APPENDIX 5

Noise Assessment

HEGGIES

REPORT 30-1977-R2

Revision 0

Kooragang Coal Terminal Stage 4 Project Fourth Dump Station and Fourth Shiploader Noise Impact Assessment

PREPARED FOR

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23 OCTOBER 2009

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Kooragang Coal Terminal Stage 4 Project
Fourth Dump Station and Fourth Shiploader
Noise Impact Assessment

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1 INTRODUCTION

Port Waratah Coal Services Ltd (PWCS) obtained a Project Approval under Part 3A of the Environmental Planning and Assessment Act (EP&A Act) in 2007 to construct and operate Kooragang Coal Terminal (KCT) with an increased throughput capacity of 120 million tonnes per annum (Mtpa), referred to as the "Project Approval (PA) 2007".

In response to continuing demand for export coal, PWCS implement an ongoing process of expansion works at KCT. This process enables PWCS to progressively design, construct and operate plant to accommodate ongoing demand for export coal. This process has been reflected in the staged approach to development consents from the original Stage 1 and 2 consents through to the current Stage 3 development consent and PA 2007.

The PA 2007 approval applies to all existing and approved plant at KCT and will be achieved through the optimisation of the capacity of the existing and approved plant. The progressive expansion process not only enables PWCS to manage KCT operations in response to demand for export coal, but also provides for ongoing improvement in operational and environmental management systems. Further discussion of the existing approvals is presented in **Section 1.2**.

As a result of increasing coal export demand, PWCS is seeking to further improve KCT's coal handling efficiency and "sprint capacity" by additional infrastructure including a fourth rail dumping station, a fourth shiploader and associated transfer conveyors systems referred to as the Stage 4 Project. PWCS is seeking approval for the Stage 4 Project by modification to the existing Project Approval (PA) 2007 under Section 75W of the Environmental Planning and Assessment Act 1979.

1.1 Impact Assessment Procedure

Heggies Pty Ltd (Heggies) has been engaged by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of PWCS to assess the environmental noise and vibration impacts from the Project as guided by the Director-General of the NSW Department of Planning (DoP) environmental assessment requirements (DGRs) dated 29 March 2009, in particular the following excerpts from the DGRs relevant to this noise assessment:

Environmental Assessment: *identify any new impacts or changes to impacts associated with the proposal and outline any new measures to minimise, manage, mitigate, monitor and/or off-set impacts, including how any new measures relate to the requirements of the existing project approval. The assessment shall address, but not necessarily be limited to:*

- *Noise and Vibration - noise and vibration impacts of the proposal, consistent with the NSW Industrial Noise Policy (EPA, 2000);*
- *Transport – [noise related] impacts to surrounding local and regional road network and port operations during construction of the proposal;*
- *Cumulative impacts - interactions with other development in the vicinity of the site.*

In accordance with the DGRs, the major sources of noise and vibration emissions may be grouped as follows:

Stage 4 Project Construction Noise and Vibration

Construction Noise and Vibration: The Stage 4 Project installation activities are consistent with the approved daytime construction and vibratory works. KCT's approved construction conditions are based on the requirements of the Environment Protection Authority (EPA) Environmental Noise Control Manual (ENCM) 1994. NSW Department of Environment, Climate Change and Water (DECCW) recently released its "*Interim Construction Noise Guideline*" (ICNG) superseding the ENCM construction noise guideline.

In addition, German Standard DIN 4150-3 1999 "*Structural Vibration Part 3: Effects of Vibration on Structures*" provides guideline criteria for evaluating the short and long-term effects of vibration on structures.

Furthermore, the DECCW's interim policy "*Assessing Vibration: A Technical Guideline"* dated February 2006, provides guideline building vibration levels associated with a low probability of annoyance to occupants.

Stage 4 Project Operating Noise

The noise assessment approach has been to consider approved 120 Mtpa operation together with the Stage 4 Project in operation as well as the specific management of noise impacts associated with the entire KCT facility. More specifically the noise assessment involves the approved 120 Mtpa operation plus the Stage 4 Project comprising**:**

- All on-site installed, approved and proposed Stage 1, 2, 3 and 4 infrastructure operating within the KCT site including rail receival (coal wagon unloading), stacking, reclaiming and shiploading conveyor systems, transfer stations as well as mobile equipment (ie stackers, reclaimers and shiploaders) balanced across the KCT site.
- Coal trains operating on the KCT rail loop including locomotives and wagons have also been assessed simultaneously with the KCT's operations.

The Stage 4 Project noise impact assessment is generally in accordance with the PA 2007 for the 120 Mtpa operations as determined in accordance with the NSW Industrial Noise Policy (INP).

Stage 4 Project Transportation Noise

Stage 4 Project transportation includes both road transport and rail transport as detailed below:

Road Traffic: KCT's operating road traffic will not be altered by the Stage 4 Project and remains consistent the operating traffic approved by the PA 2007. The Stage 4 Project will generate additional off-site construction traffic, relative to approved levels, during the construction period which is scheduled to be undertaken for a period of up to 24 months.

The NSW Environmental Criteria for Road Traffic Noise (ECRTN 1999) provides non-mandatory procedures for setting acceptable L_{Aeq} noise levels on arterial, collector and local roads and guidelines for assessing noise impacts from off-site road traffic. An assessment of the potential construction traffic noise impacts has therefore been undertaken in accordance with the ECRTN.

Rail Traffic: The Australian Rail Track Corporation Ltd (ARTC) operates the Hunter Valley Coal Rail Network in NSW. Noise emissions from the railway are regulated via ARTC's Environmental Protection Licence (EPL No 3142, review date 7 November 2013). The Stage 4 Project will not alter KCT's throughput beyond the approved 120 Mtpa capacity and there are no additional train movements associated with the Stage 4 Project. A review of the ARTC's EPL is provided to assist in the assessment of general rail traffic noise impacts.

Cumulative Industrial Noise Amenity

***Cumulative Industrial Development*:** A review of existing and approved industrial developments and associated noise emissions in the vicinity of the KCT site.

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ amenity levels for all industrial (ie non-transport related) noise in a receiver area. Note, the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources in a receiver area, but rather seeks to control cumulative noise via its amenity criteria.

1.2 Existing Approvals

Development Consent 1996 - Nominal 77 Mtpa Operation

Prior to the Consent 1996, Stage 1 and Stage 2 emissions were approved in accordance with the (then) Environment Protection Authorities (EPA's) Pollution Control Approval (PCA) process. PWCS has consent to construct and operate the Stage 3 Expansion inclusive of Stage 1 and Stage 2 (with respect to noise and vibration emissions) with a nominal throughput capacity of 77 Mtpa in accordance with the Department of Urban Affairs and Planning (DUAP) Consent No 35/96 dated 25 November 1996. An extract from the Consent's *Environmental Standards Noise* conditions are attached as **Appendix A2** and summarised in **Table 1**.

Table 1 Consent 1996 - Noise Limits and Meteorological Constraints (dBA re 20 µPa)

Receiver	Operation Stages 1 and 2 $L_{A10(15minute)}$	Operation Stage 3 (only) $L_{A10(15minute)}$	Operation Stages 1, 2 and 3 $L_{A10(15minute)}$	Construction Phase[1] $L_{A10(15minute)}$
Residential	40 dBA	40 dBA	43 dBA	Background plus 5, 10 or 20 dBA
Industrial	n/a	n/a	65 to 70 dBA	n/a
Notes	Intrusive noise emissions measured or computed at the boundary of any residential premises under acoustically **neutral atmospheric** conditions. Intrusive noise emissions measured or computed at the boundary of any industrial premises under acoustically **neutral atmospheric** conditions. The noise limit may be exceeded where the best technology that is economically available has been employed. Intrusive noise emissions must be substantially free of tonal, impulsive or intermittent characteristics.			

Note 1: Construction noise criteria dependent on the duration of the construction works.

The Stage 3 Expansion consented noise conditions are generally based on the conformance requirements of the Environment Protection Authority (EPA) Environmental Noise Control Manual 1994 (ENCM). The more recent PA 2007 contains noise conditions based on the assessment outcomes arising from the Environmental Assessment (EA) "*Kooragang Coal Terminal Increase to Capacity Throughput*" dated July 2006 (EA 2006) and in particular:

- The ENCM (1994) Chapter 171 Noise Control Guideline (Construction Site Noise) with respect to KCT's on-site construction noise; and

- The NSW INP (2000) with respect to KCT's on-site operating noise.

PWCS is seeking approval for the Stage 4 Project by modification to the existing PA 2007 and the 1996 consented noise limits are not further considered in this report.

Project Approval 2007 - Nominal 120 Mtpa Operations

PWCS has a PA to construct and operate the Stage 3 Expansion (with respect to noise and vibration emissions) with a nominal throughput capacity of 120 Mtpa in accordance the Department of Planning (DoP) Project Approval (PA) Application No. 06_0189 dated 13 April 2007. An extract from the PA's conditions in relation to *Noise Impacts, Noise Auditing and Noise Management* are attached as **Appendix A1** and summarised in **Table 2**.

Table 2 Project Approval 2007 - Noise Limits and Meteorological Constraints (dBA re 20 µPa)

Residential Receiver Area	Approved Construction Noise Condition (ENCM LA10(15minute))	LAeq(15minute) Operation[1] Daytime, Evening, Night[2]	LAeq(night) Operation[1] Night[2]	LA1(1minute) Operation[1] Night[2]
Fern Bay North	The Proponent shall only undertake construction activities associated with the project that would generate an audible noise at any residential premises between 7:00 am and 6:00 pm, seven days a week. Audible noise is defined as "noise that can be heard at the receiver".	46	43	55
Fem Bay West		50	47	55
Fern Bay East		49	46	55
Stockton West		50	47	57
Stockton East		49	46	56
Mayfield West		41	37	56
Mayfield		44	38	58
Carrington		42	38	52

Notes The maximum allowable noise contributions apply under:

a) Meteorological conditions of: wind speeds up to 3 ms^{-1} at 10 metres above ground level; or
b) Temperature inversion conditions up to 3°C per 100 metres and wind speeds up to 2ms^{-1} at 10 metres above the ground.

For the purpose of assessment of noise from the project shall be:

c) Measured at the most affected point on or within the Site boundary at the most sensitive receiver to determine compliance with LAeq(15 minute) night noise limits;
d) Measured at one metre from the dwelling facade to determine compliance with LA1(1minute) noise limits; and
e) Subject to the modification factors provided in Section 4 of the NSW INP, where applicable.

Note 1: 7 days per week, 24 hours a day.
Note 2: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

Project Approval 2007 - Nominal 120 Mtpa Operations - Condition 2.10

Furthermore, PA Condition 2.10 requires PWCS to investigate all feasible and reasonable mitigation measures, as defined by INP, to reduce KCT's potential noise impacts at Fern Bay and Stockton by setting an intrusive noise goal of 45 dB(A) (LAeq,(15 minutes) and noise amenity goal of 43 dB(A) (LAeq,(night)) under noise enhancing meteorological conditions. The noise goals nominated by PA Condition 2.10 are generally consistent with the Project Specific Noise Levels (PSNL's) established in the KCT EA 2006. PWCS have prepared and lodged the first annual noise investigation report PWCS KCT 120 Mtpa Project Approval – Condition 2.10 dated April 2009 demonstrating PWCS's on-going commitment to a continuous noise improvement programme.

Noise Management and Community Concern

For KCT operations above the nominal Stage 3 throughput capacity of 77 Mtpa, environmental noise conformance (ie field measurements and validated modelling) will be carried out in accordance with the PA's Operating Noise Management Plan.

At present, environmental noise monitoring remains in accordance with the approved 120 Mtpa Construction Noise Management Plan and the consented Stage 3 Expansion Operating Noise Management Plan. Construction and operating noise performance is reported in accordance with KCT's Annual Environment Management Report and auditing requirements.

KCT's environmental noise conformance has been verified via the approved programmes of on-going field monitoring and noise modelling. Hence, the Consent 1996 (ie operating noise) and Project Approval 2007 (ie construction noise) currently provide effective mechanisms for assessing conformance.

The relatively low level of community concern in relation to noise emitted from KCT is evidenced by the receival of no community noise related enquiries of which PWCS was found to have been accountable, during the past 5 years. PWCS has however received a number of noise enquiries from the community with subsequent investigation revealing that these were not attributable to PWCS operations or the source was unidentifiable.

2 EXISTING ENVIRONMENT

2.1 Receiver Areas

The Land Use Aerial Plan attached as **Appendix B1** identifies the nearest potentially affected residential, commercial and industrial receiver areas beyond the KCT site boundary. Selected representative assessment locations for each receiver area are presented in **Table 3**.

Table 3 Nearest Potentially Affected Receiver Areas and Assessment Locations

Receiver Area	ID and Location		INP Noise Amenity Zone[1]	LEP Zone
Fern Bay North	FN1	Bayway Village Nelson Bay Road	Suburban	Residential
Fern Bay West	FW1	1 Fullerton Lane		Residential
	FW3	30 Nelson Bay Road		
	FW2	Stockton Hospital	Hospital	Special Uses
Fern Bay East	FE1	21 Braid Road	Suburban	Residential
	FE2	Fern Bay Primary School	School	
Stockton West	SW1	284 Fullerton Street	Suburban	Residential
	SW2	Cnr Pembroke and Fullerton Streets		
Stockton East	SE1	40 Eames Avenue	Suburban	Residential
	SE2	Stockton Primary School	School	
Mayfield West	W1	47 Stevenson Avenue	Urban	Residential
	W2	4 Groongal Street		
	W4	Cnr Decora Cr & Elata Way		
	W3	Mayfield West Primary School	School	
Mayfield	M1	68 Bull Street	Urban	Residential
	M2	45 Simpson Crescent		
	M3	1 Arthur Street		
	M4	52 Arthur Street		
	M5	21 Crebert Street		
Carrington/ Maryville	C1	Cnr Hargrave and Young Streets	Urban	City Centre
	C2	Cnr Harrison and Northumberland Streets		
Mayfield West	MW1	Steel River	Commercial	Steel River
Kooragang Island	KI1	Blue Circle Southern Cement	Industrial	Port and Industry
	IB1	EDI Administration Building		
	IB2	Mountain Bulk Haulage		
	IB3	Kooragang Bulk Facilities		
	IB4	Incitec Heron Rd		
	IB5	Sims Metal Cormorant Rd		
	IB6	Cargill Australia Raven St		
Mayfield North	MN1	OneSteel	Industrial	Port and Industry

Note 1: Use of Urban and Suburban Noise Amenity Zones in accordance with the DoP's Director-General Environmental Assessment Report dated April 2007 in relation to the Major Project Assessment Newcastle Coal Infrastructure Group Coal Export Terminal.

2.2 Stage 4 Project Operation

The approved 120 Mtpa Schematic Equipment Layout is attached as **Appendix B2** with anticipated completion in approximately 2012, dependent on projected coal demand. Stage 4 involves the installation of additional infrastructure as shown on the Schematic Equipment Layout attached as **Appendix B3** necessary to improve KCT's coal handling efficiency and peak capacity while maintaining a nominal throughput capacity of 120 Mtpa, including:

- Augmentation to the rail loop to include an additional inbound and outbound track.
- Fourth dump station, inbound sample plant and inbound conveyors (8,500 tph).
- Feed out conveyor (8,000 tph) including the construction and operation of a conveyor bridge over Teal Street, on the approach to Stockton Bridge.
- Transfer houses, buffer bin and outbound sample plant.
- Shiploader conveyor (10,500 tph).
- Fourth shiploader to service the existing and approved berths.
- Involve only minor changes to the approved footprint of KCT with additional infrastructure associated with the Project to be constructed on previously disturbed land.

The Stage 4 Project does not require any significant change to the operational workforce and the facility will continue to operate 24 hours a day, for the whole year.

2.3 Stage 4 Project Construction

Once commenced, the Stage 4 construction phase has an anticipated total duration of 24 months however the timing of the works is depend on actual market demand. It is anticipated that up to 300 people would be employed during the peak construction period with nominal shift times between 7.00 am to 6.00 pm up to seven days per week together with some supplementary shift construction at other times.

The Stage 4 installation activities are consistent with approved daytime construction and vibratory works. The additional infrastructure will be constructed during defined periods and outages along side the existing KCT operating plant. The construction activities will be scheduled to minimise potential impacts on KCT operations and surrounding land uses. The major construction activities and typical equipment fleets are presented in **Table 4**.

Table 4 Major Construction Activities and Typical Equipment Fleets[3]

Mobile Plant (model/capacity)	Rail Infrastructure and Dump station		Conveyors, Transfers Stations and Bin		Shiploader	
	No of Items	Duration (months)	No of Items	Duration (months)	No of Items	Duration (months)
Mobile Cranes (25-50t)	2	24	2	24	2	12
Mobile Cranes (50-150t)	2	18	2	20	2	9
Mobile Cranes (150-300t)[1]	1	5	1	12	1	12
Elevated Work Platform	2	3	4	24	2	12
Water Trucks[2]	1	12	1	12	1	0
Dump Trucks	3	12	1	12	0	0
Dozers	1	5	0	0	0	0
Excavators	1	9	2	12	1	3
Rollers	2	9	2	12	1	3
Graders	2	9	0	0	1	3
Compactor	2	9	2	12	1	3
Track Laying Machine	1	2	0	0	0	0
Drill Rigs	1	2	2	6	0	0
Impact Piling Rigs	2	6	2	6	0	0
Loaders	1	12	1	12	1	9

Source: PWCS 2009

Note 1: 1 x (150-300t) mobile crane to be shared between the 3 sites.
Note 2: 1 x water truck to be shared between the 3 sites.
Note 3: Typical construction fleet may be modified with equivalent items as construction activities demand.

2.4 KCT Rail Loop

The ARTC controls and operates the Hunter Valley Coal Rail Network in NSW, which includes the KCT rail loop, however coal trains operating on the KCT rail loop, including locomotives and wagons, have been assessed simultaneously with KCT's on-site operations.

3 EXISTING METEOROLOGICAL AND NOISE ENVIRONMENT

As part of the KCT Proposed Increase to Throughput Capacity Environmental Assessment dated November 2006 (KCT EA 2006) - Appendix 4 Noise Assessment. An assessment of site specific winds and atmospheric stability was undertaken in accordance with the INP. For this assessment, The KCT EA 2006 assessment has been updated with the last 5 years of on-site meteorological data records, as outlined below.

3.1 Meteorological Environment

The NSW INP (2000) Section 5.3, Wind Effects, states:

> *"Wind effects need to be assessed where wind is a feature of the area. Wind is considered to be a feature where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period in any season."*

An assessment of prevailing wind conditions was derived from the meteorological data recorded adjacent to the PWCS Administration Building off Curlew Street, Kooragang Island. The dominant seasonal wind speeds and directions for the 5-year period June 2004 to June 2009 are presented in Appendix C for daytime (0700 hours to 1800 hours), evening (1800 hours to 2200 hours) and night-time (2200 hours to 0700 hours).

The prevailing winds less than (or equal to) 3 m/s with a frequency of occurrence greater than (or equal to) 30% and considered to be relevant to the site in accordance with the INP are presented in **Table 5**. The dominant conditions incorporated into noise modelling are underlined.

Table 5 Prevailing Wind Conditions in accordance with the INP

Season	Winds ± 45° ≤3 m/s with Frequency of Occurrence ≥30%		
	Daytime	**Evening[1]**	**Night-time[1]**
Summer	Nil	NE 33%, ENE 36%, E 34%	nil
Autumn	Nil	nil	W 31%, WNW 36%, NW 35%
Winter	Nil	NW 30%	W 35%, WNW 43%, NW 44%, NNW 32%
Spring	Nil	NNE 32%, NE 35%, ENE 33%	nil

Note 1: The significant seasonal wind speeds relative to residential receiver areas are underlined.

The INP Section 5.2, Temperature Inversions, states:

> *"Assessment of impacts is confined to the night noise assessment period (10.00 pm to 7.00 am), as this is the time likely to have the greatest impact - that is, when temperature inversions usually occur and disturbance to sleep is possible."*
>
> *"Where inversion conditions are predicted for at least 30% (or approximately two nights per week) of total night-time in winter, then inversion effects are considered to be significant and should be taken into account in the noise assessment".*

An assessment of atmospheric stability conditions has also been prepared from the meteorological data set described above. The winter evening and night-time frequency of occurrence of atmospheric stability classes are presented in **Table 6**, together with estimated Environmental Lapse Rates (ELR).

Table 6 Atmospheric Stability Frequency of Occurrence - Winter Evening/Night-time

Stability Class	Occurrence Percentage	Estimated ELR[1] °C/100 m	Qualitative Description
A	0%	<-1.9	Lapse
B	0%	-1.9 to-1.7	Lapse
C	0%	-1.7 to-1.5	Lapse
D	36%	-1.5 to-0.5	Neutral
E	20%	-0.5 to 1.5	Weak Inversion
F	43%	1.5 to 4.0	Moderate Inversion
G	1%	>4.0	Strong Inversion

Note 1: ELR (Environmental Lapse Rate).

In accordance with the INP the frequency of occurrence of moderate (ie 1.5 to 4.0°C/100 m) winter temperature inversions is greater than 30% during the combined evening and night-time period and therefore included in the assessment as outlined below.

Environmental Noise Model (ENM) Meteorological Parameters

The ENM noise modelling meteorological parameters presented in **Table 7** are based on analysis of the Kooragang Island meteorological data set and field measurements carried-out during previous quarterly noise monitoring coinciding with noise enhancing weather conditions. In this case, the observed meteorological conditions at Kooragang Island are generally consistent with the default parameters presented in the INP Section 5 Meteorological Conditions with cool and cold season west northwest winds and north-easterly breezes prevailing during warmer periods of the year. During winter, coastal strength moderate temperature inversions also coincide with "down river" westerly drainage flows.

Table 7 Calm (neutral) and Noise Enhancing Meteorological Modelling Parameters

Period	Meteorological Parameter	Air Temp	Relative Humidity	Wind Velocity	Temperature Gradient
Daytime	Calm	20°C	70%	0 m/s	0°C/100 m
Evening	Wind only	15°C	80%	NE 3 m/s[1] NW 3 m/s[2]	0°C/100 m
Night-time	Wind only	10°C	90%	W 3 m/s[3] NW 3 m/s[4]	0°C/100 m
	Inversion only	10°C	90%	0 m/s	3°C/100 m
	Inversion plus Drainage flow	10°C	90%	W 2 m/s[3] WNW 2 m/s[4]	3°C/100 m

Note 1: Mayfield West, Mayfield, Maryville/Carrington receiver areas.
Note 2: Fern Bay and Stockton receiver areas.
Note 3: Fern Bay receiver areas.
Note 4: Stockton receiver areas.

By comparison with the KCT EA 2006 assessment (Appendix 4 Noise Assessment) the assessment of site specific winds now includes 3 m/s north westerly wind, during the evening period, as identified through the analysis of updated meteorological data.

3.2 Noise Environment

The KCT EA 2006 (Appendix D Noise Assessment) includes an extensive assessment of the ambient noise environment in the vicinity of the Project site attached as **Appendix D**. The assessment estimated $L_{Aeq(period)}$ industrial noise has been updated noting the classification of Fern Bay and Stockton as suburban noise zone (rather than urban areas) as outlined below.

Background and Industrial Noise in the Absence of KCT for Assessment Purposes

The background noise levels at Mayfield West, Mayfield and Carrington/Maryville urban residential areas were suitable for setting INP-based intrusive and amenity project specific noise levels (PSNLs). Similarly, daytime background noise levels at Fern Bay and Stockton were also relatively unaffected by industrial noise. However, as described in **Appendix D**, industrial noise arising from Kooragang Island (including KCT's contribution) influences the evening and night-time noise environment at Fern Bay and Stockton and to a lesser extent at Fern Bay North.

The evening and night-time rating background levels (RBLs) and noise amenity in the absence of KCT's noise contribution at Fern Bay and Stockton were established by the following procedure:

- Further noise and weather analysis was carried out on Fern Bay West (FW1) to give an estimated night-time RBL of 40 dBA in the absence of KCT's noise contribution.

- At Fern Bay KCT is the dominant industrial noise source. At Stockton however, KCT and other industrial noise sources from Walsh Point contribute to the noise environment therefore the background level at Stockton (42 dBA) is higher by comparison with Fern Bay (40 dBA).
- At Fern Bay North the estimated night-time RBL was also 40 dBA and therefore generally equivalent to the EIS 1996 night-time minimum repeated background level (MRBL) of 38 dBA. (Note, the previous ENCM MRBL calculation procedure generally derived lower noise levels by comparison with the INP RBL calculation procedure).

As a result, the KCT EA 2006 noise levels have been distilled into single representative Rating Background Levels (RBLs) and industrial amenity levels as presented in **Table 8** for each area.

Table 8 Background and Industrial Noise in the Absence of KCT (dBA re 20 µPa)

Receiver Area	ID	Estimated & Measured RBLs All Noise Sources			Estimated $L_{Aeq(period)}$[2] Industrial Noise Only		
		Day	Evening	Night	Day	Evening	Night
Fern Bay North Suburban[1]	FN1	44	45	40	<49	<39	<34
Fern Bay West Suburban[1]	FW1-FW2	47	42	40	<49	<39	40
Fern Bay East Suburban[1]	FE1	40	43	41	<49	<39	38
Stockton West suburban[1]	SW1	42	43	42	<49	41	42
Stockton East Suburban[1]	SE1	41	42	42	<49	<39	38
Mayfield West Urban	W1-W3	45	46	41	<54	45	43
Mayfield Urban	M1-M5	46	47	43	<54	45	44
Carrington/ Maryville Urban	C1-C2	42	41	37	<54	45	42
Mayfield West[3] Commercial	MW1	48	45	40	<59	<59	<59
Kooragang Is Industrial	KI1	51	51	47	<64	53	51
Mayfield North Industrial	MN1	56	57	57	<64	57	57

Note 1: Estimated rating background levels and industrial amenity levels in the absence of KCTs operation

Note 2: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

Note 3: Estimated industrial noise levels based on measurements at Sandgate.

4 NOISE CRITERIA AND ASSESSMENT PROCEDURE

4.1 Construction Noise

As discussed in **Section 1.1**, KCT's approved construction noise conditions are based on the requirements of the EPA's ENCM construction noise guideline. This guideline was recently superseded with the release of the DECCW's "*Interim Construction Noise Guideline*" (ICNG) with the comparative assessments requirements summarised in **Appendix E**.

The interim guideline for major projects recommends a construction noise management level (CNML) equivalent to the RBL plus 10 dBA within standard hours (ie daytime) and RBL plus 5 dBA outside standard hours (ie evening and night-time). The approved construction noise condition and the ICNG construction noise management levels are presented in **Table 9**.

Table 9 Stage 4 Project ICNG $L_{Aeq(15minute)}$ Construction Noise Management Levels (dBA re 20 µPa)

Residential Receiver Area	Approved Construction Noise Condition[1] ($L_{A10(15minute)}$)	Daytime[1] CNML RBL plus 10 dBA	Evening CNML RBL plus 5 dBA	Night-time CNML RBL plus 5 dBA
Fern Bay North	The Proponent shall only undertake construction activities associated with the project that would generate an audible noise at any residential premises between 7:00 am and 6:00 pm, seven days a week. Audible noise is defined as "noise that can be heard at the receiver".	54	50	45
Fem Bay West		57	47	45
Fern Bay East		50	48	46
Stockton West		52	48	47
Stockton East		51	47	47
Mayfield West		55	51	46
Mayfield		56	52	48
Carrington		52	46	42

Note 1: 7 days per week - 0700 hours to 1800 hours.

The Stage 4 Project daytime $L_{Aeq(15minute)}$ CNMLs are presented in **Table 9**. For consistency with the PA 2007, it is recommended that Stage 4 Project construction would only be conducted evening and/or night-time if noise from the work is indiscernible at residential receivers.

4.2 Sleep Disturbance

Approved sleep disturbance noise limits are generally consistent with the DECCW's Application Notes (February 2008) sleep disturbance guideline. The guideline recognises that the current $L_{A1(60sec)}$ sleep disturbance criteria of 15 dBA above the prevailing $L_{A90(15min)}$ level is not ideal. The assessment of potential sleep disturbance is complex and poorly understood and the DECCW believes that there is insufficient information to determine a suitable alternative criteria.

In the interim, the DECCW suggest that the $L_{A1(60sec)}$ level 15 dBA above the Rating Background Level (RBL) is a suitable screening criteria for sleep disturbance for the night-time period. The approved night-time noise limits, the background noise levels and DECCW sleep disturbance criteria are presented in **Table 10**.

Table 10 Stage 4 Project Night-time Sleep Disturbance Noise Criteria (dBA re 20 µPa)

Residential Receiver Area	Approved Night-time[1] LA1(60second) Noise Limit	Night-time RBL	Sleep Disturbance LA1(60second) Criteria
Fern Bay North	55	40	55
Fem Bay West	55	40	55
Fern Bay East	55	41	56
Stockton West	57	42	57
Stockton East	56	42	57
Mayfield West	56	41	56
Mayfield	58	43	58
Carrington	52	37	52

Note 1: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

The Stage 4 Project night-time $L_{A1(60seconds)}$ sleep disturbance criteria are generally consistent with approved noise limits presented in **Table 10**.

4.3 Operating Noise

The NSW DECCW has regulatory responsibility for the control of noise from "scheduled premises" under the Protection of the Environment Operations (POEO) Act 1997. KCT is a scheduled activity as defined under the POEO Act and is regulated via PWCS's Environment Protection Licence (EPL) No. 1552 (anniversary date 01 June, review date 27 August 2014).

In implementing the INP, the DECCW has two broad objectives:

- Controlling intrusive noise impacts in the short term.
- Maintaining noise level amenity for particular landuses over the medium to long term.

The INP prescribes detailed calculation routines for establishing project specific noise levels (PSNLs) (ie $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity (ie non-transport related) criteria) for an industrial development at potentially affected receivers.

Ideally, the intrusive noise emission should generally not exceed the background level by more than 5 dBA. Similarly, the amenity level should generally not exceed the specified INP "acceptable" or "maximum" noise level appropriate for the particular locality and land use as shown in **Table 11**.

Table 11 INP Acceptable and Maximum Noise Amenity Levels (dBA re 20 µPa)

Receiver Area	Land Use	Amenity $L_{Aeq(period)}$[2] Acceptable			Amenity $L_{Aeq(period)}$[2] Maximum		
		Day	Evening	Night	Day	Evening	Night
Fern Bay North Fern Bay (west/ east) Stockton (west/ east)	Suburban Residential	55	45	40	60	50	45
Mayfield West Mayfield Carrington Maryville	Urban Residential	60	50	45	65	55	50
Mayfield West	Commercial Steel River	65	65	65	70	70	70
Kooragang Island Mayfield North	Industrial	70	70	70	75	75	75
Any	School[1]	External 45 when in use			External 50 when in use		
Any	Hospital	External 50 when in use			External 55 when in use		

Note 1: External criteria equivalent to internal criteria plus 10 dBA.

Note 2: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

In accordance with the INP's Chapter 2 Industrial Noise Criteria in conjunction with the INP's Application Notes (February 2008), the project specific intrusive noise and amenity levels for the residential, commercial and industrial receiver areas are presented in **Table 12**.

Table 12 Project Specific Intrusive Noise and Amenity Levels (dBA re 20 µPa)

Receiver Area	Land Use	Intrusive LAeq(15minute)			Acceptable Amenity LAeq(period)[1]			Maximum Amenity LAeq(9hour)
		Day	Evening	Night	Day	Evening	Night	Night
Fern Bay North	Suburban Residential	49	47	45	55	45	40	45
Fern Bay West		52	47	45	55	45	32	43
Fern Bay East		45	45	45	55	45	36	45
Stockton West		47	47	47	55	43	32	42
Stockton East		46	46	46	55	45	36	45
Mayfield West	Urban Residential	50	50	46	60	48	41	50
Mayfield		51	51	48	60	48	39	50
Carrington/ Maryville		47	46	42	60	48	43	50
Mayfield West	Commercial Steel River	Intrusive noise not applicable			65	65	65	70
Kooragang Island	Industrial	Intrusive noise not applicable			70	70	70	75
Mayfield North		Intrusive noise not applicable			70	70	70	75
Any	School	Intrusive noise not applicable			External 45 when in use			50
Any	Hospital	Intrusive noise not applicable			External 50 when in use			55

Note 1: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours, Night-time 2200 hours to 0700 hours.

The INP states that these criteria have been selected to preserve the amenity of at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, then most people would consider the resultant noise levels acceptable.

In those cases where the INP project specific assessment criteria are not achieved, it does not automatically follow that all people exposed to the noise would find the noise unacceptable. In subjective terms, exceedances of the INP project specific assessment criteria can be generally described as follows:

- Negligible noise level increase <1 dBA
  (Not noticeable by all people)
- Marginal noise level increase 1 dBA to 2 dBA
  (Not noticeable by most people)
- Moderate noise level increase 3 dBA to 5 dBA
  (Not noticeable by some people but may be noticeable by others)
- Appreciable noise level increase >5 dBA
  (Noticeable by most people)

4.4 Stage 4 Project Construction and Operating Residential Noise Limits

As discussed in **Section 1.2**, PWCS is seeking approval for the Stage 4 Project by modification to the existing PA 2007. The approved 120 Mtpa residential operating noise limits (intrusive, amenity and maximum) were previously determined in accordance INP's noise assessment methodology and approvals processes and have therefore being adopted for noise assessment purposes for Stage 4 Project. The construction noise management levels construction (CNML's) are nominated in accordance with the current ICNG as presented in **Table 13**. Any supplementary noise assessments are assessed against the relevant project specific noise levels (PSNLs) to noise sensitive receivers as well as industrial and commercial areas as applicable.

Table 13 Stage 4 Project Construction and Operating Residential Noise Limits (dBA re 20 μPa)

Residential Receiver Area	LAeq(15minute) Construction Daytime[1,2]	LAeq(15minute) Operation[3] Day, Evening, Night[4]	LAeq(night) Operation[3] Night[4]	LA1(1minute) Operation[3] Night[4]
Fern Bay North	54	46	43	55
Fem Bay West	57	50	47	55
Fern Bay East	50	49	46	55
Stockton West	52	50	47	57
Stockton East	51	49	46	56
Mayfield West	55	41	37	56
Mayfield	56	44	38	58
Carrington	52	42	38	52

Notes The maximum allowable noise contributions apply under:

a) Meteorological conditions of: wind speeds up to 3 ms^{-1} at 10 metres above ground level; or
b) Temperature inversion conditions up to 3°C per 100 metres and wind speeds up to 2ms^{-1} at 10 metres above the ground.

For the purpose of assessment of noise from the project shall be:

c) Measured at the most affected point on or within the Site boundary at the most sensitive receiver to determine compliance with $L_{Aeq(15\ minute)}$ night noise limits;
d) Measured at one metre from the dwelling facade to determine compliance with $L_{A1(1minute)}$ noise limits; and
e) Subject to the modification factors provided in Section 4 of the NSW INP, where applicable.

Note 1: 7 days per week, 0700 hours to 1800 hours.

Note 2: Permitted during evening and night-time if construction noise indiscernible at residential receivers.

Note 3: 7 days per week, 24 hours a day.

Note 4: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

5 KCT NOISE MITIGATON STRATEGY

5.1 Continuous Noise Improvement Programme

The INP focuses on achieving the desired environmental noise outcomes with *no prescribed management or mitigation strategy to achieve PSNL's*. In this way, the Proponent *is given maximum flexibility* with the design and implementation of a noise management and control programme applicable to its operations.

PWCS has elected to implement an INP-based Continuous Noise Improvement Programme. The Programme began at the commencement of the Stage 3 expansion and continues to be implemented as part of ongoing KCT operations. The Programme involves plant and equipment Acoustical Design, Procurement, Construction and Commissioning together with Monitoring and Reporting, to ensure that the approved environmental noise limits are achieved. An overview of the on-going programme is presented as **Figure 1** and described in **Table 14**.

Figure 1 Overview of the Continuous Noise Improvement Programme

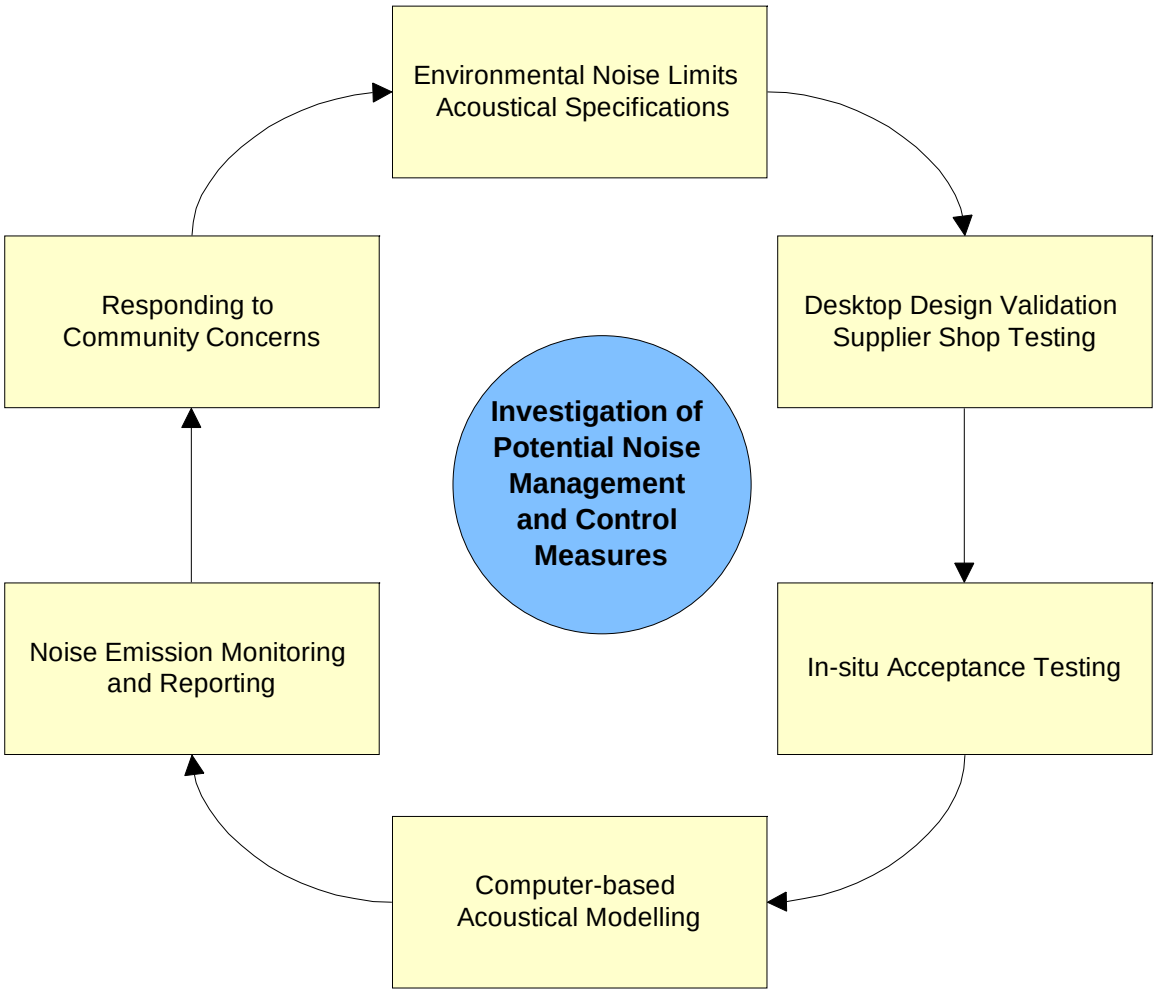


Table 14 Description of Continuous Noise Improvement Programme

Programme	Improvement Activities
Environmental noise limits and acoustical specifications	• Best Available Technology noise limits for each phase of development • Environmental and OHS acoustical specifications for all equipment type
Supplier desktop design validation and supplier shop testing	• Equipment suppliers must demonstrate acoustical conformance during tender • Environmental and OHS acoustical shop testing during procurement
Proponent in-situ acceptance testing	• Environmental and OHS acoustical field testing during plant commissioning • Refitting and or replacement in the event of non-compliance
Computer-based acoustical modelling	• Acoustical modelling of installed plant using actual achieved SWLs • Preparation of detailed acoustical compliance report for each phase of development
Noise emission monitoring and reporting	• On-site operator-attended noise surveillance measurements of acoustically significant plant • Off-site operator-attended noise monitoring programme including representative locations at Fern Bay and Stockton • Develop KCT Key Performance Indicators (KPIs) to quantify monthly on-site and off-site acoustical performance based on measured equipment SWLs, weather conditions and KCT plant operating logs
Responding to community concerns	• Prompt response and targeted noise monitoring where required • Refinement of on-site noise operating procedures where practicable
Ongoing investigation of potential noise controls	• Investigate and research potential source noise and propagation path controls based on new technology • Rank and implement the noise controls based on potential noise reduction, cost effectiveness and operational requirements • Validate supplier data on new, improved acoustical performance of equipment

5.2 Noise Investigation and Improvement Progress

By implementing the Programme described in **Section 5.1**, in many cases PWCS has gone well beyond Best Available Technology by promoting research and development (R&D) of practical acoustical solutions not previously commercial available or considered economically achievable. In particular, the development of low noise technology in relation to conveyor assemblies (ie open-steel, metal-pan, concrete-pan, and PPAG) and conveyor drive assemblies with demonstrated source noise reductions and incremental improvement with each phase of installed infrastructure.

A summary of KCT's noise reduction measures and improvements are summarised in **Table 15**. The current focus of the programme is to design, construct and operate sustainable at source noise controls for the remaining Stage 3 infrastructure. In the interim, Stage 1 and 2 plant and equipment are subject to replacement in accordance with KCT's ongoing maintenance activities with Stage 1 and 2 off-site alarm noise levels currently the subject of investigation and rectification as described in **Table 15** in accordance with the continuous noise improvement programme.

Table 15 Summary of KCT's Noise Reduction Measures

Equipment Type	Stage 1 & 2	Stage 3 & 4
Conveyor Drives	Near-field barriers Replace noisiest drives	Low noise drive specification and compliance programme prior to acceptance on site Noise reductions to gearbox, motor, coupling/brake, frame/ guards and lube system
Stockyard and Shiploading Conveyors (Open Steel Assembly)	Replace highly worn idlers Replacement of suspended return idlers with staggered return idler spacing and fixed idler support frame	Low noise idler specification and compliance programme prior to acceptance on site Soft-mount noise barriers Staggered return idler spacing and fixed return idler support frame
Transfer Conveyors (Concrete and Metal Pan Assembly)	Replace highly worn idlers Conveyor mounted barriers Attenuation from enclosure	Low noise idler specification and compliance programme prior to acceptance on site Low noise prefabricated (PPAG) conveyor gantry
Stackers, Reclaimers and Shiploaders	Replace noisiest drives and highly worn idlers	Low noise idler specification and compliance programme including conveyor drives and idlers. Demonstration of noise compliance by machine supplier at design stage
Buffer Bins, Chutes	Vibrating feeder opposing phase control to "cancel" noise effects	Soft flow chutes Vibrating feeder opposing phase control to "cancel" noise effects
Receival, Sample and Transfer Station buildings	Enclosed with minimum penetrations, double cladding where required Maintenance access doors closed when operating plant and equipment	Enclosed with minimum penetrations, double cladding where required Maintenance access doors closed when operating plant and equipment
Equipment start up and travel alarms	Retro design alarm systems to replace those that cause off-site disturbance	Develop alarms with frequency and volume control Design and install alarms systems[1]
Management	• Maintenance and operational staff - noise awareness training • Noise awareness part of the site induction training • Integrated community enquiries and response programme • Regular noise monitoring programme and analysis of results	

Note 1: Alarms are subject to procurement specifications detailing the tone frequency, noise emission levels, directionality and coverage. They are installed to optimise safety and to minimise off-site noise leakage. In the unlikely event that alarm noise remains a source of disturbance, then further on-site optimisation and fine adjustments are implemented to achieve further noise reductions without compromising safety standards.

The sound power levels (SWLs) for approved Stages 1, 2 and 3 infrastructure and the proposed Stage 4 Project are presented in **Table 16**. The approved Stage 3 MasterPlan Completion procurement specifications are being prepared and subject to the demonstrated project 3Exp operating performance a further reduction to the relevant Stage 4 noise specifications may be possible in the future. PWCS will continue to investigate all reasonable and feasible measures to achieve ongoing noise reductions through the continuous noise improvement programme.

Table 16 KCT Stage 1, 2, 3 and 4 Plant and Equipment L_{Aeq} Sound Power Levels (dBA re 10ρW)

As at completion of	Stage 1 (installed)	Stage 2 (installed)	Stage 3A, Steps 1-4, 3D (installed)	Stage 3Exp (design)	MasterPlan (design)	Stage 4 (design)
Stage 1	132	132	132	131	131	130
Stage 2	-	131	131	131	131	131
3A, Steps 1-4, 3D	-	-	126	126	126	126
3Exp	-	-	-	119	119	119
MasterPlan	-	-	-	-	120	120
Stage 4	-	-	-	-	-	119
TOTAL	**132**	**135**	**135**	**135**	**135**	**135**
			Typical SWL Range of Equipment in each Stage:			
	Conveyor drives 630kW: 104-116dBA	Conveyor drives 630kW: 105-110 dBA	Conveyor drives 630kW: 98-107 dBA	Conveyor drives 630kW: 96 dBA	Conveyor drives 630kW: 96 dBA	Conveyor drives 630kW: 96 dBA
	Conveyor drives 800kW: 107-114 dBA	Conveyor drives 800kW: 104-117 dBA	Conveyor drives 800kW: 99-115 dBA	Conveyor drives 800kW: 98 dBA	Conveyor drives 800kW: 98 dBA	Conveyor drives 800kW: 98 dBA, 1000kW: 99 dBA
	Receival/Transfer Conveyors (per 100m): 105-110dBA	Receival/Transfer Conveyors (per 100m): 104-108 dBA	Receival/Transfer Conveyors (per 100m): 97-100dBA (PPAG)	Receival/Transfer Conveyors (per 100m): 100 dBA (PPAG)	Receival/Transfer Conveyors (per 100m): 100 dBA (PPAG)	Receival/Transfer Conveyors (per 100m): 98 dBA (PPAG)
	Shiploading Conveyors (per 100m): 115dBA	Shiploading Conveyors (per 100m): 113-115 dBA	Shiploading Conveyors (per 100m): 108 dBA	Shiploading Conveyors (per 100m): 103 dBA	Shiploading Conveyors (per 100m): 103 dBA	Shiploading Conveyors (per 100m): 103 dBA
	Stockyard Conveyors (per 100m): 109-113dBA	Stockyard Conveyors (per 100m): 103-114 dBA	Stockyard Conveyors (per 100m): 107 dBA	Stockyard Conveyors (per 100m): 103 dBA	Stockyard Conveyors (per 100m): 103 dBA	
	Shiploader,Reclaimer,Stacker: 113, 115, 114-117 dBA	Shiploader: 115 dBA	Shiploader,Reclaimer,Stacker: 111, 108, 105 dBA	Reclaimer,Stacker: 107, 106 dBA	Reclaimer,Stacker: 107, 106 dBA	

5.3 Stage 4 Project Noise Modelling

The KCT computer model was developed to incorporate the significant noise sources associated with the Kooragang Island site. Additionally, surrounding terrain, aspects of the built environment and nearby receiver areas were also included in the model. The noise model was modified to include key components of the Stage 4 Project as identified through project design information.

The KCT computer model was prepared using RTA Software's Environmental Noise Model (ENM for Windows, Version 3.06), a commercial software system developed in conjunction with the NSW EPA. The acoustical algorithms utilised by this software have been endorsed by the Australian and New Zealand Environment and Conservation Council (ANZECC) and all State Environmental Authorities throughout Australia as representing one of the most appropriate predictive methodologies currently available. The following scenarios were assessed:

Stage 4 Project: The approved 120 Mtpa operation plus Stage 4 Project comprising:

- All on-site installed, approved and proposed Stage 1, 2, 3 and 4 infrastructure operating within the KCT site including rail receival (coal wagon unloading), stacking, reclaiming and shiploading conveyor systems, transfer stations as well as mobile equipment (ie stackers, reclaimers and shiploaders) balanced across the KCT site.
- Coal trains operating on the KCT rail loop including locomotives and wagon rakes have also been assessed simultaneously with the KCT's operations.

The operational modelling includes all significant items of plant and equipment working concurrently to simulate the maximum capacity of the facility and predict the intrusive $L_{Aeq(15minute)}$ and amenity $L_{Aeq(Period)}$ levels.

5.4 Stage 1 and 2 Noise Control for Residential Areas

As shown in **Table 16** the Stage 4 infrastructure will be designed to achieved an approximate SWL of 119 dBA and therefore well below SWL's for Stages 1 (installed 132 dBA) Stage 2 (installed 131 dBA), Stage 3 (installed 126 dBA) and Stage 3 (approved 123 dBA). Therefore in the general terms, the Stage 4 infrastructure represents best available technology and has only the marginal potential to increase off-site environmental noise emissions.

The Stage 4 Project predictive noise modelling involved the investigation of feasible and reasonable mitigation measures, particularly in relation to night-time operations. Preliminary Stage 4 Project noise predictions indicated a marginal (1 dBA) noise increase at several receiver areas during noise enhancing weather conditions. Hence a number of steps were taken to develop potential noise control measures for the Stage 4 Project involving iterative modelling and consideration of various combinations of Stage 1 and/or 2 noise control measures to assess their relative effectiveness.

In order to ensure that Stage 4 Project (including the KCT rail loop) does not introduce any noise increase at all receiver areas relative to operating noise limits (**Section 4.4**) it will be necessary to reduce the noise emissions from all four Stage 1 (ie eastern section) stockyard conveyors (or equivalent Stage 2 noise controls) and the Stage 1 (ie full length) wharf conveyor (or equivalent Stage 2 noise controls). The required source noise reductions can be achieved by relacing existing idler rolls and modifying conveyor assemblies in accordance with Stage 3 (and 4) noise specification requirements (refer **Table 16**). These mitigation measures would be implemented by PWCS as part of ongoing maintenance activities and the continuous noise improvement programme and have been assumed to be implemented for the purposes of the predictive modelling.

The outcome of these investigations into the implementation of reasonable and feasible noise controls would be reported on annual basis in accordance with PA Condition 2.10.

5.5 Noise Controls for Industrial Receivers

As shown in **Appendix B1**, the nearest industrial premise to the KCT site is Kooragang Bulk Facilities (KBF, Location 1B3). The KBF administrative building has existing noise controls to minimise conveyor noise intrusion from the adjacent KCT transfer conveyors. The noise controls include building treatments installed to ensure ambient internal noise levels meet with the relevant occupancy and office use design noise level.

In 2008 quarterly noise monitoring adjacent to the KBF administrative building showed KCT's noise emissions to be approximately 73 dBA. As a result, in early 2009 PWCS upgraded the idler rolls on the adjacent transfer conveyors to reduce emissions to 70 dBA which was confirmed to have been achieved by the June 2009 quarterly noise monitoring survey.

In order to ensure that Stage 4 Project and in particular the proposed outbound conveyors CV3 and CV4 do not introduce any noise increase at the KBF administrative building (IB3) further noise reductions to the adjacent transfer conveyors (ie Stage 1 conveyors 5.30/5.03 and Stage 2 conveyors 5.31/5.04) are necessary. The required source noise reductions and can be achieved by the replacement of existing idler rolls in accordance with Stage 3 (and 4) noise specification requirements**.** These mitigation measures have been assumed to be implemented for the purposes of the predictive modelling.

In addition to the mitigation of Stage 1 and 2 conveyors several other noise control measures are potentially available to PWCS to address any future potential noise impacts in the vicinity of the KBF building including improvements to the Transfer House 05.01 sound transmission loss performance. However, such potential improvements are not considered necessary to achieve a noise level of 70 dBA. PWCS will continue to investigate reasonable and feasible measures to manage any industrial noise impacts as part of the continuous noise improvement programme.

Furthermore, phase locking devices are currently installed on the Stage 3 Buffer Bin to minimise the potential annoyance to the occupants of the KBF building from infrasonic noise (approximately 20 Hz or less) associated with the operation of electro magnetic feeders. To mitigate potential infrasonic noise annoyance the distance between the KBF building and the Stage 4 Buffer Bin has been maximised for the layout plan and phase locking devices will be installed on the electro magnetic feeders.

Alternatively, PWCS may consider the use of "belt feeders" rather than electro magnetic feeders (or mechanical feeders) for the Stage 4 Buffer Bin. The extent of the necessary noise mitigation will be defined during the Stage 4 Project engineering design phase and will aim to minimise potential infrasonic noise annoyance as much as practicable utilising best available technology.

6 CONSTRUCTION IMPACT ASSESSMENT

6.1 Construction Noise

PWCS carries out construction noise monitoring in accordance with an approved Construction Noise Management Plan. A review of noise measurements during the previous Stage 3 and the current project 3Exp construction phase confirms that noise emissions arising from construction activities are indiscernible at the nearest residential receiver areas of Fern Bay and Stockton and any construction noise impacts are therefore minimal. This outcome was also noted in the DoP Director-General's Environmental Assessment Report dated April 2007 in relation to the approved 120 Mtpa throughput capacity where submissions confirmed that KCT's Stage 3 construction activities were not discernible.

As discussed in **Section 2.3**, the Stage 4 Project installation activities are consistent with approved daytime construction and vibratory work. It is reasonable to anticipate that the intrusive construction noise emissions will remain indiscernible at the nearest residential receiver areas and well below the construction noise limits presented in **Section 4.4**. Hence, any construction noise impacts arising from the Stage 4 Project installation works are considered minimal.

6.2 Construction Vibration

Assessment Criteria

German Standard DIN 4150-3 1999 "*Structural Vibration Part 3: Effects of Vibration on Structures*" provides guideline criteria for evaluating the short and long-term effects of vibration on structures. In addition, the DECCW has recently released an interim guideline "*Assessing Vibration: A Technical Guideline"* dated February 2006 which provides guideline building vibration levels associated with a low probability of annoyance from occupants. The range of applicable damage and annoyance risk vibration velocity criteria are discussed in **Appendix F** and summarised in **Table 17**.

Table 17 Vibration Velocity Damage and Annoyance Risk Criteria (mm/s)

Receiver Area	Damage Risk (mm/s)		Annoyance Risk (mm/s)	
	Horizontal	Vertical	Horizontal	Vertical
Residential/Dwellings	15	5	1.2	0.45
Commercial/Offices	40	20	1.6	0.6
Industrial/Workshops	40	20	3.2	1.2
Mechanical (On/Off)[1]	20/5	20/5	-	-
Electronic/Computers	5	5	-	-
Subsurface/Pipework	50-100	50-100	-	-

Note 1: Use of machinery on/use of machinery off.

Buffer Distance from Impact Piling

As shown in **Table 4**, impact piling rigs are anticipated for use during the rail receival and conveyor construction activities. The buffer distances predicted to achieve compliance with the range of damage and annoyance risk criteria are presented in **Table 18**. The safe distances are based on the operation of a single hydraulic hammer rated at 5 tonne-metres (t-m) driving 450 mm concrete piles at both 50% and 100% piling capacity. As the vertical criterion is equal or lower than the horizontal criterion in all cases, buffer distances are provided in **Table 4** with respect to the vertical criterion only.

Table 18 Predicted Buffer Distance from Impact Piling (m)

Receiver Area	Damage Risk (m)		Annoyance Risk (m)	
	Vertical 50%	Vertical 100%	Vertical 50%	Vertical 100%
Residential/Dwellings	80	100	150	180
Commercial/Offices	9	12	130	150
Industrial/Workshops	9	12	100	120
Mechanical (On/Off)	9/80	12/100	-	-
Electronic/Computers	9	12	-	-
Subsurface/Pipework	2	3	-	-

Impact Assessment

Based on the predicted buffer distances from single hydraulic hammering, it is concluded that the damage and annoyance risk to all residential receivers is negligible - as the nearest dwellings are well beyond 180 m from the Stage 4 construction and vibratory activities.

Similarly, the damage risk to the nearest commercial and industrial receivers are considered minimal as the nearest buildings and mechanical plant (assumed operating) are beyond 12 m from the Stage 4 construction and vibratory activities.

The risk of annoyance to the occupants of offices and workshops is also considered minimal based on distance at all but the very nearest adjacent industrial neighbours (ie the KBF Administrative Building), where vibration monitoring and short term piling energy management may be required during piling activities to achieve compliance with the relevant criteria.

7 OPERATING INTRUSIVE NOISE ASSESSMENT

7.1 Daytime and Evening

The predicted daytime and evening $L_{Aeq(15minute)}$ intrusive noise levels from the Stage 4 Project to the nearest residential receiver areas are presented in **Table 19** together the PA 2007 intrusive noise limits (refer **Section 4.4)**.

Table 19 Stage 4 Project Daytime and Evening Intrusive Noise (dBA re 20 µPa)

Receiver Area	ID/Location		Daytime Calm[1]	Daytime Limit	Evening Wind[1]	Evening Limit
Fern Bay North	FN1	Bayway Village Nelson Bay Road	36	46	39	46
Fern Bay West	FW1	1 Fullerton Lane	40	50	45	50
	FW3	30 Nelson Bay Road	39		42	
Fern Bay East	FE1	21 Braid Road	39	49	46	49
Stockton West	SW1	284 Fullerton Street	38	50	49	50
	SW2	Cnr Pembroke and Fullerton Streets	35		45	
Stockton East	SE1	40 Eames Avenue	38	49	48	49
Warabrook/ Mayfield West	W1	47 Stevenson Avenue	27	41	37	41
	W2	4 Groongal Street	31		40	
	W4	Cnr Decora Cr & Elata Way	26		32	
Mayfield	M1	68 Bull Street	31	44	40	44
	M2	45 Simpson Crescent	32		41	
	M3	1 Arthur Street	29		41	
	M4	52 Arthur Street	32		42	
	M5	21 Crebert Street	30		42	
Carrington/ Maryville	C1	Cnr Hargrave and Young Streets	31	42	41	42
	C2	Cnr Harrison and Northumberland Streets	26		38	

Note 1: Daytime and evening meteorological parameters as described in **Table 7**

All predicted intrusive noise levels are below the respective daytime and evening PA 2007 noise limits with no incremental noise impacts associated with the Stage 4 Project.

7.2 Night-time

The predicted night-time $L_{Aeq(15minute)}$ intrusive noise levels from the Stage 4 Project to the nearest residential receiver areas are presented in **Table 20** together the PA 2007 intrusive noise limits (refer Section 4.4). .

Table 20 Stage 4 Project Night-time Intrusive Noise (dBA re 20 µPa)

Receiver Area	ID/Location		Calm[1]	Wind[1]	Inversion[1]	Inversion & Drainage[1]	Noise Limit
Fern Bay North	FN1	Bayway Village Nelson Bay Road	38	45	42	46	46
Fern Bay West	FW1	1 Fullerton Lane	41	48	45	49	50
	FW3	30 Nelson Bay Road	40	47	44	48	
Fern Bay East	FE1	21 Braid Road	40	49	45	49	49
Stockton West	SW1	284 Fullerton Street	39	49	45	49	50
	SW2	Cnr Pembroke and Fullerton Streets	36	46	42	46	
Stockton East	SE1	40 Eames Avenue	39	49	45	49	49
Warabrook/ Mayfield West	W1	47 Stevenson Avenue	29	26	36	28	41
	W2	4 Groongal Street	32	29	39	31	
	W4	Cnr Decora Cr & Elata Way	26	23	32	26	
Mayfield	M1	68 Bull Street	32	30	38	32	44
	M2	45 Simpson Crescent	33	31	40	32	
	M3	1 Arthur Street	29	31	37	32	
	M4	52 Arthur Street	32	34	39	35	
	M5	21 Crebert Street	31	32	37	33	
Carrington/ Maryville	C1	Cnr Hargrave and Young Streets	33	39	38	39	42
	C2	Cnr Harrison and Northumberland Streets	27	31	35	33	

Note 1: Night-time meteorological parameters as described in **Table 7**.

All predicted intrusive noise levels are below the respective night-time PA 2007 noise limits with no incremental noise impacts associated with the Stage 4 Project.

The outer envelope night-time $L_{Aeq(15minute)}$ intrusive noise contours are presented as **Appendix G1**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5 dBA. This means that in some cases the contour locations presented in **Appendix G1** will differ slightly from the values in **Table 19**.

7.3 Sleep Disturbance Noise Assessment

KCT's operations comprise predominately fixed mechanical plant (ie conveyors, drives and transfer stations) together with relatively stationary items of mobile equipment (ie stackers, reclaimers and shiploaders). Noise associated with multiple noise sources operating simultaneously gives rise to a relatively continuous (or steady) emission – being typical of KCT's noise emissions particularly at far-field receivers. However, some noise sources have the potential to emerge from KCT's relatively steady level including the operation of trains on the KCT rail loop as well as (untreated) start-up alarms.

A review of noise events from coal unloading operations was conducted in accordance with existing Stage 3 Development Consent (DA 35/96) Condition 7 and presented in Report 7283-R6 KCT Stage 3 Expansion Train Unloading Noise Monitoring (Heggies 1998). Night-time continuous one second LAeq measurements were carried-out in the nearfield adjacent to the ARTC's rail loop and KCT's coal unloading infrastructure with simultaneous far field measurements carried-out at Fern Bay. The review indicated there was little (or no) emergence of on-site maximum noise levels (particularly from train movements) at Fern Bay due to distance attenuation and the prevailing (L90) background noise environment.

More recently, KCT's night-time noise emissions (Stages 1, 2 and 3 operating) were observed during noise enhancing north-westerly winds at the key receiver locations of Fern Bay West (FN1) and Stockton West (SW1). The field measured intrusive and maximum noise levels arising from start-up alarms summarised in **Table 21** together with the proposed sleep disturbance criteria.

Table 21 KCT's Measured Maximum Noise Levels and Sleep Disturbance Noise Criteria (dBA re 20 µPa)

Residential Receiver Area	Measured intrusive LAeq(15minute) Level	Measured Maximum Level	Sleep Disturbance LA1(60second) Criteria[1]
Fem Bay West	50	55	55
Stockton West	49	55	57

Note 1: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

The field measurements results at the two key receiver locations demonstrate a 5 dBA to 6 dBA the difference between the intrusive and maximum level with the maximum level of 55 dBA being on (or below) the proposed sleep disturbance criteria. While demonstrating compliance, **,** Stage 1 and 2 off-site alarm noise levels are currently being investigated by PWCS as part of ongoing noise improvements at KCT. The Stage 4 Project alarms are subject to the KCT low noise procurement specification (refer **Section 5.2)** thus minimising potential off-site noise disturbance.

8 OPERATING NOISE AMENITY ASSESSMENT

8.1 Daytime and Evening

The predicted daytime $L_{Aeq(11hour)}$ and evening $L_{Aeq(4hour)}$ noise amenity levels from the Stage 4 Project to the nearest receiver areas are presented in **Table 22** together the relevant acceptable noise amenity levels (refer **Section 4.3**).

Table 22 Stage 4 Project Daytime and evening Noise Amenity Levels (dBA re 20 µPa)

Receiver Area	ID/Location		Daytime Calm[1]	Daytime PSNL	Evening Wind[1]	Evening PSNL
Fern Bay North	FN1	Bayway Village Nelson Bay Road	33	55	36	45
Fern Bay West	FW1	1 Fullerton Lane	37	55	42	45
	FW3	30 Nelson Bay Road	36		39	
	FW2	Stockton Hospital	38	50	44	50
Fern Bay East	FE1	21 Braid Road	36	55	43	45
	FE2	Fern Bay Primary	36	45	40	45
Stockton West	SW1	284 Fullerton Street	35	55	46	43
	SW2	Cnr Pembroke and Fullerton Streets	32		42	
Stockton East	SE1	40 Eames Avenue	35	55	45	45
	SE2	Stockton Primary	29	45	39	45
Warabrook/ Mayfield West	W1	47 Stevenson Avenue	24	60	34	48
	W2	4 Groongal Street	28		37	
	W4	Cnr Decora Cr & Elata Way	23		29	
	W3	Mayfield West Primary	28	45	40	45
Mayfield	M1	68 Bull Street	28	60	37	48
	M2	45 Simpson Crescent	29		38	
	M3	1 Arthur Street	26		38	
	M4	52 Arthur Street	29		39	
	M5	21 Crebert Street	27		39	
Carrington/ Maryville	C1	Cnr Hargrave and Young Streets	28	60	38	48
	C2	Cnr Harrison and Northumberland Streets	23		35	
Mayfield West	MW1	Steel River	39	65	48	65
Kooragang Island	KI1	Blue Circle Southern Cement	49	70	52	70
	IB1	EDI Administration Building	62		61	
	IB2	Mountain Bulk Haulage	60		59	
	IB3	Kooragang Bulk Facilities[2]	69		69	
	IB4	Incitec Heron Rd	55		56	
	IB	Sims Metal Cormorant Rd	56		56	
	IB6	Cargill Australia Raven St	52		54	
Mayfield North	MN1	OneSteel	39	70	47	70

Note 1: Daytime and evening meteorological parameters as described **Table 7**.
Note 2 Existing noise controls on KBF administration building to minimise conveyor noise intrusion.

All predicted noise amenity levels are below the daytime and evening relevant acceptable level except for a moderate (3 dBA) exceedance at Stockton West, due to the assessment of north-westerly winds during the evening period. The evening noise amenity level of 46 dBA remains below the PA 2007 (night-time) amenity limit of 47 dBA at Stockton West.

8.2 Night-time

The predicted night-time $L_{Aeq(9hour)}$ noise amenity levels from the Stage 4 Project to the nearest receiver areas are presented in **Table 23** together the PA 2007 amenity noise limits (refer **Section 4.4**).

Table 23 Stage 4 Project Night-time Noise Amenity Levels (dBA re 20 µPa)

Receiver Area	ID/Location		Calm[1]	Wind[1]	Inversion[1]	Inversion & Drainage[1]	Noise Limit
Fern Bay North	FN1	Bayway Village Nelson Bay Road	35	42	39	43	43
Fern Bay West	FW1	1 Fullerton Lane	38	45	42	46	47
	FW3	30 Nelson Bay Road	37	44	41	45	
	FW2	Stockton Hospital	39	46	43	47	50
Fern Bay East	FE1	21 Braid Road	37	46	42	46	46
	FE2	Fern Bay Primary	37	44	41	45	45
Stockton West	SW1	284 Fullerton Street	36	46	42	46	47
	SW2	Cnr Pembroke and Fullerton Streets	33	43	39	46	
Stockton East	SE1	40 Eames Avenue	36	46	42	46	46
	SE2	Stockton Primary	30	39	37	39	45
Warabrook/ Mayfield West	W1	47 Stevenson Avenue	26	23	33	25	37
	W2	4 Groongal Street	29	26	36	28	
	W4	Cnr Decora Cr & Elata Way	23	20	29	23	
	W3	Mayfield West Primary	29	28	38	30	45
Mayfield	M1	68 Bull Street	29	27	35	29	38
	M2	45 Simpson Crescent	30	28	37	29	
	M3	1 Arthur Street	26	28	34	29	
	M4	52 Arthur Street	29	31	36	32	
	M5	21 Crebert Street	28	29	34	30	
Carrington/ Maryville	C1	Cnr Hargrave and Young Streets	30	36	35	36	38
	C2	Cnr Harrison and Northumberland Streets	24	28	32	30	
Mayfield West	MW1	Steel River	38	39	45	41	65
Kooragang Island	KI1	Blue Circle Southern Cement	49	48	51	49	70
	IB1	EDI Administration Building	62	62	62	62	
	IB2	Mountain Bulk Haulage	60	62	61	63	
	IB3	Kooragang Bulk Facilities[2]	69	69	70	69	
	IB4	Incitec Heron Rd	55	58	57	59	
	IB	Sims Metal Cormorant Rd	55	55	57	56	
	IB6	Cargill Australia Raven St	52	53	54	54	
Mayfield North	MN1	OneSteel	40	38	44	40	70

Note 1: Night-time meteorological parameters as described **Table 7**.
Note 2 Existing noise controls on KBF administration building to minimise conveyor noise intrusion.

All predicted noise amenity levels are below the respective night-time PA 2007 noise limits with no incremental noise impacts associated with the Stage 4 Project.

The outer envelope night-time $L_{Aeq(9hour)}$ noise amenity contours are presented as **Appendix G2**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5 dBA. This means that in some cases the contour locations presented in **Appendix G2** will differ slightly from the values in **Table 24**.

9 CUMULATIVE NOISE AMENITY ASSESSMENT

9.1 Noise Amenity Criteria $L_{Aeq(period)}$

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ amenity levels for all industrial (ie non-transport related) noise in a receiver area. Note, the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources in a receiver area, but rather seeks to control cumulative noise via its amenity criteria.

9.2 Approved Industrial Developments in the Vicinity of Kooragang Island

A review of existing, approved and proposed industrial developments in the vicinity of Kooragang Island are summarised in **Table 24**.

Table 24 Approved Industrial Development on Kooragang Island and Surrounds

Site	Operator	Approval Date	Development	Status	Source of Noise Data
Kooragang Coal Terminal (KCT)	Port Waratah Coal Services Ltd	77 Mtpa 23/07/1997 120 Mtpa 13/04/2007	Stage 1, 2 and 3A S3 steps (1-4), 3D S3 3Exp & Masterplan Stage 4	Operating Operating Construction Planned	Existing Industrial Noise Predicted Noise Amenity Levels
Newcastle Coal Export Terminal (NCET)	Newcastle Coal Infrastructure Group Ltd	66 Mtpa 13/04/2007	Stages 1 33 Mtpa Stages 2 33 Mtpa	Construction Subject to demand	Resource Strategies (2006)
Cargill Oilseed Processing Facility	Cargill Australia Ltd	04/04/2006	Stage 1 Stage 2 Expansion	Operating Approved	HLA (2005)
Extension of Shipping Channels	NSW Waterways Authority	09/08/2005	Approved	Temporary Planned Development	NSW Waterways Authority (2004)
Multi-purpose Facility	BHP Company Ltd	06/04/2001	Approved	Not yet commenced	URS (2000)
Marstel Bulk Liquids Storage Facility	Marstel Terminals Newcastle Pty Ltd	21/12/2007	Approved	Construction	HLA (2007)
Manildra Park Facility	Manildra Park Pty Ltd	02/06/2008	Approved	Construction	Heggies (2008)

9.3 Night-time Cumulative Noise Amenity Assessment

In accordance with the INP's Chapter 2 Industrial Noise Criteria (Section 2.2.4), the night-time cumulative sum of existing, approved and proposed industrial noise amenity levels are presented in **Table 25**, together with the acceptable and maximum amenity criteria for the residential receiver areas. It should be noted that for each of the cases discussed below, the likelihood of all existing, approved and proposed developments emitting maximum noise emission at any one time appears remote and the assessment assumes a degree of conservatism.

Table 25 Night-time Cumulative Industrial Noise Amenity Levels (dBA re 20 µPa)

Receiver Area	Existing Industry Measured[1]	PWCS KCT Approved Remainder[1]	PWCS Stage 4[1] only	NCIG NCET[1]	Cargill Stage 2[1]	Channel Extension[1]	Multi Purpose (Limits)	Manildra Park[1]	Marstel Terminal[1]	Cumulative Sum (Adverse[1])	Acceptable to Maximum
Fern Bay North	42	28	34	32	27	24	30	20	20	43	40-45[2]
Fern Bay West	48	34	36	36	33	30	30	25	25	49	
Fern Bay East	43	29	35	36	28	25	30	23	22	44	
Stockton West	48	35	35	35	33	35	30	37	34	49	
Stockton East	44	31	35	35	28	30	30	34	31	45	
Mayfield West	43	32	26	39	25	33	30	20	20	45	45-50[2]
Mayfield	44	31	27	38	28	39	36	20	20	47	
Carrington/Maryville	42	24	24	31	25	30	34	25	25	43	

Note 1 Measured or predicted noise level during noise enhancing (adverse) weather conditions.

Note 2 Use of Urban and Suburban Noise Amenity Zones in accordance with the DoP's Director-General Environmental Assessment Report dated April 2007 in relation to the Major Project Assessment Newcastle Coal Infrastructure Group Coal Export Terminal.

As discussed in **Appendix D**, existing industrial noise is a feature of the residential night-time noise environment at all receiver areas. Sometimes it is not discernible - but at other times it is distinguishable - particularly during lulls in transport, domestic and natural noise sources (ie ocean noise). As shown in **Table 24** there are no incremental increases in the cumulative industrial noise amenity levels due to the introduction of the Stage 4 Project (isolation), as further discussed below:

Fern Bay (North): Existing night-time industrial noise generally emanates from Kooragang Island and was estimated as 42 dBA during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain under the maximum noise amenity level of 45 dBA. Industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions and below the acceptable noise amenity level of 40 dBA.

Fern Bay (West)/Stockton (West): Existing night-time industrial noise generally emanates from Kooragang Island and was estimated as 48 dBA at both receiver areas during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain moderately (4 dBA) above the maximum noise amenity level of 45 dBA. Industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions and therefore below the maximum noise amenity level of 45 dBA.

Fern Bay (East)/Stockton (East): Existing night-time industrial noise from Kooragang Island was estimated as 43 dBA to 44 dBA during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain within the maximum noise amenity level of 45 dBA. Similarly, industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions. Ocean noise is also a feature of the area particularly during north-easterly breezes.

Mayfield West/Carrington/Maryville: Existing night-time industrial noise generally emanates from the industrial areas located to the immediate north of the receiver areas and was estimated as 42 dBA to 45 dBA. Cumulative noise amenity levels are anticipated to increase by 1 dBA to 2 dBA and remain within the acceptable noise amenity level of 45 dBA. Due to the relatively close proximity of the industry to the residential receiver areas, noise enhancement due to weather effects is less by comparison with Fern Bay and Stockton and the industrial noise contribution is relatively more constant.

Mayfield: Existing night-time industrial noise generally emanates from the industrial areas located to the immediate north of the receiver areas and was estimated as 44 dBA. Cumulative noise amenity levels are anticipated to increase by approximately 3 dBA (independent of the Stage 4 Project) and remain under the maximum noise amenity level of 50 dBA.

10 OFF-SITE ROAD TRANSPORT

10.1 Traffic Noise Criteria

Based on the DECC's "*Environmental Criteria for Road Traffic Noise*" policy (ECRTN) dated May 1999, Nelson Bay Road, Cormorant Road and Industrial Drive are classified as "arterial roads". The applicable noise criteria are presented in **Table 26**.

Table 26 NSW Environmental Criteria for Road Traffic Noise

Receiver Area	Road	Policy	Descriptor	Traffic Noise Goal
Fern Bay Kooragang Island Warabrook/Mayfield	Nelson Bay Road Cormorant Road Industrial Drive	Land use developments with the potential to create additional traffic on existing freeways/arterials	Daytime $L_{Aeq(15hour)}$	60 dBA
			Night-time $L_{Aeq(9hour)}$	55 dBA

Note that in all cases where the nominated criteria are already exceeded, traffic associated with the development should not be permitted to lead to an increase in the existing noise traffic levels of more than 2 dBA.

10.2 Traffic Movements

KCT's operating road traffic will not be altered by the Stage 4 Project and remains consistent the operating traffic approved by the PA 2007. The Stage 4 Project will generate additional off-site construction traffic, relative to approved levels, during the construction period which scheduled to be undertaken for a period of up to 24 months.

The Stage 4 Project construction phase is described in **Section 12** and a breakdown of the anticipated peak construction traffic movements is presented in **Table 27**.

Table 27 Stage 4 Project Peak Construction Daily Two-way Traffic Movements[1]

Vehicle Type	Daily Two-way Traffic Movements
Employee	240
Visitors/representatives	20
Heavy vehicles and deliveries	3
Concrete trucks	8 for first 18 months

Source: PWCS 2009

The estimated future traffic flows on the arterial road network are presented in **Table 28** for the daytime (0700 hours to 2200 hours) and night-time (2200 hours to 0700 hours). The percentage increase arising from the Stage 4 Project construction traffic is shown in brackets.

Table 28 Arterial Road Network Current and Future Traffic Flows

Location	Time Period	2012 Estimated Traffic Flow	Stage 4 Project Construction Phase	Estimated Total Traffic Flow
Nelson Bay Road	Daytime 0700 hrs to 2200 hrs	17,557	57 (0.3%)	17,614
Cormorant Road		22,834	322 (1.4%)	23,156
Industrial Drive		29,004	322 (1.1%)	29,326
Nelson Bay Road	Night-time 2200 hrs to 0700 hrs	2,927	17 (0.6%)	2,944
Cormorant Road		3,712	97 (2.6%)	3,809
Industrial Drive		4,741	97 (2.0%)	4,837

Source: KCT EA 2006 and Stapleton Transport and Planning 2009

10.3 Traffic Noise Impact

The maximum increase in daytime construction related traffic flow occurs along Cormorant Road. The anticipated 1.4% increase in vehicle movements corresponds to a very small <0.1 dB increase in the existing daytime $L_{Aeq(15hour)}$ noise level and is negligible.

Similarly, the maximum increase in night-time construction related traffic flow also occurs along Cormorant Road. The anticipated 2.6% increase in vehicle movements corresponds to a small 0.1 dB increase in the existing night-time $L_{Aeq(9hour)}$ noise level and is also considered negligible.

11 OFF-SITE RAIL TRANSPORT

11.1 Railway Noise Criteria

The Australian Rail Track Corporation Ltd (ARTC) controls and operates the Hunter Valley Coal Rail Network in NSW. Noise emissions from the railway are regulated via ARTC's Environmental Protection Licence (EPL No 3142, Review Date 7 November 2013).

The intent of the relevant EPL conditions is to control airborne noise by two principal means:

- Noise Limits.
- Management of noise via Pollution Reduction Programmes (PRPs).

EPL Section L6 - Noise Limits (Appendix H)

Maximum locomotive source noise levels and tonality criteria for stationary and in-service test conditions are specified in EPL Condition L6 *Noise Limits*. EPL Section L6 nominates airborne noise limits at receiver locations as follows:

L6.1.1 General Noise Limits

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am - 10pm), 60 dB(A)Leq, (night time from 10pm - 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Program.

The goals do not represent unobtrusive noise levels. Rather, the objectives recognise that rail operations are inherently noisy and represent a compromise between what may be desirable from a community point of view (ie maintaining amenity) and what is necessary to enable trains to operate.

It should be noted that the Main Northern Railway does not currently have a PRP, however the stated objectives of the PRP provide guidance for noise regulation for the Hunter Valley rail network. Based on the foregoing the guideline noise assessment criteria for the Main Northern Railway are presented **Table 29**.

Table 29 ARTC's Guideline Noise Assessment Criteria

Railway	Licence Holder	Descriptor	Rail Traffic Goal
Main Northern Railway	ATRC EPL 3142	Daytime $L_{Aeq(15hour)}$	65 dBA
		Night-time $L_{Aeq(9hour)}$	60 dBA
		Maximum L_{Amax}	85 dBA

Prior to arrival (or departure) at the KCT's rail loop, the maximum concentration of train movements along the Main Northern Railway generally occurs between Sandgate and Thornton, hence existing and future noise impacts at this location are assessed below.

The Stage 4 Project will not alter KCT's throughput beyond the approved 120Mtpa capacity and there are no additional train movements associated with the Stage 4 Project. A review of the ARTC's EPL is provided to assist in the assessment of general rail traffic noise impacts.

11.2 Railway Noise Prediction

The daytime (0700 hours to 2200 hours) existing, approved and proposed movements are presented in **Table 30** together with the estimated operating conditions between Sandgate and Thornton in the vicinity of residential receiver areas established for KCT EA 2006. The passenger and general freight rail traffic remains valid by comparison with contemporary ARTC standard working timetables.

Table 30 Existing, Approved and Proposed Daytime Train Passbys

Scenario	Train Type	Train Passbys[1]		Train Length[2] (m)	Train Speed[2] (kph)	Throttle Setting[2] (Notch)
		Average	Peak			
Existing Passenger, Freight and KCT 77 Mtpa Capacity	Intercity	78	78	50	80	6
	Country Link	2	2	200	70	6
	General Freight	10	12	1200	60	8
	CCT Coal Trains	12	22	1200	60	8
	KCT Coal Trains	34	42	1300	60	8
Approved KCT 120 Mtpa Capacity	KCT Coal Trains	8	12	1300	60	8
Stage 4 Project 120 Mtpa Capacity	KCT Coal Trains	0	0	-	-	-
Cumulative	**Overall Total**	**144**	**168**			

Note 1: Source ARTC Hunter Valley Logistics - Main Northern Railway Sandgate to Thornton.

Note 2: Approximate train length, train speed and throttle setting in the vicinity of the residential receiver areas.

Similarly, the night-time (2200 hours to 0700 hours) existing, approved and proposed train movements are presented in **Table 31** together with the estimated operating conditions along the Main Northern Railway between Sandgate and Thornton in the vicinity of residential receiver areas established for KCT EA 2006. The passenger and general freight rail traffic remains valid by comparison with contemporary ARTC standard working timetables.

Table 31 Existing, Approved and Proposed Night-time Train Passbys

Scenario	Train Type	Train Passbys[1]		Train Length[2] (m)	Train Speed[2] (kph)	Throttle Setting[2] (Notch)
		Average	Peak			
Existing Passenger, Freight and KCT 77 Mtpa Capacity	Intercity	20	20	50	80	6
	Country Link	2	2	200	70	6
	General Freight	6	8	1200	60	8
	CCT Coal Trains	10	20	1200	60	8
	KCT Coal Trains	34	42	1300	60	8
Approved KCT 120 Mtpa Capacity	KCT Coal Trains	6	12	1300	60	8
Stage 4 Modification 120 Mtpa Capacity	KCT Coal Trains	0	0	-	-	-
Cumulative	**Overall Total**	**78**	**104**			

Note 1: Source ARTC Hunter Valley Logistics - Main Northern Railway Sandgate to Thornton.

Note 2: Approximate train length, train speed and throttle setting in the vicinity of the residential receiver areas.

The calculation of the daytime and night-time equivalent continuous noise levels and the maximum passby levels have been conducted using a computer prediction model developed by Heggies Pty Ltd. This model has previously been accepted by the DoP and DECC.

The prediction model uses characteristic noise levels for the various sources (locomotive engine and exhaust noise as a function of throttle notch, wheel/rail noise as a function of train speed, and wagon type, etc) at a fixed reference distance. The model then makes adjustments for the train length and distance from the track (assuming no barriers) and facade reflection. Parameters including the daytime $L_{Aeq(15hour)}$, night-time $L_{Aeq(9hour)}$ and maximum passby level (L_{Amax}) can then be determined by summing the effects of the individual noise sources and by incorporating the number of train events.

The daytime $L_{Aeq(15hour)}$ and maximum (L_{Amax}) noise levels for the approved and proposed train movements are presented in **Table 32**.

Table 32 Approved and Proposed Daytime Rail Traffic Noise (dBA re 20 µPa)

Distance to Receiver	Approved KCT 120 Mtpa Trains[1]			Proposed Stage 4 120 Mtpa Trains[2]		
	Average LAeq(15hour)	Peak LAeq(15hour)	Passby LAmax	Average LAeq(15hour)	Peak LAeq(15hour)	Passby LAmax
50 m	68	69	87	68	69	87
100 m	65	66	83	65	66	83
200 m	62	65	77	62	65	77

Note 1: Rail traffic noise from existing and approved KCT 120 Mtpa capacity.

Note 2: Rail traffic noise from existing and proposed Stage 4 Modification 120 Mtpa capacity.

Similarly, the night-time $L_{Aeq(9hour)}$ and maximum (L_{Amax}) noise levels for the approved and proposed train movements are presented in **Table 33**.

Table 33 Approved and Proposed Night-time Rail Traffic Noise (dBA re 20 µPa)

Distance to Receiver	Approved KCT 120 Mtpa Trains[1]			Proposed Stage 4 120 Mtpa Trains[2]		
	Average LAeq(9hour)	Peak LAeq(9hour)	Passby LAmax	Average LAeq(9hour)	Peak LAeq(9hour)	Passby LAmax
50 m	68	69	87	68	69	87
100 m	65	66	83	65	66	83
200 m	63	64	77	63	64	77

Note 1: Rail traffic noise from existing approved KCT 120 Mtpa capacity.

Note 2: Rail traffic noise from existing and proposed Stage 4 Modification 120 Mtpa capacity.

11.3 Railway Noise Impact

Daytime approved (average and peak $L_{Aeq(15hour)}$) train noise levels remain unaltered by the Stage 4 Project. The daytime 65 dBA criterion is generally achieved at distances greater than 100 m.

Night-time approved (average and peak $L_{Aeq(9hour)}$) train noise levels also remain unaltered by the Stage 4 Project. The night-time 60 dBA criterion is generally achieved at distances greater than 200 m.

As is the case for the existing train levels, the maximum (L_{Amax}) noise criterion of 85 dBA is generally achieved by train movements at distances greater than 50 m.

12 SUMMARY OF FINDINGS

12.1 Construction Noise Assessment

As discussed in **Section 1.2**, the Stage 4 Project installation activities are consistent with approved daytime construction and vibratory work. A review of noise measurements during the previous Stage 3 and the current project 3Exp construction phase confirms that noise emissions arising from construction activities are indiscernible at the nearest residential receiver areas of Fern Bay and Stockton and any construction noise impacts are therefore minimal. It is reasonable to anticipate that the intrusive construction noise emissions will remain indiscernible at the nearest residential receiver areas and well below the construction noise limits presented in **Section 4.4** with the continuation of the same (or similar) Stage 4 Project construction works.

The range of applicable damage and annoyance risk vibration velocity criteria are discussed in **Appendix F**. Based on the predicted buffer distances from single hydraulic hammering, it is concluded that the damage and annoyance risk to all residential receivers is negligible - as the nearest dwellings are well beyond 180 m. Similarly, the damage risk to the nearest commercial and industrial receivers are considered minimal as the nearest buildings and mechanical plant (assumed operating) are beyond 12 m.

The risk of annoyance to the occupants of offices and workshops is also considered minimal based on distance at all but the very nearest adjacent industrial neighbours (ie the KBF Administrative Building), where vibration monitoring and short term piling energy management may be required during piling activities to achieve compliance with the relevant criteria.

12.2 Operating Noise Assessment Procedure

As discussed in **Section 1.2**, PWCS is seeking approval for the Stage 4 Project by modification to the existing PA 2007. The approved 120 Mtpa residential operating noise limits (intrusive, amenity and maximum) were previously determined in accordance INP's noise assessment methodology and approvals processes and have therefore being adopted for noise assessment purposes for Stage 4 Project. The construction noise management levels construction (CNML's) are nominated in accordance with the current ICNG as presented in **Table 34**. Any supplementary noise assessments are assessed against the relevant project specific noise levels (PSNLs) to noise sensitive receivers as well as industrial and commercial areas as applicable.

Table 34 Stage 4 Project Construction and Operating Residential Noise Limits (dBA re 20 µPa)

Residential Receiver Area	LAeq(15minute) Construction Daytime[1,2]	LAeq(15minute) Operation[3] Day, Evening, Night[4]	LAeq(night) Operation[3] Night[4]	LA1(1minute) Operation[3] Night[4]
Fern Bay North	54	46	43	55
Fem Bay West	57	50	47	55
Fern Bay East	50	49	46	55
Stockton West	52	50	47	57
Stockton East	51	49	46	56
Mayfield West	55	41	37	56
Mayfield	56	44	38	58
Carrington	52	42	38	52

Notes The maximum allowable noise contributions apply under:

a) Meteorological conditions of: wind speeds up to 3 ms^{-1} at 10 metres above ground level; or
b) Temperature inversion conditions up to 3°C per 100 metres and wind speeds up to 2ms^{-1} at 10 metres above the ground.

For the purpose of assessment of noise from the project shall be:

c) Measured at the most affected point on or within the Site boundary at the most sensitive receiver to determine compliance with $L_{Aeq(15\ minute)}$ night noise limits;
d) Measured at one metre from the dwelling facade to determine compliance with $L_{A1(1minute)}$ noise limits; and
e) Subject to the modification factors provided in Section 4 of the NSW INP, where applicable.

Note 1: 7 days per week, 0700 hours to 1800 hours.
Note 2: Permitted during evening and night-time if construction noise indiscernible at residential receivers.
Note 3: 7 days per week, 24 hours a day.
Note 4: Monday to Saturday 2200 hours to 0700 hours; Sundays and Public Holidays 2200 hours to 0600 hours.

Stage 4 Project Noise Modelling

The KCT computer model was developed to incorporate the significant noise sources associated with the Kooragang Island site. Additionally, surrounding terrain, aspects of the built environment and nearby receiver areas were also included in the model. The noise model was modified to include key components of the Stage 4 Project as identified through project design information.

The following scenarios were assessed:

Stage 4 Project: The approved 120 Mtpa operation plus Stage 4 Project comprising:

- All on-site installed, approved and proposed Stage 1, 2, 3 and 4 infrastructure operating within the KCT site including rail receival (coal wagon unloading), stacking, reclaiming and shiploading conveyor systems, transfer stations as well as mobile equipment (ie stackers, reclaimers and shiploaders) balanced across the KCT site.
- Coal trains operating on the KCT rail loop including locomotives and wagon rakes have also been assessed simultaneously with the KCT's operations.

- The operational modelling includes all significant items of plant and equipment working concurrently to simulate the maximum capacity of the facility and predict the intrusive $L_{Aeq(15minute)}$ and amenity $L_{Aeq(Period)}$ levels.

Stage 4 Project Noise Controls

By implementing the Continuous Noise Improvement Programme described in **Section 5.1**, in many cases PWCS has gone well beyond Best Available Technology by promoting research and development (R&D) of practical acoustical solutions not previously commercially available or considered economically achievable. In particular, the development of low noise technology in relation to conveyor assemblies (ie open-steel, metal-pan, concrete-pan, and PPAG) and conveyor drive assemblies with demonstrated source noise reductions and incremental improvement with each phase of installed infrastructure.

The current focus of the programme is to design, construct and operate sustainable at source noise controls for the remaining Stage 3 infrastructure. In the interim, Stage 1 and 2 plant and equipment are subject to replacement in accordance with KCT's ongoing maintenance activities with Stage 1 and 2 off-site alarm noise levels currently the subject of investigation and rectification as described in **Table 15**.

As shown in **Table 16** the Stage 4 Project will be designed to achieved an approximate SWL of 119 dBA and therefore well below SWL's for Stages 1 (installed 132 dBA) Stage 2 (installed 131 dBA), Stage 3 (installed 126 dBA) and Stage 3 (remaining 123 dBA). Therefore in the general terms, the Stage 4 infrastructure has only the marginal potential to increase off-site environmental noise emissions.

In order to ensure that Stage 4 Project (including the KCT rail loop) does not introduce any noise increase at all receiver areas it will be necessary to reduce the noise emissions from Stage 1 (ie eastern section) stockyard conveyors (or equivalent Stage 2 noise controls) and the Stage 1 (ie full length) wharf conveyor (or equivalent Stage 2 noise controls). These controls were considered as part of the modelling of the Stage 4 Project and consistent with the on-going investigation and implementation of reasonable and feasible noise controls in accordance with PA Condition 2.10.

The nearest industrial premise to the KCT site is Kooragang Bulk Facilities (KBF, location 1B3). The KBF administrative building has existing noise controls to minimise conveyor noise intrusion from the adjacent transfer conveyors. In order to ensure that Stage 4 Project and in particular outbound conveyors CV3 and CV4 do not introduce any noise increase at the KBF administrative building (IB3) further noise reductions to the adjacent transfer conveyors (ie Stage 1 conveyors 5.30/5.03 and Stage 2 conveyors 5.31/5.04) are necessary. These controls were considered as part of the modelling of the Stage 4 Project.

12.3 Intrusive Noise Impact Assessment

All predicted intrusive noise levels are below the daytime, evening and night-time PA 2007 noise limits with no incremental noise impacts associated with the Stage 4 Project.

The outer envelope night-time $L_{Aeq(15minute)}$ intrusive noise contours are presented as **Appendix G1**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5 dBA. This means that in some cases the contour locations presented in **Appendix G1** will differ slightly from the single point values particularly where topographic effects are prominent.

To assess the potential noise impact at Fern Bay (West and East) and Stockton (West and East) further assessments have been carried-out including a review of KCT's recent approvals and associated infrastructure development as summarised in **Table 35** The comparative intrusive noise levels at Fern Bay West (FW1) and Stockton West (SW1) are shown graphically **Figure 2** and **Figure 3**.

Table 35 Comparative EIS 1996, Consented, Approved and Proposed Operations

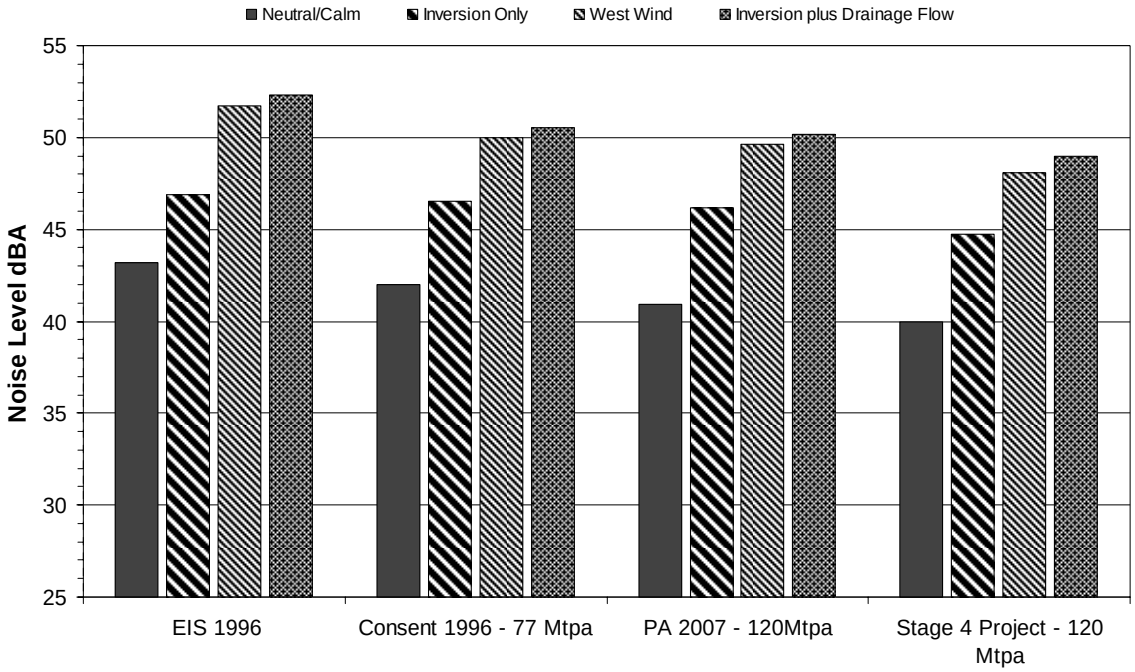
Scenario[1]	Description
EIS 1996	Predicted Stage 1, 2 and 3 noise emissions as presented in the EIS 1996 plus coal trains on the KCT rail loop
Consent 1996 77 Mtpa Operation	The EIS 1996 Operation but with all Stage 3 constructed with "low noise" plant and equipment
PA 2007 120 Mtpa Operation	The Consent 1996 77 Mtpa Operation plus "low noise" conveyor drives associated with the Increase to Throughput Capacity (EA 2006)
Stage 4 Project 120 Mtpa Operation	The PA 2007 120 Mtpa Operation plus "low noise" plant and equipment associated with the Stage 4 project plus "low noise" refitting of selected Stage 1 (and/or 2) conveyors

Note 1: Each scenario includes train movements on the KCT rail loop.

As discussed in **Section 5**, the Stage 4 Project will employ similar noise control measures as those described in the KCT EA 2006 (Appendix 4 Noise Impact Assessment), hence the following conclusions can be drawn in relation to the introduction of the Stage 4 infrastructure:

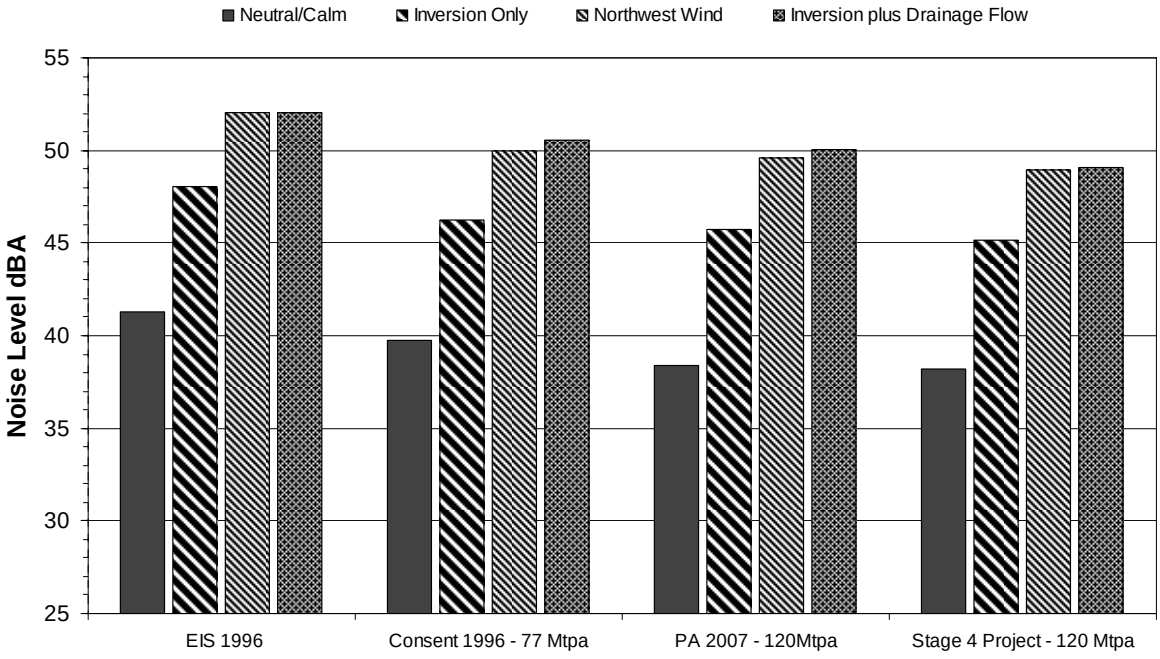
- The Continuous Noise Improvement Programme has been very successful and it can be demonstrated that the Stage 4 Project will be designed, procured, constructed and commissioned using Best Available Technology. The approved 120 Mtpa operation is "on track" to achieve the PA 2007 noise limit of 50 dBA at Fern Bay and Stockton.
- In order to ensure that Stage 4 Project (including the KCT rail loop) does not introduce any noise increase at all receiver areas it will be necessary to reduce the noise emissions by selected retrofitting of Stage 1 plant and equipment (or equivalent Stage 2) designed to reduce the overall noise emission by at least 1 dBA.
- KCT's operations current and future emissions comply with the 1996 Consented 43 dBA noise limit (under neutral atmospheric conditions) and the PA 2007 noise limits (under noise enhancing weather conditions) and it is recommended that the approved operating noise limits remain unchanged by the Stage 4 modification.

Figure 2 KCT Operating Intrusive Noise Levels - Fern Bay West (FW1)



KCT Operating Scenario under Neutral and Noise Enhancing Weather Conditions

Figure 3 KCT Operating Intrusive Noise Levels - Stockton West (SW1)



KCT Operation Scenario under Neutral and Noise Enhancing Weather Conditions

12.4 Noise Amenity Impact Assessment

All predicted noise amenity levels are below the daytime and evening relevant acceptable level except for a moderate (3 dBA) exceedance at Stocktion West, due to the assessment of north-westerly winds during the evening period. The evening noise amenity level of 46 dBA remains below the PA 2007 (night-time) amenity limit of 47 dBA at Stockton West.

All predicted night-time noise amenity levels are below the night-time PA 2007 noise limits with no incremental noise impacts associated with the Stage 4 Project.

The outer envelope night-time $L_{Aeq(9hour)}$ noise amenity contours are presented as **Appendix G2**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to approximately ±2.5 dBA. This means that in some cases the contour locations presented in **Appendix G2** will differ slightly from the single point values particularly where topographic effects are prominent.

12.5 Cumulative Noise Amenity Assessment

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ amenity levels for all industrial (ie non-transport related) noise in a receiver area. Note, the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources in a receiver area, but rather seeks to control cumulative noise via its amenity criteria.

A review of existing, approved and proposed industrial developments in the vicinity of Kooragang Island are summarised in **Table 36**.

Table 36 Approved Industrial Development on Kooragang Island and Surrounds

Site	Operator	Approval Date	Development	Status	Source of Noise Data
Kooragang Coal Terminal (KCT)	Port Waratah Coal Services Ltd	77 Mtpa 23/07/1997 120 Mtpa 13/04/2007	Stage 1, 2 and 3A S3 steps (1-4), 3D S3 3Exp & Masterplan Stage 4	Operating Operating Construction Planned	Existing Industrial Noise Predicted Noise Amenity Levels
Newcastle Coal Export Terminal (NCET)	Newcastle Coal Infrastructure Group Ltd	66 Mtpa 13/04/2007	Stages 1 33 Mtpa Stages 2 33 Mtpa	Construction Subject to demand	Resource Strategies (2006)
Cargill Oilseed Processing Facility	Cargill Australia Ltd	04/04/2006	Stage 1 Stage 2 Expansion	Operating Planned[1]	HLA (2005)
Extension of Shipping Channels	NSW Waterways Authority	09/08/2005	Approved	Temporary Planned Development	NSW Waterways Authority (2004)
Multi-purpose Facility	BHP Company Ltd	06/04/2001	Approved	Not yet commenced	URS (2000)
Marstel Bulk Liquids Storage Facility	Marstel Terminals Newcastle Pty Ltd	21/12/2007	Approved	Construction	HLA (2007)
Manildra Park Facility	Manildra Park Pty Ltd	02/06/2008	Approved	Construction	Heggies (2008)

In accordance with the INP's Chapter 2 Industrial Noise Criteria (Section 2.2.4), the night-time cumulative sum of existing, approved and proposed industrial noise amenity levels are presented in **Table 25**, together with the acceptable and maximum amenity criteria for the residential receiver areas (ie as determined by the DoP the acceptable level is 40 dBA and the maximum is 45 dBA for Fern Bay and Stockton suburban noise zone areas). There are no incremental increases in the cumulative industrial noise amenity levels due to the introduction of the Stage 4 Project (isolation).

In summary, existing night-time industrial noise that generally emanates from Kooragang Island and was estimated as 48 dBA at both Fern Bay (West) and Stockton (West) receiver areas during noise-enhancing weather conditions. Cumulative noise amenity levels are anticipated to increase by approximately 1 dBA and remain moderately (4 dBA) above the maximum noise amenity level of 45 dBA. Industrial noise is at least 5 dBA less in the absence of noise enhancing weather conditions and therefore below the maximum noise amenity level of 45 dBA.

12.6 Off-site Road Transport

KCT's operating road traffic will not be altered by the Stage 4 Project and remains consistent the operating traffic approved by the PA 2007. The Stage 4 Project will generate additional off-site construction traffic, relative to approved levels, during the construction period which scheduled to be undertaken for a period of up to 24 months.

The maximum increase in daytime construction related traffic flow occurs along Cormorant Road. The anticipated 1.4% increase in vehicle movements corresponds to a very small <0.1 dB increase in the existing daytime $L_{Aeq(15hour)}$ noise level and is negligible.

Similarly, the maximum increase in night-time construction related traffic flow also occurs along Cormorant Road. The anticipated 2.6% increase in vehicle movements corresponds to a small 0.1 dB increase in the existing night-time $L_{Aeq(9hour)}$ noise level and is also considered negligible.

12.7 Off-site Rail Transport

The Australian Rail Track Corporation Ltd (ARTC) controls and operates the Hunter Valley Coal Rail Network in NSW. Noise emissions from the railway are regulated via ARTC's Environmental Protection Licence (EPL No 3142, Review Date 7 November 2013) with the guideline noise assessment criteria presented in **Table 37**.

Table 37 ARTC's Guideline Noise Assessment Criteria

Railway	Licence Holder	Descriptor	Rail Traffic Goal
Main Northern Railway	ATRC EPL 3142	Daytime $L_{Aeq(15hour)}$	65 dBA
		Night-time $L_{Aeq(9hour)}$	60 dBA
		Maximum L_{Amax}	85 dBA

The Stage 4 Project will not alter KCT's throughput beyond the approved 120Mtpa capacity and there are no additional train movements associated with the Stage 4 Project. A review of the ARTC's EPL is provided to assist in the assessment of general rail traffic noise impacts.

The existing, approved and proposed train movements and associated rail noise levels have been determined for the Main Northern Railway between Sandgate and Thornton in the vicinity of residential receiver areas as established for KCT EA 2006. The passenger and general freight rail traffic remains valid by comparison with contemporary ARTC standard working timetables.

The daytime (0700 hours to 2200 hours) and night-time (2200 hours to 0700 hours) rail noise impacts are summarised as follows:

Daytime approved (average and peak $L_{Aeq(15hour)}$) train noise levels remain unaltered by the Stage 4 Project. The daytime 65 dBA criterion is generally achieved at distances greater than 100 m.

Night-time approved (average and peak $L_{Aeq(9hour)}$) train noise levels also remain unaltered by the Stage 4 Project. The night-time 60 dBA criterion is generally achieved at distances greater than 200 m.

As is the case for the existing train levels, the maximum (L_{Amax}) noise criterion of 85 dBA is generally achieved by train movements at distances greater than 50 m.

SPECIFIC ENVIRONMENTAL CONDITIONS

Noise Impacts

6. The Proponent shall minimise noise emissions from plant and equipment operated on the Site in relation to the project according to the principles outlined in the NSW Government's *Industrial Noise Policy.*

Construction Noise

7. The Proponent shall only undertake construction activities associated with the project that would generate an audible noise at any residential premises between 7:00 am and 6:00 pm, seven days a week. Audible noise is defined as "noise that can be heard at the receiver". This condition does not apply in the event of a direction from police or other relevant authority for safety or emergency reasons.

Note: "Safety or emergency reasons" refers to emergency works which may need to be undertaken to avoid loss of life, property loss and/or to prevent environmental harm.

Operation Noise

8. The Proponent shall design, construct, operate and maintain the project to ensure that the noise contributions from the expanded coal terminal do not exceed the maximum allowable noise contributions specified in Table 1 below, at those locations and during those periods indicated. The maximum allowable noise contributions apply under:

   a) meteorological conditions of: wind speeds up to 3 ms^{-1} at 10 metres above ground level; or

   b) temperature inversion conditions up to 3°C per 100 metres and wind speeds up to 2ms^{-1} at 10 metres above the ground.

Table 1 - Maximum Allowable Noise Contributions (dB(A))

Location	Day, Evening, Night At all times	Night 10.00 pm to 7.00 am Monday to Saturday 10.00pm to 6.00am on Sundays and Public Holidays	
	$L_{Aeq(15minute)}$	$L_{Aeq(night)}$	$L_{A1(1minute)}$
Fern Bay North	46	43	55
Fem Bay West	50	47	55
Fern Bay East	49	46	55
Stockton West	50	47	57
Stockton East	49	46	56
Mayfield West	41	37	56
Mayfield	44	38	58
Carrington	42	38	52

9. For the purpose of assessment of noise contributions specified under condition 2.8 of this consent, noise from the project shall be:

   a) measured at the most affected point on or within the Site boundary at the most sensitive receiver to determine compliance with $L_{Aeq(15\ minute)}$ night noise limits;

   b) measured at one metre from the dwelling facade to determine compliance with $L_{A1(1minute)}$ noise limits; and

   c) subject to the modification factors provided in Section 4 of the New South Wales Industrial Noise Policy (EPA, 2000), where applicable.

Notwithstanding, should direct measurement of noise from the development be impractical, the Proponent may employ an alternative noise assessment method deemed acceptable by the DEC (refer to Section 11 of the *New South Wales Industrial Noise Policy (EPA, 2000)).* Details of such an alternative noise assessment method accepted by the DEC shall be submitted to the Director-General prior to the implementation of the assessment method.

10. The Proponent shall investigate all feasible and reasonable mitigation measures, as defined in the New South Wales Industrial Noise Policy (EPA, 2000), to reduce noise impacts from the upgraded coal terminal at Fern Bay and Stockton to achieve noise contributions of no greater than 43 dB(A) ($L_{Aeq,(night)}$), and 45 dB(A) ($L_{Aeq,(15\ minutes)}$) under adverse meteorological conditions specified under condition 2.8 of this approval.

    A report on investigations shall be submitted to DEC and the Director-General within 12 months of commencement of works the subject of this approval and annually thereafter, unless otherwise agreed by DEC and the Director-General, until levels specified above are achieved. A program for ongoing investigation and implementation of feasible and reasonable mitigation measures to reduce noise contributions at Fern Bay and Stockton shall be implemented. The program shall commence no later than six months following the DEC's agreement to a noise reduction program, unless otherwise agreed by the DEC and the Director-General.

Train Noise Performance

11. The Proponent shall take all necessary actions to ensure that trains operated on the Site meet the noise performance criteria established under condition 2.8.

3. ENVIRONMENTAL MONITORING AND AUDITING

Noise Auditing

3.4 Within 90 days of the commencement of operation of the project, or as otherwise agreed by the Director-General, and during a period in which the project is operating under normal operating conditions, the Proponent shall undertake a program to confirm the noise performance of the project. The noise program shall include, but not necessarily be limited to:

a) noise monitoring, consistent with the guidelines provided in the New South Wales Industrial Noise Policy (EPA, 2000), to assess compliance with condition 2.8 of this consent.

b) methodologies, locations and frequencies for noise monitoring;

c) identification of monitoring sites at which pre- and post-project noise levels can be ascertained;

d) details of any complaints and enquiries received in relation to noise generated by the project within the first 90 days of operation;

e) an assessment of night-time use of audible alarm systems;

f) a statement of whether the Site is in compliance with noise limits in condition 2.8; and

g) any additional noise mitigation measures and timetables for implementation.

3.5 Within 28 days of conducting the noise monitoring referred to under condition 3.4 of this approval, or as otherwise agreed by the Director-General, the Proponent shall provide the Director-General and the DEC with a copy of the report. If the noise monitoring report identifies any non-compliance with the noise limits imposed under this approval (refer condition 2.8), the Proponent shall detail what additional measures would be implemented to ensure compliance, clearly indicating who would implement these measures, when these measures would be implemented, and how the effectiveness of these measures would be measured and reported to the Director-General.

KCT's noise emissions are regulated via the Stage 3 Development Consent. KCT Stages 1, 2 and 3 are approved to operate on a 24 hour basis, 7 days per week basis throughout the year. The DoP Conditions of Development Consent Schedule 2, Noise, Condition No 3 and No 4 nominate construction and operating noise limits as follows:

Noise

3. During the construction phase of the proposal the Applicant shall ensure that the following noise criteria are met at the nearest residential premises as noted in the Environmental Impact Statement boundaries under neutral weather conditions:

    - For those components of the development where the construction period is less than 4 weeks - L_{10} level from construction activities on the site measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A);
    - For those components of the development where the construction period is greater than 4 weeks but less than 26 weeks - L_{10} level from construction activities on the site measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A);
    - For those components of the development where the construction period is greater than 26 weeks - L_{10} level measured from construction activities on the site over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 5 dB(A).

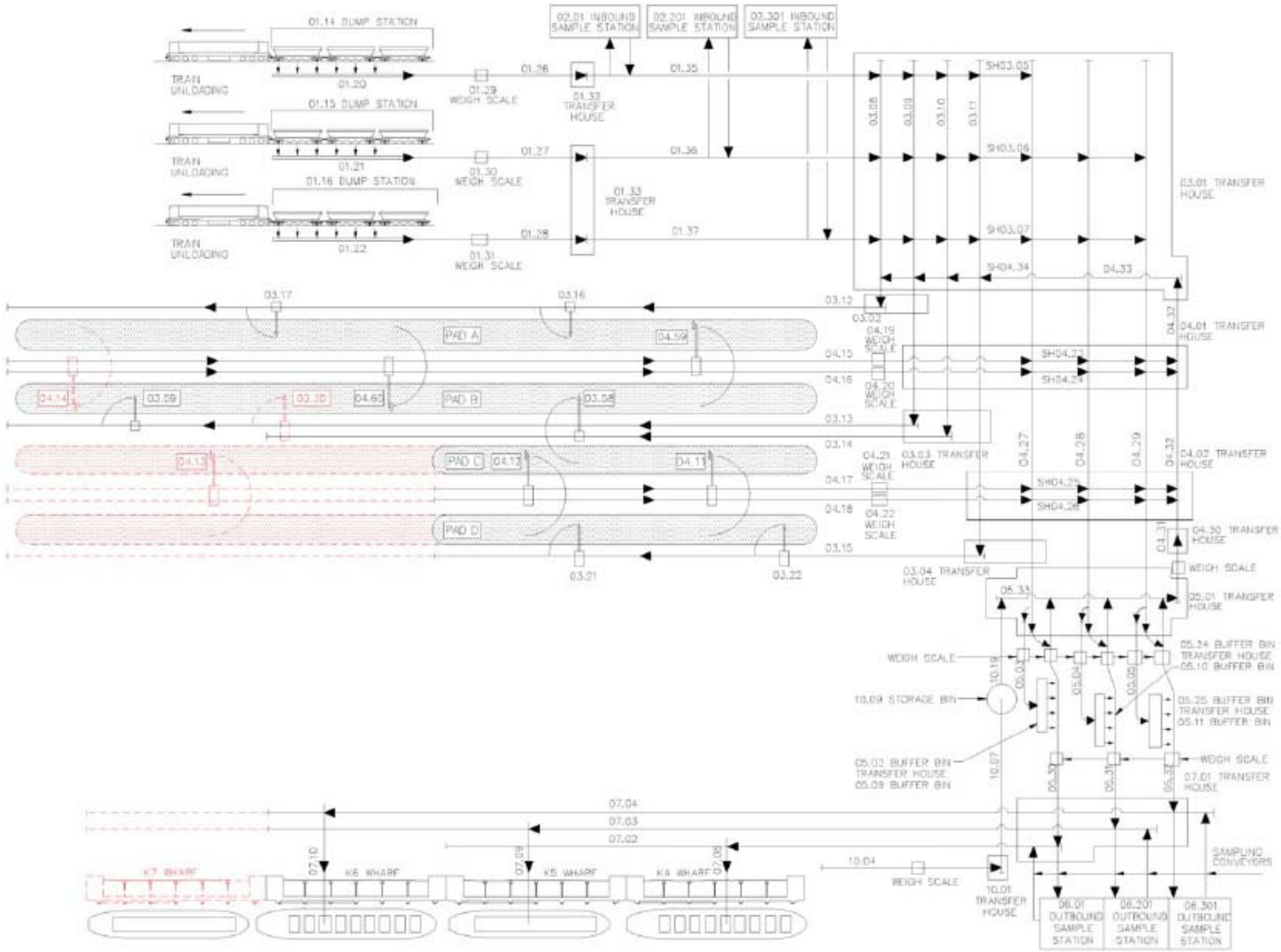
4. During operation of the Stage 3 Expansion, the Applicant shall ensure that the following noise criteria are met:

    - The $L_{A10,15min}$ noise emitted from the proposed Stage 3 Expansion should not exceed 40 dB(A) when computed at the boundary of any residential premises under neutral atmospheric conditions;
    - The $L_{A10,15min}$ noise emitted from Stages 1, 2 and 3 in operation must not exceed 43 dB(A) when measured at the boundary of any residential premises under neutral atmospheric conditions;
    - The $L_{A10,15min}$ noise emitted from the proposed Stages 1, 2 and 3 in operation must not exceed 65 dB(A) when measured at the boundary of any industrial premises under neutral atmospheric conditions. This level may be exceeded by 5 dB(A) in circumstances where other noise attenuating structures adequately protect the receptors;
    - The noise emission from the operation of the Kooragang Coal Terminal must be substantially free of tonal, impulsive or intermittent characteristics; and
    - The $L_{10,15min}$ noise emitted from Stage 1, 2 and 3 operations under acoustically neutral atmospheric conditions should not exceed 70 dB(A), and preferably be not greater than 65 dB(A) when measured or computed at the boundary of any other industrial premises. This 70 dB(A) level may be exceed in Circumstances where the best technology that is economically available has been employed to minimise noise emissions.

LAND USE

Legend

- Kooragang Coal Terminal
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Approved NCIG Coal Export Terminal
- Suburban



Source: Port Waratah Coal Services Limited, 2009

Legend

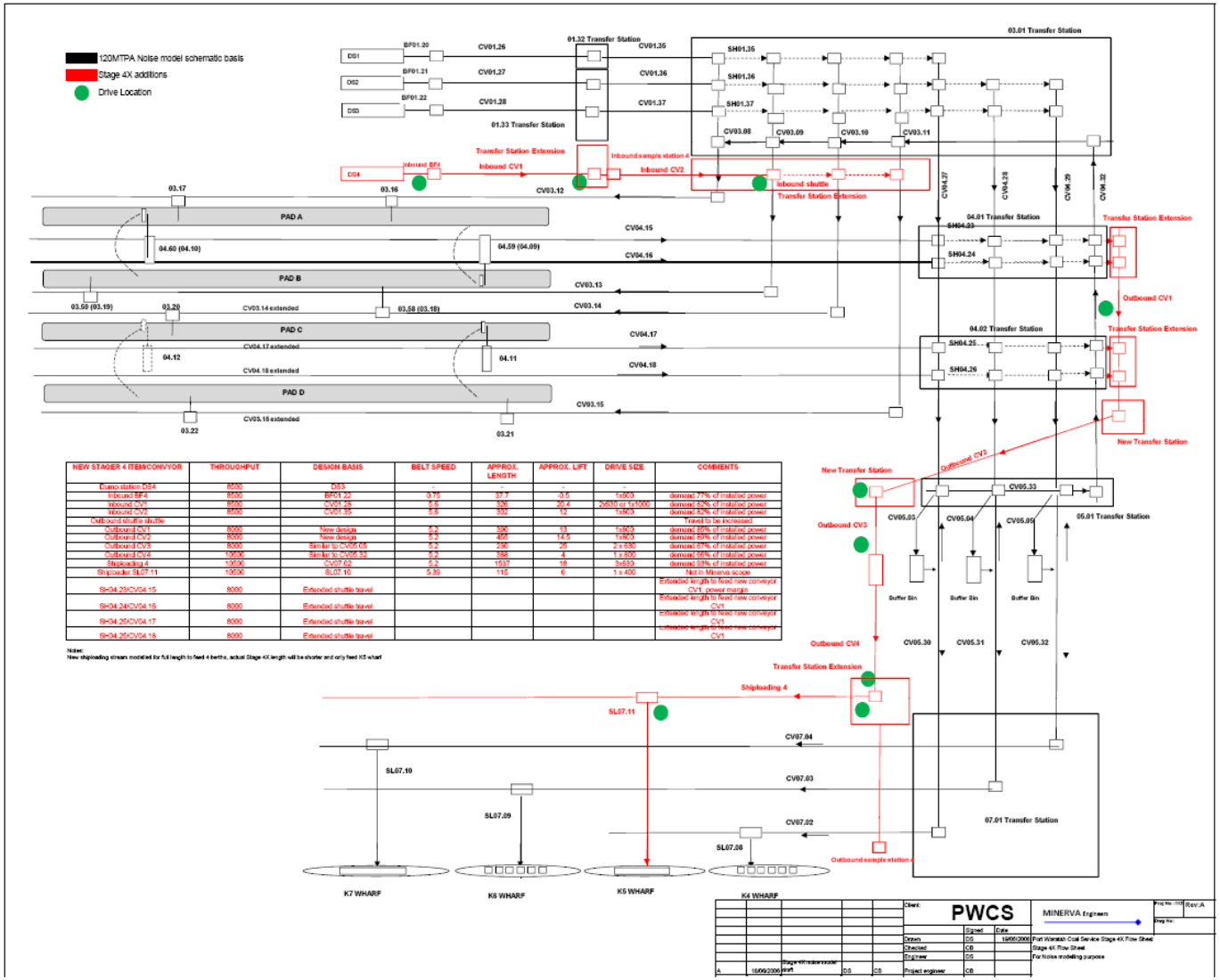
Existing Plant

Approved Plant yet to be Built

Appendix B2

Report 30-1977-R2 Page 1 of 1

KCT EXISTING AND APPROVED SCHEMATIC EQUIPMENT LAYOUT



NEW STAGER 4 ITEM/CONVYOR	THROUGHPUT	DESIGN BASIS	BELT SPEED	APPROX. LENGTH	APPROX. LIFT	DRIVE SIZE	COMMENTS
Dump station DS4	8500	DS3	-	-	-	-	
Inbound BF4	8500	BF01.22	0.75	37.7	-0.5	1x800	demand 77% of installed power
Inbound CV1	8500	CV01.28	5.6	326	20.4	2x630 or 1x1000	demand 82% of installed power
Inbound CV2	8500	CV01.35	5.6	502	12	1x800	demand 82% of installed power
Outbound shuttle shuttle							Travel to be increased
Outbound CV1	8000	New design	5.2	330	13	1x800	demand 85% of installed power
Outbound CV2	8000	New design	5.2	450	14.5	1x800	demand 85% of installed power
Outbound CV3	8000	Similar to CV05.05	5.2	230	25	2 x 630	demand 87% of installed power
Outbound CV4	10690	Similar to CV05.32	5.2	388	4	1 x 800	demand 88% of installed power
Shiploading 4	10690	CV07.02	5.2	1637	18	3x630	demand 93% of installed power
Shiploader SL07.11	10690	SL07.10	5.39	115	6	1 x 400	Not in Minerva scope
SH04.23/CV04.15	8000	Extended shuttle travel					Extended length to feed new conveyor CV1 power margin
SH04.24/CV04.16	8000	Extended shuttle travel					Extended length to feed new conveyor CV1
SH04.25/CV04.17	8000	Extended shuttle travel					Extended length to feed new conveyor CV1
SH04.26/CV04.18	8000	Extended shuttle travel					Extended length to feed new conveyor CV1

Notes:
New shiploading stream modelled for full length to feed 4 berths, actual Stage 4X length will be shorter and only feed K5 wharf

Appendix B3

Report 30-1977-R2 Page 1 of 1

KCT STAGE 4 PROJECT SCHEMATIC EQUIPMENT LAYOUT

KOORAGANG ISLAND METEOROLOGICAL DATA SET - JUNE 2004 TO JUNE 2009

Table C1 Seasonal Frequency of Occurrence Wind Speed Intervals - Daytime

Period	Calm (<0.5 m/s)	Wind Direction ±(45º)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Summer	1%	ESE	4%	14%	18%
Autumn	3%	ESE	8%	12%	20%
Winter	7%	NW	10%	12%	22%
Spring	2%	E	5%	14%	19%

Table C2 Seasonal Frequency of Occurrence Wind Speed Intervals - Evening

Period	Calm (<0.5 m/s)	Wind Direction ±(45º)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Summer	7%	ENE	16%	20%	36%
Autumn	16%	NE	17%	7%	24%
Winter	20%	NW	19%	11%	30%
Spring	11%	NE	20%	15%	35%

Table C3 Seasonal Frequency of Occurrence Wind Speed Intervals - Night-time

Period	Calm (<0.5 m/s)	Wind Direction ±(45º)	Wind Speed		
			0.5 to 1.5 m/s	1.5 to 3 m/s	0.5 to 3 m/s
Summer	14%	ENE	18%	6%	24%
Autumn	22%	WNW	27%	9%	36%
Winter	18%	WN	25%	19%	44%
Spring	19%	NW	20%	8%	28%

Season	Winds ± 45º ≤3 m/s with Frequency of Occurrence ≥30%		
	Daytime	Evening	Night-time
Summer	Nil	NE 33%, ENE 36%, E 34%	nil
Autumn	Nil	nil	W 31%, WNW 36%, NW 35%
Winter	Nil	NW 30%	W 35%, WNW 43%, NW 44%, NNW 32%
Spring	Nil	NNE 32%, NE 35%, ENE 33%	nil

Table C4 Frequency of Occurrence of Atmospheric Stability Classes - Evening & Night-time

Stability Class	Frequency of Occurrence				Estimated ELR ºC/100 m	Qualitative Description
	Summer	Autumn	Winter	Spring		
A	0%	0%	0%	0%	<-1.9	Lapse
B	0%	0%	0%	0%	-1.9 to -1.7	Lapse
C	0%	0%	0%	0%	-1.7 to -1.5	Lapse
D	24%	29%	36%	25%	-1.5 to -0.5	Neutral
E	15%	22%	20%	18%	-0.5 to 1.5	Weak Inversion
F	61%	48%	43%	56%	1.5 to 4	Moderate Inversion
G	0%	1%	1%	1%	>4.0	Strong Inversion

Note: ELR (Environmental Lapse Rate).

Noise monitoring to establish ambient noise levels at four representative locations in Fern Bay and Stockton were presented in the KCT Stage 3 Expansion EIS (ERM Mitchell McCotter 1996) and summarised in **Table D1**. The Minimum Repeated Background Level (MRBL) recorded at Fern Bay North (FN1) and estimated at Fern Bay West (FW1) in the absence of KCT's noise contribution was 38 dBA.

Subsequent approvals processes established the MRBL of 38 dBA to be conservatively representative of the daytime, evening and night-time noise environment at all receiver locations. As a result, the intrusive 43 dBA noise criteria under acoustically neutral atmospheric conditions was approved at all receiver locations for all periods of the day.

Table D1 Unattended Noise Logger Results 1996 (dBA re 20 µPa)

Receiver Area/ Receiver Type	ID (Ref)[1]	Daytime	Night-time				
		L90[2]	L1	L10	LEQ	L90[2]	L90[3]
Fern Bay North Suburban	FN1 (BG5)	46	68	61	57	38	n/a
Fern Bay West Urban	FW1 (BG4)	47	60	54	51	40	38
Fern Bay West Hospital	FW3 (BG3)	49	65	57	55	42	n/a
Stockton West Urban	SW1 (BG1)	44	64	53	54	41	n/a

Note 1: EIS 1996 measurement location reference.
Note 2: Minimum Repeated Background Level (MRBL) in accordance with ENCM procedures.
Note 3: Estimated background noise level in the absence of KCT's noise contribution.

Ambient Noise April and July 2006

A noise monitoring programme was conducted in April 2006 to quantify ambient noise levels (ie all noise sources) and to estimate industrial noise only (ie in the absence of transport, natural and domestic noise) at ten representative residential, commercial and industrial receiver areas in the vicinity of Kooragang Island in relation to the proposed Newcastle Coal Export Terminal (EA Resource Strategies 2006). Supplementary noise monitoring was carried-out at two additional locations, Fern Bay North (FN1) and Fern Bay West (FW3) commencing Tuesday 25 July 2006 for a period of 10 days.

In order to supplement the unattended logger measurements and to assist in identifying the character and duration of the noise sources, operator-attended daytime, evening, and night-time surveys were also conducted at all twelve logging locations. The operator-attended measurement results are summarised in **Table D2**.

Table D2 Operator-Attended Noise Survey Results 2006 (dBA re 20 µPa)

Receiver Area and Amenity Zone	ID (Ref)[1]	Measured $L_{A90(15minute)}$ All Noise Sources			Estimated $L_{Aeq(15minute)}$ Industrial Noise Only[2]		
		Day	Evening	Night	Day	Evening	Night
Fern Bay North Suburban	FN1 (BG5)	47, 55	50, 46	45, 45	n/d, n/d	<40, 40	41, 42
Fern Bay West Urban	FW1 (BG4)	59, 57, 52	44, 50, 49	49, 39, 40	49, n/d, n/d	40, n/d, n/d	49, n/d, <35
	FW3	49, 51	49, 53	46, 45	<45, n/d	45, <43	45, 45
Fern Bay East Urban	FE1	45, 39, 38	42, 41, 41	47, 35, 35	40, n/d, n/d	<36, n/d, <35	43, 35, 35
Stockton West Urban	SW1 (BG1)	52, 44, 45	48, 47, 47	50, 50, 51	51, n/d, n/d	48, <45, <45	49, 49, 50
Stockton East Urban	SE1	51, 48, 48	48, 49, 49	50, 48, 48	n/d, n/d, n/d	<43, n/d, <43	<43, 42, 42

Receiver Area and Amenity Zone	ID (Ref)[1]	Measured $L_{A90(15minute)}$ All Noise Sources			Estimated $L_{Aeq(15minute)}$ Industrial Noise Only[2]		
		Day	Evening	Night	Day	Evening	Night
Warabrook/Mayfield West Urban	W1	55, 48, 49	49, 48, 48	42, 46, 45	n/d, n/d, n/d	49, 46, 46	n/d, <45, <45
	W2	55, 54, 54	53, 53, 53	47, 49, 49	n/d, n/d, n/d	50, 51, 52	45, 49, 48
Mayfield Urban	M1	54, 58, 53	55, 53, 53	49, 51, 51	n/d, 51, 50	55, 52, 52	47, 50, 50
Sandgate Commercial	SG1	46, 53, 52	45, 45, 46	52, 52, 52	45, 52, 51	n/d, n/d, n/d	n/d, n/d, n/d
Kooragang Island Industrial	KI1	56, 57, 56	53, 56, 54	55, 51, 51	57, 57, 56	54, 54, 54	55, 50, 52
Mayfield North Industrial	MN1	62, 59, 59	62, 59, 59	55, 60, 61	63, 63, 62	63, 60, 60	59, 61, 62

Note 1: EIS 1996 measurement Location reference.
Note 2: n/d - Industrial noise not discernible.

The unattended ambient noise logger data from each monitoring location and the on-site weather conditions were analysed on a daily basis and presented graphically as statistical 24 hour ambient noise profiles. The background noise data were then processed in accordance with the requirements of the INP to derive the background noise levels presented in **Table D3**.

Other Background Noise Studies 2003

Noise monitoring to establish background levels and industrial noise at four representative residential locations in Mayfield was carried out in relation to the Port of Newcastle Extension EIS (GHD 2003). The measurement methodology is described in the Heggies Report 10-2718-R1 dated 6 August 2003 "*Noise and Blasting Assessment Proposed Extension of Shipping Channels Port of Newcastle"*.

Similarly, background levels and industrial noise in Carrington have been derived from Heggies Report 30-1157-R2 dated 30 May 2003 "*Noise Impact Assessment - Proposed Concrete Plant Carrington*". In each case the background noise data were processed in accordance with the requirements of the INP to derive the background noise levels as presented in **Table D3**.

Table D3 Unattended Noise Logger Results 2006 and 2003 (dBA re 20 µPa)

Receiver Area and Amenity Zone	ID (Ref)[1]	Measured RBL[4] All Noise Sources			Measured $L_{Aeq(period)}$[3] All Noise Sources			Estimated $L_{Aeq(period)}$[3] Industrial Noise Only		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Fern Bay North Suburban	FN1 (BG5)	44	46	41	62	61	58	<49	43	42
Fern Bay West Urban	FW1 (BG4)	50	43	44	60	55	54	<54	46	48
	FW3	47	45	43	63	62	57	<54	44	44
Fern Bay East Urban	FE1	40	44	42	48	46	46	<54	42	43
Stockton West Urban	SW1 (BG1)	42	44	44	63	57	59	<54	47	48
Stockton East Urban	SE1	41	43	43	55	51	49	<54	43	44
Warabrook/Mayfield West Urban	W1	44	45	40	59	54	52	<54	45	42
	W2	51	49	47	63	57	56	<54	45	43

Receiver Area and Amenity Zone	ID (Ref)[1]	Measured RBL[4] All Noise Sources			Measured $L_{Aeq(period)}$[3] All Noise Sources			Estimated $L_{Aeq(period)}$[3] Industrial Noise Only		
		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Mayfield Urban	M1	47	49	47	58	53	52	<54	49	48
	M2[2]	46	49	46	53	52	51	42	42	42
	M3[2]	46	46	43	58	62	51	42	42	42
	M4[2]	51	50	43	58	56	54	41	41	41
	M5[2]	57	53	48	69	63	61	45	45	45
Carrington/ Maryville Urban	C1[2]	42	41	37	62	67	57	46	45	42
Sandgate Commercial	SG1	48	45	40	57	54	55	<59	46	43
Kooragang Island Industrial	KI1	51	51	47	61	56	55	<64	53	51
Mayfield North Industrial	MN1	56	57	57	60	59	59	<64	57	57

Note 1: Extension EIS 1996 measurement Location reference.

Note 2: Supplementary background and industrial noise.

Note 3: Daytime 0700 hours to 1800 hours, Evening 1800 hours to 2200 hours and Night-time 2200 hours to 0700 hours.

Note 4: Rating Background Level.

Industrial noise is a feature of the residential night-time noise environment at all receiver areas. Sometimes it is not discernible - but at other times it is distinguishable - particularly during lulls in transport, domestic and natural noise sources (ie ocean noise).

Fern Bay (North): Existing night-time industrial noise generally emanates from Kooragang Island and was estimated as 42 dBA. Light westerly wind generally prevailed throughout the monitoring period enhancing industrial noise from the island.

Fern Bay (West)/Stockton (West): Existing night-time industrial noise generally emanates from Kooragang Island and was estimated as 48 dBA at both receiver areas. Light westerly wind generally prevailed throughout the monitoring period enhancing industrial noise from the island to the nearest residential receivers. The surveys indicated that industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions.

Fern Bay (East)/Stockton (East): Existing night-time industrial noise from Kooragang Island was estimated as 43 dBA to 44 dBA during noise enhancing conditions. Industrial noise therefore attenuates by approximately 5 dBA from west to east at Fern Bay and Stockton. Similarly, industrial noise is at least 5 dBA less in the absence of westerly winds and/or temperature inversions. Ocean noise is also a feature of the area particularly during north-easterly breezes.

Warabrook/Mayfield West/Mayfield/Carrington/Maryville: Existing night-time industrial noise generally emanates from the industrial areas located to the immediate north of the receiver areas (eg Mayfield North) and was estimated as 42 dBA to 44 dBA. Due to the relatively close proximity of the industry to the residential receiver areas, noise enhancement due to weather effects is less by comparison for Fern Bay and Stockton and the industrial noise contribution relatively more constant. It reasonable to assume Kooragang Island industrial noise is minimal.

DECCW INTERIM CONSTRUCTION NOISE GUIDELINE

The table below presents a comparison of the EPA's ENCM (1994) Chapter 171 Noise Control Guideline and the DECCW's new interim guideline.

<table>
<tr><th>Chapter 171 Noise Control Guideline</th><th>Interim guideline</th></tr>
<tr><td colspan="2">Recommended standard hours</td></tr>
<tr><td>Monday to Friday 7am to 6pm
Saturdays 8am to 1pm
No work on Sundays or public holidays</td><td>No change from previous</td></tr>
<tr><td colspan="2">Choice of assessment method</td></tr>
<tr><td>No choice - only numeric noise criteria given</td><td>Choice of either qualitative assessment for projects under three weeks, or quantitative assessment for major projects</td></tr>
<tr><td colspan="2">Noise levels</td></tr>
<tr><td>Noise goal</td><td>Noise management level</td></tr>
<tr><td>0 to 4 weeks
Background + 20 dB(A)</td><td rowspan="3">Short-term infrastructure maintenance
Qualitative assessment - apply work practices in checklist at all times of the day
Major construction projects
Recommended standards hours
Background + 10 dB(A) and L_{Aeq} 75 dB(A)
Outside recommended standard hours:
Background +5 dB(A)</td></tr>
<tr><td>5 to 26 weeks
Background + 10 dB(A)</td></tr>
<tr><td>Greater than 26 weeks
Background + 5 dB(A)</td></tr>
<tr><td colspan="2">Guidance on work practices</td></tr>
<tr><td>No guidance</td><td>Extensive list of options for work practices, based on world-wide review of best approaches</td></tr>
<tr><td colspan="2">Examples on applying guideline</td></tr>
<tr><td>No examples</td><td>Six case studies based on real-life projects
Also worked examples throughout the Guideline</td></tr>
<tr><td colspan="2">Ground-borne noise levels</td></tr>
<tr><td>No guidance</td><td>Evening internal level L_{Aeq} 40 dB(A)
Night internal level L_{Aeq} 35 dB(A)</td></tr>
</table>

Vibration - Building Structures

The German Standard DIN 4150-3:1999 "*Structural Vibration Part 3: Effects of vibration in structures*" provides the most recently updated criteria against which the likelihood of building damage from ground vibration can be assessed. The recommended limits for short term vibration to ensure minimal risk of damage are presented numerically in **Table F1**.

Table F1 Guideline Values for Vibration - Effects of Short Term Vibration on Structures

Line	Type of Structure	Vibration at the Foundation at a Frequency of			Vibration at Horizontal Plane of Highest Floor at all Frequencies
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 H*	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under Lines 1 and 2 and are of great intrinsic value (eg listed buildings under preservation order)	3	3 to 8	8 to 10	8

Note * At frequencies above 100 Hz, the values given in this column may be used as minimum values

Vibration - Mechanical Plant

The criteria in **Table F2** are based on previous experience at the Kooragang Coal Terminal site.

Table F2 Guideline Values for Vibration - Effect of Short Term Vibration on Mechanical Plant

Situation	Vibration Measured on Support Structure (ppv mm/s)
Mechanical Plant (ie conveyors, reclaimers) **In Operation**	20
Mechanical Plant (ie conveyors, reclaimers) **Not In Operation**	5

Vibration - Buried Pipework

The German Standard DIN 4150-3:1999 "*Structural Vibration Part 3: Effects of vibration in structures*" provides guideline values for evaluating the effect of vibration on buried pipework. The values are based on the assumption that pipes have been manufactured and laid using current technology. Additional considerations may be required at junctions. The recommended limits for short term vibration to ensure minimal risk of damage are presented numerically in **Table F3**.

Table F3 Guideline Values for Vibration - Effects of Short Term Vibration on Buried Pipework

Pipe Material	Vibration Measured on the Pipe[1] (ppv mm/s)
Steel (including welded pipes)	100
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
Masonry, plastic	50

Note 1: Mounting equipment directly onto pipes may not be possible. If the vibration source is not immediately next to the pipework, measurements can be made on the ground surface to obtain an estimate. Generally, this vibration level will be greater than the level measured directly on the pipework.

Vibration - Computer Rooms

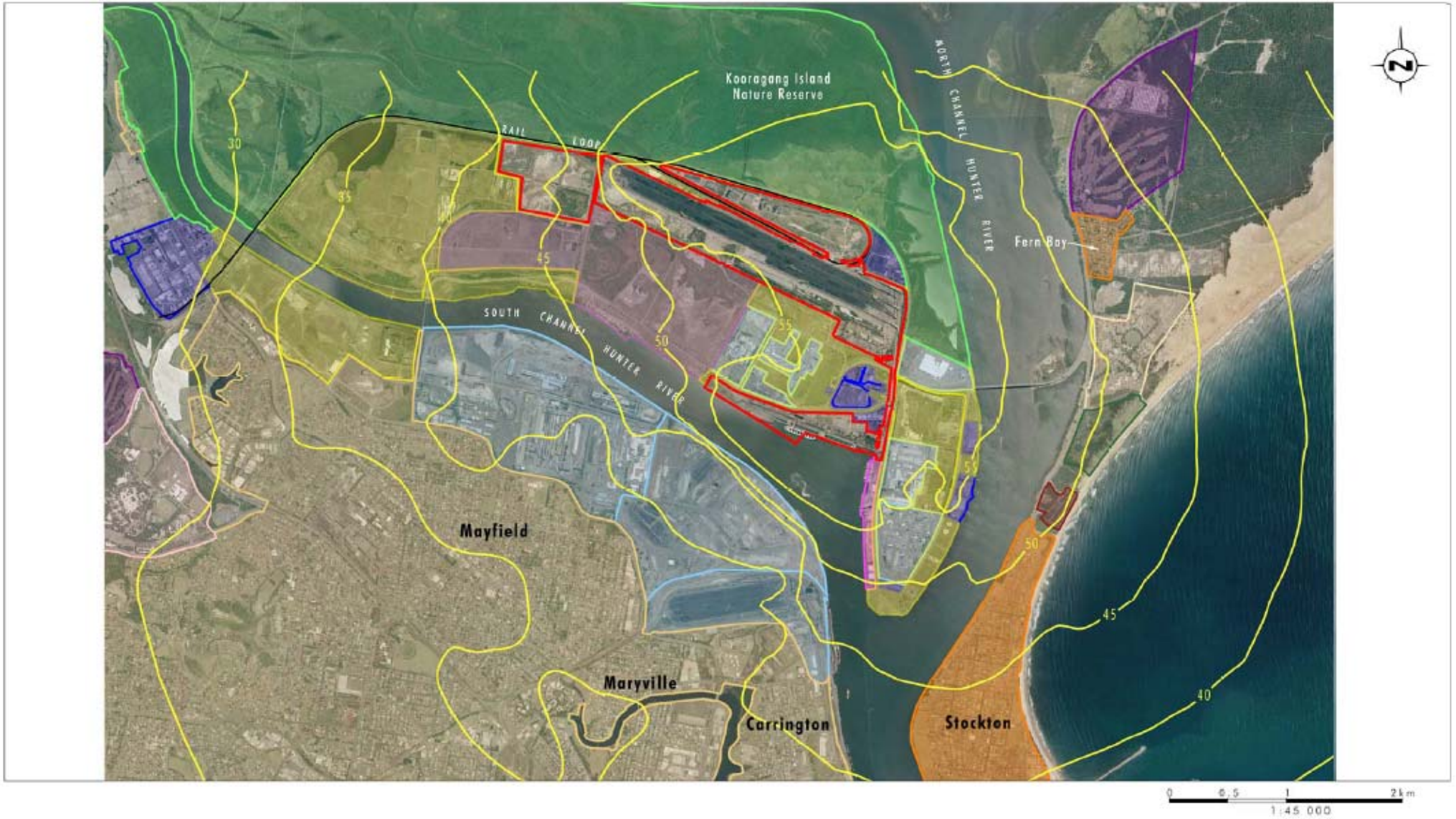
Based on previous experience, Heggies have found a peak particle velocity (ppv) criterion of 5 mm/s to be appropriate for computer room floors (based on vibration requirements for hard drives). If it is determined that more sensitive equipment is stored in these rooms, this criterion may need to be revised.

Vibration – Human Comfort

The NSW DEC has recently released an interim guideline Assessing Vibration: A Technical Guideline dated February 2006. The DEC's guideline is based on the information set out in British Standard 6472-1992 "*Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".* This standard defines levels of building vibration associated with a "low probability of adverse comment" from occupants. The applicable levels for continuous daytime activities are shown in **Table F4**.

Table F4 Vibration Levels with "Low Probability of Adverse Comment" (1 Hz to 80 Hz)

Building Type	Peak Floor Vibration	Peak Floor Vibration (Z Vertical)
Residential	0.8 mm/s to 1.6 mm/s	0.3 mm/s to 0.6 mm/s
Offices	1.6 mm/s	0.6 mm/s
Workshops	3.2 mm/s	1.2 mm/s



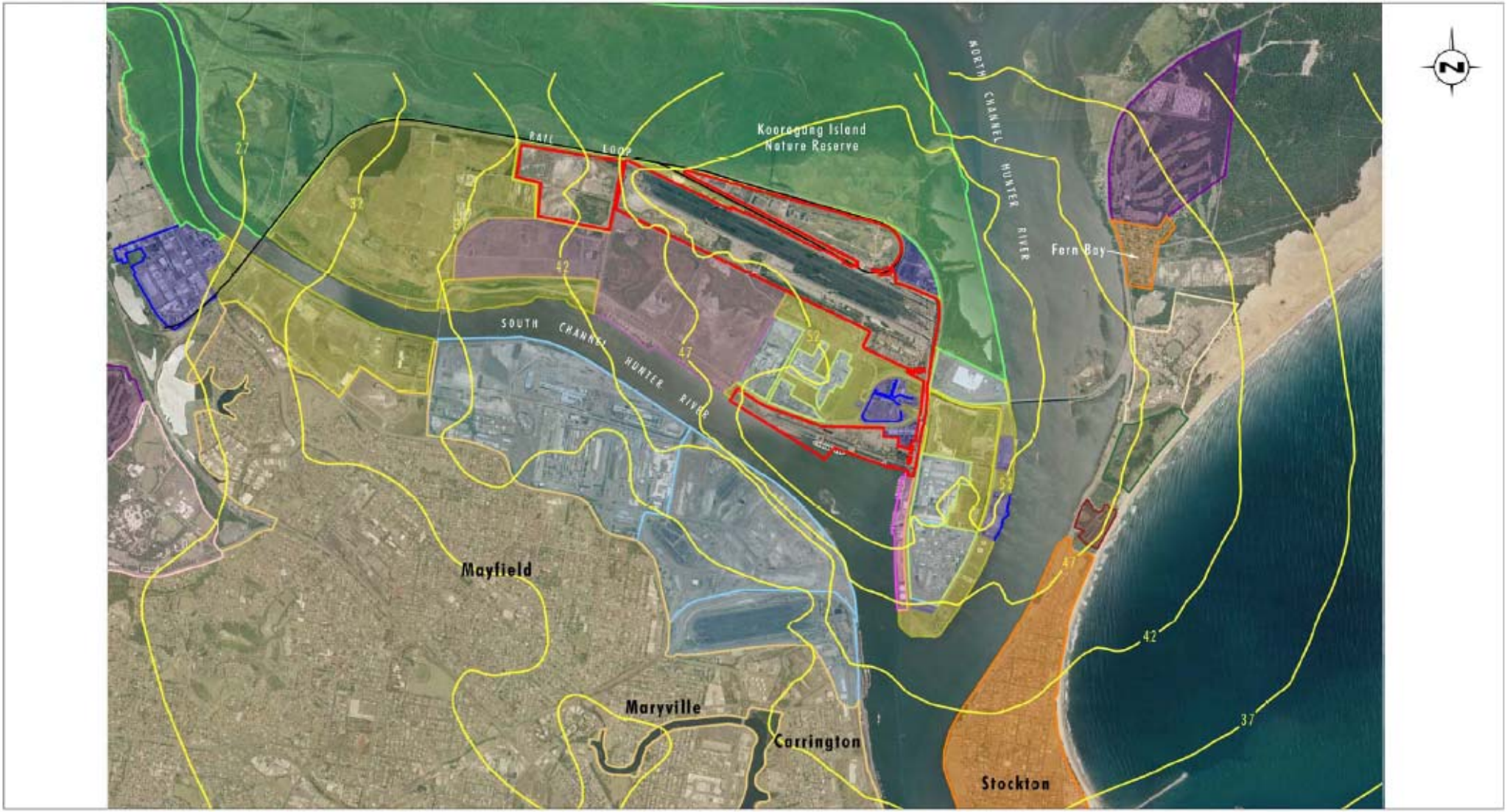
Legend

- Kooragang Coal Terminal
- Predicted Night Time Amenity Noise Level (dB[A]) - Stage 4 Project
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Approved NCIG Coal Export Terminal
- Suburban
- Newcastle University

Appendix G1

Report 30-1977-R2 Page 1 of 1

Night-time $L_{Aeq(15minute)}$ INTRUSIVE NOISE CONTOUR



Legend

- Kooragang Coal Terminal
- Predicted Night Time Intrusive Noise Level (dB[A]) - Stage 4 Project
- Heavy Industry
- Light Industry
- Vacant Land
- Urban
- Sewage Treatment
- Port Facilities
- Golf Course
- Nature Reserve
- Approved NCIG Coal Export Terminal
- Suburban
- Newcastle University

Appendix G2

Night-time $L_{Aeq(9HOUR)}$ AMENITY NOISE CONTOUR

L6 Noise Limits

L6.1 Approvals for Locomotives

The licensee must seek approval from the EPA prior to permitting operation on the "premises" of:

1. a class or type of locomotive, whether new or existing, that has not been operated on the NSW rail network; or
2. a locomotive that has been substantially modified since it was last used on the NSW rail network

EPA approval will be on the basis of compliance with the locomotive noise limits in Condition L6.2.

This condition L6 does not apply to the operation of a locomotive solely for the purposes of conducting noise or other tests that are required for the locomotive's acceptance by the EPA, the licensee or any person concerned with the design, manufacture, supply or acquisition of the locomotive, provided that multiple pass bys do not occur adjacent to residential premises in the course of the testing.

Note: EPA approval for a class or type of locomotive will require noise test results from a representative number of locomotives from that class or type.

L6.1 General Noise Limits

L6.1.1 General Noise Limits

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am – 10pm), 60 dB(A)Leq, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.

L6.2 EPA Locomotive Noise Limits

L6.2.1 General Noise Limits

Operating Condition	Speed & Location of Measurement	Noise Limit at a microphone height of 1.5 metres above ground level
Idle with compressor radiator fans and air conditioning operating at maximum load occurring at idle	Stationary 15 metre contour	70 dB(A) $_{Max}$
All other throttle settings under self load with compressor radiator fans and air conditioning operating	Stationary 15 metre contour	87 dB(A) $_{Max}$ 95 dB Linear $_{Max}$
All service conditions	As per Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA	87 dB(A) $_{Max}$ 95 dB Linear $_{Max}$

L6.2.2 Limits for Tonality

All external noise must be non-tonal. For the purpose of this condition, external noise is non-tonal if the sound pressure level in each unweighted (linear) one-third octave band does not exceed the level of the adjacent bands on both sides by:

a) 5 dB if the centre frequency of the band containing the tone is above 400 Hz; and

b) 8 dB if the centre frequency of the band containing the tone is between 160 and 400 Hz, inclusively; and

c) 15 dB if the centre frequency of the band containing the tone is below 160 Hz.

L6.2.3 Limits for Low-Frequency Noise

All external noise must not exhibit an undue low-frequency component. To comply with this requirement, linear noise levels must not exceed the A-weighted noise levels by more than 15 dB.

L6.3 Locomotive Noise Emission Test Methods

Application for approval as required by L6.1 must be supported by type testing of the locomotive using procedures that are consistent with the requirements of Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA. The type testing must provide all necessary measurement parameters for demonstrating compliance with the locomotive noise limits in L6.2.

Information supplied to the EPA as part of the application for approval must fulfil the requirements of Section 11 of AS2377-2002 for reporting.

Note: The measurement parameters required in L6.2 differ in some cases from those identified in AS2377-2002. The test procedures, measurement equipment and environmental conditions applied in supporting the application to the EPA for approval are to yield all parameters identified in L6.2 but are otherwise to be applied in a manner that is consistent with the requirements of AS2377-2002. The 15 metre contour specified in L6.2.1 is to be represented by the 12 measurement points shown in AS2377-2002, Figure 1.

L6.4 Approval of Locomotives Not Meeting All EPA Limits

The EPA may approve locomotives that do not comply with all limits prescribed by L6.2, provided that the application for approval demonstrates that:

a) the noise emission performance of the locomotive is consistent with current best practice; and

b) all measures for minimising the extent of any non-compliance have been investigated and those that are identified as reasonable and feasible have been implemented; and

c) none of the non-compliances will result in unacceptable environmental impacts.