increase in rail traffic is expected to be approximately 15-16 trains per week. This is a 7% growth for the main east-west line. The likely increase in the 24-hour average rail traffic noise level ($L_{eq,24\ hour}$) is expected to be 0.4 dB(A) at houses near to the east-west line. This is considerably less than 3 dB(A) and unlikely to lead to any adverse impacts.

It is likely that rail traffic increases on the rail loop will be more significant than the increases on the east-west line, due to the current limited use of the rail loop. The increase in use of the rail loop will be from approximately 10 trains per week, to approximately 40 trains per week. Assuming an even spread of trains across the 24 hours in a day, the average number of trains per night is two. The proposed modification to the rail loop will locate it approximately 1.3 km from residences to the west and south-west (Figure 3.4).

The Blackwater Rail System, North Coast line (to Fisherman's Landing) and the existing rail loop currently used by SPS are electrified. However, it is understood from discussions with QR representatives that both diesel and electric trains operate on these lines (M. Lloyd, Acting Regional Transit Manager, QR, pers. comm., 28.11.05). Therefore, potential noise impacts from rail traffic were assessed assuming all trains will be diesel, thereby providing an assessment of the worst case scenario. The typical maximum sound power level (Lw) of a diesel train under full load is approximately 125 dB(A). The typical maximum sound power level (Lw) of a train shunt is approximately 120 dB(A). Using the PEN computer

model, the predicted noise levels at residences to the west and south-west, under adverse meteorological conditions are as follows:

- Noise from diesel train under high load - 47 dB(A) L_{Amax}; and
- Noise from train shunt - 38 dB(A) L_{Amax}.

9.2.4 Noise Assessment

Background Creep Assessment

The calculated noise levels in Table 9.18 comply with the specific noise level criteria in Table 9.14 at the closest residential area to the Project. The noise contours under adverse conditions (Figure 9.3) show that the 31 dB(A) night criterion is exceeded at two residences located at the north-eastern corner of the project site. The noise level at these locations is up to 36 dB(A), up to 5 dB(A) higher than at the residential area to the north of Neerkol Creek.

The noise measurements near the location of these dwellings conducted in August 2000 (Location A4), found that the night-time background noise level was approximately 34 dB(A). Using the Ecoaccess Guidelines (Tables 9.12 and 9.13), and proposing that these receivers are residential land uses in an area dominated by light industry, the Specific Noise Criteria at location A4 is 42 dB(A). The calculated noise levels of up to 36 dB(A), comply with the 42 dB(A) criterion. On occasions it is possible that noise levels may be higher than predicted due to plant start-up or upset conditions. These events are transient in nature and are not considered to impact the long-term background noise level.

Sleep Disturbance

Noise levels from the operation of heavy equipment (e.g. front end loaders and bobcats) may be up to 43 dB(A) if multiple loaders and bobcats are operating at maximum load conditions under adverse meteorological conditions. The sleep disturbance goals described above are met at all noise sensitive receptors within Stanwell and in the surrounding rural community, with the attenuation measures proposed. Under plant start-up or upset conditions the elevated noise levels are not expected to cause sleep disturbance, as the noise levels are not likely to exceed sleep disturbance criteria and the events are not expected to be regularly occurring.

Low Frequency Noise

The calculated noise level readily complies with the low frequency noise criterion at the closest residences within Stanwell and in the surrounding rural community, with the attenuation measures discussed above.

Start-up and Upset Conditions

As discussed above, transient noise levels during plant start-up and upset conditions can be significantly higher than normal operating conditions. Start-up noise emissions will occur on commencement of plant operations. This will be planned so as not to occur in noise-sensitive periods. Other intermittent start-up or upset emissions will occur when maintenance is required or in emergency situations. These emissions will be managed to occur over as short a time period as possible. The elevated noise levels from these intermittent sources are not expected to cause sleep disturbance, as the noise levels are not likely to exceed criteria and the events are not expected to be regularly occurring.

Construction Noise

Noise from construction of the Project is expected to include steady or quasi-steady noise sources (e.g. motors, pumps etc) and intermittent noise sources (e.g. earthmoving equipment, site vehicles etc). It is expected that steady or quasi-steady noise sources will be of a lower noise level to the operational plant, as modelled with noise controls. Nevertheless, it is proposed that noise emissions from steady or quasi-steady construction activities are to comply with the evening and night-time operational noise limits in Table 9.14. Noise from mobile equipment, and other intermittent noise sources (e.g. hammering), is required to comply with sleep disturbance criteria above, at night-time.

It is common practice that noise limits are relaxed during daytime construction works, where it may not be practicable to achieve operational noise limits. The reasons for the relaxation of limits include that:

- Construction activities are not a long-term noise source; and
- Operational noise can be controlled within enclosures or buildings, whereas these buildings are not completed during the construction phase.

Nevertheless the daytime noise limit in Table 9.14 will be considered a goal during construction phase where it can be practically achieved.

Traffic Noise

Road Traffic

Increases in road traffic noise would be acceptable with only minor increases in noise levels along the service road to the project site.

Rail Traffic

Increases in rail traffic on the main east-west line are acceptable with only minor increases in noise levels. On the rail loop the relative increase in rail movements is more significant and therefore a more detailed assessment has been conducted. Based on an expectation of two trains or four train movements per night, the allowable sleep disturbance criterion is approximately 56 dB(A). The predicted noise level of 47 dB(A), at residences to the west, complies with this sleep disturbance criterion.

The noise from trains shunting involves a series of short-term noises (bangs) when each train carriage is moved forward for unloading. This noise source will occur repeatedly during the train unloading process. The predicted noise level at the nearest residences to the west and south-west, is 38 dB(A). This noise level will be easily audible, as would be the existing shunting operations, however, it is not likely to cause sleep disturbance, and is therefore considered acceptable. Trains backed up around the rail loop will likely be less noisy than moving or shunting trains. If more than one train was shunting at the same time it is unlikely that the noises would be synchronised. Therefore, the noise level from shunting would likely remain the same, but would be more continuous. In addition, if two noise sources of the same type are close together in location (e.g. shunting trains on the rail loop), the overall total noise level increases by approximately 3 dB(A). This increase is still less than the sleep disturbance criteria at the closest residences.

An existing residence is located near the northern end of the rail loop (between Brickworks Road and the Capricorn Highway). This house has not been included in the assessment of noise from the rail loop due to its proximity to the more trafficked east-west rail line.

Noise from Fisherman's Landing

The ship loading facility will be situated at Fisherman's Landing in a developing industrial area some 10 km north of Gladstone. The closest residences are located approximately 1.8 km to the south, off Fisherman's Road. The noise sources at the Fisherman's Landing are relatively minor compared with other manufacturing facilities in the area. As a consequence of the remote location and minor operations (compared to other local industry) it is not considered necessary to further investigate noise impacts of this aspect of the Project.

9.2.5 Mitigation Measures

The analysis of project components/activities has identified the likely makeup of the noise level emissions from the Project. The noise levels presented are considered to be representative of the maximum noise level from that component/activity. The Ecoaccess Guidelines "Planning For Noise Control" (EPA, 2004a) and "Assessment of Low Frequency Noise" (EPA, 2004b) was used to develop noise level goals relating to background creep, sleep disturbance, low frequency noise impacts as well as acceptable traffic noise increases. Without any noise attenuation measures, the noise emissions from the Project would likely exceed noise level criteria. The modelled noise levels provide a design noise level spectrum for ongoing detailed design of the plant and these levels would be readily obtained through standard design mitigation measures, such as machinery guarding and other health and safety-related control measures, without any further environmental noise control.

In some instances, such as for the power plant cooling tower fans and/or the main ID fans, the component would require low noise units or attenuators. For other noise sources such as the quench tower, crusher, transfer points, surge bins and day bins, it is expected that the design of the equipment will address potential noise impacts to ensure that the design complies with the sound power levels contained in this report and specifically to minimise potential noise emissions towards Stanwell. Attenuation measures for

the noisier plant items include enclosure of shielding barriers or enclosures, fan attenuators, and upgraded building construction. The sound power levels which incorporate these attenuation measures will be considered a design noise level spectrum for ongoing detailed design of the plant. With the implantation of the proposed attenuation measures the predicted noise emission levels comply with all noise level goals at all noise sensitive receptors.

Contractors will be required to meet permissible noise levels through supply selection of machinery, plant and equipment, plant layouts and building designs. Equipment and machinery purchases will also give preference to low-noise equipment. If operation experience indicates that additional noise control measures may be necessary, additional mitigation measures will be considered and may include physical barriers, acoustic enclosures, etc.