Gales-Kingscliff Pty Ltd
ABN: 75 093 540 080

Cudgen Lakes Sand Extraction Project

Noise Assessment

Prepared by

Ron Rumble Pty Limited

April, 2008

Specialist Consultant Studies Compendium

Part 8

Gales-Kingscliff Pty Ltd

ABN: 75 093 540 080

Cudgen Lakes Sand Extraction Project

Noise Assessment

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EXECUTIVE SUMMARY

Ron Rumble Pty Ltd has been commissioned by R.W. Corkery & Co. Pty. Limited on behalf of Gales-Kingscliff Pty Ltd (the "Proponent") to undertake a Noise Impact Assessment for the Cudgen Lakes Sand Extraction Project (the "Project").

The Project involves the removal of approximately 5 000 000m^3 of sand over a period of 15 to 20 years whilst progressively rehabilitating the site to provide a recreational lake and surrounding parklands. Sand removed as part of the Project would be used either as fill sand (for nearby lands) or processed for sale as construction material.

The purpose of this report is to establish the likely noise emissions that will occur during the construction and operation of the Project, compare the predicted noise emissions with regulatory criteria specified in the NSW EPA *Industrial Noise Policy (INP) 2000* and to establish what measures could be implemented to control noise emissions. Noise emissions from trucks on the local road network are also compared with the NSW EPA *Environmental Noise Management: Environmental Criteria for Road Traffic Noise*.

Background noise measurements were measured through unattended noise logging at four locations surrounding the Project Site over a 7 day period and a series of attended noise measurements. The recorded daytime rating background noise level ranged between 41dB(A) and 51dB(A).

Noise modelling was undertaken using the computer modelling program SoundPlan™ which was configured using the CONCAVE algorithms. Five scenarios were modelled (one during site establishment and four during operations) taking into account various atmospheric effects including temperature inversions and wind effects.

From the results of the modelling and assessment, the following conclusions have been drawn.

- Noise emissions from the unmitigated Project are predicted to comply with the noise limits imposed by the INP under most operating conditions and atmospheric conditions. During some of the scenarios, particularly under downwind and inversion conditions, the unmitigated Project has the potential to marginally exceed the noise limits by between 1dB(A) and 4dB(A).
- The combined noise impact of the Project with the operations of Hanson Tweed Sand have been assessed and found to still comply with the limits of the INP.

Two noise reduction strategies are proposed; namely:

(i) to reduce noise emissions from the site, through attenuation of the dredge to reduce noise emission levels to a Sound Power Level of 97dB(A). This would be achieved by enclosing the engine with appropriately selected acoustic louvres and installation of a higher performance muffler; and

(ii) the addition of a noise barrier and/or acoustical treatments to the Sand Wash plant to achieve a noise reduction of 5dB(A) at Residences 2, 3 and 4.

With the proposed attenuation measures in place, compliance with the noise limits is achieved during all scenarios for the default downwind and inversion conditions prescribed by the INP.

The noise impact of trucks on Altona Drive (including the combined effect of trucks from the Hanson Tweed Sand extraction operation) and the effect of increased traffic on Tweed Coast Road has been assessed and shown to comply with the ECRTN.

In order to demonstrate noise limits are met and compliance is being achieved, a monitoring and compliance program has been outlined.

In summary, with the proposed noise attenuation measures, noise emissions from the Cudgen Lakes Sand Extraction Project are predicted to comply with the noise limits imposed by the INP at all residences during both the construction and operational phases.

1 INTRODUCTION

Ron Rumble Pty Ltd has been commissioned by R.W. Corkery & Co. Pty. Limited on behalf of Gales-Kingscliff Pty Ltd (the "Proponent") to undertake a Noise Impact Assessment for the Cudgen Lakes Sand Extraction Project (the "Project").

The Project involves the removal of approximately 5 000 000m^3 of sand over a period of 15 to 20 years whilst progressively rehabilitating the site to provide a recreational lake and surrounding parklands. Sand removed as part of the Project would be used either as fill sand (to raise the level of nearby lands) or processed for sale as construction materials. The location of the Project Site is shown on **Figure 1.**

The purpose of this report is to establish the likely noise emissions that will occur during the construction and operation of the Project, compare predicted noise emissions with regulatory criteria specified in the NSW EPA *Industrial Noise Policy (INP) 2000* and to establish what measures could be implemented to control noise emissions within the criteria specified.

Noise emissions from trucks on the local road network are compared with NSW EPA *Environmental Noise Management: Environmental Criteria for Road Traffic Noise*.

2 PROJECT BACKGROUND

Within the area nominated on **Figure 2**, the Proponent currently holds Development Consent DA 96/518 and Environment Protection Licence No. 12385 to remove 400 000m^3 of sand from the Project Site and hydraulically transport the fill sand to another parcel of land directly east of the Project Site. The initial extraction pond (0.5ha) for the approved extraction operation has been completed, however, operational dredging has not yet commenced. The extent of the approved dredge pond (7ha) would form the first stage of this Project.

Noise emissions relating to the approved sand extraction for inclusion in the Proponent's Environment Protection Licence application were previously assessed by Ron Rumble Pty Ltd (2005).

A summary of the Cudgen Lakes Sand Extraction Project is included in **Section 3**.

3 PROPOSED DEVELOPMENT

The Proponent proposes to develop and operate a sand extraction operation to supply fill sand to a number of nominated fill sites via two pipeline corridors and to produce a range of sand products for sale to the local construction industry. The Project would also be appropriately licensed to accept virgin excavated natural material (VENM) which would be used in production of saleable sand products, used to backfill the northern extraction pond or interned at or near the base of the southern extraction pond.

The Project would involve the removal of approximately 5 000 000m^3 of sand over a period of 15 to 20 years. The Project Site covers a total area of 67ha which includes:

- a 37ha extraction site south of Altona Drive ('southern extraction site');
- a 9ha extraction site north of Altona Drive ('northern extraction site'); and
- a processing area north of Altona Drive covering an area of 3.7ha.

Two pipeline corridors are proposed extending north and east from the southern extraction site. These are referred to as the "northern pipeline corridor" (0.8km in length) and the "eastern pipeline corridor" (1.5km in length). The proposed northern pipeline corridor would be located in the road reserve on the western side of Tweed Coast Road. The proposed eastern pipeline corridor would be located within the road reserve for a proposed subdivision road east of Tweed Coast Road within land owned by the Proponent. It is acknowledged that the proposed road has not yet been approved. Therefore, an alternative eastern pipeline corridor (see **Figure 2**) has been proposed in the event that the proposed road east of Tweed Coast Road is not approved within a suitable timeframe. An alternative northern pipeline has also been proposed in the event that suitable agreements are reached with an adjoining landholder.

The operation has been designed to optimise the recovery of sand whilst at the same time addressing and managing the environmental constraints within and surrounding the Project Site. As the Project proceeds, the northern extraction pond would be progressively backfilled to ultimately form sporting fields and recreational facilities and finalised sections of the southern extraction pond would be progressively rehabilitated in order to form a recreational lake and surrounding parklands.

Construction and site establishment would occur over an approximately 3 month period in which three site entrances and internal roads would be constructed together with the processing plants, offices, workshop and perimeter bunding. The dredge, pipelines to the processing area, pumps and other equipment would also be installed during the site establishment and construction period. Construction activities would occur between 7:00am and 6:00pm Monday to Friday and 7:00am to 1:00pm Saturday.

The extraction sequence would involve: stripping of topsoil; formation of bunds; and extraction of the sand resource (loamy sand and fine grained sand). Extraction of all material within the northern extraction site would be undertaken over four stages progressing east to west to a depth of approximately 5m using excavator and trucks. Within the southern extraction site extraction would occur over 10 stages, generally progressing west to east. Extraction would occur to the depth of the resource, typically 20m below current ground level with the upper loamy sand material extracted using an excavator and the remaining fine grained sand material extracted using a cutter-suction dredge.

The upper loamy sand material would be treated using alkaline amendments, such as agricultural lime, prior to being transferred to the processing area for production of various construction materials, such as mortar sand. The fine grained sand material would either be trucked or pumped to the processing area and washed to remove oversize and undersize materials, producing construction grade sand, or be pumped to a nominated fill site for use as fill material. All fines separated during processing or returned from the fill sites would be returned towards the base of either the northern or southern extraction pond.

All soil removal and excavation of sand (ie. mechanical removal) would occur between 7:00am and 6:00pm Monday to Friday and 7:00am to 1:00pm Saturday. Dredging and pumping of sand to the processing area, and processing activities, would occur between 6:30am and 10:00pm Monday to Friday and 7:00am to 4:00pm Saturday whilst dredging of sand for pumping to fill sites would occur between 6:30am and 6:30pm Monday to Friday and 7:00am to 1:00pm Saturday.

Sand to be used as a filling material to raise the level of various parcels of land in the Kingscliff, Chinderah and Cudgen areas would be pumped hydraulically to the fill sites from the southern extraction site as a sand / water slurry. Water draining from the sand at the fill sites would be pumped back to the southern extraction pond. The Proponent intends to use up to two enclosed staging pumps beyond the dredge to convey the sand to the fill sites, one located within the Project Site and one within each pipeline corridor. Pumping would only occur along one corridor at a time. Up to 450 000m^3 of sand could be pumped annually to the fill sites.

Based on maximum annual sales of 300 000tpa (200 000m^3) average truck loads of 20t and transportation 5.5 days per week, 50 weeks per year the average number of product truck movements on any weekday or Saturday would be approximately 100 and 60 respectively (50 and 30 loads). As sales would vary from day to day, the 85th percentile number of product truck movements on the local roads on a busy weekday or Saturday would be 130 and 80 respectively (65 and 40 loads). It is noted that, in reality most products would be despatched using truck and dog trailer rigs with capacities of 30t to 33t. Therefore the use of 20t truck capacities is considered conservative. Based on the importation and receival of up to 45 000tpa (30 000m^3) of VENM, it is estimated that the incoming VENM would generate approximately 24 truck movements (12 loads) per week. The 85th percentile volume has been estimated at 32 truck movements (16 loads) per day.

In total, it is assumed, once the Project is fully operational, the despatch of products and importation of VENM would generate up to 124 truck movements (62 loads) per day on an average day. All product distribution and VENM receival would occur between 7:00am to 6:00pm Monday to Friday and 7:00am to 1:00pm Saturday.

Both non acid generating VENM - VENM(a) and acid producing VENM – VENM(b) would be received at the Project Site via road trucks, appropriate details recorded and the material classification verified. VENM(a) would either: be processed to produce saleable products or used to backfill the northern extraction pond or finalised edges of the southern extraction pond. VENM(b) which is suitable for processing would be placed adjacent to the southern extraction pond for treatment, as for the loamy sand material, prior to processing. VENM(b) not suitable for processing would be either used to backfill the northern extraction pond or interned at or near the base of finalised sections of the southern extraction pond.

All VENM delivered to the Project Site and processed materials despatched from the processing area would be transported via Altona Drive, Crescent Street and Tweed Coast Road. Access to the Project Site would be provided via three entrances off Altona Drive, one to the processing area and northern extraction site and two to the southern extraction site.

The Proponent would adopt a progressive approach to site landscaping and rehabilitation to ensure that, wherever possible, disturbed areas are either temporarily or permanently stabilised to limit erosion and adverse visual impacts. An important component of the rehabilitation of the Project Site would be the progressive backfilling of selected finalised sections of the shore of the southern extraction pond and introduction of native vegetation to create wetland areas and parklands. The construction of recreational facilities such as walking and equestrian / cycling tracks would occur following completion of sand extraction activities. The final lake would have a depth of up to 20m and cover an area of approximately 37ha.

4 NOISE SENSITIVE LOCATIONS

For the purposes of assessing the noise impacts of the Project, five representative locations surrounding the Project Site were identified (see **Figure 3**). The positions of these locations and description of their surrounds and distances to the various proposed activities are discussed as follows.

North

To the north and northeast of the Project Site, there are three houses along the western side of Tweed Coast Road north of the Crescent Street intersection.

The nearest residence to the Project Site is located approximately 30m north of the intersection of Crescent Street and Tweed Coast Road and is set back approximately 25m from Tweed Coast Road. This residence is highset and is referred to as Receptor G on **Figure 3**. Between Tweed Coast Road and the Chinderah Golf Club there is another single residence which is located on a large lot. This residence is currently owned by the Proponent and has not been assessed further.

East

Land to the east of Tweed Coast Road is mostly vacant and low-lying. To the northeast of the Project Site is the Noble Lakeside Park Estate, located on the eastern side of Tweed Coast Road. The residences on this site are demountable type buildings. These residences are further removed from the Project Site than Receptor G and compliance with noise limits at Receptor G would ensure compliance at those residences further removed from the extraction site.

West

Land to the west is mainly agricultural land and also contains an existing sand extraction operation (Hanson Tweed Sand). There are no residences within 1.5km of the extraction site in a westerly direction. The existing sand extraction operation directly adjoins the western boundary of the Project Site.

South

To the south of the Project Site there are residences at various distances within and adjacent to Cudgen. The most potentially affected residences are located adjacent to Collier Street and at the northern end of Crescent Street. Collier Street residences are typically around 275m from the southern boundary of the Project Site and are elevated approximately 30m above the level of the proposed extraction pond that will be present within the southern extraction site. The Cudgen Public School is also located adjacent to Collier Street approximately 300m south of the Project Site and at a similar elevation as the surrounding residences. The nearest residences in Crescent Street are typically around 125m from the eastern end of the southern boundary of the Project Site and are elevated approximately 5m to 10m above the site. These residences are partially shielded from the western end of the southern extraction site by the existing surrounding topography.

Two of the most potentially affected residences to the south of the Project Site have been selected for the purposes of the noise assessment; Receptor DD in Crescent Street and Receptor B in Collier Street. Another location (Receptor F) is included on John Robb Way which is further removed than Receptor DD but does not have the same degree of topographic shielding to parts of the Project Site. The Cudgen Public School is located approximately 40m south of Receptor B. These locations are all shown on **Figure 3.**

Further to the southeast along Cudgen Road, approximately 400m from Collier Street, there are another two residences. There is a single residence located directly on Cudgen Road (which is shielded by topography and another residence at a distance of approximately 150 metres north from the road. This northern residence has been assessed as Receptor O.

Table 1 lists the approximate distances from the five representative residences to the nearest proposed operational areas.

Table 1
Proximity of Surrounding Representative Residences to Project Site Activities

Activity/Operational Area	Distance to Residences (m)				
	G	DD	F	B	O
Initial Dredge Pond (Stages 1 and 2)	920	600	815	500	620
Stage 7 (Closest Point)	600	315	530	290	630
Stage 10 (Closest Point)	225	290	450	380	880
Stage A (Closest Point)	195	430	525	570	1090
On-site Booster Pump	700	430	650	380	880
Processing Area (Closest Point)	745	770	950	780	1000

5 NOISE CRITERIA

5.1 Site Establishment and Construction Noise

The initial stages of the Project site establishment are construction activities which have been assessed against relevant construction noise criteria drawn from the EPA NSW – Environmental Noise Control Manual.

Some construction activities are, by their nature, noisy activities albeit for comparatively short periods. It is generally accepted by the community that construction activities are a necessary impost, particularly those such as bund wall construction that will assist in attenuating operational noise levels. An individual's own dwelling could not have been built without some construction noise.

Most communities will accept the noise of construction activities provided that:

(a) they are confined to *reasonable hours*, and

(b) it is *perceived* that *all reasonable measures* have been taken to minimise noise. This includes commonsense measures such as locating noisy equipment away from houses, maintaining noise control devices such as mufflers in good condition, avoiding unnecessary devices such as telephone extension bells or unnecessary reversing beepers.

Many local authorities acknowledge and respond to community requirements by imposing limits on construction hours.
The New South Wales *Industrial Noise Policy* (INP) *2000* specifically excludes construction noise from assessment. However, the EPA NSW – Environmental Noise Control Manual, Chapter 171 (dated 1985) remains relevant to construction noise. The restriction of operating hours, noise level restrictions and silencing are considered as follows.

1. For a construction period greater than 4 weeks and not exceeding 26 weeks, such as that proposed for the Project, Chapter 171 nominates that the L_{10} level 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 10dB(A).
2. Construction should be limited between the hours of 7:00am to 6:00pm Monday to Friday, and 7:00am to 1:00pm on Saturdays.
3. All possible steps should be taken to silence construction equipment.

It is perhaps noteworthy that in the last 10 years, most local authorities in Queensland have abandoned noise criteria for construction noise. A contemporary approach applied by many authorities is to restrict hours of operation and ensure that contractors take all reasonable measures to keep noise emissions to a minimum.

For the initial construction stages of the Project, it is proposed to apply a limit of background rating level plus 10dB(A) in accordance with Chapter 171 of the Environmental Noise Control Manual.

5.2 Extraction, Pumping and Processing Operations

For this application, the Director-General Requirements (DGRs) nominated that the assessment of operational noise emissions from the Project must be made against the INP.

The INP has two components that must be taken into account for noise sensitive receivers. They are:

(i) controlling ***intrusive*** noise impacts in the short term for residences; and

(ii) maintaining noise level ***amenity*** for particular land uses for residences and other land uses.

The INP requires both of these components to be taken into account, but recognises that in most cases, only one (the most stringent) will become the limiting criterion which is applied as the Project specific noise level.

Intrusive Noise Impacts

The INP states that noise emissions measured at any affected residence as the *equivalent* or energy-averaged, A-weighted noise level, over any 15 minute period, $L_{Aeq\ (15\ minute)}$ and adjusted as necessary for any annoying characteristics, shall not exceed the *rating background level*[1] by more than 5dB(A). The intrusiveness criterion is summarised as follows.

$$L_{Aeq,\ 15\ minute}{}^{2} \leq \text{rating background noise level plus 5dB(A)}$$

Amenity Impacts

To protect residential amenity, the ambient noise level from industrial sources at any affected residence, measured as the L_{Aeq} parameter during the day, evening and night periods, should not exceed the *acceptable* levels defined in Table 2.1 of the INP. In this instance, the relevant limits are summarised in **Table 2**.

Table 2
Acceptable Noise Levels (Amenity Limits)

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A)	
			Acceptable	Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Industrial Premises	All	When in use	70	75

In general, the L_{Aeq} reading in each time period is a combination of *normal* ambient noises in the area plus the introduced noise emissions from plant which normally operates in each time period.

When the existing noise from industrial noise sources is close to the acceptable noise level, the INP requires that noise from new source(s) must be controlled to preserve the amenity of an area. New source(s) must be controlled depending on the level of existing noise. The adjustments in **Table 3** are to be made.

For large properties, the INP advises that compliance with noise limits are only required within 30m of the residence under assessment.

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[1] Rating background noise level is the background noise level to be used for assessment purposes. The rating background noise level is the overall single figure background noise level (L_{A90}) representing each assessment period (day/evening/night).

[2] $L_{Aeq,\ 15minute}$ is the equivalent or energy averaged A-weighted sound pressure level during a measurement period of 15 minutes.

Table 3
Modification to Acceptable Noise to Account for Existing Level of Industry Noise

Total existing L_{Aeq} noise level from industrial sources dB(A)	Maximum L_{Aeq} noise level for noise for new sources alone dB(A)
≥ ACCEPTABLE NOISE LEVEL PLUS 2	If the existing noise level is *likely* to decrease in future: acceptable noise level minus 10 If existing noise level is *unlikely* to decrease in future: existing level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level
Source: INP (Table 2.2)	

Sleep Interference Levels

Assessment of sleep interference by intermittent noise is required under the INP between the hours of 10:00pm to 7:00am. For the Project, the activities occurring during this time would be dredging, and processing. Neither of these generate intermittent noise, only continuous noise which has been assessed using the amenity and intrusive noise criteria.

5.3 Transport Noise

Noise emissions from the realigned Altona Drive and Crescent Street are assessed against the NSW EPA Environmental *Noise Management: Environmental Criteria for Road Traffic Noise* (ECRTN).

Section 2 of the Policy outlines criteria to be used in specific applications. In this case, there are two distinct aspects of truck noise impacts, namely:

- noise emissions from Altona Drive and Crescent Street; and
- additional noise impact from the introduction of additional trucks onto Tweed Coast Road.

Altona Drive and Crescent Street

Section 2.2 of the ECRTN states that '*some industries (such as mines and extractive industries) are, by necessity, in locations that are often not served by arterial roads. Heavy vehicles must be able to get to their bases of operation, and this may mean travelling on local roads. Good planning practice recognises that we must acknowledge this type of road use and develop ways of managing any associated adverse impacts. To this end, the concept of*

'principal haulage routes' has been endorsed by the Department of Urban Affairs and Planning's North Coast Extractive Industries Standing Committee. Ways of identifying 'principal haulage routes' and managing associated adverse impacts have not yet been fully defined. Where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for collector roads, recognising the intent that they carry a different level and mix of traffic to local roads'.

Therefore, the noise criteria for a *New Collector Road corridor* presented in Table 1 of the ECRTN have been applied to traffic on Altona Drive and Crescent Street. In accordance with these criteria, the following limits should desirably be met at any residence affected by all traffic travelling along the road:

Day (7am-10pm)	$L_{Aeq(1hr)}$ 60dB(A)
Night (10pm-7am)	$L_{Aeq(1hr)}$ 55dB(A)

Tweed Coast Road

On Tweed Coast Road, the Project would add additional traffic to the existing level of traffic. Therefore assessment has been made against Criterion 8 of the ECRTN: *Land use developments with potential to create additional traffic on Collector Road*.

For additional traffic arising from a development, Criterion 8 requires that noise emissions from a particular road must not increase by more than 2dB(A).

6 EXISTING AMBIENT NOISE LEVELS

6.1 Introduction

Ambient noise levels have been measured using a combination of unattended noise logging over a 7-day period and by attended noise measurements to identify existing noise sources and noise levels around the Project Site.

6.2 Unattended Noise Logging

Unattended noise logging was carried out at four locations (Receptors G, DD, F and B) surrounding the Project Site. The locations were selected to represent the nearest and most potentially affected non-Project related residences and to characterise the varying noise environment around the extraction sites. The locations of the unattended noise logging are indicated on **Figure 3** and are described as follows.

Receptor G – Residence - 216 Tweed Coast Road

The instrumentation used at this location was:

- ARL Pty Ltd - Environmental Logger Type EL-215 (SN 194650)

The noise logger was located approximately 2m from the southern boundary of the residence approximately 25m from the edge of Tweed Coast Road a distance comparable from the façade of the residence to Tweed Coast Road. The microphone was positioned in a free field arrangement approximately 1.4m above ground level. This location was also selected to record the levels of traffic noise currently experienced at the residence.

Receptor DD – Residence - 34A Crescent Street

The instrumentation used at this location was:

- ARL Pty Ltd - Environmental Logger Type EL-315 (SN 15299451)

The location of the noise logger was adjoining the south-facing lower balcony of the residence. The logger was located at ground level. The microphone was positioned in a free field arrangement at a height of 1.4m above ground level. The logger was approximately 3m from the façade of the residence.

Receptor F – Residence - 64 John Robb Way

The instrumentation used at this location was:

- ARL Pty Ltd - Environmental Logger Type EL-215 (SN 194629)

The noise logger was located on the rear balcony of the residence approximately 1m above ground level (microphone height 2.5m).

Receptor B – Residence - Lot 1 Collier Street, Cudgen

The instrumentation used at this location was:

- ARL Pty Ltd - Environmental Logger Type EL-215 (SN 194649).

At this site, the logger was located approximately 20m to the east of the residence at ground level. The microphone was positioned in a free field arrangement at approximately 1.5m above ground level.

Receptor O – Residence – Lot 2 DP 701967_Cudgen Road, Cudgen

No noise measurements were carried out at Receptor O for two reasons, namely:

i) due to the influence of the existing sand extraction to the north of the location (Hanson Tweed Sand); and

(ii) because Receptor B was considered to be representative of the ambient noise levels at Receptor O.

Development Consent (DA 152-6-2005) has been issued for the expansion of Hanson Tweed Sand operation. Development Consent has been issued for 30 years with a total approved extraction volume of 4 500 000m^3 and a maximum extraction rate of 150 000m^3pa.

Assessment of the existing background noise levels and noise impact from the approved operations at Hanson Tweed Sand was assessed by James Heddle Acoustical Consultants in May 2005. The James Heddle report indicated that noise emissions from the expanded operations at Receptor O would be between 40dB(A) and 45dB(A) L_{Aeq} during the daytime period depending on wind and where equipment is located. This predicted level of industrial noise has been used to calculate the amenity noise limit.

The James Heddle Report also provided Intrusive noise criteria for this location. The noise criteria have been based upon background noise data from a logger placed at the north-eastern corner of the Tweed Surf and Sand site (approximately perpendicular to the end of Altona Drive at a distance of 1 150 metres from Receptor O). It is considered that the location of the logger is not representative of the background noise levels which would occur at Receptor O. Therefore, the noise assessment has been conducted using noise logging data from Receptor B.

Continuous noise logging at Receptors G, DD, F and B was carried out over a 7-day period, from approximately 4:00pm on Tuesday 16th August 2005 to approximately 2:30pm Tuesday 23rd August 2005. During this period, noise level statistics were gathered over consecutive 15 minute intervals at each location.

Noise level measurements were carried out in accordance with AS 1055-1997.1, *Acoustics - Description and Measurement of Environmental Noise*. Weather conditions throughout the measurement period were mostly fine and clear with mostly southeasterly winds.

The meteorological observations for the duration of the noise logging were obtained for the nearest permanent monitoring location at Coolangatta Airport which is approximately 10km from the Project Site. These data are included in **Appendix A**. There was no rain recorded during the period of unattended noise logging.

For the Coolangatta Airport, the wind observations recorded during the period of noise logging had a statistical distribution similar to, if not slightly calmer than the prevailing winds for the month of August shown in **Appendix A**. These observations from Coolangatta Airport are from a height of 10m above ground level. For the open country at the Project Site, the wind speed at the height of the noise loggers would be approximately 20% lower than at 10m above ground level (logarithmic wind speed profile and a terrain constant of 0.12).

Where the wind speed was greater than 5m/s, data has been excluded from the analysis in accordance with the INP. The total number of observations excluded was approximately 8%.

For the duration of the unattended noise logging, there was no construction activity at the site of the new sewage treatment plant which is to be located immediately west of the proposed processing area.

The measured ambient noise levels derived from the noise logging are summarised in **Tables 4** to **Table 11** in accordance with the requirements of the INP.

Table 4
Existing Background Noise Levels – Receptor G

Date	L_{A90}[3] Parameter (dB(A)) (Lower 10th-Percentile Level)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Tuesday, 16 August 2005	53	40	38
Wednesday, 17 August 2005	52	42	40
Thursday, 18 August 2005	51	44	41
Friday, 19 August 2005	48	42	32
Saturday, 20 August 2005	47	38	31
Monday, 22 August 2005	48	42	37
Tuesday, 23 August 2005	51	-	-
(Median of Results) **Rating Background Noise Level**	**51**	**42**	**38**

Table 5
Existing Equivalent (L_{Aeq}) Noise Levels – Receptor G

Date	L_{Aeq}[4] Parameter (dB(A)) (Logarithmic Average of all measurement data)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Existing Level	**62**	**59**	**56**

At Receptor G, the existing L_{Aeq} noise levels were almost entirely dominated by traffic noise from Tweed Coast Road. No noise from industry was audible or measurable at the location.

Table 6
Existing Background Noise Levels – Receptor DD

Date	L_{A90} Parameter (dB(A)) (Lower 10th-Percentile Level)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Tuesday, 16 August 2005	42	38	34
Wednesday, 17 August 2005	42	41	38
Thursday, 18 August 2005	36	44	42
Friday, 19 August 2005	49	45	33
Saturday, 20 August 2005	44	41	29
Monday, 22 August 2005	44	42	36
Tuesday, 23 August 2005	36	-	-
(Median of Results) **Rating Background Noise Level**	**42**	**41**	**35**

[3] L_{A90} corresponds to the A-weighted sound pressure level which is exceeded for 90% of the time. This parameter is used to measure the background noise level.
[4] L_{Aeq} corresponds to the equivalent or energy-averaged level.

Table 7
Existing Equivalent (LAeq) Noise Levels – Receptor DD

Date	L_{Aeq} Parameter (dB(A)) (Logarithmic Average of all measurement data)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Existing Level	**55**	**49**	**45**

Like Receptor G, L_{Aeq} noise levels at Receptor DD, were almost entirely dominated by traffic noise from Tweed Coast Road. No noise from industry was audible or measurable at the location, with the exception of trucks from the existing Hanson Tweed Sand extraction operation travelling along Altona Drive and Crescent Street.

Table 8
Existing Background Noise Levels – Receptor F

Date	L_{A90} Parameter (dB(A)) (Lower 10th-Percentile Level)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Tuesday, 16 August 2005	43	37	35
Wednesday, 17 August 2005	42	38	35
Thursday, 18 August 2005	41	42	40
Friday, 19 August 2005	40	44	36
Saturday, 20 August 2005	46	40	35
Monday, 22 August 2005	39	41	37
Tuesday, 23 August 2005	42		
(Median of Results) **Rating Background Noise Level**	**42**	**40**	**35**

Table 9
Existing Equivalent (LAeq) Noise Levels – Receptor F

Date	L_{Aeq} Parameter (dB(A)) (Logarithmic Average of all measurement data)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Existing Level	**58**	**58**	**47**

The L_{Aeq} noise levels at Receptor F, were dominated by traffic noise from Tweed Coast Road.

Table 10
Existing Background Noise Levels – Receptor B

Date	L_{A90} Parameter (dB(A)) (Lower 10th-Percentile Level)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Tuesday, 16 August 2005	41	37	37
Wednesday, 17 August 2005	42	38	39
Thursday, 18 August 2005	40	41	42
Friday, 19 August 2005	43	42	33
Saturday, 20 August 2005	43	35	31
Monday, 22 August 2005	40	40	36
Tuesday, 23 August 2005	40	-	-
(Median of Results) **Rating Background Noise Level**	**41**	**39**	**37**

Table 11
Existing Equivalent (L_{Aeq}) Noise Levels – Receptor B

Date	L_{Aeq} Parameter (dB(A)) (Logarithmic Average of all measurement data)		
	Day 7am – 6pm	***Evening*** 6pm – 10pm	***Night*** 10pm – 7am
Existing Level	**55**	**47**	**48**

Receptor B is the closest assessment location for the Proponent's proposal to the Hanson Tweed Sand extraction operation. Noise from the sand extraction operation was not audible or measurable during site visits. According to the occupier of this residence, noise from the existing sand extraction operation is not audible in proximity of his residence. Only trucks travelling along Altona Drive are audible.

The daily noise level traces recorded during background measurements are displayed in **Appendix B**.

6.3 Attended Ambient noise measurements

A series of attended ambient noise level measurements were also carried out during the daytime of Tuesday 23rd August 2005 to establish noise sources at each noise logging location. Measurements were made over a period of 15 minutes.

Test instrumentation consisted of the following.

- Precision sound level meter, Rion NA-27 (S/N 00380650).
- Acoustical Calibrator, Bruel & Kjaer Type 4231 (S/N 1897734).
- Tripod and accessories.

The measurement locations are shown on **Figure 3**. Test conditions were fine and clear with an ambient temperature of 20°C and a light southeasterly breeze. The results are presented in **Table 12**.

Table 12
Results of Attended Noise Measurements – 23/08/05

Receptor / Time	Noise Level (dB(A))			Comments
	L_{A10}[5]	L_{Aeq}	L_{A90}	
Receptor G 14:46pm	66	63	53	Traffic noise from Tweed Coast Road
Receptor DD 14:26pm	53	53	44	Breeze in trees, distant traffic, distant construction noise, dog barking
Receptor F 13:42pm	57	54	44	Dog barking, overflying aircraft, breeze, local cars
Receptor B 14:03pm	55	51	43	Breeze through wind break, distant construction noise, distant traffic noise

All the L_{A90} levels recorded during the attended measurements were 1dB(A) to 2dB(A) above the unattended levels whilst the $L_{Aeq\ (15\ minute)}$ levels were generally slightly below the unattended levels.

6.4 Attended Pilot Dredge Noise Measurements

Between 19 April 2006 and 12 July 2006, the initial dredge pond was established within the approved extraction area under DA96/518. A series of noise measurements were conducted around the dredge. The purpose of these measurements was to establish the effects of the ground attenuation at the site, directional effects of the dredge and to establish the actual noise levels likely to be received at the residences surrounding the Project Site.

Test instrumentation consisted of the following.

- Precision sound level meter, Rion NA-27 (S/N 00380650).
- Acoustical Calibrator, Bruel & Kjaer Type 4231 S/N 1897734).
- Tripod and accessories.

The results are presented in **Table 13**. The 12 O'clock position was at the front of the dredge.

Table 13
Results of Attended Noise Measurements – 24/04/06

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Location / Time	L_{Aeq}	L_{A90}	Comments
Dredge @ 33 m 3 O'clock Position 11:57am	68	-	-
Dredge @ 25 m 6 O'clock Position 12:00pm	75	-	Clear view into engine housing
Dredge @ 30 m 7:30 O'clock Position 12:02pm	73	-	View into engine housing
Dredge @ 40 m 9 O'clock Position 12:03pm	68	-	-

[5] L_{A10} corresponds to the A-weighted sound pressure level which is exceeded for 10% of the time.

Table 13 (Cont'd)
Results of Attended Noise Measurements – 24/04/06

Location / Time	L_{Aeq}	L_{A90}	Comments
Dredge @ 25 m 12 O'clock Position 12:05pm	69	-	-
Dredge @ 50 m 6 O'clock Position 12:09pm	63	62	-
Dredge @ 100 m 6 O'clock Position 12:09pm	56	53	-
Dredge @ 150 m 6 O'clock Position 12:22pm	53	52	-
Dredge @ 200 m 6 O'clock Position 12:25pm	50	48	-
Dredge @ 300 m 6 O'clock Position 12:30pm	48	46	-

The pilot dredge was not audible at Receptors G, DD and F. At Receptor B4, it was only just occasionally audible, but not measurable above the background noise level and traffic noise from Tweed Coast Road.

7 NOISE LIMITS

7.1 Intrusive Noise Limits

The Rating Background Noise Levels have been determined from the noise logging recorded in **Tables 4, 6, 8, and 10**. As the Project would operate between 6:30am and 7:00am, this period has been assessed in accordance with the INP as a shoulder period. The resulting intrusive noise limits at the nearest noise sensitive receiver locations are summarised in **Table 14**.

Table 14
Intrusive Noise Criteria

Receptor	Period	Rating Background Noise Level, (LA90 dB(A))	Intrusive Noise Limit, LAeq, 15 min dB(A)
G	Day (7am – 6pm)	51	56
DD		42	47
F		42	47
B & O		41	46
G	Evening (6pm – 10pm)	42	47
DD		41	46
F		40	45
B & O		39	44

Table 14 (Cont'd)
Intrusive Noise Criteria

Receptor	Period	Rating Background Noise Level, (LA90 dB(A))	Intrusive Noise Limit, LAeq, 15 min dB(A)
G	Night (10pm – 6am)	38	43
DD		35	40
F		35	40
B & O		37	42
G	Shoulder Period (6am-7am)	44	49
DD		38	43
F		38	43
B & O		39	44

7.2 Noise Amenity Limits

To limit continuing increases of industrial noise levels, the INP sets upper limits on the total noise emission received at sensitive locations from industrial noise. The upper limits for receivers are shown in **Table 2**.

Where the existing noise levels from industrial noise are close to the acceptable level, the INP requires that adjustments be made to ensure that acoustical amenity is protected. The adjustments are shown in **Table 3**.

From the results of noise logging, the existing L_{Aeq} noise levels have been determined and are shown in **Tables 5, 7, 9 and 11** for each of the four locations. All receivers are considered to be Suburban as at all locations, there are other residences in close proximity.

As discussed in Section 6, it is considered that the most significant contributor to the L_{Aeq} noise level at the locations of the loggers is road traffic noise, overflying aircraft, wind in vegetation and animals.

The nearest source of industrial noise to the Project Site is the existing Hanson Tweed Sand extraction operation to the west, located over 800m from the nearest noise logger location (Receptor B) and 250m from Receptor O. In the future, there will also be the new waste water treatment plant to the northwest of the Project Site. Waste water treatment plants by their nature do not emit significant levels of noise and no account has therefore been made of its contribution.

The contribution of the existing Hanson Tweed Sand extraction operation to the L_{Aeq} noise level at a distance of 800m is considered to be negligible. It was not audible or measurable during any site visit and the occupier of Receptor B reported it to be inaudible in the proximity of his residence. As other noise measurements positions are all further removed than Receptor B (with the exception of Receptor O), it has been assumed that there is no contribution from industrial sources. At Receptor O, the Amenity Noise limits have been calculated assuming the noise levels predicted by James Heddle for the adjoining operation.

Even though Receptor B is effectively absent of existing industrial noise and traffic noise, the measured L_{Aeq} noise levels attributable to a range of non-extraction related sources exceed the acceptable noise levels in the INP. From attended noise measurements at Receptor B, this is due to breeze through the windbreak and from activity on the site (working farm). At this location, the acceptable noise levels have therefore been applied without correction.

Receptor G is in close proximity to Tweed Coast Road, where the L_{Aeq} (due to traffic noise) was more than 10dB(A) above the acceptable noise level. From **Table 3** and in accordance with Section 2.2.3 of the INP, the noise limit for Receptor G has been set at the $L_{Aeq,(traffic)}$ minus 10dB(A).

Based on the criteria in **Table 1**, the amenity noise limits in **Table 15** are applicable for the Project.

Table 15
Amenity Noise Criteria

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Noise Limit
			$L_{Aeq, period}$
Residence	Suburban	Day	Receptor G – 55dB(A) Receptor DD – 55dB(A) Receptor F – 55dB(A) Receptor B – 55dB(A) Receptor O – 55dB(A)
		Evening	Receptor G – 49*dB(A) Receptor DD – 45dB(A) Receptor F – 48*dB(A) Receptor B – 45dB(A) Receptor O – 45dB(A)
		Night	Receptor G – 46*dB(A) Receptor DD – 40dB(A) Receptor F – 40dB(A) Receptor B – 40dB(A) Receptor O – 40dB(A)
		Shoulder Period 6am-7am	Receptor G – 50dB(A) Receptor DD – 48dB(A) Receptor F – 48dB(A) Receptor B – 48dB(A) Receptor O – 48dB(A)
Industrial Premises	All	When in use	70dB(A)

*Adjusted in accordance with INP Section 2.2.3.

7.3 Project Specific Noise Criteria

The Intrusive Noise Criteria and Amenity Noise Criteria have been determined from the noise logging recorded and resulting criteria are shown in **Table 14** and **Table 15** respectively. From these criteria the Project Specific Noise Criteria have been established. The resulting and most stringent limits at the nearest noise sensitive receivers locations have been determined as shown **Table 16**.

Table 16
Project Specific Noise Criteria

Receptor	Period	Intrusive Noise Limit, $L_{Aeq,\ 15\ min}$ dB(A)	Amenity Limit $L_{Aeq,\ period}$ dB(A)	Project Specific Limits
G	Day	56	55	55dB(A) $L_{Aeq,\ period}$
DD		47	55	47dB(A) $L_{Aeq,\ 15\ min}$
F		47	55	47dB(A) $L_{Aeq,\ 15\ min}$
B		46	55	46dB(A) $L_{Aeq,\ 15\ min}$
O		46	55	46dB(A) $L_{Aeq,\ 15\ min}$
G	Evening	47	49	47dB(A) $L_{Aeq,\ 15\ min}$
DD		46	45	45dB(A) $L_{Aeq,\ period}$
F		45	48	45dB(A) $L_{Aeq,\ 15\ min}$
B		44	45	44dB(A) $L_{Aeq,\ 15\ min}$
O		44	45	44dB(A) $L_{Aeq,\ 15\ min}$
G	Night	43	46	43dB(A) $L_{Aeq,\ 15\ min}$
DD		40	40	40dB(A) $L_{Aeq,\ 15\ min}$
F		40	40	40dB(A) $L_{Aeq,\ 15\ min}$
B		42	40	42dB(A) $L_{Aeq,\ period}$
O		42	40	40dB(A) $L_{Aeq,\ period}$
G	Shoulder Period (6am-7am)	49	50	49dB(A) $L_{Aeq,\ 15\ min}$
DD		43	48	43dB(A) $L_{Aeq,\ 15\ min}$
F		43	48	43dB(A) $L_{Aeq,\ 15\ min}$
B		44	48	44dB(A) $L_{Aeq,\ 15\ min}$
O		44	48	44dB(A) $L_{Aeq,\ 15\ min}$

7.4 Construction Noise Criteria

As discussed during Section 5.1, it is proposed to apply construction noise criteria to the construction activities during the site establishment phase of the Project. These are shown in **Table 17**.

Table 17
Construction Noise Criteria

Receptor	Period	Rating Background Noise Level, (L_{A90} dB(A))	Construction Noise Limits
G	Day	51	61dB(A) $L_{Aeq,\ 15\ min}$
DD		42	52dB(A) $L_{Aeq,\ 15\ min}$
F		42	52dB(A) $L_{Aeq,\ 15\ min}$
B		41	51dB(A) $L_{Aeq,\ 15\ min}$
O		41	51dB(A) $L_{Aeq,\ 15\ min}$

8 NOISE MODELLING METHODOLOGY

8.1 Software

Noise emissions from the Project Site have been predicted using the SoundPlan™ computer program. SoundPlan is an integrated software package for noise and air pollution evaluation developed in Germany by Braunstein + Berndt GmbH. It has been configured to predict the noise emissions from the Project Site using the CONCAWE algorithms.

The CONCAWE methods were developed under funding from European and North American groups to quantify noise prediction procedures for emission from large industrial facilities such as oil refineries and petrochemical plants. The methods were first published in 1981 in research paper entitled *The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities.*

Both SoundPlan and the CONCAWE algorithms have had widespread application and acceptance throughout Australia.

8.2 Noise Modelling Scenarios

The Project would be developed in a number of sequenced sand extraction stages. The sand extraction stages have been described by R.W. Corkery & Co. Pty Limited for the purpose of this analysis. R.W. Corkery & Co. Pty Limited has also provided the locations and types of equipment for the purpose of noise predictions. Five possible scenarios have been modelled, one during site establishment and four during site operations.

1. Scenario 1 – Site Establishment (**Figure 4**).
   - Placement of cutter suction dredge within initial dredge pond using a crane.
   - Enlargement of the southern extraction pond using the cutter suction dredge.
   - Stripping of topsoil and formation of bunding using swamp dozer and elevating scraper.
   - Laying of pipelines using road trucks and front-end loader.
   - Formation of processing area base and bunding using swamp dozer.
   - Formation of access roads using grader.
   - Placement of processing equipment using crane.
   - Formation of Initial Western Excavation Pond using 30t excavator.
2. Scenario 2A – Operations - Extraction and Processing – Stages 1 to 4 and A to D (**Figure 5**).
   - Dredging of sand from southern extraction site to processing area and refuelling of the dredge using fuel tanker.
   - Excavation of loamy sand from southern extraction site and sand from northern extraction site using 30t excavators and / or swamp dozers.
   - Transport of sand from northern extraction site to processing area using haul trucks.

- Processing of sand, loamy sand and VENM using the wash plant and multipurpose plant.
- Delivery and handling of VENM material to southern extraction site using road trucks.
- Handling and loading of sand products using front-end loader.
- Transport of products via Altona Drive.

3. 2B – Operations - Extraction and Processing – Stages 8 to 10 (**Figure 5**).
   - Operations would be the same as described for Stage 2A, however, extractive operations within the northern extraction site would have ceased and the northern extraction pond would be progressively backfilled with VENM.
4. Scenarios 3A – Operations - Pumping to Fill Sites and Processing – Stages 1 to 4 and A to D (**Figure 6**).
   - Processing of sand, loamy sand and VENM using multipurpose plant.
   - Dredging of sand from the southern extraction site to the fill sites utilising onsite booster pump.
   - Excavation of sand form the northern extraction site and transport to the processing area using a 30t excavator and haul trucks.
   - Delivery and handling of VENM material to southern extraction site using road trucks.
   - Handling and loading of sand products using front-end loader.
   - Transport of products via Altona Drive.
5. Scenarios 3B – Operations - Pumping to Fill Sites and Processing – Stages 8 to 10 (**Figure 6**).
   - Operations would be the same as described for Stage 3A, however, extractive operations within the northern extraction site would have ceased and the northern extraction pond would be progressively backfilled with VENM.

Scenario 1 has also been divided into Scenarios A, B and C to represent the locations of various equipment.

Scenarios 2A to 3B have been subdivided further into day and evening periods and early morning shoulder periods. During the evening period and early morning, only the dredge and processing plant would operate.

The locations of equipment used in noise modelling are shown on **Figures 4** to **6**.

8.3 Atmospheric Effects

Inversions

The INP requires that the effect of inversions be considered between the hours of 10:00pm – 7:00am. The only proposed operations during this time would occur between the hours of 6:30am and 7:00am.

The likelihood and frequency of inversion conditions during this time are unknown for the site. The nearest permanent meteorological station to the site is located at Coolangatta Airport which is approximately 10km north of the Project Site. From discussions with the Department of Environment and Conservation (DEC) (now Department of Environment and Climate Change) it would be unrealistic to rely on meteorological observations at this distance. Therefore a screening test has been conducted.

Initial screening tests recommended by the INP are to consider if inversion conditions are significant for a Project. In this case, the only relevant period is between 6:30am and 7:00am. This initial screening test has been conducted in accordance with the INP.

The Project Site has a rainfall greater than 500mm per annum and the receivers are located above or approximately level with the noise sources on the site. Given these parameters, Appendix C of the INP indicates that assessment should be made for an F-class inversion (3ºC/100m) without source to receiver drainage winds i.e. calm.

Wind Effects

The INP requires that noise levels enhanced by wind need to be considered when wind speeds of 3m/s (11km/h) or below occur $\geq$30 percent of the time in any assessment period blowing from source to receiver.

Wind analysis tables from the Bureau of Meteorology for Coolangatta are included in **Appendix A.** The tables show instantaneous observations for single periods. These observations show that wind speeds up to 3m/s are dominated by winds from the south and southwest. In terms of source to receiver wind conditions (N and NW) the maximum number of observations is 5 percent during the month of October.

From discussions with the, then, DEC, half hourly observations over an extended period would be required to evaluate if 30 percent or more of each assessment period would be warranted. Such observations would also be need to be closer to the site than Coolangatta Airport to provide accurate guidance. In the absence of this data, the default wind speed of 3m/s recommended by the INP has been adopted for the purposes of this assessment.

Atmospheric Modelling Assumptions

Calculations for the day period have been carried out assuming a temperature of 20ºC and 70% humidity and an atmospheric stability category of A which relates to conditions that occur on a sunny day with light winds.

Predictions for the evening period have been carried out assuming a temperature of 15ºC and 80% humidity and an atmospheric stability category of B.

Wind effects of 3m/s source to receiver have been assumed for all periods except for the early morning shoulder periods.

During the early morning shoulder period, modelling has assumed 10ºC and 80% humidity and an atmospheric stability category of B. Modelling of inversions has used the same temperature and humidity with F- Class Stability. Given the height differences between receivers and sources no drainage flows have been considered.

8.4 Noise Emission Data for Proposed Equipment

Ron Rumble Pty Ltd has collected various noise data associated with earthmoving equipment in the southeast Queensland area and northern New South Wales over many years. These data have been collected into a data file which is used for the assessment of various earthmoving activities. The data file includes results of tests conducted to AS2012.1-1990[6]. This Code provides a maximum sound power level for the machine working at full capacity. The actual noise emissions are generally lower due to cycling of the machine and changing orientation.

A series of noise measurements has also been carried out in conjunction with Neumann Contractors who undertook preparatory works for the approved operations under DA 96/518.

Data applicable to actual machine operations are presented in **Table 18**.

Table 18
Sound Power Levels for Earthmoving and Related Equipment

Plant Item	Sound Power Level (L_{WA})	Assumed Source Height (m AGL[#])
(i) Cat Excavator 325 (30t)	97dB(A)($_w$)	2.5
(ii) Cat D6 Bulldozer or Swamp Bulldozer	107dB(A)($_w$)	2.5
(iii) Cat 615 Elevated Scraper	111dB(A)($_w$)	2.5
(iv) Cat 950 Front-end Loader	105dB(A)($_w$)	2.5
(v) Mini Tanker	100dB(A)($_w$)	2.5
(vi) On-road Truck (15m^3 total capacity) (on Altona Drive)	108dB(A)($_w$)	2.5
(vii) Off-road Truck (15m^3 total capacity) (moving on the site for 4 minutes in every 15 minutes)	102dB(A)($_w$)	2.5
(viii) 300mm Suction Dredge (Neumann Unit 3008) (HP 500 / 700 / 1 000)	105dB(A)($_w$) (operated at 1500rpm)	2.5
(ix) Booster Pump Stations (Neumann Unit 3773)	101dB(A)($_w$)	2.5
(x) Multipurpose Plant and Wash Plant (Combined)	114dB(A)($_w$)	3.0
(xi) Grader	106dB(A)($_w$)	2.5
(xi) Medium Sized Crane	100dB(A)($_w$)	2.5
[#] Above Ground Level		

[6] AS2012.1-1990 "Acoustics – Measurement of Airborne Noise Emitted by Earthmoving Machinery and Agricultural Tractors – Stationary Test, Part 1 : *Determination of Compliance with the Limits for Exterior Noise*

Due to the plant possibly being orientated in any direction, no directivity information has been included in the noise modelling except where identified in **Section 11**.

9 PREDICTED NOISE LEVELS

9.1 Predicted Noise Emissions from the Extraction Site - Unattenuated

Using the data in **Table 18**, the likely noise emissions **without** additional (ie. non-standard) attenuation measures have been calculated for each of the scenarios at the five locations selected to represent the potentially worst affected residences in each specific area.

The calculations have included:

- the distance to the nominated residence;
- screening attenuation (where applicable) including air and ground absorption and barrier effects from bunds, walls and topography; and
- atmospheric conditions as described in **Section 8.3**.

The results of the calculations are presented in **Tables 19** to **26**.

10 ASSESSMENT OF NOISE EMISSIONS

10.1 Discussion of Modelling Results without Attenuation

The following subsection assesses the predicted noise emissions **prior to** the use of any additional attenuation measures. An assessment of noise emission levels following attenuation is provided in Section 11.

Scenario 1A, 1 B & 1C

Results are shown in **Tables 19, 20 and 21**. For all of these scenarios, noise emissions from the proposed development are predicted to comply with the construction noise limits at all locations, including the default downwind condition of 3m/s.

Scenario 2A

Scenario 2A represents noise emissions during early extraction stages (ie. Stages 1 to 4) with sand being pumped to the processing area. Results are shown in **Table 22**. Compliance with the noise criteria would be achieved at all locations under calm conditions during the evening and during the early morning shoulder period of 6:30am to 7:00am.

Table 19
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 1A

Source	Predicted Noise Levels	
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))
Receptor G - 216 Tweed Coast Rd		
1 300mm Cutter Suction Dredge	22.9	29.9
2 D6 Swamp Dozer	24.8	31.8
3 950 FEL	25.4	31.8
4 Road Truck for Pipes	22	28.5
5 Crane	18.8	25.6
6 Elevating Scraper	28.7	35.7
7 Grader	27.1	33.4
8 30t Excavator	19.2	25.3
TOTAL	**33.8**	**40.5**
Construction Noise Limit	**61**	**61**
Compliant	**Yes**	**Yes**
Receptor DD - 34A Crescent St		
1 300mm Cutter Suction Dredge	10.7	17
2 D6 Swamp Dozer	11.9	18.4
3 950 FEL	27.5	33.6
4 Road Truck for Pipes	21	27
5 Crane	6.5	12.5
6 Elevating Scraper	15.9	22.4
7 Grader	26.8	33.3
8 30t Excavator	16.9	23.6
TOTAL	**31.1**	**37.4**
Construction Noise Limit	**52**	**52**
Compliant	**Yes**	**Yes**
Receptor F - 64 John Robb Way		
1 300mm Cutter Suction Dredge	26.7	31.8
2 D6 Swamp Dozer	27.9	33.1
3 950 FEL	27	31.9
4 Road Truck for Pipes	24.3	29.1
5 Crane	22.5	27.3
6 Elevating Scraper	31.5	36.8
7 Grader	26.9	32.1
8 30t Excavator	17.5	22.7
TOTAL	**36.0**	**41.2**
Construction Noise Limit	**52**	**52**
Compliant	**Yes**	**Yes**
Receptor B - Lot 1 Collier St		
1 300mm Cutter Suction Dredge	38.7	39.3
2 D6 Swamp Dozer	39.8	40.5
3 950 FEL	37.6	38.4
4 Road Truck for Pipes	35.6	36.2
5 Crane	35.2	35.4
6 Elevating Scraper	43	43.9
7 Grader	35.6	37
8 30t Excavator	24.8	26.7
TOTAL	**47.3**	**48.1**
Construction Noise Limit	**51**	**51**
Compliant	**Yes**	**Yes**
Receptor O – Lot 2 Cudgen Road		
1 300mm Cutter Suction Dredge	27.8	34.2
2 D6 Swamp Dozer	28.2	35.1
3 950 FEL	22.7	29.9
4 Road Truck for Pipes	20.7	27.7
5 Crane	20.9	27.5
6 Elevating Scraper	32.2	39.1
7 Grader	21.4	29.1
8 30t Excavator	11	18.9
TOTAL	**35.4**	**42.3**
Construction Noise Limit	**51**	**51**
Compliant	**Yes**	**Yes**

Table 20
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 1B

Source	Predicted Noise Levels	
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))
Receptor G - 216 Tweed Coast Rd		
1 300mm Cutter Suction Dredge	22.9	29.9
2 D6 Swamp Dozer	26.8	33.5
3 950 FEL	39.3	42.4
4 Road Truck for Pipes	39.8	42.1
5 Crane	35.7	38.5
6 Elevating Scraper	31	37.5
7 Grader	21.6	29.1
8 30t Excavator	19.2	25.3
TOTAL	**43.8**	**47.0**
Construction Noise Limit	**61**	**61**
Compliant	**Yes**	**Yes**
Receptor DD - 34A Crescent St		
1 300mm Cutter Suction Dredge	10.7	17
2 D6 Swamp Dozer	26.2	33.1
3 950 FEL	37	40.9
4 Road Truck for Pipes	34.7	38.4
5 Crane	34.9	38.1
6 Elevating Scraper	30	36.9
7 Grader	18.6	25.9
8 30t Excavator	16.9	23.6
TOTAL	**41.0**	**45.2**
Construction Noise Limit	**52**	**52**
Compliant	**Yes**	**Yes**
Receptor F - 64 John Robb Way		
1 300mm Cutter Suction Dredge	26.7	31.8
2 D6 Swamp Dozer	26.4	32
3 950 FEL	37	39.4
4 Road Truck for Pipes	35.8	37.8
5 Crane	34.9	36.6
6 Elevating Scraper	30.2	35.8
7 Grader	23.1	29.2
8 30t Excavator	17.5	22.7
TOTAL	**41.5**	**44.3**
Construction Noise Limit	**52**	**52**
Compliant	**Yes**	**Yes**
Receptor B - Lot 1 Collier St		
1 300mm Cutter Suction Dredge	38.7	39.3
2 D6 Swamp Dozer	34.7	36.6
3 950 FEL	42.7	42.5
4 Road Truck for Pipes	39.5	39.4
5 Crane	38.8	38.5
6 Elevating Scraper	38.1	40.2
7 Grader	32.2	34.5
8 30t Excavator	24.8	26.7
TOTAL	**47.3**	**47.8**
Construction Noise Limit	**51**	**51**
Compliant	**Yes**	**Yes**
Receptor O – Lot 2 Cudgen Road		
1 300mm Cutter Suction Dredge	27.7	34.2
2 D6 Swamp Dozer	21.5	29.4
3 950 FEL	22	29.3
4 Road Truck for Pipes	18.7	26.1
5 Crane	17.3	24.6
6 Elevating Scraper	25.2	33.1
7 Grader	24.8	32.3
8 30t Excavator	11	18.9
TOTAL	**32.2**	**39.5**
Construction Noise Limit	**51**	**51**
Compliant	**Yes**	**Yes**

Table 21
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 1C

Source	Predicted Noise Levels	
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))
Receptor G - 216 Tweed Coast Rd		
1 300mm Cutter Suction Dredge	22.8	29.9
2 D6 Swamp Dozer	26.8	33.5
5 Crane	20.9	27.2
6 Elevating Scraper	31	37.5
7 Grader	48.9	50
8 30t Excavator	19.2	25.3
TOTAL	**49.0**	**50.4**
Construction Noise Limit	**61**	**61**
Compliant	**Yes**	**Yes**
Receptor DD - 34A Crescent St		
1 300mm Cutter Suction Dredge	10.6	16.9
2 D6 Swamp Dozer	26.2	33.1
5 Crane	19.8	26.6
6 Elevating Scraper	30	36.9
7 Grader	37.8	41.7
8 30t Excavator	16.9	23.6
TOTAL	**38.8**	**43.5**
Construction Noise Limit	**52**	**52**
Compliant	**Yes**	**Yes**
Receptor F - 64 John Robb Way		
1 300mm Cutter Suction Dredge	26.6	31.8
2 D6 Swamp Dozer	26.4	32
5 Crane	20.1	25.5
6 Elevating Scraper	30.2	35.8
7 Grader	40.9	42.6
8 30t Excavator	17.5	22.7
TOTAL	**41.6**	**44.1**
Construction Noise Limit	**52**	**52**
Compliant	**Yes**	**Yes**
Receptor B - Lot 1 Collier St		
1 300mm Cutter Suction Dredge	38.7	39.3
2 D6 Swamp Dozer	34.7	36.6
5 Crane	28.2	30
6 Elevating Scraper	38.1	40.2
7 Grader	42.5	42.5
8 30t Excavator	24.8	26.7
TOTAL	**45.5**	**46.3**
Construction Noise Limit	**51**	**51**
Compliant	**Yes**	**Yes**
Receptor O – Lot 2 Cudgen Road		
1 300mm Cutter Suction Dredge	27.8	34.2
2 D6 Swamp Dozer	21.5	29.4
5 Crane	14.6	22.4
6 Elevating Scraper	25.2	33.1
7 Grader	22.2	29.7
8 30t Excavator	11	18.9
TOTAL	**31.1**	**38.3**
Construction Noise Limit	**51**	**51**
Compliant	**Yes**	**Yes**

Table 22
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 2A

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor G - 216 Tweed Coast Rd							
1 300mm Cutter Suction Dredge	23.5	30.4	23.5	30.4	23.6	30.8	
2+3 Wash and Multi-Purpose	34.2	40.6	34.2	40.6	34.6	41	
4 950 Fel	24.9	31.5					
6 30ton Excavator	15.9	22.7					
7 Mini Tanker	19.1	25.8					
8 Road Truck (VENM)	21.2	27.9					
9 Road Truck Loamy Sand	21.4	28.1					
10 30t Excavator	34.5	36.9					
11 Haul Truck	27.2	32.5					
TOTAL	**38.4**	**43.5**	**34.6**	**41.0**	**34.9**	**41.4**	**6.5**
Project Specific Noise Limit	**55**	**55**	**47**	**47**	**49**	**49**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor DD - 34A Crescent St							
1 300mm Cutter Suction Dredge	11.6	17.5	11.6	17.5	11.2	17.7	
2+3 Wash and Multi-Purpose	33.2	39.9	33.2	39.9	33.5	40.3	
4 950 Fel	24.2	31					
6 30ton Excavator	3.7	9.6					
7 Mini Tanker	7	12.8					
8 Road Truck (VENM)	9	14.9					
9 Road Truck Loamy Sand	9.4	15.1					
10 30t Excavator	20.5	26.4					
11 Haul Truck	25	31					
TOTAL	**34.5**	**41.1**	**33.2**	**39.9**	**33.5**	**40.3**	**6.8**
Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor F - 64 John Robb Way							
1 300mm Cutter Suction Dredge	27.8	32.6	27.8	32.6	27.3	33	
2+3 Wash and Multi-Purpose	33.4	38.9	33.4	38.9	33.8	39.3	
4 950 Fel	24.4	29.9					
6 30ton Excavator	19.7	24.4					
7 Mini Tanker	23.2	27.8					
8 Road Truck (VENM)	24.7	29.5					
9 Road Truck Loamy Sand	25.3	29.9					
10 30t Excavator	23.1	27					
11 Haul Truck	25.3	29.9					
TOTAL	**36.6**	**41.7**	**34.5**	**39.8**	**34.7**	**40.2**	**5.5**
Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

Table 22 (Cont'd)
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 2A

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor B - Lot 1 Collier St							
1 300mm Cutter Suction Dredge	41	41.1	41	41.1	39.3	41.3	
2+3 Wash and Multi-Purpose	41.2	43.2	41.2	43.2	41.6	43.6	
4 950 Fel	32.4	34.4					
6 30ton Excavator	32.6	32.7					
7 Mini Tanker	36.4	36.4					
8 Road Truck (VENM)	37.4	37.6					
9 Road Truck Loamy Sand	38.2	38.3					
10 30t Excavator	27.1	28.5					
11 Haul Truck	33.3	34.3					
TOTAL	**46.9**	**47.7**	**44.1**	**45.3**	**43.6**	**45.6**	**2.0**
Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**	
Compliant	**No +0.9**	**No +1.7**	**No +0.1**	**No +1.3dBA**	**Yes**	**No +1.6**	
Receptor O – Lot 2 Cudgen Road							
1 300mm Cutter Suction Dredge	28.9	35.1	28.9	35.1	29	35.4	
2+3 Wash and Multi-Purpose	28.3	36.1	28.3	36.1	28.9	36.7	
4 950 Fel	19.5	27.3					
6 30ton Excavator	18.9	25.4					
7 Mini Tanker	21.8	28.2					
8 Road Truck (VENM)	22.9	29.5					
9 Road Truck Loamy Sand	23.1	29.5					
10 30t Excavator	10.7	18.6					
11 Haul Truck	17.3	25					
TOTAL	**33.5**	**40.4**	**31.6**	**38.6**	**32.0**	**39.1**	**7.1**
Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

Table 23
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 2B

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor G - 216 Tweed Coast Rd							
1 300mm Cutter Suction Dredge	34.5	38.8	34.5	38.8	34.7	39.0	
2+3 Wash and Multi-Purpose	34.2	40.6	34.2	40.6	34.6	41.0	
4 950 Front End Loader	25.1	31.6					
6 30t Excavator	25.6	30.1					
7 Mini Tanker	29.5	33.8					
8 Road Truck (VENM)	32.0	36.2					
9 Road Truck Loamy Sand	32.7	36.7					
TOTAL	**40.2**	**45.2**	**37.4**	**42.8**	**37.7**	**43.1**	**5.5**
Project Specific Noise Limit	**55.0**	**55.0**	**47.0**	**47.0**	**49.0**	**49.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor DD - 34A Crescent St							
1 300mm Cutter Suction Dredge	35.7	39.9	35.7	39.9	35.9	40.1	
2+3 Wash and Multi-Purpose	33.2	39.9	33.2	39.9	33.5	40.3	
4 950 Front End Loader	24.3	31.1					
6 30t Excavator	24.5	29.5					
7 Mini Tanker	27.8	32.7					
8 Road Truck (VENM)	31.4	35.9					
9 Road Truck Loamy Sand	32.4	36.7					
TOTAL	**40.0**	**45.1**	**37.6**	**42.9**	**37.9**	**43.2**	**5.3**
Project Specific Noise Limit	**47.0**	**47.0**	**45.0**	**45.0**	**43.0**	**43.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor F - 64 John Robb Way							
1 300mm Cutter Suction Dredge	34.7	37.7	34.7	37.7	34.9	37.9	
2+3 Wash and Multi-Purpose	33.4	38.9	33.4	38.9	33.8	39.3	
4 950 Front End Loader	24.5	30.0					
6 30t Excavator	24.3	27.9					
7 Mini Tanker	27.7	31.2					
8 Road Truck (VENM)	30.9	34.1					
9 Road Truck Loamy Sand	31.8	34.8					
TOTAL	**39.6**	**43.5**	**37.1**	**41.4**	**37.4**	**41.7**	**4.3**
Project Specific Noise Limit	**47.0**	**47.0**	**45.0**	**45.0**	**43.0**	**43.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

Table 23
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 2B (Cont'd)

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor B - Lot 1 Collier St							
1 300mm Cutter Suction Dredge	42.9	42.7	42.9	42.7	43.1	42.9	
2+3 Wash and Multi-Purpose	41.2	43.2	41.2	43.2	41.6	43.6	
4 950 Front End Loader	32.6	34.5					
6 30t Excavator	32.5	32.7					
7 Mini Tanker	35.5	35.7					
8 Road Truck (VENM)	38.8	38.7					
9 Road Truck Loamy Sand	39.4	39.3					
TOTAL	**47.5**	**48.1**	**45.1**	**46.0**	**45.4**	**46.3**	**0.8**
Project Specific Noise Limit	**46.0**	**46.0**	**44.0**	**44.0**	**44.0**	**44.0**	
Compliant	**No +1.5**	**No +2.1**	**No +1.1**	**No +2.0**	**No +1.4**	**No +2.3**	
Receptor O – Lot 2 Cudgen Road							
1 300mm Cutter Suction Dredge	22.6	29.8	22.6	29.8	23.1	30.3	
2+3 Wash and Multi-Purpose	28.3	36.1	28.3	36.1	28.9	36.7	
4 950 Front End Loader	19.5	27.3					
6 30t Excavator	13.8	21.2					
7 Mini Tanker	16.6	24.0					
8 Road Truck (VENM)	19.1	26.4					
9 Road Truck Loamy Sand	19.3	26.5					
TOTAL	**30.7**	**38.3**	**29.4**	**37.0**	**29.9**	**37.6**	**7.7**
Project Specific Noise Limit	**46.0**	**46.0**	**44.0**	**44.0**	**44.0**	**44.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

Table 24
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 3A

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor G - 216 Tweed Coast Rd							
1 300mm Cutter Suction Dredge	23.1	30.2	23.1	30.2	23.6	30.6	
7 Wash and Multi-Purpose	33.8	40.3	33.8	40.3	24.6	40.7	
6 950 Fel	24.9	31.5					
5 Mini Tanker	18.1	25.1					
3 Booster Pump	35.3	38.4			32.2	38.6	
8 VENM Truck	20	27					
10 30t Excavator	34.5	36.9					
11 Haul Truck	42.6	44.2					
TOTAL	**44.4**	**47.2**	**34.2**	**40.7**	**33.4**	**43.0**	**9.7**
Project Specific Noise Limit	**55**	**55**	**47**	**47**	**49**	**49**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor DD - 34A Crescent St							
1 300mm Cutter Suction Dredge	10.9	17.2	10.9	17.2	11.2	17.5	
7 Wash and Multi-Purpose	33.6	40.3	33.6	40.3	12.2	40.7	
6 950 Front End Loader	24.2	31					
5 Mini Tanker	5.6	11.9					
3 Booster Pump	33.2	37.1			32.6	37.2	
8 VENM Truck	7.4	13.9					
10 30t Excavator	20.5	26.4					
11 Haul Truck	28	33.3					
TOTAL	**37.3**	**43.0**	**33.6**	**40.3**	**32.7**	**42.3**	**9.6**
Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor F - 64 John Robb Way							
1 300mm Cutter Suction Dredge	26.8	31.9	26.8	31.9	27.2	32.4	
7 Wash and Multi-Purpose	33.6	39	33.6	39	28.2	39.5	
6 950 Front End Loader	24.4	29.9					
5 Mini Tanker	21.2	26.4					
3 Booster Pump	33.2	35.6			31.8	35.8	
8 VENM Truck	22.8	28.1					
10 30t Excavator	23.1	27					
11 Haul Truck	30.5	33.8					
TOTAL	**38.3**	**42.6**	**34.4**	**39.8**	**34.3**	**41.6**	**7.3**
Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

Table 24 (Cont'd)
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 3A

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor B - Lot 1 Collier St							
1 300mm Cutter Suction Dredge	38.9	39.4	38.9	39.4	39.1	39.7	
7 Wash and Multi-Purpose	42	43.8	42	43.8	40.1	44.2	
6 950 Front End Loader	32.4	34.4					
5 Mini Tanker	32.8	33.6					
3 Booster Pump	38.8	38.6			39.2	38.8	
8 VENM Truck	34.1	35					
10 30t Excavator	27.1	28.5					
11 Haul Truck	34.5	35.3					
TOTAL	**46.1**	**47.2**	**43.7**	**45.1**	**44.3**	**46.4**	**2.1**
Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**	
Compliant	**No +0.1**	**No +1.2**	**Yes**	**No +1.1**	**No +0.3**	**No +2.4**	
Receptor O – Lot 2 Cudgen Road							
1 300mm Cutter Suction Dredge	28.8	35.2	28.8	35.2	29	35.5	
7 Wash and Multi-Purpose	29.1	36.7	29.1	36.7	30	37.3	
6 950 Front End Loader	19.5	27.3					
5 Mini Tanker	22.9	29.7					
3 Booster Pump	18.1	25.4			18.9	25.8	
8 VENM Truck	24.8	31.6					
10 30t Excavator	10.7	18.6					
11 Haul Truck	16.7	24.4					
TOTAL	**33.6**	**40.6**	**32.0**	**39.0**	**32.7**	**39.7**	**7.0**
Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

Table 25
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 3B

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor G - 216 Tweed Coast Rd							
1 300mm Cutter Suction Dredge	34.8	39.1	34.8	39.1	35.0	39.3	
7 Wash and Multi-Purpose	33.9	40.4	33.9	40.4	34.3	40.8	
6 950 Front-end Loader	25.1	31.6					
5 Mini Tanker	30.8	34.8					
8 VENM Truck	33.0	37.0					
TOTAL	**39.5**	**44.6**	**37.4**	**42.8**	**37.7**	**43.1**	**5.4**
Project Specific Noise Limit	**55.0**	**55.0**	**47.0**	**47.0**	**49.0**	**49.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Receptor DD - 34A Crescent St							
1 300mm Cutter Suction Dredge	38.2	42.1	38.2	42.1	38.3	42.3	
7 Wash and Multi-Purpose	38.4	45.1	38.4	45.1	38.7	45.4	
6 950 Front-end Loader	29.0	35.8					
5 Mini Tanker	30.5	34.7					
8 VENM Truck	34.4	38.2					
TOTAL	**42.6**	**47.9**	**41.3**	**46.9**	**41.5**	**47.1**	**5.6**
Project Specific Noise Limit	**47.0**	**47.0**	**45.0**	**45.0**	**43.0**	**43.0**	
Compliant	**Yes**	**No +0.9**	**Yes**	**No +1.9**	**Yes**	**No+4.1**	
Receptor F - 64 John Robb Way							
1 300mm Cutter Suction Dredge	35.8	38.6	35.8	38.6	36.0	38.9	
7 Wash and Multi-Purpose	36.6	42.0	36.6	42.0	37.1	42.5	
6 950 Front-end Loader	27.3	32.8					
5 Mini Tanker	29.9	32.8					
8 VENM Truck	33.2	35.8					
TOTAL	**40.8**	**44.9**	**39.2**	**43.6**	**39.6**	**44.1**	**4.5**
Project Specific Noise Limit	**47.0**	**47.0**	**45.0**	**45.0**	**43.0**	**43.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No +1.1**	

Table 25
Predicted Unattenuated Noise Emissions at nearest Residences – Scenario 3B (Cont'd)

Source	Predicted Noise Levels						
	Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))	Change due to inversion (dB(A))
Receptor B - Lot 1 Collier St							
1 300mm Cutter Suction Dredge	43.5	43.4	43.5	43.4	43.7	43.4	
7 Wash and Multi-Purpose	43.2	45.4	43.2	45.4	43.6	45.4	
6 950 Front-end Loader	33.8	36.2					
5 Mini Tanker	37.4	37.5					
8 VENM Truck	40.5	40.5					
TOTAL	**48.0**	**48.9**	**46.4**	**47.5**	**46.7**	**47.5**	**0.9**
Project Specific Noise Limit	**46.0**	**46.0**	**44.0**	**44.0**	**44.0**	**44.0**	
Compliant	**No +2.0**	**No +2.9**	**No +2.4**	**No +3.5**	**No +2.7**	**No +3.5**	
Receptor O – Lot 2 Cudgen Road							
1 300mm Cutter Suction Dredge	21.3	28.4	21.3	28.4	21.7	28.8	
7 Wash and Multi-Purpose	32.7	40.3	32.7	40.3	33.2	40.9	
6 950 Front-end Loader	23.1	30.9					
5 Mini Tanker	18.8	26.1					
8 VENM Truck	19.4	26.6					
TOTAL	**33.7**	**41.3**	**33.0**	**40.6**	**33.5**	**41.2**	**7.7**
Project Specific Noise Limit	**46.0**	**46.0**	**44.0**	**44.0**	**44.0**	**44.0**	
Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	

The most significant noise sources audible at Receptor B would be the dredge and wash plant and multipurpose plant. During the day and evening, there would be marginal exceedances of approximately 2dB(A) at Receptor B during downwind conditions. This exceedance would only occur when northwesterly winds blow from source to receiver. Based on the wind observation data from Coolangatta Airport the frequency of observations where this occurs is between 1 and 5 percent of all observations. During the day, there would be marginal exceedance of approximately 1dB(A) at Receptor B during calm conditions.

Scenario 2B

Later extraction stages (ie. Stages 8 to 10) with sand being pumped to the processing area for processing are represented by Scenario 2B. Results of predictions are shown in **Table 23**. Compliance with the noise limits would be achieved at all locations expect for Receptor B where the limit is exceeded by 1dB(A) to 2dB(A) during all atmospheric conditions. Like Scenario 2A, the most significant noise sources would be the dredge and fixed plant.

Scenario 3A

This scenario represents the noise emissions when pumping is occurring off site to nominated fill sites rather than to the processing area. Predicted noise emissions during early extraction stages (ie. Stage 1 to 4) are represented by Scenario 3A, and are shown on **Table 24**. It can be seen that compliance would be achieved at all locations except for Receptor B where again the noise emissions create an exceedance between 1dB(A) and 2dB(A) under downwind conditions and during the early morning period. Again, the most significant noise sources would be the dredge and fixed plant.

Scenario 3B

This scenario represents the noise emissions when pumping is occurring off site to nominated fill sites rather than to the processing area. Predicted noise emissions during later extraction stages (ie. Stages 8 to 10) are represented by Scenario 3B and are shown in **Table 25**.

This scenario has the majority of noise sources at the eastern end of the southern extraction site which is significantly closer to Receptors DD, F and B. When this stage is reached, the southern extraction pond would also extend back to the western boundary. At this stage much of the propagation path from the processing area to Receptors DD and F would be over the extraction pond resulting in much lower ground attenuation rates than over grassed paddocks. As a result, noise levels at Receptor DD, would exceed the noise limit by between 1dB(A) and 2dB(A) during downwind conditions and the early morning shoulder period and up to 4dB(A) during inversion conditions in the early morning period between 6:30am and 7:00am. The frequency of inversions during the period of 6:30am to 7:00am at this site is unknown but would generally be restricted to some mornings in the winter months.

At Receptor B, noise exceedance of between 2dB(A) and 3.5dB(A) are predicted under all conditions.

As for Scenario 2A, the wind observation data from Coolangatta Airport shows the frequency of observations wind will blow from source to receiver is only between 1 and 5 percent of all the observations.

Noise levels at Receptor F would remain compliant under all conditions except for inversion conditions during the early morning period with a predicted marginal exceedances of 1dB(A).

Summary of Results - Unattenuated

A review of scenarios shows that there is only likely to be marginal exceedances of 1dB(A) to 2dB(A) at Receptor B during most of the atmospheric conditions in Scenarios 2A to 3A. Increased exceedances of between 2dB(A) and 3.5dB(A) are predicted to occur during most atmospheric conditions in Scenario 3B. These exceedances are mainly due to fixed processing plant and the dredge.

There will also be marginal exceedances of the noise limits at Receptor DD and Receptor F during the later Stages of the Project under downwind conditions and when inversions occur during the early morning. Based on the wind observations from Coolangatta Airport, the likelihood of downwind conditions will be rare. The frequency of inversions between 6:30am and 7:00am are unknown, but would be restricted to winter months.

In order to remain compliant with the noise criteria at Receptors DD, F and B when certain atmospheric conditions prevail, attenuation measures would be necessary

10.2 Cumulative Noise Impact with Adjoining Sand Extraction

As identified in Section 7.2, immediately to the west of the southern extraction site is the Hanson Tweed Sand extraction operation. There are two locations which could be considered to have a combined impact with the proposed Project, namely Receptor B and Receptor O. The combined traffic noise impact from both developments on Altona Drive also presents a cumulative impact.

Receptor B

The Hanson Tweed Sand extraction operation is located approximately 800m from Receptor B. During visits at Receptor B, noise from the Hanson Tweed Sand operation was not audible or measurable. The occupier advised that he could not hear noise from these operations at his residence but could in the sections of his property closer to the Hanson Tweed Sand operation.

As identified in Section 6.0, an application to expand these operations has been approved and an acoustic assessment carried out by James Heddle Acoustical Consultants (2005). The James Heddle report focused on noise emissions received at residences further to the south which are in closer proximity to the Hanson Tweed Sand site. No assessment or calculations were carried out at Receptor B. This was most likely due to the fact that noise impact at this distance would be insignificant.

No further consideration has been given to operational cumulative noise impacts at Receptor B. This is due to the fact that the additional contribution from the Hanson Tweed Sand operations would not result in a cumulative impact with the activities associated with the Project.

Receptor O

At Receptor O, noise impact from the approved Hanson Tweed Sand extraction operations was also assessed by James Heddle Acoustical Consultants (2005). The operating hours considered were 7:00am to 5:00pm. Noise emissions at Receptor O were predicted to be 40dB(A) L_{Aeq} during the daytime period under calm conditions and up to 43dB(A) when the Hanson Tweed Sand operates within the southeastern corner of their approved extraction area. Under downwind conditions, noise impact could increase by an additional 2dB(A) to 5dB(A) resulting in noise levels between 42dB(A) and 45dB(A).

The timing of dredge locations at the Hanson Tweed Sand site in conjunction with this Project site are unknown. Therefore assessment of the combined effect has been made on the basis of 40dB(A) from the Hanson Tweed Sand operations during calm conditions and 42dB(A) during downwind conditions during daytime operations only. The combined impact is shown in **Table 26.**

Table 26
Predicted Combined Noise Level Impact L_{Aeq} dB(A) at Receptor O

Scenario	Condition	Hanson Tweed Sand Contribution	Project Contribution	Total	Project Specific Noise Limit	Compliant
1A	Calm	40	35.5	41.3	56	Yes
	Downwind	42	42.3	45.2	56	Yes
1B	Calm	40	31.5	40.6	56	Yes
	Downwind	42	38.7	43.7	56	Yes
1C	Calm	40	31.2	40.5	56	Yes
	Downwind	42	38.4	43.6	56	Yes
2A	Calm	40	35.0	41.2	46	Yes
	Downwind	42	42.0	45.0	46	Yes
2B	Calm	40	30.7	40.5	46	Yes
	Downwind	42	38.3	43.5	46	Yes
3A	Calm	40	33.4	40.9	46	Yes
	Downwind	42	40.5	44.3	46	Yes
3B	Calm	40	33.7	40.9	46	Yes
	Downwind	42	41.3	44.7	46	Yes

The predicted cumulative noise impacts from both operations would still comply with the project-specific noise limits.

Altona Drive

The cumulative effect of truck noise on Altona Drive from both the Project and the Hanson Tweed Sand operation are assessed in Section 12.

11 CONSTRUCTION AND OPERATIONAL NOISE MITIGATION MEASURES AND NOISE MONITORING PROGRAM

11.1 Noise Attenuation Measures

In Section 10, it was identified that there would be a number of marginal and some minor exceedances of the noise limits at Receptors DD, F and B (under certain atmospheric conditions) **without** the adoption of additional noise attenuation measures. It will therefore be necessary to reduce the noise emissions of the dredge and from equipment within the processing area.

The dredge measured and modelled for the purposes of this assessment had open louvres around the engine and a basic muffler. It is recommended that the dredge used for the operation be acoustically treated including the engine being enclosed with acoustic louvres and a high performance muffler installed. With such treatments, the sound power level could be reduced by between 5dB(A) and 10dB(A). For purposes of modelling, a sound power level for the treated dredge of 97dB(A) L_{WA} has been used.

Attenuation to the wash plant could also be applied by increasing the height of the noise barrier on the southern side of the processing area. An increase in height could be achieved by either increasing the height of the bund or by using a noise barrier on top of the bund. The actual height of the barrier necessary to achieve the reduction would depend on the height and final configuration of the plant. Noise reduction of the plant could also be achieved by enclosing noisier components of the equipment. Barrier heights and / or enclosure of plant would need to be determined during commissioning of the plant. For the purposes of this report, it is assumed that the additional height of the noise barrier and / or enclosing parts of the plant would reduce the noise of the sand plant by 5dB(A).

A common source of complaint for operations such as this Project is the use of reversing beepers on mobile vehicles. To avoid the possibility of this possible annoyance it is recommended that all mobile vehicles on the site be fitted with broadband type reversing beepers or alternative safety devices such as strobe lights and / or cameras.

Based on the proposed noise mitigation measures the noise model was reconfigured for Receptors DD, F and B incorporating a sound power level of 97dB(A) for the dredge and 5dB(A) of attenuation to the sand wash plant.

The results of revised calculations are shown in **Table 27.**

From **Table 27**, it can be seen that all scenarios comply with the noise limits at all surrounding receivers with implementation of the proposed the noise attenuation measures (ie. the dredge has sound power of ≤97dB(A) L_{WA} and 5dB(A) of attenuation is achieved for the wash and multipurpose plant).

11.2 Monitoring and Compliance Program

A program of noise monitoring is proposed to confirm that the initial noise emission levels from the various construction and operational activities are acceptable. An ongoing program is also proposed to ensure that noise emissions from the Project Site are within the Project specific noise limits throughout the life of the Project.

Table 27
Predicted Noise Emission with Noise Attenuation Measures to Dredge and Processing Plant

Scenario	Source	Predicted Noise Levels					
		Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))
Scenario 2 A	**Receptor G - 216 Tweed Coast Rd**						
	TOTAL	**36.9**	**41.4**	**29.4**	**35.8**	**29.8**	**36.2**
	Project Specific Noise Limit	**55**	**55**	**47**	**47**	**49**	**49**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor DD - 34A Crescent St						
	TOTAL	**31.4**	**37.9**	**28.3**	**34.9**	**28.6**	**35.3**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor F - 64 John Robb Way						
	TOTAL	**34.1**	**39.0**	**29.0**	**34.4**	**29.3**	**34.8**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor B - Lot 1 Collier St						
	1 300mm Cutter Suction Dredge	33	33.1	33	33.1	31.3	33.3
	2+3 Wash and Multi-Purpose	36.2	38.2	36.2	38.2	36.6	38.6
	4 950 Fel	32.4	34.4				
	6 30ton Excavator	32.6	32.7				
	7 Mini Tanker	36.4	36.4				
	8 Road Truck (VENM)	37.4	37.6				
	9 Road Truck Loamy Sand	38.2	38.3				
	10 30t Excavator	27.1	28.5				
	11 Haul Truck	33.3	34.3				
	TOTAL	**44.6**	**45.3**	**37.9**	**39.4**	**37.7**	**39.7**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor O – Lot2 Cudgen Road						
	TOTAL	**30.5**	**37.4**	**25.4**	**32.6**	**25.8**	**33.1**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Scenario 2 B	**Receptor G - 216 Tweed Coast Rd**						
	TOTAL	**38.0**	**42.7**	**31.1**	**36.8**	**31.4**	**37.2**
	Project Specific Noise Limit	**55**	**55**	**47**	**47**	**49**	**49**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor DD - 34A Crescent St						
	TOTAL	**37.4**	**42.4**	**31.0**	**36.7**	**31.2**	**37.0**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 27 (Cont'd)

Predicted Noise Emission with Noise Attenuation Measures to Dredge and Processing Plant

	Source	Predicted Noise Levels					
		Under Calm Conditions (dB(A))	Under Downwind Conditions 3m/s (dB(A))	Evening Operations Under Calm Conditions (dB(A))	Evening Operations Under Downwind Conditions 3m/s (dB(A))	Early Morning Operations Under Calm Conditions (dB(A))	Early Morning Operations Under F-Class Inversion Conditions (dB(A))
Scenario 2 B	**Receptor F - 64 John Robb Way**						
	TOTAL	**37.0**	**40.8**	**30.7**	**35.3**	**31.0**	**35.7**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor B - Lot 1 Collier St						
	1 300mm Cutter Suction Dredge	34.9	34.7	34.9	34.7	35.1	34.9
	2+3 Wash and Multi-Purpose	36.2	38.2	36.2	38.2	36.6	38.6
	4 950 Front End Loader	32.6	34.5				
	6 30ton Excavator	32.5	32.7				
	7 Mini Tanker	35.5	35.7				
	8 Road Truck (VENM)	38.8	38.7				
	9 Road Truck Loamy Sand	39.4	39.3				
	TOTAL	**44.9**	**45.3**	**38.6**	**39.8**	**38.9**	**40.1**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor O – Lot 2 Cudgen Road						
	TOTAL	**27.5**	**35.1**	**23.9**	**31.6**	**24.5**	**32.2**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Scenario 3 A	**Receptor G - 216 Tweed Coast Rd**						
	TOTAL	**44.1**	**46.4**	**29.0**	**35.5**	**21.3**	**35.9**
	Project Specific Noise Limit	**55**	**55**	**47**	**47**	**49**	**49**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor DD - 34A Crescent St						
	TOTAL	**35.8**	**40.9**	**28.6**	**35.3**	**11.3**	**35.7**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor F - 64 John Robb Way						
	TOTAL	**36.8**	**40.5**	**29.1**	**34.4**	**24.7**	**34.9**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 27 (Cont'd)

Predicted Noise Emission with Noise Attenuation Measures to Dredge and Processing Plant

	Source	**Predicted Noise Levels**					
		Under Calm Conditions (dB(A))	**Under Downwind Conditions 3m/s (dB(A))**	**Evening Operations Under Calm Conditions (dB(A))**	**Evening Operations Under Downwind Conditions 3m/s (dB(A))**	**Early Morning Operations Under Calm Conditions (dB(A))**	**Early Morning Operations Under F-Class Inversion Conditions (dB(A))**
Scenario 3 A	**Receptor B - Lot 1 Collier St**						
	1 300mm Cutter Suction Dredge	30.9	31.4	30.9	31.4	31.1	31.7
	7 Wash and Multi-Purpose	37.0	38.8	37.0	38.8	35.1	39.2
	6 950 Front End Loader	32.4	34.4				
	5 Mini Tanker	32.8	33.6				
	3 Booster Pump	38.8	38.6				
	8 VENM Truck	34.1	35.0				
	10 30t Excavator	27.1	28.5				
	11 Haul Truck	34.5	35.3				
	TOTAL	**43.7**	**44.6**	**38.0**	**39.5**	**36.6**	**39.9**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor O – Lot 2 Cudgen Road						
	TOTAL	**30.4**	**37.5**	**25.8**	**33.0**	**26.5**	**33.6**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Scenario 3 B	**Receptor G - 216 Tweed Coast Rd**						
	TOTAL	**36.8**	**41.5**	**31.0**	**36.8**	**31.3**	**37.1**
	Project Specific Noise Limit	**55**	**55**	**47**	**47**	**49**	**49**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor DD - 34A Crescent St						
	1 300mm Cutter Suction Dredge	30.2	34.1	30.2	34.1	30.3	34.3
	7 Wash and Multi-Purpose	33.4	40.1	33.4	40.1	33.7	40.4
	6 950 Front-end Loader	29.0	35.8				
	5 Mini Tanker	30.5	34.7				
	8 VENM Truck	34.4	38.2				
	TOTAL	**39.0**	**44.2**	**35.1**	**41.1**	**35.3**	**41.4**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor F - 64 John Robb Way						
	1 300mm Cutter Suction Dredge	27.8	30.6	27.8	30.6	28.0	30.9
	7 Wash and Multi-Purpose	31.6	37.0	31.6	37.0	32.1	37.5
	6 950 Front-end Loader	27.3	32.8				
	5 Mini Tanker	29.9	32.8				
	8 VENM Truck	33.2	35.8				
	TOTAL	**37.5**	**41.4**	**33.1**	**37.9**	**33.5**	**38.4**
	Project Specific Noise Limit	**47**	**47**	**45**	**45**	**43**	**43**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

Table 27 (Cont'd)
Predicted Noise Emission with Noise Attenuation Measures to Dredge and Processing Plant

	Source	**Predicted Noise Levels**					
		Under Calm Conditions (dB(A))	**Under Downwind Conditions 3m/s (dB(A))**	**Evening Operations Under Calm Conditions (dB(A))**	**Evening Operations Under Downwind Conditions 3m/s (dB(A))**	**Early Morning Operations Under Calm Conditions (dB(A))**	**Early Morning Operations Under F-Class Inversion Conditions (dB(A))**
Scenario 3 B	**Receptor B - Lot 1 Collier St**						
	1 300mm Cutter Suction Dredge	35.5	35.4	35.5	35.4	35.7	35.4
	7 Wash and Multi-Purpose	38.2	40.4	38.2	40.4	38.6	40.4
	6 950 Front-end Loader	33.8	36.2				
	5 Mini Tanker	37.4	37.5				
	8 VENM Truck	40.5	40.5				
	TOTAL	**44.7**	**45.5**	**40.1**	**41.6**	**40.4**	**41.6**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	Receptor O – Lot 2 Cudgen Road						
	TOTAL	**29.9**	**37.5**	**27.9**	**35.4**	**28.4**	**36.0**
	Project Specific Noise Limit	**46**	**46**	**44**	**44**	**44**	**44**
	Compliant	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

It is proposed to:

1. confirm that the equipment used on the Project Site have sound power levels within the noise emission levels outlined in **Table 18**;
2. conduct a series of tests on the sand processing plant to establish the additional height of the noise barrier necessary to gain compliance with the noise limits at all locations;
3. conduct noise measurements during initial extraction operations, following site establishment, to confirm noise levels at the surrounding assessment locations comply with the nominated noise limits; and
4. conduct noise measurements at the surrounding assessment locations on an annual or biennial basis to ensure that noise emissions remain within the noise limits imposed.

The extent of noise monitoring would be regularly reviewed throughout the life of the Project to ensure meaningful data is being collected.

12 TRAFFIC NOISE IMPACT ASSESSMENT

Prior to the proposed sand extraction reaching the existing alignment of Altona Drive, in accordance with separate development consent (DA 05/1450), Altona Drive will be realigned so as to form the northern boundary of the final lake that will be formed by the southern extraction pond.

The alignment of the realigned Altona Drive is shown on **Figure 2**. It will almost exclusively be used for site access and product despatch for the Project and operations of Hanson Tweed Sand. There will also be minor traffic associated with the new waste water treatment plant located immediately west of the processing area. The realigned road will have a sealed surface and a speed limit of 50km/h.

12.1 Background Information

As identified in Section 10.2, the application for development consent for the expansion of the Hanson Tweed Sand operation was supported by an acoustical assessment carried out by James Heddle Acoustical Consultants (2005). The James Heddle report identified that the Hanson Tweed Sand operation will generate up to a maximum of 200 truck movements per 10 hour working day with an average of 80 truck movements per 10 hour working day.

For the Proponent's Project it is conservatively estimated that the average number of truck movements would be approximately 100 per day (ie. 50 loads). It is recognised that daily traffic levels would vary and for the purposes of describing a busy day the 85th percentile level or 130 movements (65 loads) would occur. Across an 11 hour working day, this relates to approximately 12 truck movements (6 loads) per hour on a busy day.

It is further recognised that a busy day or hour for both operations would rarely coincide and for the purposes of this assessment, it is assumed that the maximum hourly number of combined truck movements would be 30.

At the end of Altona Drive, trucks will turn into Crescent Street and then onto Tweed Coast Road. Tweed Coast Road currently carries approximately 12,000 vehicles per day (north of Cudgen Road) with 7% to 9% heavy vehicles (Veitch Lister Consulting (2007) – see Part 7 of the Specialist Consultant Studies Compendium). During the time of peak flow, the flow rate is approximately 900 vehicles per hour and during the periods of lowest flow during mid-morning and early afternoon the flow rate drops to around 600 vehicles per hour. This flow rate includes the trucks currently travelling to and from the Hanson Tweed Sand operation.

12.2 Prediction Methodology

Altona Drive

There is no specific model which can calculate the $L_{Aeq(1hr)}$ noise with the low traffic flows anticipated on Altona Drive. Therefore the SoundPlan computer model prepared for the Project Site was modified to predict the noise emissions from heavy vehicles travelling along the realigned roadway.

Noise emissions from a single truck on individual sections of roadway were calculated using a series of point sources. These points were spaced evenly along the roadway at 100 metre increments. A base sound power level of 108dB(A) L_W was used and a correction was made for the time the truck would spend on each segment of roadway. The contribution from each segment was then calculated using the SoundPlan model. Note that the sound power level used for the truck would correspond to an average of normal driving operations under load.

The predicted noise levels were then adjusted for the numbers of trucks anticipated on the roadway. The calculation methodology is set out in **Table 28**.

Table 28
Example of Calculation of $L_{Aeq(1hr)}$ Truck Noise Levels

Truck Sound Power level	L_W 108dB(A) L_{Aeq}
Segment length	100m
Time to travel 100m at 50 km/h under acceleration/ deceleration	15 seconds
Correction from 15 seconds to 1 hour (10*log(15/3600))	-24dB(A)
Sound Power Level	L_W 81dB(A) $L_{Aeq(1hr)}$
Distance attenuation L_W to L_P	Calculated by SoundPlan using CONCAWE algorithms
Segment Contributions	$Lp_{(Total)} = L_{P(Seg\ 1)} + L_{P(Seg\ 2)} + L_{P(Seg\ 3)} + L_{P(Seg\ 4)}$…….
Total	$Lp_{(Total)}$ per truck
Correction to Number of Trucks	$Lp_{(Total)}$ per truck +10*log(Number of Trucks)

Tweed Coast Road

As identified above, there is no specific model that calculates the $L_{Aeq(1hr)}$ noise level. However, the applicable criteria only relate to the increase in noise levels.

The CoRTN 1988 [7] algorithms however do calculate the $L_{A10(1hr)}$ noise level. Experience has shown that the offset between the $L_{A10(1hr)}$ and $L_{Aeq(1hr)}$ is constant at around 3dB(A) when traffic is free-flowing. Therefore, the change to the $L_{A10(1hr)}$ parameter are directly transferable to the $L_{Aeq(1hr)}$.

The changes to noise emissions attributable to Project-related trucks travelling on Tweed Coast Road have been calculated using the TNOISE™ computer program. This program was developed by the Western Australian Department of Main Roads, and uses the CoRTN algorithms.

12.3 Results of Predictions – Altona Drive

The results of noise level calculations are shown in **Table 29**.

Table 29
Calculated Truck Noise Levels $L_{Aeq(1hr)}$ on Altona Drive

Receptor	Predicted $L_{Aeq(1hr)}$ Noise level due to Altona Drive Traffic
Receptor G - 216 Tweed Coast	57.6dB(A)
Receptor DD - 34A Crescent St	48.5dB(A)
Receptor F - 64 John Robb	56.0dB(A)
Receptor B - Lot 1 Collier St	53.2dB(A)

12.4 Results of Predictions – Tweed Coast Road

The results of noise levels calculations are shown in **Table 30**.

Table 30
Calculated Change in Noise Levels on Tweed Coast Road

Scenario	Change	Total Flow	Heavy Vehicle Flow	Change in Noise Level
Peak Hour Flow Increase	Existing Flow Rate	900 vph	45 vph (5.0%)	-
	Flow Rate with Project	910 vph	55 vph (6.1%)	+0.3dB(A)
Off-peak flow	Existing Flow Rate	600 vph	30 vph (5%)	-
	Flow Rate with Project	610 vph	40 vph (6.6%)	+0.4dB(A)

12.5 Discussion

Altona Drive

Noise emissions calculated using the ECRTN for the combined truck traffic on Altona Drive from both the Hanson Tweed Sand operation and the Project would easily comply with the noise limits specified in Section 5.3.

Tweed Coast Road

The increase in the noise levels due to the additional trucks on Tweed Coast Road are between 0.3dB(A) and 0.4dB(A) depending on the time of day. These changes in noise levels are less than the permissible change of 2dB(A) specified by the ECRTN (see Section 5.3).

13 REMOTE BOOSTER PUMPS

During Scenarios 3A and 3B, extracted material would be pumped to remote fill sites to the north and east of the Project Site. The proposed pipeline corridors are indicated on **Figure 7**. As discussed in Section 3, there are two proposed pipeline corridors, one to the north and one to the east and alternative pipeline corridors to the north and east.

For both corridors, staging booster pumps are required to move the water and sand over the necessary distances. For both proposed and the alternative corridors, at times there would be a booster pump located within the Project Site as shown on **Figure 7**. When present, the booster pump located within the Project Site has been assessed as part of the main assessment. For the eastern corridor, there will be a remote booster pump part way along the corridor. This remote booster pump has the potential to affect surrounding residences in proximity to the booster pump. Due to the comparatively short distance, a remote booster pump has not been included for the northern pipeline corridor.

The exact location of the remote booster pump would be determined at the commencement of pumping, however, the approximate locations are indicated on **Figure 7**. The location of the booster pump on the proposed eastern pipeline is located at a distance of approximately 240m from the nearest residences in Kingfisher Circuit. The location of the booster pump on the alternative eastern pipeline would be located approximately 30m south of residences in Kingfisher Circuit. The proposed operating hours for this pump would be in accordance with the hours indicated in Section 3.0; ie. 6:30am to 6:00pm.

The exact size and capacity of the booster pump proposed at this location would be determined at the commencement of pumping, however, the pump would be a similar configuration to the on-site pump (see **Table 18**).

[7] CoRTN 1988 – *Calculation of Road Traffic Noise* UK Department of Transport HMSO.

13.1 Noise Limits

The potentially affected residences on Kingfisher Drive are located at a similar distance back from Tweed Coast Road as Receptor F (34A Crescent Street, Cudgen). For purposes of a preliminary assessment and to demonstrate feasibility of the remote booster pump, it is proposed to use the Project Specific Noise Criteria for Receptor F as shown in **Table 16**. Based on criteria at Receptor F, the lowest noise level that must be met during the proposed hours of operation is 43dB(A) during the early morning shoulder period of 6:30am-7:00am. Confirmation of noise criteria for residences in Kingsfisher Circuit would be required prior to the commencement of pumping sand to the fill sites.

13.2 Assessment

As the exact location of the booster pump is unknown, a sliding scale has been developed to determine the separation distance between the residences and the pump based on the sound power level of the pump. The results of calculations are shown in **Table 31.**

Table 31
Booster Pump Separation Distance to meet noise limits

Pump Sound Power L_{WA}	Necessary Separation distance (m)
105dB(A)	500m
100dB(A)	275m
95dB(A)	160m
90dB(A)	90m
81dB(A)	30m

The proposed eastern pipeline corridor would result in the pump being located a distance of approximately 240m from residences in Kingfisher Circuit. The results of calculations in **Table 31** show that the pump must have a sound power level of ≤99dB(A) L_{WA} in order to comply. The measured booster pumps was recorded to have sound power level of 101dB(A) $_{LWA}$ by orientating the pump with quieter end facing away from the residence. Invariably, the sound power level for such pumps is managed through additional acoustic cladding.

14 CONCLUSIONS

From the results of this assessment, the following conclusions have been drawn.

- Noise emissions from the **unmitigated** Cudgen Lakes Sand Extraction Project are predicted to comply with the noise limits imposed by the INP under most operating conditions and atmospheric conditions. During some of the unmitigated scenarios, particularly under downwind and inversion conditions, the unmitigated Project has the potential marginally exceed the noise limits by between 1dB(A) and 4dB(A).

- Two noise reduction strategies have been proposed, namely:

  (i) attenuation to the dredge to reduce noise emission levels to a sound power level of 97dB(A). This could be achieved by enclosing the engine with appropriately selected acoustic louvres and installation of a higher performance muffler.

(ii) an additional noise barrier and/or acoustical treatments to the wash and / or multipurpose plant to achieve a noise reduction of 5dB(A) at Residence 2,3, and 4.

- With these attenuation measures in place, compliance with the noise limits would be achieved at all surrounding residences during all scenarios including under the default downwind and inversion conditions prescribed by the INP

- The cumulative noise impact of the Project with the Hanson Tweed Sand operation has been assessed as remaining compliant with the noise limits established in accordance with the INP.

- The noise impact of trucks on the realigned Altona Drive (including the combined effect of trucks from the Hanson Tweed Sand operation) and the effect of increased traffic on Tweed Coast Road has been assessed and shown to comply with the ECRTN.

- The monitoring and compliance program outlined, would be required to ensure the noise limits are met and to confirm the modelling results

15 REFERENCES

James Heddle Acoustical Consultant (May 2005), Noise Impact Assessment Sand Quarry Expansion, Cudgen NSW (P. Guinane Pty Ltd)

Ron Rumble Pty Ltd (2005), Report No 05-5070B Proposed Dredging and Filling Operations – Crescent Street, Cudgen Environment Protection Licence Application – Noise Impact Assessment

Veitch Lister Consulting Pty Ltd (2007), Traffic Assessment, prepared on behalf of Gales-Kingscliff Pty Ltd (Volume 2 – Part 7 of the Specialist Consultant Studies Compendium)

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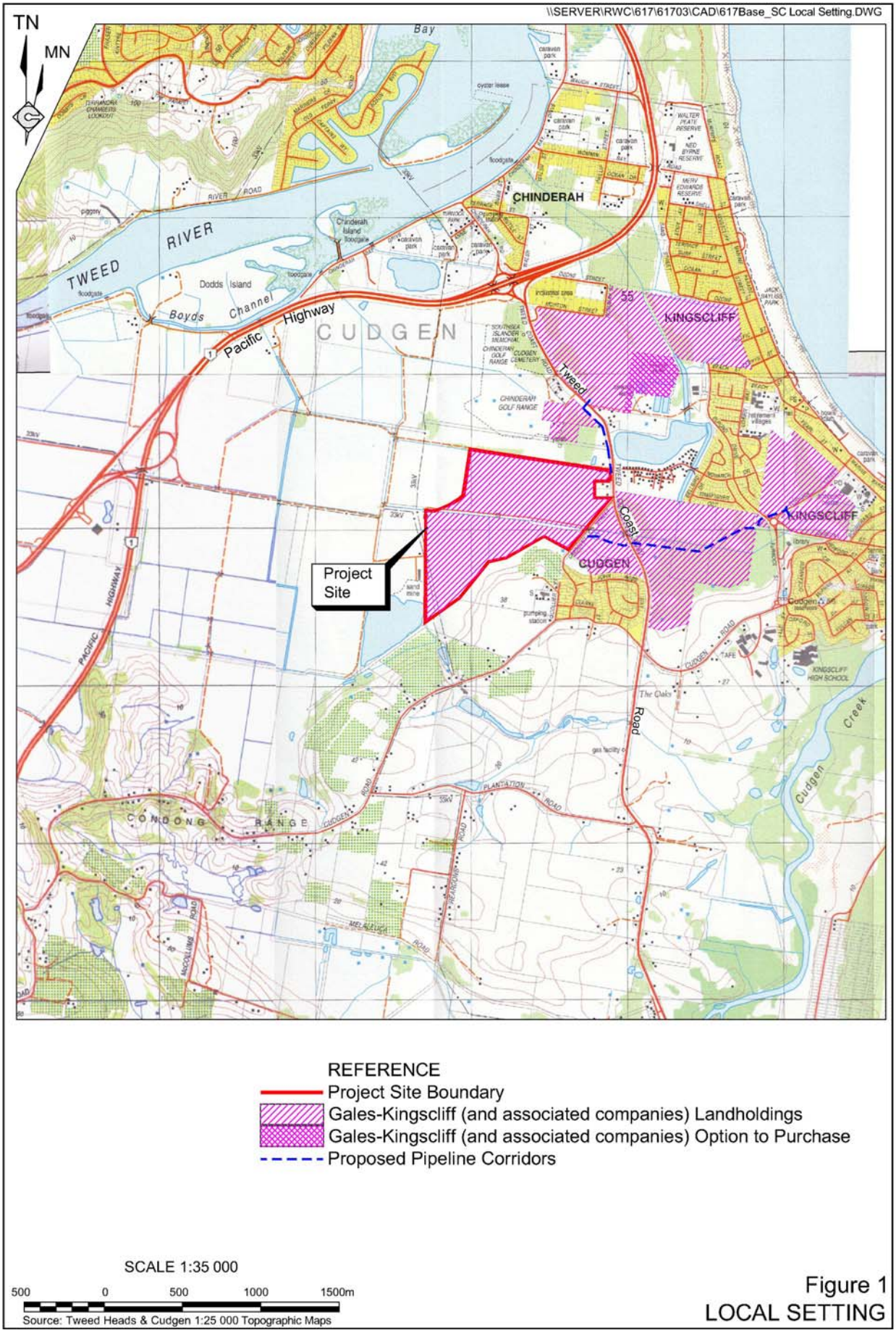


Figure 1
LOCAL SETTING

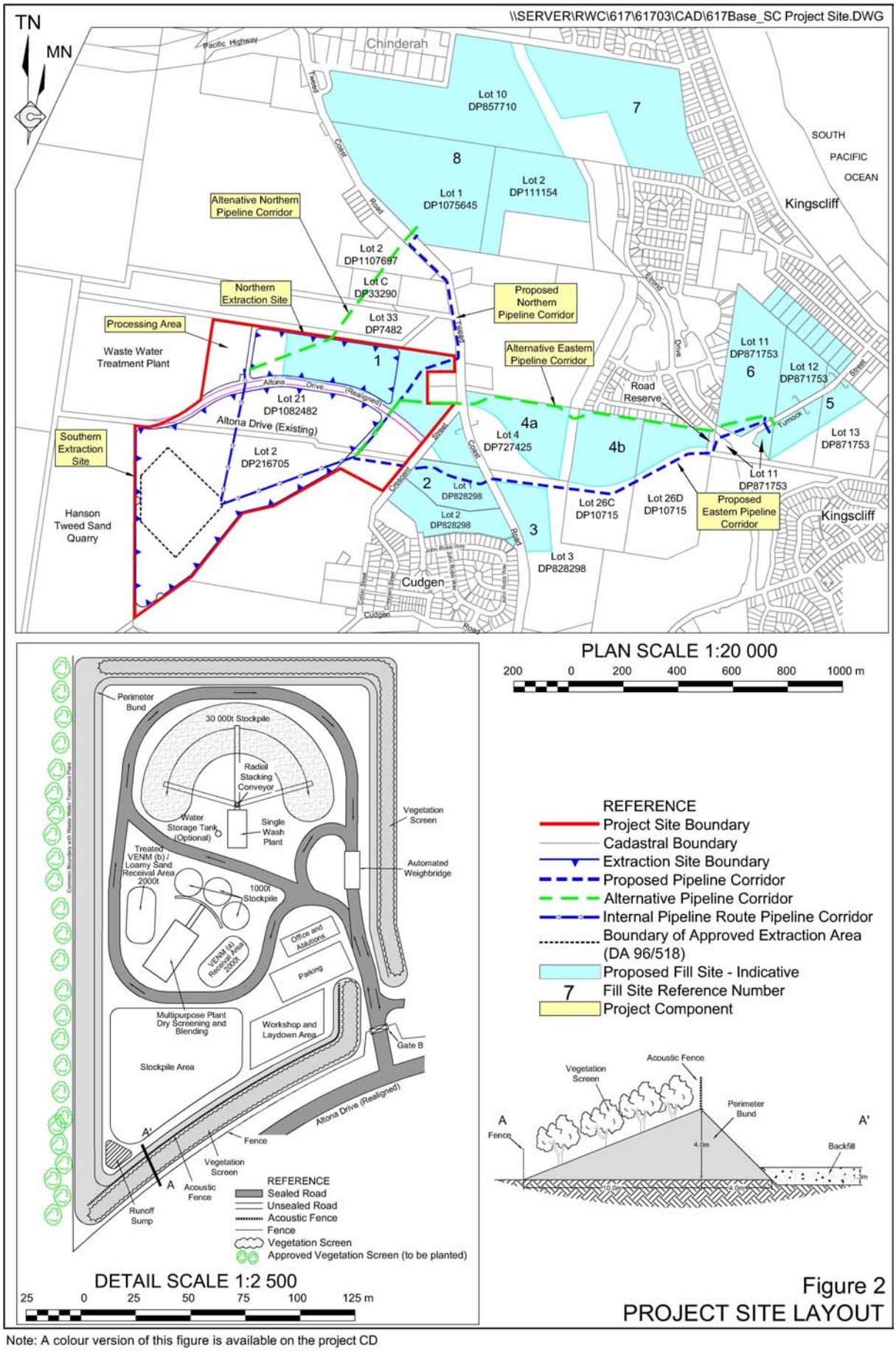


Figure 2
PROJECT SITE LAYOUT

Note: A colour version of this figure is available on the project CD

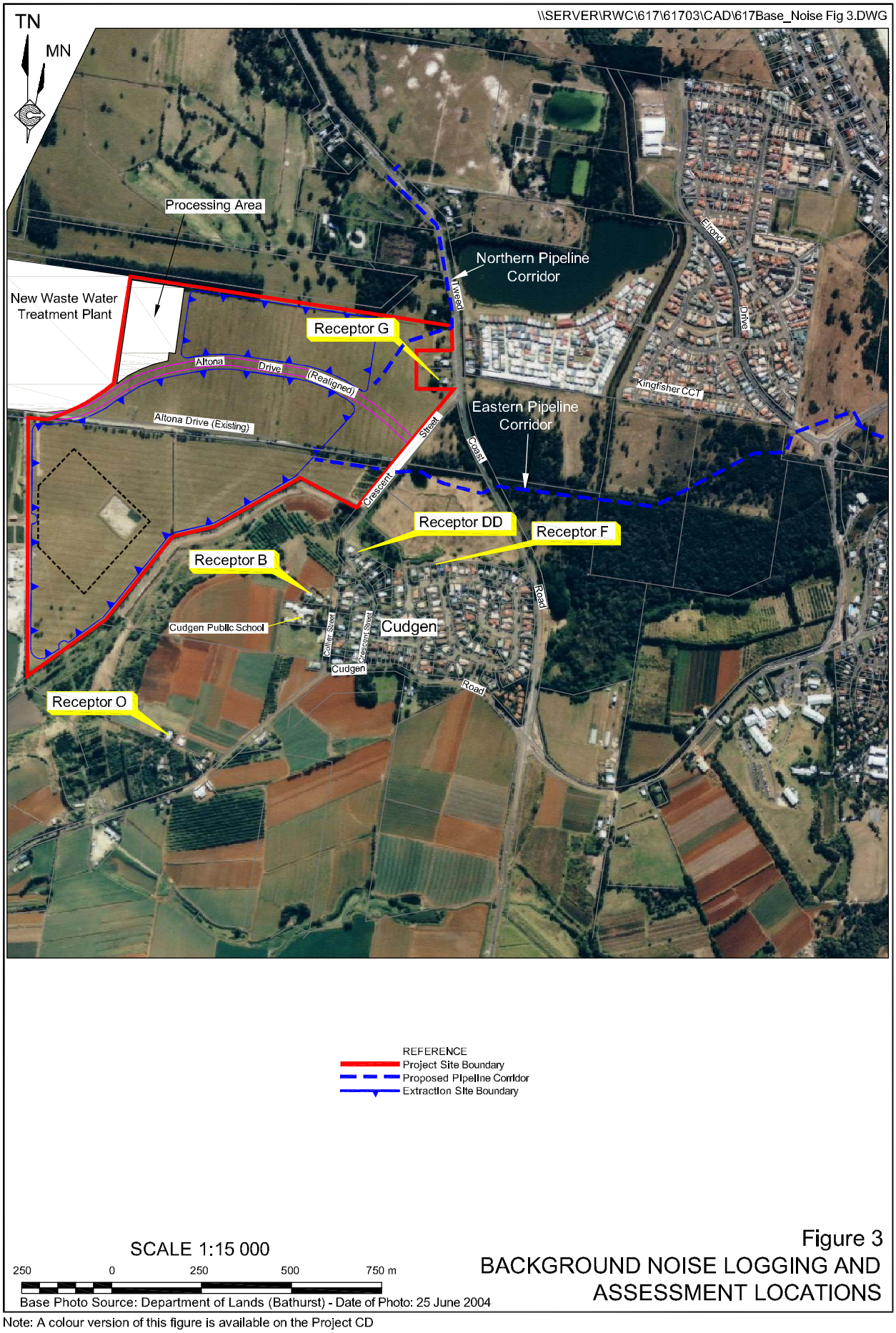


Figure 3
BACKGROUND NOISE LOGGING AND ASSESSMENT LOCATIONS

Note: A colour version of this figure is available on the Project CD

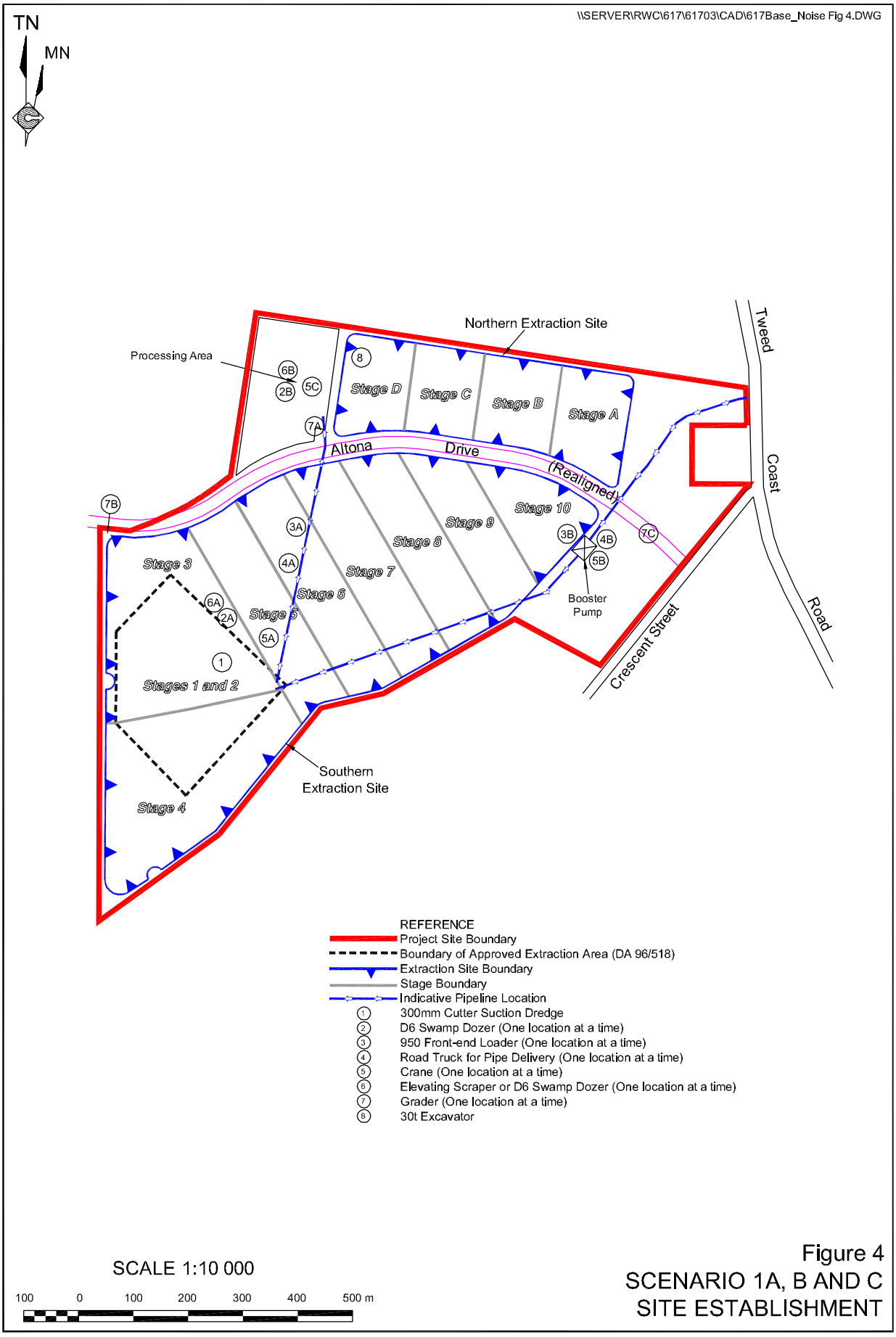
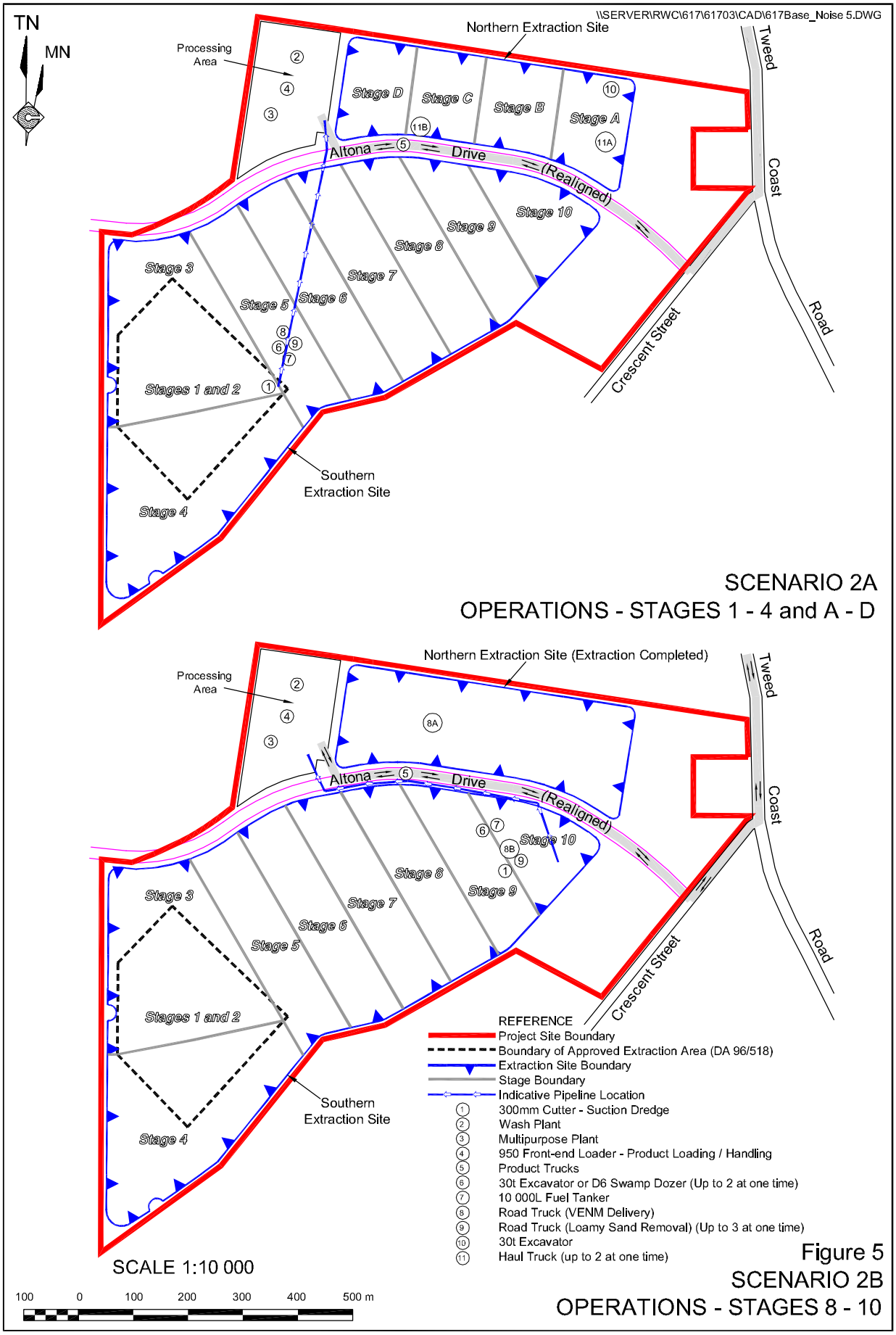
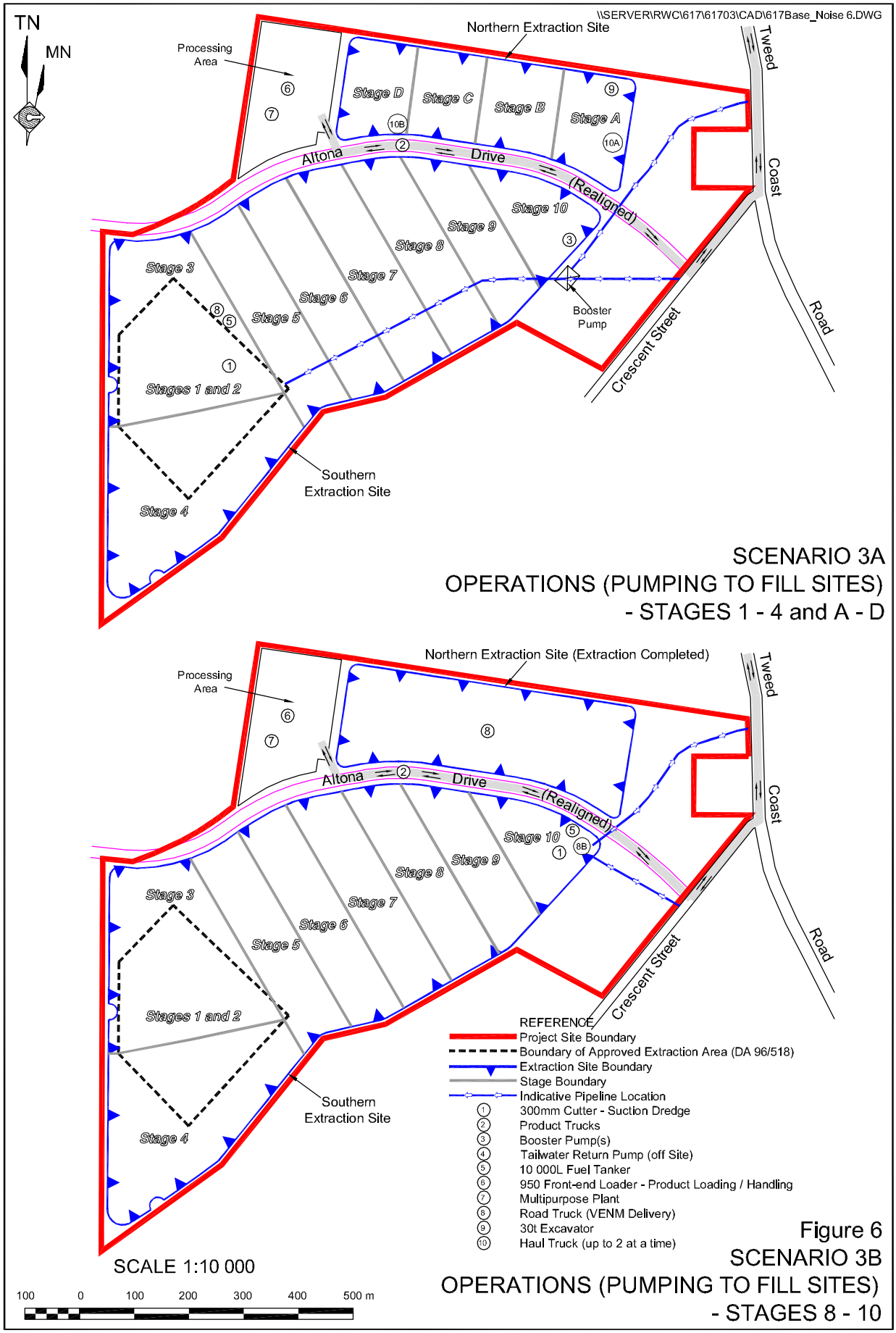
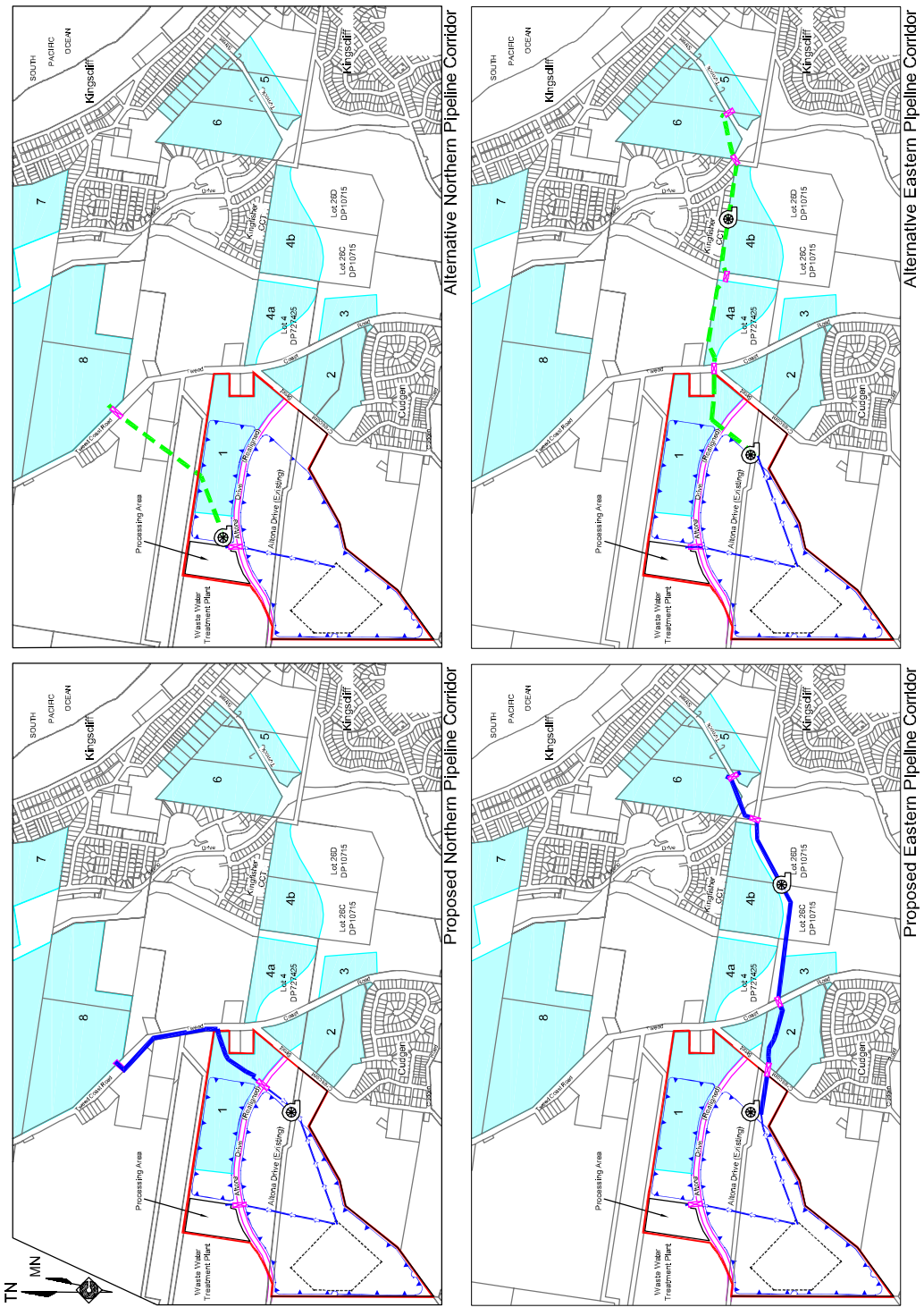


Figure 4
SCENARIO 1A, B AND C
SITE ESTABLISHMENT


\\SERVER\RWC\617\61703\CAD\617Base_Noise 5.DWG
TN
MN
Northern Extraction Site
Processing Area
Tweed
Coast
Road
Crescent Street
Altona Drive (Realigned)
Stage A
Stage B
Stage C
Stage D
Stage 10
Stage 9
Stage 8
Stage 7
Stage 6
Stage 5
Stage 3
Stage 4
Stages 1 and 2
Southern Extraction Site
SCENARIO 2A
OPERATIONS - STAGES 1 - 4 and A - D
Northern Extraction Site (Extraction Completed)
REFERENCE
Project Site Boundary
Boundary of Approved Extraction Area (DA 96/518)
Extraction Site Boundary
Stage Boundary
Indicative Pipeline Location
1 300mm Cutter - Suction Dredge
2 Wash Plant
3 Multipurpose Plant
4 950 Front-end Loader - Product Loading / Handling
5 Product Trucks
6 30t Excavator or D6 Swamp Dozer (Up to 2 at one time)
7 10 000L Fuel Tanker
8 Road Truck (VENM Delivery)
9 Road Truck (Loamy Sand Removal) (Up to 3 at one time)
10 30t Excavator
11 Haul Truck (up to 2 at one time)
SCALE 1:10 000
100 0 100 200 300 400 500 m
Figure 5
SCENARIO 2B
OPERATIONS - STAGES 8 - 10


\\SERVER\RWC\617\61703\CAD\617Base_Noise 6.DWG
TN
MN
Northern Extraction Site
Processing Area
Tweed
Coast
Road
Altona
Drive
(Realigned)
Stage A
Stage B
Stage C
Stage D
Stage 10
Stage 9
Stage 8
Stage 7
Stage 6
Stage 5
Stage 3
Stage 4
Stages 1 and 2
Booster Pump
Crescent Street
Southern Extraction Site
SCENARIO 3A
OPERATIONS (PUMPING TO FILL SITES)
- STAGES 1 - 4 and A - D
Northern Extraction Site (Extraction Completed)
REFERENCE
Project Site Boundary
Boundary of Approved Extraction Area (DA 96/518)
Extraction Site Boundary
Stage Boundary
Indicative Pipeline Location
1 300mm Cutter - Suction Dredge
2 Product Trucks
3 Booster Pump(s)
4 Tailwater Return Pump (off Site)
5 10 000L Fuel Tanker
6 950 Front-end Loader - Product Loading / Handling
7 Multipurpose Plant
8 Road Truck (VENM Delivery)
9 30t Excavator
10 Haul Truck (up to 2 at a time)
SCALE 1:10 000
100 0 100 200 300 400 500 m
Figure 6
SCENARIO 3B
OPERATIONS (PUMPING TO FILL SITES)
- STAGES 8 - 10

\\SERVER\RWC\617\61703\CAD\617Base_Noise Fig 7.DWG



REFERENCE

- Project Site Boundary
- Extraction Site Boundary
- Internal Pipeline Route
- Proposed Pipeline Corridor
- Alternative Pipeline Corridor
- Boundary of Approved Dredge Pond (DA 96/518)
- 1 Proposed Fill Site - (Indicative) and Fill Site Number
- Underbored Pipeline Road Crossing
- Booster Pump

SCALE 1:30 000

500 0 500 1000 1500 m

Figure 7
PIPELINE CORRIDORS

Note: A colour version of this figure is available on the Project CD

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APPENDICES

(No. of pages excluding this page = 32)

Appendix A Meteorological Data

Appendix B Background Noise Traces

Appendix C Coverage of Environmental Assessment Requirements and Environmental Issues

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Appendix A

Meteorological Data

(No. of pages excluding this page = 14)

1. **Meteorological Data for the Period of Unattended Noise Logging (Source: Coolangatta Airport)**

2. **Wind Frequency Analysis – October 1987 to September 2005 (Source: Coolangatta Airport)**

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Metrological Data for the Period of Unattended Noise Logging

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
16/08/2005 12:00	0	22	15.1	9	43	24	130	1024
16/08/2005 12:30	0	22	14.7	8	41	26	140	1024
16/08/2005 13:00	0	20	14.7	10	53	31	150	1024
16/08/2005 13:30	0	21	15.5	11	53	31	160	1024
16/08/2005 14:00	0	20	14.7	10	53	31	150	1024
16/08/2005 14:30	0	20	15.1	11	56	33	150	1024
16/08/2005 15:00	0	20	14.7	10	53	33	160	1024
16/08/2005 15:30	0	19	14.2	10	56	33	150	1025
16/08/2005 16:00	0	19	14.2	10	56	35	170	1025
16/08/2005 16:30	0	18	13.8	10	59	30	160	1025
16/08/2005 17:00	0	18	13.8	10	59	28	160	1025
16/08/2005 17:30	0	17	13.3	10	63	21	170	1026
16/08/2005 18:00	0	17	13.3	10	63	21	180	1026
16/08/2005 18:30	0	16	12.9	10	68	18	190	1027
16/08/2005 19:00	0	16	12.9	10	68	17	190	1027
16/08/2005 19:30	0	16	12.9	10	68	15	190	1027
16/08/2005 20:00	0	15	12.4	10	72	13	190	1028
16/08/2005 20:30	0	15	12.4	10	72	15	190	1028
16/08/2005 21:00	0	15	12	9	67	15	200	1028
16/08/2005 21:30	0	15	12	9	67	15	200	1028
16/08/2005 22:00	0	14	11	8	67	13	200	1029
16/08/2005 22:30	0	14	11	8	67	13	200	1029
16/08/2005 23:00	0	14	11	8	67	13	210	1029
16/08/2005 23:30	0	14	11	8	67	11	200	1029
17/08/2005 0:00	0	13	10.6	8	72	13	200	1028
17/08/2005 0:30	0	14	11	8	67	13	200	1028
17/08/2005 1:00	0	13	10.6	8	72	13	190	1028
17/08/2005 1:30	0	13	10.6	8	72	13	190	1028
17/08/2005 2:00	0	14	11	8	67	18	210	1028
17/08/2005 2:30	0	14	11	8	67	17	210	1028
17/08/2005 3:00	0	14	11	8	67	17	200	1028
17/08/2005 3:30	0	15	12	9	67	17	210	1028
17/08/2005 4:00	0	15	12	9	67	18	210	1028
17/08/2005 4:30	0	15	12	9	67	18	200	1029
17/08/2005 5:00	0	15	11.5	8	63	18	200	1029
17/08/2005 5:30	0	14	11	8	67	17	200	1029
17/08/2005 6:00	0	13	11	9	77	13	190	1029
17/08/2005 6:30	0	14	11.5	9	72	18	200	1030
17/08/2005 7:00	0	14	11	8	67	21	200	1030
17/08/2005 7:30	0	16	12.4	9	63	18	200	1030
17/08/2005 8:00	0	16	12.4	9	63	22	210	1031
17/08/2005 8:30	0	18	12.9	8	52	21	210	1031

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
17/08/2005 9:00	0	19	13.4	8	49	18	210	1031
17/08/2005 9:30	0	19	13.4	8	49	21	190	1031
17/08/2005 10:00	0	19	13.4	8	49	26	180	1031
17/08/2005 10:30	0	20	14.3	9	49	24	200	1031
17/08/2005 11:00	0	20	14.3	9	49	18	190	1031
17/08/2005 11:30	0	20	14.3	9	49	22	190	1030
17/08/2005 12:00	0	21	14.7	9	46	21	170	1030
17/08/2005 12:30	0	20	13.8	8	46	24	160	1029
17/08/2005 13:00	0	20	13.8	8	46	22	150	1029
17/08/2005 13:30	0	20	13.5	7	43	24	150	1029
17/08/2005 14:00	0	21	13.9	7	40	24	140	1028
17/08/2005 14:30	0	21	13.5	6	38	24	140	1028
17/08/2005 15:00	0	20	13.8	8	46	22	140	1028
17/08/2005 15:30	0	20	13.5	7	43	21	150	1028
17/08/2005 16:00	0	19	13.4	8	49	22	140	1028
17/08/2005 16:30	0	19	13.8	9	52	17	150	1029
17/08/2005 17:00	0	18	13.8	10	59	15	160	1029
17/08/2005 17:30	0	16	12.9	10	68	13	170	1029
17/08/2005 18:00	0	15	12.4	10	72	11	170	1029
17/08/2005 18:30	0	15	12.4	10	72	9	190	1030
17/08/2005 19:00	0	15	12.4	10	72	11	200	1030
17/08/2005 19:30	0	15	12.4	10	72	11	200	1030
17/08/2005 20:00	0	14	11.9	10	77	9	180	1030
17/08/2005 20:30	0	13	11.5	10	82	9	190	1030
17/08/2005 21:00	0	13	12	11	88	8	180	1030
17/08/2005 21:30	0	13	12	11	88	2	180	1030
17/08/2005 22:00	0	13	11.5	10	82	9	230	1031
17/08/2005 22:30	0	13	11.5	10	82	5	210	1031
17/08/2005 23:00	0	12	10.5	9	82	11	240	1031
17/08/2005 23:30	0	12	11	10	88	8	230	1030
18/08/2005 0:00	0	12	10.5	9	82	9	230	1030
18/08/2005 0:30	0	11	10	9	87	9	230	1030
18/08/2005 1:00	0	12	11	10	88	8	200	1030
18/08/2005 1:30	0	11	10	9	87	8	220	1030
18/08/2005 2:00	0	12	11	10	88	8	210	1029
18/08/2005 2:30	0	11	10	9	87	8	200	1029
18/08/2005 3:00	0	11	10	9	87	8	210	1029
18/08/2005 3:30	0	11	10	9	87	8	210	1029
18/08/2005 4:00	0	12	11	10	88	9	240	1029
18/08/2005 4:30	0	12	10.5	9	82	8	220	1029
18/08/2005 5:00	0	11	10	9	87	9	180	1029
18/08/2005 5:30	0	11	10	9	87	11	180	1029
18/08/2005 6:00	0	11	10	9	87	13	170	1029
18/08/2005 6:30	0	11	10	9	87	13	180	1029
18/08/2005 7:00	0	13	12	11	88	13	180	1029
18/08/2005 7:30	0	15	12.9	11	77	11	190	1030

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
18/08/2005 8:00	0	17	13.8	11	68	9	180	1030
18/08/2005 8:30	0	18	13.8	10	59	15	190	1030
18/08/2005 9:00	0	19	13.8	9	52	18	200	1030
18/08/2005 9:30	0	19	14.2	10	56	21	190	1030
18/08/2005 10:00	0	20	14.7	10	53	21	180	1030
18/08/2005 10:30	0	20	14.7	10	53	21	210	1030
18/08/2005 11:00	0	19	14.2	10	56	15	160	1030
18/08/2005 11:30	0	21	14.7	9	46	17	150	1029
18/08/2005 12:00	0	21	15.1	10	49	18	160	1028
18/08/2005 12:30	0	22	15.5	10	46	21	150	1028
18/08/2005 13:00	0	21	14.3	8	43	21	120	1027
18/08/2005 13:30	0	21	13.9	7	40	21	120	1027
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18/08/2005 15:00	0	20	14.2	9	49	21	130	1027
18/08/2005 15:30	0	20	14.2	9	49	21	120	1026
18/08/2005 16:00	0	20	14.2	9	49	18	120	1026
18/08/2005 16:30	0	19	14.2	10	56	17	120	1026
18/08/2005 17:00	0	18	13.3	9	56	15	140	1026
18/08/2005 17:30	0	17	13.3	10	63	9	160	1027
18/08/2005 18:00	0	16	12.9	10	68	9	200	1027
18/08/2005 18:30	0	15	12.9	11	77	8	210	1027
18/08/2005 19:00	0	14	12.4	11	82	8	230	1027
18/08/2005 19:30	0	14	12.4	11	82	8	220	1028
18/08/2005 20:00	0	14	11.9	10	77	8	230	1028
18/08/2005 20:30	0	13	11.5	10	82	9	230	1028
18/08/2005 21:00	0	13	11.5	10	82	5	220	1028
18/08/2005 21:30	0	12	11	10	88	8	210	1028
18/08/2005 22:00	0	12	11	10	88	8	220	1028
18/08/2005 22:30	0	12	11	10	88	5	210	1028
18/08/2005 23:00	0	11	10.5	10	94	8	210	1027
18/08/2005 23:30	0	11	10.5	10	94	5	210	1027
19/08/2005 0:00	0	11	10.5	10	94	8	200	1027
19/08/2005 0:30	0	11	10	9	87	9	170	1027
19/08/2005 1:00	0	11	10	9	87	8	210	1026
19/08/2005 1:30	0	11	10.5	10	94	8	190	1026
19/08/2005 2:00	0	10	9.5	9	93	5	190	1025
19/08/2005 2:30	0	10	9	8	87	8	220	1025
19/08/2005 3:00	0	10	9.5	9	93	8	210	1025
19/08/2005 3:30	0	10	9	8	87	8	200	1024
19/08/2005 4:00	0	10	9	8	87	8	200	1024
19/08/2005 4:30	0	10	9	8	87	8	220	1025
19/08/2005 5:00	0	9	8.1	7	87	8	190	1025
19/08/2005 5:30	0	9	8.5	8	93	8	200	1025
19/08/2005 6:00	0	9	8.5	8	93	5	190	1025
19/08/2005 6:30	0	10	9.5	9	93	8	210	1025

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
19/08/2005 7:00	0	11	10	9	87	8	220	1025
19/08/2005 7:30	0	13	12	11	88	5	190	1025
19/08/2005 8:00	0	14	12.4	11	82	5	170	1025
19/08/2005 8:30	0	17	14.3	12	72	8	180	1026
19/08/2005 9:00	0	19	14.2	10	56	5	180	1026
19/08/2005 9:30	0	20	15.1	11	56	4	70	1026
19/08/2005 10:00	0	20	13.8	8	46	9	360	1026
19/08/2005 10:30	0	20	14.2	9	49	11	40	1025
19/08/2005 11:00	0	20	14.2	9	49	13	30	1025
19/08/2005 11:30	0	20	14.2	9	49	13	30	1025
19/08/2005 12:00	0	20	14.7	10	53	15	30	1024
19/08/2005 12:30	0	20	14.2	9	49	15	40	1024
19/08/2005 13:00	0	20	14.2	9	49	17	30	1023
19/08/2005 13:30	0	21	15.1	10	49	17	40	1023
19/08/2005 14:00	0	21	15.1	10	49	17	40	1022
19/08/2005 14:30	0	20	14.7	10	53	18	40	1022
19/08/2005 15:00	0	21	15.1	10	49	18	30	1021
19/08/2005 15:30	0	20	14.7	10	53	18	20	1021
19/08/2005 16:00	0	20	14.7	10	53	18	30	1021
19/08/2005 16:30	0	20	15.1	11	56	17	20	1021
19/08/2005 17:00	0	19	14.7	11	60	18	10	1021
19/08/2005 17:30	0	19	14.7	11	60	18	10	1021
19/08/2005 18:00	0	19	14.7	11	60	21	10	1021
19/08/2005 18:30	0	19	14.7	11	60	21	10	1021
19/08/2005 19:00	0	19	14.7	11	60	21	10	1021
19/08/2005 19:30	0	19	14.7	11	60	18	360	1022
19/08/2005 20:00	0	19	14.7	11	60	21	360	1022
19/08/2005 20:30	0	19	14.2	10	56	18	360	1022
19/08/2005 21:00	0	17	13.8	11	68	11	320	1021
19/08/2005 21:30	0	16	13.3	11	72	11	320	1021
19/08/2005 22:00	0	16	13.3	11	72	13	320	1021
19/08/2005 22:30	0	16	13.3	11	72	13	320	1021
19/08/2005 23:00	0	15	12.4	10	72	13	320	1021
19/08/2005 23:30	0	16	12.9	10	68	13	310	1020
20/08/2005 0:00	0	15	12.4	10	72	11	330	1020
20/08/2005 0:30	0	15	12.9	11	77	15	320	1020
20/08/2005 1:00	0	15	12.9	11	77	13	310	1019
20/08/2005 1:30	0	15	12.9	11	77	11	310	1019
20/08/2005 2:00	0	15	12.9	11	77	11	300	1019
20/08/2005 2:30	0	16	13.3	11	72	9	290	1020
20/08/2005 3:00	0	16	12.9	10	68	11	280	1019
20/08/2005 3:30	0	16	12.9	10	68	11	280	1019
20/08/2005 4:00	0	16	12.9	10	68	8	290	1019
20/08/2005 4:30	0	16	12.9	10	68	8	300	1019
20/08/2005 5:00	0	16	13.3	11	72	11	360	1019
20/08/2005 5:30	0	14	11.9	10	77	13	330	1018

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
20/08/2005 6:00	0	16	13.3	11	72	13	340	1018
20/08/2005 6:30	0	15	12.4	10	72	15	320	1018
20/08/2005 7:00	0	15	12.9	11	77	11	310	1019
20/08/2005 7:30	0	17	13.8	11	68	13	340	1019
20/08/2005 8:00	0	18	14.2	11	64	21	310	1019
20/08/2005 8:30	0	20	14.7	10	53	24	310	1020
20/08/2005 9:00	0	19	14.2	10	56	21	320	1020
20/08/2005 9:30	0	20	14.7	10	53	24	340	1020
20/08/2005 10:00	0	21	15.1	10	49	22	350	1019
20/08/2005 10:30	0	21	15.1	10	49	26	350	1018
20/08/2005 11:00	0	21	15.5	11	53	26	350	1018
20/08/2005 11:30	0	21	15.1	10	49	30	350	1017
20/08/2005 12:00	0	22	15.9	11	50	30	360	1016
20/08/2005 12:30	0	22	15.9	11	50	31	360	1016
20/08/2005 13:00	0	22	16.4	12	53	28	360	1016
20/08/2005 13:30	0	21	16	12	56	26	360	1015
20/08/2005 14:00	0	21	16	12	56	28	360	1015
20/08/2005 14:30	0	22	15.9	11	50	28	360	1014
20/08/2005 15:00	0	21	16.4	13	60	24	360	1014
20/08/2005 15:30	0	21	16.4	13	60	21	360	1014
20/08/2005 16:00	0	21	16.4	13	60	22	360	1014
20/08/2005 16:30	0	21	16.9	14	64	24	360	1015
20/08/2005 17:00	0	21	16.9	14	64	26	360	1015
20/08/2005 17:30	0	21	16.9	14	64	18	350	1015
20/08/2005 18:00	0	20	16	13	64	13	350	1016
20/08/2005 18:30	0	20	16.5	14	68	13	340	1016
20/08/2005 19:00	0	17	14.3	12	72	8	280	1016
20/08/2005 19:30	0	16	13.8	12	77	8	310	1017
20/08/2005 20:00	0	16	13.8	12	77	13	290	1017
20/08/2005 20:30	0	14	12.9	12	88	13	250	1017
20/08/2005 21:00	0	14	12.4	11	82	11	250	1017
20/08/2005 21:30	0	13	12	11	88	9	220	1018
20/08/2005 22:00	0	13	11.5	10	82	0	0	1018
20/08/2005 22:30	0	12	11	10	88	9	240	1018
20/08/2005 23:00	0	12	11	10	88	13	220	1018
20/08/2005 23:30	0	12	10.5	9	82	13	230	1018
21/08/2005 0:00	0	13	10.5	8	72	11	240	1018
21/08/2005 0:30	0	13	10.5	8	72	9	200	1018
21/08/2005 1:00	0	13	10.1	7	67	11	200	1018
21/08/2005 1:30	0	12	9.2	6	67	13	200	1018
21/08/2005 2:00	0	13	9.7	6	62	15	210	1017
21/08/2005 2:30	0	12	8.8	5	62	9	170	1017
21/08/2005 3:00	0	10	7.8	5	71	8	230	1017
21/08/2005 3:30	0	12	9.2	6	67	4	280	1017
21/08/2005 4:00	0	10	7.8	5	71	5	350	1017
21/08/2005 4:30	0	7	5.7	4	81	9	210	1017

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
21/08/2005 5:00	0	9	7.6	6	81	4	260	1018
21/08/2005 5:30	0	8	6.7	5	81	9	240	1018
21/08/2005 6:00	0	8	7.1	6	87	11	240	1018
21/08/2005 6:30	0	8	7.1	6	87	4	240	1019
21/08/2005 7:00	0	9	7.6	6	81	5	240	1019
21/08/2005 7:30	0	11	9.1	7	76	2	230	1019
21/08/2005 8:00	0	13	10.5	8	72	4	220	1019
21/08/2005 8:30	0	16	12	8	59	5	220	1019
21/08/2005 9:00	0	18	11.8	5	42	2	10	1019
21/08/2005 9:30	0	18	11.8	5	42	8	40	1019
21/08/2005 10:00	0	19	12.6	6	43	9	50	1019
21/08/2005 10:30	0	19	12.2	5	40	11	40	1019
21/08/2005 11:00	0	19	12.2	5	40	13	40	1019
21/08/2005 11:30	0	20	12.7	5	37	15	60	1019
21/08/2005 12:00	0	19	12.2	5	40	13	70	1018
21/08/2005 12:30	0	19	12.6	6	43	15	70	1018
21/08/2005 13:00	0	19	12.6	6	43	15	60	1017
21/08/2005 13:30	0	20	13.4	7	43	15	70	1017
21/08/2005 14:00	0	19	13	7	46	17	60	1017
21/08/2005 14:30	0	19	13	7	46	15	60	1017
21/08/2005 15:00	0	19	13.4	8	49	15	60	1017
21/08/2005 15:30	0	19	13.4	8	49	15	70	1017
21/08/2005 16:00	0	19	13.4	8	49	13	70	1017
21/08/2005 16:30	0	19	13.4	8	49	13	70	1017
21/08/2005 17:00	0	19	13.4	8	49	11	70	1017
21/08/2005 17:30	0	18	13.3	9	56	9	70	1018
21/08/2005 18:00	0	16	12	8	59	5	100	1018
21/08/2005 18:30	0	13	11	9	77	9	230	1018
21/08/2005 19:00	0	13	11	9	77	8	240	1018
21/08/2005 19:30	0	12	10.5	9	82	8	250	1019
21/08/2005 20:00	0	12	10.5	9	82	11	250	1019
21/08/2005 20:30	0	12	10.5	9	82	9	240	1019
21/08/2005 21:00	0	12	10.5	9	82	8	230	1019
21/08/2005 21:30	0	12	10.5	9	82	0	0	1019
21/08/2005 22:00	0	11	10	9	87	9	250	1019
21/08/2005 22:30	0	11	10	9	87	8	220	1019
21/08/2005 23:00	0	11	10	9	87	8	230	1019
21/08/2005 23:30	0	11	10	9	87	9	270	1019
22/08/2005 0:00	0	10	9	8	87	9	270	1018
22/08/2005 0:30	0	11	10	9	87	5	240	1018
22/08/2005 1:00	0	10	9	8	87	11	240	1018
22/08/2005 1:30	0	10	9	8	87	11	240	1018
22/08/2005 2:00	0	10	9	8	87	5	210	1018
22/08/2005 2:30	0	10	9	8	87	2	230	1017
22/08/2005 3:00	0	9	8.5	8	93	2	240	1017

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
22/08/2005 3:30	0	9	8.1	7	87	2	250	1017
22/08/2005 4:00	0	8	7.1	6	87	8	280	1017
22/08/2005 4:30	0	9	8.1	7	87	0	0	1017
22/08/2005 5:00	0	9	7.6	6	81	5	290	1017
22/08/2005 5:30	0	8	7.1	6	87	4	240	1017
22/08/2005 6:00	0	7	6.1	5	87	9	210	1018
22/08/2005 6:30	0	9	7.6	6	81	5	280	1018
22/08/2005 7:00	0	12	9.2	6	67	9	260	1018
22/08/2005 7:30	0	14	10.6	7	63	0	0	1018
22/08/2005 8:00	0	15	11.1	7	59	4	230	1018
22/08/2005 8:30	0	17	11.7	6	48	11	200	1019
22/08/2005 9:00	0	17	11.3	5	45	15	210	1019
22/08/2005 9:30	0	18	11.4	4	39	17	240	1019
22/08/2005 10:00	0	19	11.9	4	37	11	220	1019
22/08/2005 10:30	0	19	11.6	3	34	11	220	1018
22/08/2005 11:00	0	19	12.6	6	43	15	20	1018
22/08/2005 11:30	0	19	13	7	46	17	30	1018
22/08/2005 12:00	0	19	12.6	6	43	17	40	1017
22/08/2005 12:30	0	19	12.2	5	40	17	30	1017
22/08/2005 13:00	0	19	11.9	4	37	17	20	1017
22/08/2005 13:30	0	20	12.7	5	37	15	50	1016
22/08/2005 14:00	0	19	11.9	4	37	15	60	1016
22/08/2005 14:30	0	19	11.9	4	37	17	70	1016
22/08/2005 15:00	0	20	13	6	40	15	80	1016
22/08/2005 15:30	0	19	12.6	6	43	15	80	1016
22/08/2005 16:00	0	19	13	7	46	15	70	1016
22/08/2005 16:30	0	19	13	7	46	13	80	1016
22/08/2005 17:00	0	18	12.5	7	49	11	120	1016
22/08/2005 17:30	0	17	12	7	52	9	130	1017
22/08/2005 18:00	0	14	11	8	67	8	220	1017
22/08/2005 18:30	0	13	10.5	8	72	13	250	1017
22/08/2005 19:00	0	12	10.5	9	82	9	230	1018
22/08/2005 19:30	0	13	10.5	8	72	8	220	1019
22/08/2005 20:00	0	12	10	8	76	8	220	1019
22/08/2005 20:30	0	12	10	8	76	9	230	1019
22/08/2005 21:00	0	12	10.5	9	82	8	230	1019
22/08/2005 21:30	0	11	9.5	8	82	8	200	1019
22/08/2005 22:00	0	11	9.5	8	82	8	220	1019
22/08/2005 22:30	0	10	9	8	87	9	200	1020
22/08/2005 23:00	0	11	10	9	87	8	220	1020
22/08/2005 23:30	0	10	9	8	87	11	240	1020
23/08/2005 0:00	0	10	9	8	87	8	190	1019
23/08/2005 0:30	0	10	9.5	9	93	8	220	1019
23/08/2005 1:00	0	10	9	8	87	8	210	1019
23/08/2005 1:30	0	10	9	8	87	9	220	1019

Time / Date	Rain since 9am local time in mm	Air Temp in degrees C	Wet bulb temp in degrees C	Dew point temp in degrees C	Relative humidity %	Wind speed in km/h	Wind direction in degrees true	Mean sea level pressure in hPa
22/08/2005 3:30	0	9	8.1	7	87	2	250	1017
23/08/2005 2:30	0	9	8.5	8	93	8	200	1019
23/08/2005 3:00	0	9	8.1	7	87	8	180	1019
23/08/2005 3:30	0	8	7.5	7	93	9	230	1019
23/08/2005 4:00	0	9	8.1	7	87	11	230	1019
23/08/2005 4:30	0	10	9	8	87	5	210	1019
23/08/2005 5:00	0	9	8.1	7	87	9	180	1020
23/08/2005 5:30	0	11	9.1	7	76	2	210	1020
23/08/2005 6:00	0	10	8.2	6	76	11	210	1020
23/08/2005 6:30	0	13	10.5	8	72	17	220	1021
23/08/2005 7:00	0	14	10.6	7	63	18	210	1021
23/08/2005 7:30	0	14	10.6	7	63	18	200	1021
23/08/2005 8:00	0	16	11.2	6	51	18	200	1021
23/08/2005 8:30	0	17	11.7	6	48	21	210	1022
23/08/2005 9:00	0	18	12.1	6	45	18	200	1022
23/08/2005 9:30	0	19	12.6	6	43	21	210	1022
23/08/2005 10:00	0	19	12.6	6	43	18	190	1022
23/08/2005 10:30	0	19	12.6	6	43	21	200	1021
23/08/2005 11:00	0	20	12.7	5	37	18	180	1021
23/08/2005 11:30	0	20	12.7	5	37	17	150	1021
23/08/2005 12:00	0	20	12.7	5	37	21	150	1021
23/08/2005 12:30	0	21	13.5	6	38	22	140	1020
23/08/2005 13:00	0	21	13.5	6	38	24	120	1020
23/08/2005 13:30	0	20	13.4	7	43	24	120	1020
23/08/2005 14:00	0	20	13.4	7	43	26	120	1020
23/08/2005 14:30	0	19	13	7	46	22	140	1020
23/08/2005 15:00	0	19	13	7	46	22	160	1020
23/08/2005 15:30	0	18	12.5	7	49	21	160	1020
23/08/2005 16:00	0	19	13	7	46	21	120	1020
23/08/2005 16:30	0	18	12.9	8	52	17	140	1020
23/08/2005 17:00	0	18	12.9	8	52	17	140	1020
23/08/2005 17:30	0	16	12	8	59	11	160	1020
23/08/2005 18:00	0	15	11.9	9	67	11	170	1021
23/08/2005 18:30	0	14	11	8	67	8	200	1021
23/08/2005 19:00	0	13	10.5	8	72	8	200	1021
23/08/2005 19:30	0	13	11	9	77	8	220	1022
23/08/2005 20:00	0	12	10.5	9	82	8	200	1022
23/08/2005 20:30	0	13	10.5	8	72	11	210	1022
23/08/2005 21:00	0	13	10.5	8	72	13	220	1023
23/08/2005 21:30	0	13	10.1	7	67	13	210	1023
23/08/2005 22:00	0	14	10.6	7	63	15	220	1023
23/08/2005 22:30	0	14	10.6	7	63	15	220	1023
23/08/2005 23:00	0	14	10.6	7	63	17	220	1023
23/08/2005 23:30	0	15	11.1	7	59	17	210	1023
24/08/2005 0:00	0	14	10.6	7	63	13	210	1023

Wind Frequency analysis using available data between Oct 1987 and Sep 2005 for Coolangatta

Site Number 040717 • Locality: Coolangatta • Opened Jan 1982 • Still Open • Latitude 28°09'56"S • Longitude 153°30'34"E • Elevation 6m

Values are percentage frequencies; * indicates the range has occurred but with a frequency of less than 0.5%.

January 6 am

Calm 7	A total of 522 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	*	1	14	15	4	3	38
11–20	6	1	2	2	18	6	*	5	40
21–30	2	1	*	1	6	3		1	15
>30					*				*
All	8	2	2	4	38	25	5	9	100

February 6 am

Calm 5	A total of 473 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	*	*	*	17	18	3	3	43
11–20	2	1	*	2	21	7	*	3	37
21–30	2	1	1	1	6	2		1	13
>30	*			*	1	*		*	2
All	6	2	2	4	44	27	3	6	100

January 9 am

Calm 1	A total of 525 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	3	*	1	5	1	1	1	14
11–20	12	6	4	4	16	1	*	1	44
21–30	9	1	1	6	16	2		1	36
>30	*	*	*	*	3	*		*	4
All	23	10	6	11	39	5	1	4	100

February 9 am

Calm 1	A total of 466 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	2	1	2	6	2	1	2	18
11–20	8	2	2	4	23	4	*	1	45
21–30	6	*	2	6	12	3		1	31
>30		*		1	3	1		*	5
All	17	5	5	12	44	10	1	5	100

January 12 pm

Calm *	A total of 528 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	*		*	*	*	3
11–20	5	15	8	4	4	1	*	*	38
21–30	11	5	5	18	9	1		*	48
>30	2	*	*	2	6				11
All	19	21	13	25	19	2	1	1	100

February 12 pm

Calm	A total of 466 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	1	1	1	*		4
11–20	5	14	10	7	5	2			42
21–30	8	2	6	15	10	1		*	43
>30	1		*	3	5	*	*	*	10
All	15	18	17	25	21	4	*	1	100

January 3 pm

Calm 1	A total of 525 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	1	*	*				1
11–20	3	15	10	4	2	*		*	34
21–30	14	6	4	18	7	1		*	50
>30	2	*		6	6				14
All	20	21	14	28	15	1		*	100

February 3 pm

Calm	A total of 474 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	*	*	1	*	*		3
11–20	4	12	14	5	3	1	*		40
21–30	8	3	5	19	9	1	*	*	46
>30	1		*	2	6			*	11
All	13	16	20	27	20	2	1	1	100

January 6 pm

Calm	A total of 527 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	1	1	1	*		*	6
11–20	8	12	11	10	5	*	*	1	47
21–30	13	1	1	12	14	*			41
>30	1			1	4				6
All	24	14	13	24	23	1	*	1	100

February 6 pm

Calm *	A total of 473 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	*	1	1	1	1	*	*	7
11–20	9	11	10	15	6	2	1	*	54
21–30	7	*	1	9	15	1	*	*	34
>30	1		*	*	3	*			5
All	18	12	14	24	26	4	1	1	100

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Wind Frequency analysis using available data between Oct 1987 and Sep 2005 for Coolangatta

Site Number 040717 • Locality: Coolangatta • Opened Jan 1982 • Still Open • Latitude 28°09'56"S • Longitude 153°30'34"E • Elevation 6m

Values are percentage frequencies; * indicates the range has occurred but with a frequency of less than 0.5%.

March 6 am

Calm 6	A total of 539 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*			*	18	15	3	3	39
11–20	2	*	1	1	20	10	1	3	38
21–30	1	*	1	2	7	4		*	15
>30	*			*	1	*			2
All	3	*	2	4	45	29	4	6	100

April 6 am

Calm 7	A total of 527 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1		*	1	17	16	4	2	41
11–20	1	*	*	1	23	12	1	3	40
21–30	*	*	1	1	4	4			11
>30			*	*					1
All	1	*	2	3	44	33	5	5	100

March 9 am

Calm 1	A total of 536 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	3	1	1	6	1	1	*	16
11–20	6	2	2	2	28	4	*	3	46
21–30	4	*	1	3	18	4	*	2	32
>30			*	1	3	*			4
All	12	5	4	7	54	10	1	5	100

April 9 am

Calm 1	A total of 534 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	*	1	1	6	4	2	2	20
11–20	3	*	1	1	32	7	1	3	47
21–30	1	*	2	2	15	6		3	29
>30			1	1	1	*			2
All	6	1	4	5	54	18	3	8	100

March 12 pm

Calm	A total of 531 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	*	*	1	*	*	*	3
11–20	4	11	9	7	7	1	*	*	40
21–30	9	3	4	17	15	1		1	48
>30	*		*	2	7				9
All	13	15	13	26	29	3	*	1	100

April 12 pm

Calm *	A total of 525 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	1	1	1	*		*	4
11–20	6	11	10	9	11	2	1	1	50
21–30	3	1	3	13	17	3	*	1	42
>30			*	1	2				4
All	10	13	14	24	31	5	1	2	100

March 3 pm

Calm	A total of 541 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	*	*	1	*	*	3
11–20	2	9	13	7	3	1	*		36
21–30	9	3	4	22	9	1	*		48
>30	1	*	*	3	8	*			13
All	13	13	17	33	21	2	1	*	100

April 3 pm

Calm	A total of 532 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	1	1	*			4
11–20	3	11	12	10	7	3	1	1	48
21–30	4	2	2	19	14	1	*	*	43
>30			*	1	4				5
All	9	13	15	31	27	4	1	1	100

March 6 pm

Calm *	A total of 544 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	2	4	2	1	1	*	13
11–20	7	5	6	15	17	2	*	*	54
21–30	8	1	1	6	13	1		*	30
>30	1	*	*	*	1		*		3
All	17	8	10	25	34	5	1	1	100

April 6 pm

Calm 1	A total of 530 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	3	3	5	12	4	2	1	31
11–20	6	3	4	5	24	4	1	1	48
21–30	3	*	1	3	8	1		*	17
>30	*	*	*	1	1				2
All	13	6	8	14	44	9	3	2	100

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Prepared by Climate and Consultancy Section in the Brisbane Office of the Bureau of Meteorology.
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Wind Frequency analysis using available data between Oct 1987 and Sep 2005 for Coolangatta

Site Number 040717 • Locality: Coolangatta • Opened Jan 1982 • Still Open • Latitude 28°09'56"S • Longitude 153°30'34"E • Elevation 6m

Values are percentage frequencies; * indicates the range has occurred but with a frequency of less than 0.5%.

May 6 am

Calm 5	A total of 535 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1		*	1	16	16	5	2	41
11–20	1		1	*	20	13	1	2	39
21–30	1		1	1	5	5	*	*	13
>30		*	*	*	*	*			1
All	2	*	2	3	42	34	6	5	100

June 6 am

Calm 9	A total of 525 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*	1	17	15	7	2	42
11–20	1		*	*	16	10	2	4	34
21–30	*		*	1	4	7	*	*	13
>30		*	*		*	1		*	2
All	2	*	1	1	37	32	9	7	100

May 9 am

Calm 5	A total of 543 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	*		2	11	5	2	1	23
11–20	1	*	*	1	19	13	1	5	41
21–30	*	*	1	2	14	10	*	1	29
>30		*	1	*	1				2
All	3	1	2	5	45	28	3	8	100

June 9 am

Calm 11	A total of 532 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2		*	*	11	8	3	2	26
11–20	3	*	*	1	17	10	2	8	41
21–30			1	*	8	9		2	20
>30			*	*	1	*			2
All	4	*	2	2	37	28	5	11	100

May 12 pm

Calm 1	A total of 534 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	2	1	1	3	1	1	1	11
11–20	9	6	3	5	20	4	1	2	50
21–30	3		1	3	19	6	*	2	34
>30			1	1	3	*			5
All	13	8	6	9	44	11	2	5	100

June 12 pm

Calm 1	A total of 528 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	3	2	2	3	1	1	1	15
11–20	10	4	1	3	19	5	2	3	47
21–30	3	*	1	1	16	6	1	4	31
>30	*	*		*	3	1		*	5
All	17	8	3	7	40	13	4	8	100

May 3 pm

Calm *	A total of 535 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	1	1	2	1	1	*	9
11–20	6	8	7	10	13	5	1	1	50
21–30	4	1	1	9	17	3	*	2	36
>30	*		1	*	2	*			3
All	11	11	10	20	33	9	2	3	100

June 3 pm

Calm 1	A total of 532 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	4	2	2	2	1	2	1	15
11–20	9	6	5	10	12	5	2	3	52
21–30	6	*	*	4	13	3	2	2	30
>30		*		*	2	1			3
All	16	11	7	16	30	9	5	6	100

May 6 pm

Calm 2	A total of 537 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	1	*	2	10	14	6	1	36
11–20	6	*	1	2	23	10	4	2	49
21–30	2	*	1	1	7	1		*	12
>30			*	*	*				1
All	9	2	3	5	40	26	10	3	100

June 6 pm

Calm 4	A total of 528 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	*	9	17	7	3	40
11–20	5	*	1	*	17	11	5	5	44
21–30	2	1	*	1	5	2	*	1	11
>30		*	*		*	*			1
All	9	2	1	2	31	30	12	9	100

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Wind Frequency analysis using available data between Oct 1987 and Sep 2005 for Coolangatta

Site Number 040717 • Locality: Coolangatta • Opened Jan 1982 • Still Open • Latitude 28°09'56"S • Longitude 153°30'34"E • Elevation 6m

Values are percentage frequencies; * indicates the range has occurred but with a frequency of less than 0.5%.

July 6 am

Calm 12	A total of 538 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*	1	12	15	4	4	37
11–20	2			*	18	13	2	4	40
21–30	*	1	*		3	5	*	1	10
>30	*	*			*	*	*	*	1
All	3	1	*	1	33	33	7	9	100

August 6 am

Calm 9	A total of 547 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*	*	14	19	4	4	43
11–20	3	*	*	1	14	10	2	7	37
21–30	1			1	2	4	*	1	10
>30	*		*	*	*	*		*	1
All	6	1	*	2	31	34	7	12	100

July 9 am

Calm 11	A total of 535 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	1		1	9	5	5	4	26
11–20	4	*	*	*	14	12	3	6	39
21–30	1	1	*	*	7	10	*	3	23
>30		*			*	*	*		1
All	7	2	*	1	30	27	9	13	100

August 9 am

Calm 5	A total of 551 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	*	*	2	8	4	4	3	24
11–20	7	1	*	*	16	8	1	9	43
21–30	4	*	*	1	10	8	*	5	28
>30					1	1		*	2
All	13	1	1	3	34	21	6	17	100

July 12 pm

Calm	A total of 539 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	4	1	2	2	1	1	1	17
11–20	9	8	3	2	14	5	1	3	44
21–30	5	1	*	1	17	5	1	5	35
>30	1			*	2	*	*	*	4
All	20	13	4	5	35	11	4	9	100

August 12 pm

Calm *	A total of 551 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	1	1	1	*	1	*	6
11–20	10	10	6	5	9	2	1	2	46
21–30	15	*	1	5	14	2	3	4	43
>30	1			*	3	*	*	*	5
All	26	12	8	12	26	5	5	6	100

July 3 pm

Calm *	A total of 537 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	3	2	1	1	*	1	*	9
11–20	7	10	8	8	11	3	2	4	53
21–30	8	*	*	4	13	2	3	3	34
>30	*	*	*	*	3				4
All	17	13	11	13	28	5	6	7	100

August 3 pm

Calm *	A total of 551 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	1	*	1	*	*		4
11–20	6	12	10	7	4	1	3	2	46
21–30	15	1	1	11	10	1	3	2	45
>30	2			1	1	*	1	*	5
All	23	15	12	19	16	3	7	4	100

July 6 pm

Calm 3	A total of 537 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	1	1	10	13	6	3	36
11–20	9	1	1	*	15	9	5	4	45
21–30	4	*			6	1	1	1	14
>30	*	*	*	*	1			*	1
All	15	3	1	2	32	23	12	9	100

August 6 pm

Calm 1	A total of 547 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	3	3	5	9	5	3	1	31
11–20	12	2	2	3	16	4	4	4	46
21–30	13			1	4	*	1	1	21
>30	1								1
All	27	5	5	9	29	10	9	6	100

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September 6 am

Calm 10	A total of 521 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	*	*	*	12	17	7	5	43
11–20	6		*	1	10	6	2	9	33
21–30	4	*	*		3	2		3	13
>30	*				*	*		*	1
All	12	1	1	2	24	25	9	17	100

October 6 am

Calm 7	A total of 535 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*	1	13	14	5	5	40
11–20	7	1	*	1	10	6	1	8	33
21–30	7	*	*	*	5	2	*	3	18
>30	1		*		*			*	2
All	16	1	1	2	29	22	6	16	100

September 9 am

Calm 3	A total of 513 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	5	3	2	1	3	3	1	1	18
11–20	11	2	1	2	14	4	1	4	40
21–30	13	*	1	*	12	3	1	6	36
>30	1				2	1	*	*	4
All	30	5	4	3	31	10	4	11	100

October 9 am

Calm 1	A total of 546 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	1	2	1	3	*	1	1	11
11–20	16	6	2	3	13	3	1	3	46
21–30	18	*	1	2	12	1	*	3	38
>30	1			*	2	*		*	4
All	37	8	4	7	30	5	2	7	100

September 12 pm

Calm	A total of 513 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*	*	1	*	*	*	3
11–20	5	18	7	5	3	1	1	1	42
21–30	20	2	1	10	7	1	1	2	44
>30	6			1	2	*	1	1	11
All	32	21	9	16	13	2	3	4	100

October 12 pm

Calm	A total of 548 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	*	1	*	*	*	4
11–20	5	13	8	3	3	*	*	*	34
21–30	18	6	5	11	5	1	1	1	48
>30	7	*		3	3		*	1	14
All	31	21	14	18	11	1	2	2	100

September 3 pm

Calm	A total of 524 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	*	*			*	3
11–20	4	16	10	5	1	*	1	*	37
21–30	20	4	1	13	5	1	4	2	49
>30	7			2	2		*	*	11
All	31	20	12	20	8	1	5	3	100

October 3 pm

Calm *	A total of 546 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	1	*	*	1	*	*		3
11–20	6	14	11	5	2	*	*	*	38
21–30	22	5	2	10	4	*	1	1	45
>30	5			4	3	*	1	*	14
All	33	20	13	19	9	1	3	1	100

September 6 pm

Calm *	A total of 514 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	4	4	4	4	4	1	1	1	23
11–20	13	4	4	5	11	2	4	3	46
21–30	19	*	*	1	5	*	1	1	28
>30	2			*	*	*			3
All	37	8	8	11	21	3	6	5	100

October 6 pm

Calm 1	A total of 540 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	4	2	3	4	1	1	1	1	15
11–20	13	8	4	9	8	1	1	2	46
21–30	21	1	1	2	8	*	1	1	34
>30	2			*	1		*	*	4
All	40	11	7	15	18	2	2	4	100

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November 6 am

Calm 8	A total of 512 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	1	1	12	11	3	4	35
11–20	7	*	*	*	14	5	1	8	37
21–30	6	*	*	1	5	3		3	19
>30	*				1	*		*	2
All	15	1	1	2	33	20	4	15	100

December 6 am

Calm 6	A total of 543 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	*		1	12	15	4	4	38
11–20	6	1	1	1	14	6	*	8	37
21–30	5	1	1	1	5	3		3	18
>30	*		*	*	*				1
All	14	1	2	2	31	23	5	15	100

November 9 am

Calm 1	A total of 509 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	1	*	1	3	1	1	1	9
11–20	14	7	3	4	14	3	*	2	46
21–30	15	1	1	3	11	3	*	4	38
>30	2		*	*	3	*		1	7
All	32	9	4	9	31	6	1	8	100

December 9 am

Calm 1	A total of 551 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	3	2	1	1	3	2	*	1	13
11–20	13	7	3	4	13	2	1	2	45
21–30	17	1	1	4	11	1	*	2	37
>30	1		*	1	2	*			4
All	34	9	6	10	29	6	1	5	100

November 12 pm

Calm	A total of 512 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*		*	*	*		3
11–20	4	12	8	5	3	*	*	*	33
21–30	18	7	6	11	6	1	*	1	51
>30	4	*		3	4		*	1	13
All	27	20	15	19	13	1	2	3	100

December 12 pm

Calm *	A total of 538 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	*	*	*	*	*			2
11–20	6	14	9	4	2	*		*	35
21–30	18	7	6	14	5	*	1	1	52
>30	4		*	4	3			*	11
All	29	21	15	21	11	1	1	1	100

November 3 pm

Calm *	A total of 515 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	1	*	*			*	2
11–20	5	12	9	5	2	*	1	*	34
21–30	21	5	4	13	4		1	1	48
>30	4	*		4	5		*	*	15
All	31	18	14	22	11	*	2	2	100

December 3 pm

Calm	A total of 552 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	*	*	*		*			*	1
11–20	6	13	10	4	1	1	1	*	35
21–30	20	4	4	16	5	1	1	1	51
>30	5	*	*	3	4		*	*	12
All	31	17	14	24	10	2	1	1	100

November 6 pm

Calm 1	A total of 511 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	2	2	2	2	1	1	1	*	11
11–20	12	8	9	8	5	1	1	1	45
21–30	17	1	1	5	10	*	1	1	37
>30	3			*	3				6
All	35	10	11	16	20	2	3	2	100

December 6 pm

Calm *	A total of 544 observations analysed								
km/h	N	NE	E	SE	S	SW	W	NW	All
1–10	1	2	1	1	1	*	1	1	7
11–20	14	8	10	12	5	*	1	1	51
21–30	16	2	1	9	8	*	*	*	38
>30	3	*	*	*	1	*		*	5
All	34	11	12	23	15	1	2	2	100

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Appendix B

Background Noise Traces

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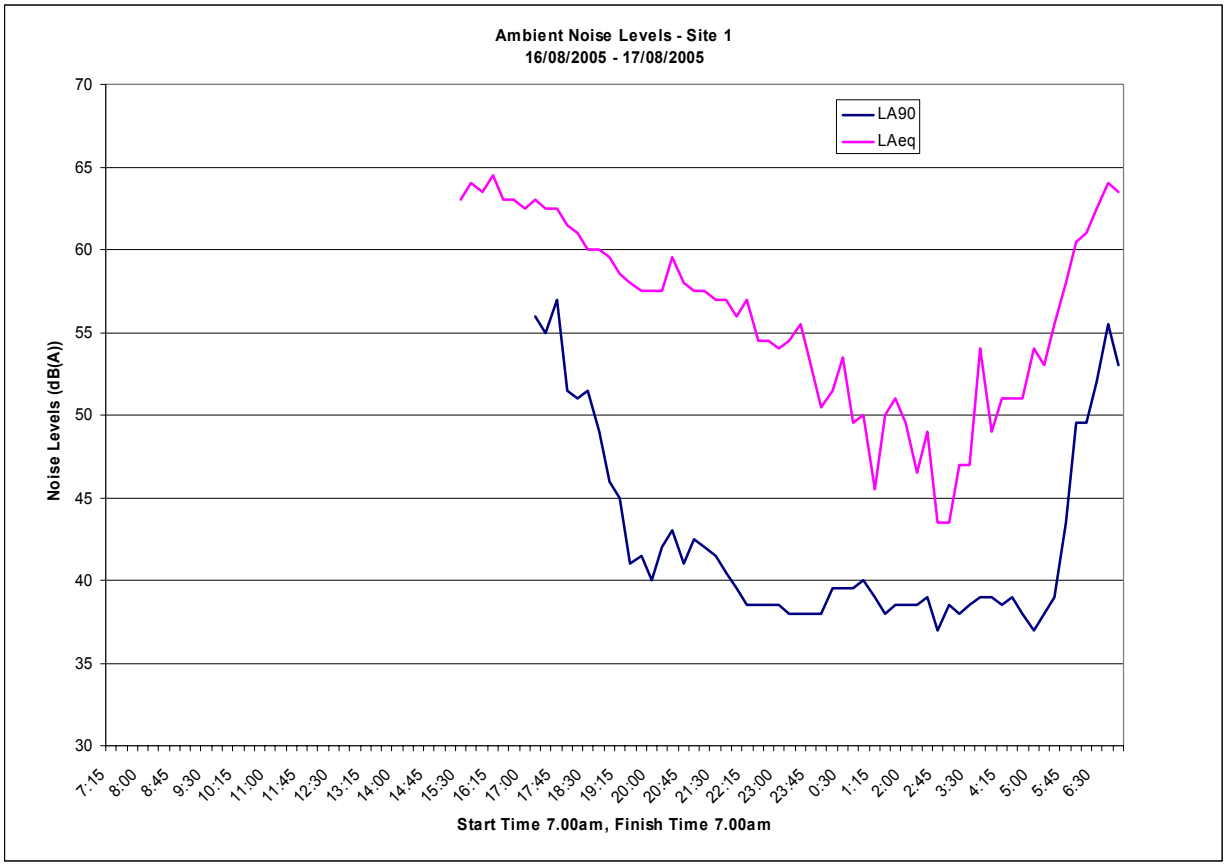
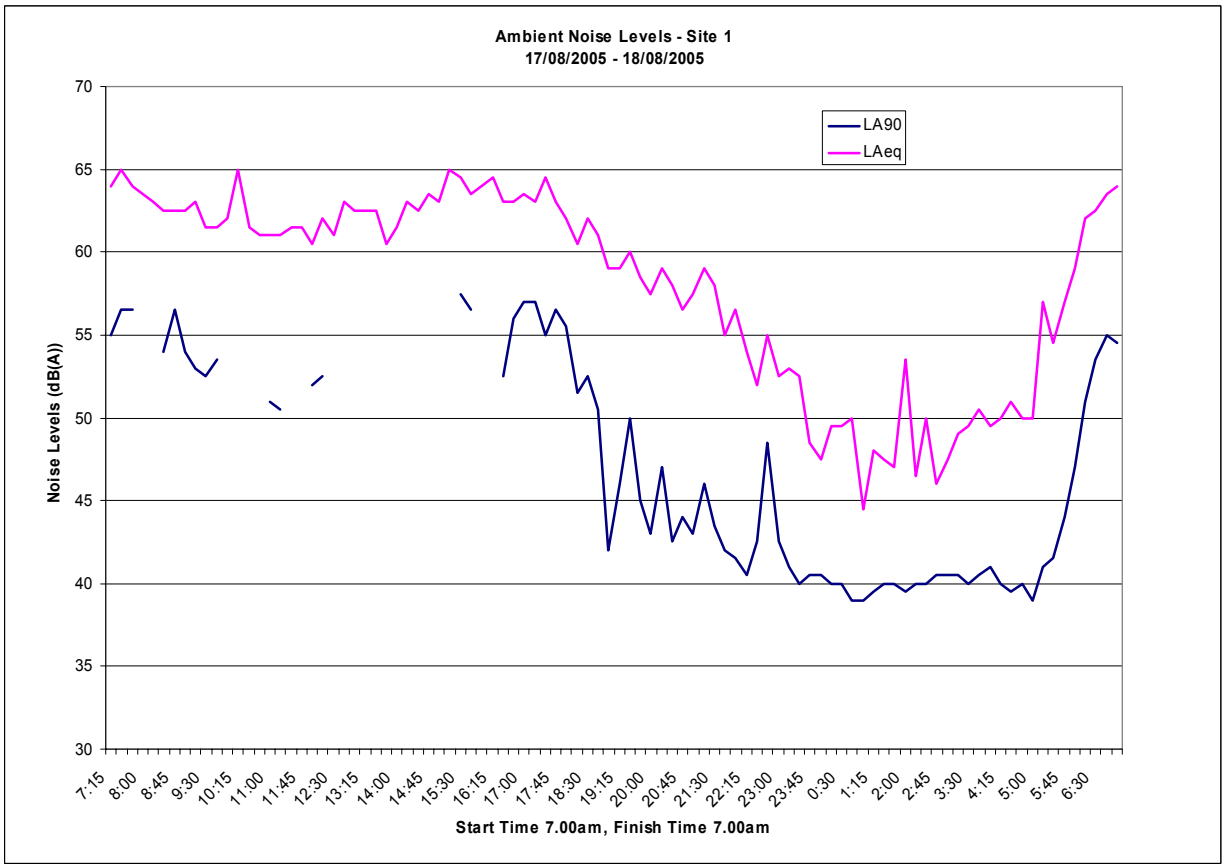

Ambient Noise Levels - Site 1
16/08/2005 - 17/08/2005
LA90
LAeq
Noise Levels (dB(A))
70
65
60
55
50
45
40
35
30
7:15 8:00 8:45 9:30 10:15 11:00 11:45 12:30 13:15 14:00 14:45 15:30 16:15 17:00 17:45 18:30 19:15 20:00 20:45 21:30 22:15 23:00 23:45 0:30 1:15 2:00 2:45 3:30 4:15 5:00 5:45 6:30
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 1
17/08/2005 - 18/08/2005
LA90
LAeq
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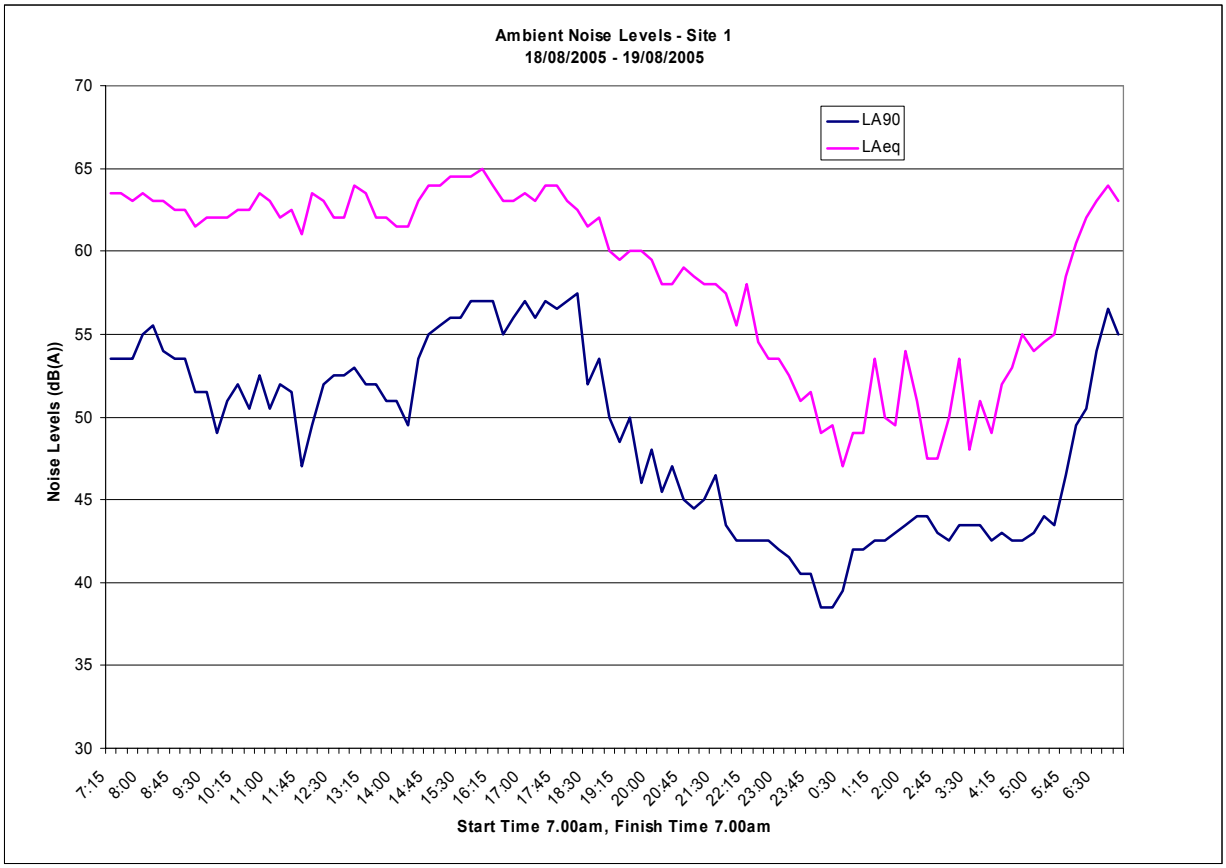
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 1
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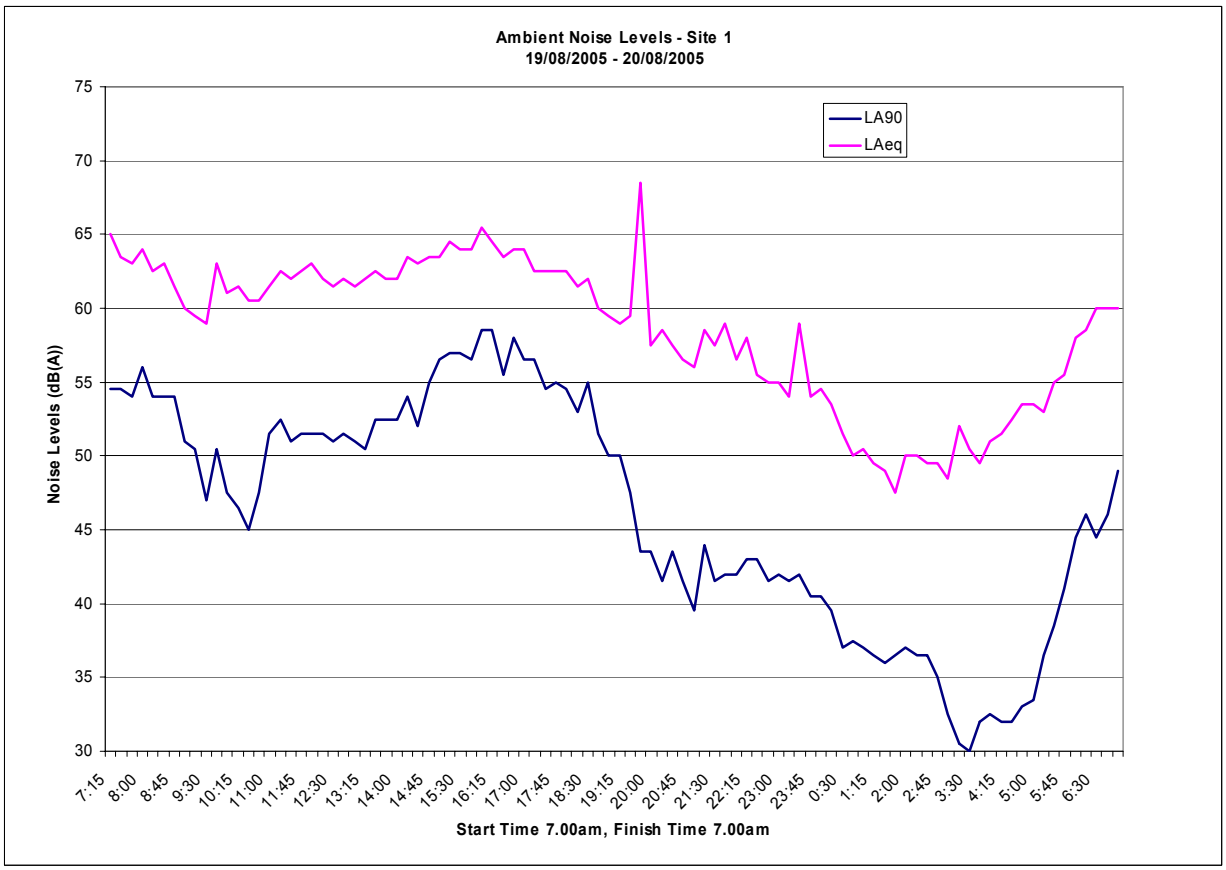
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 1
19/08/2005 - 20/08/2005
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Noise Levels (dB(A))
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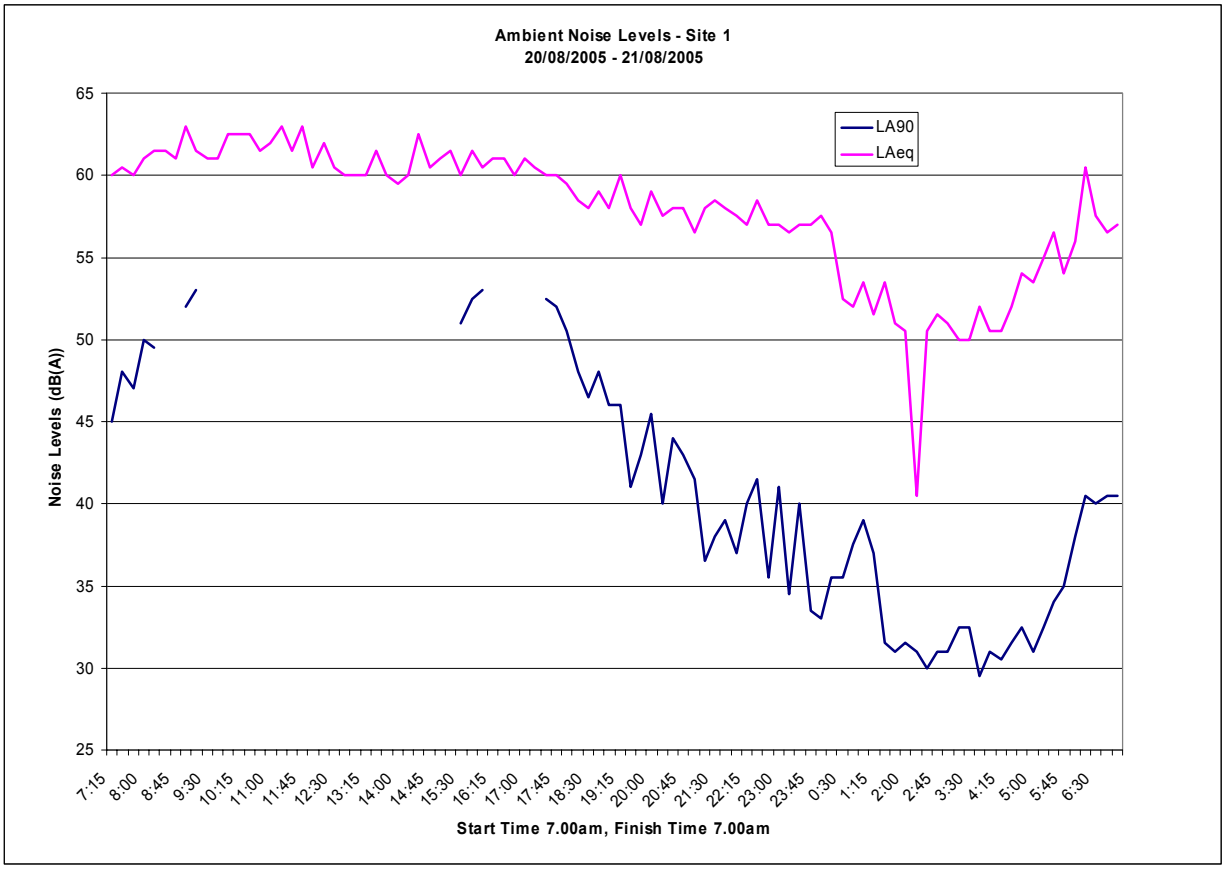
Ambient Noise Levels - Site 1
20/08/2005 - 21/08/2005
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Noise Levels (dB(A))
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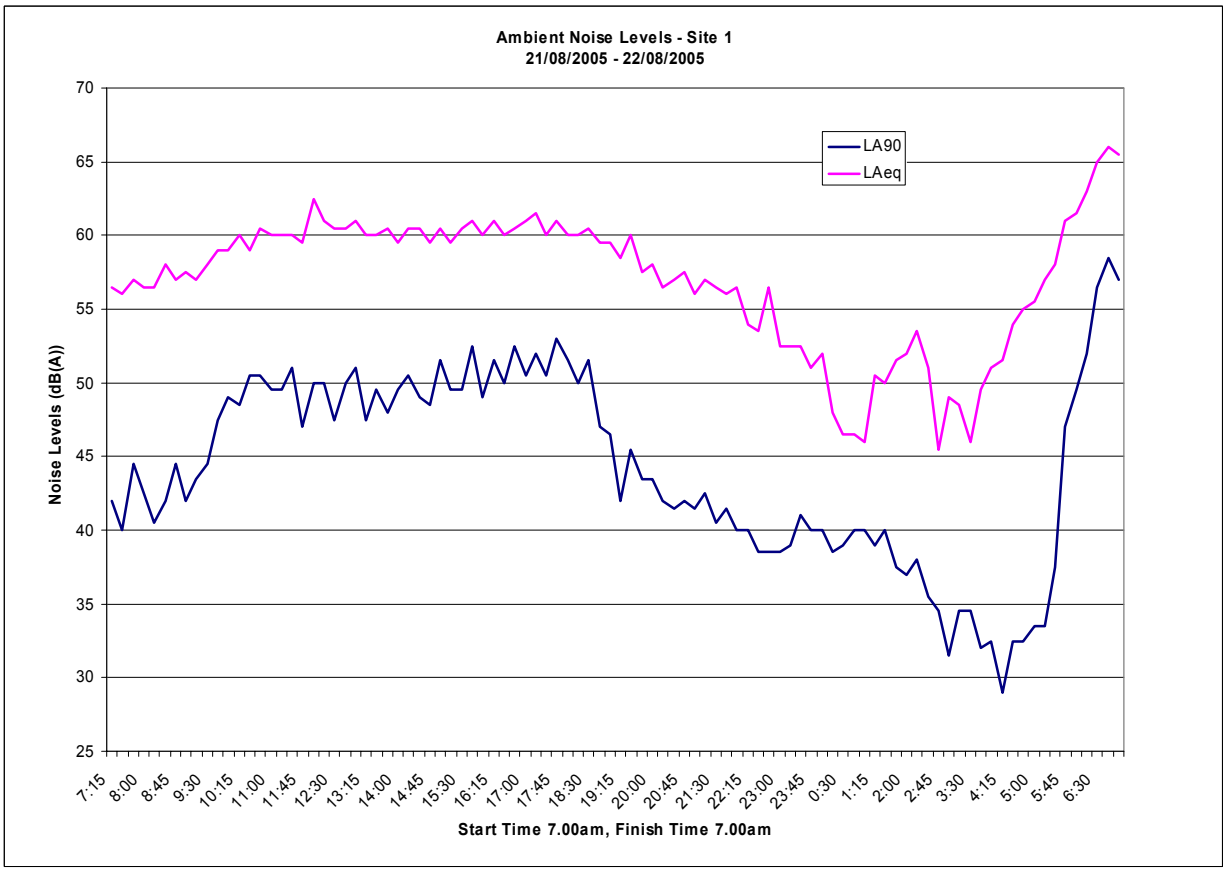
Ambient Noise Levels - Site 1
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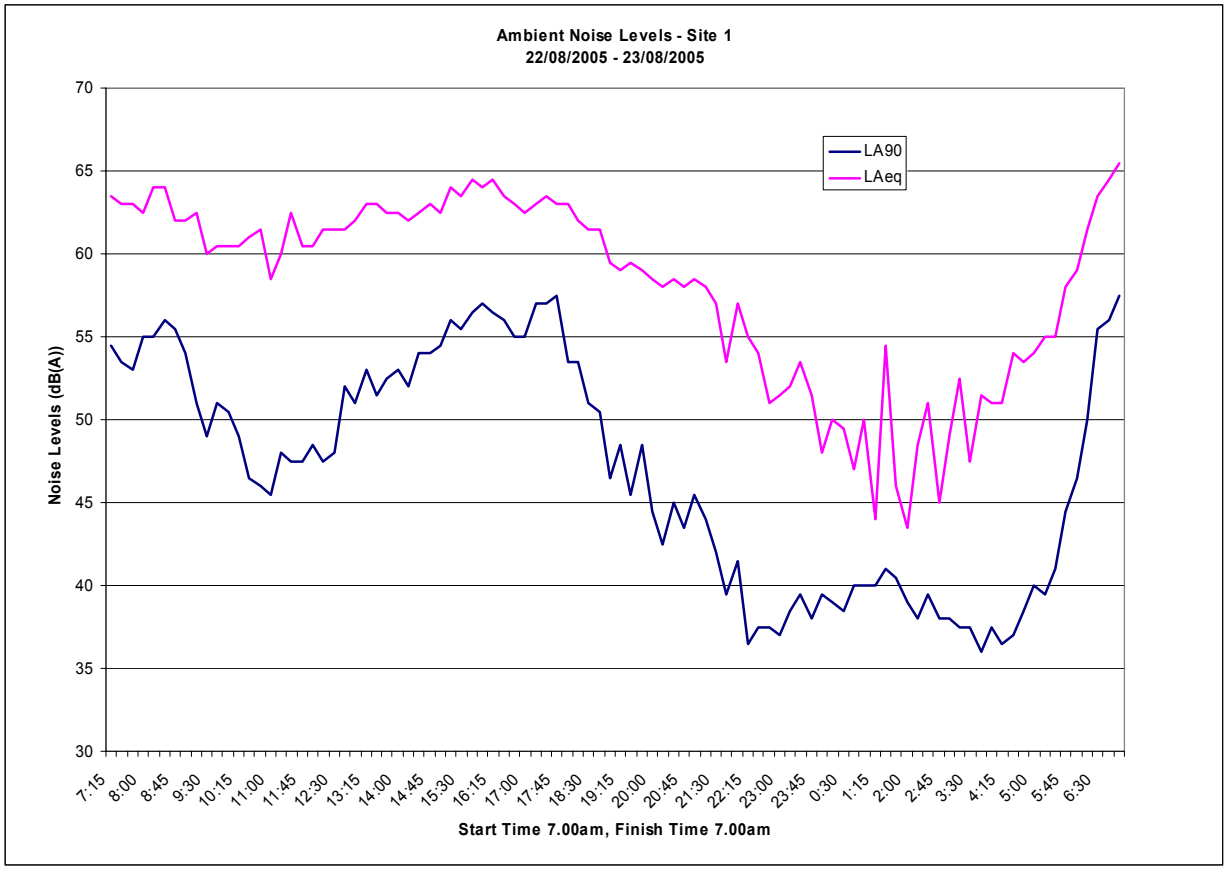
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 1
22/08/2005 - 23/08/2005
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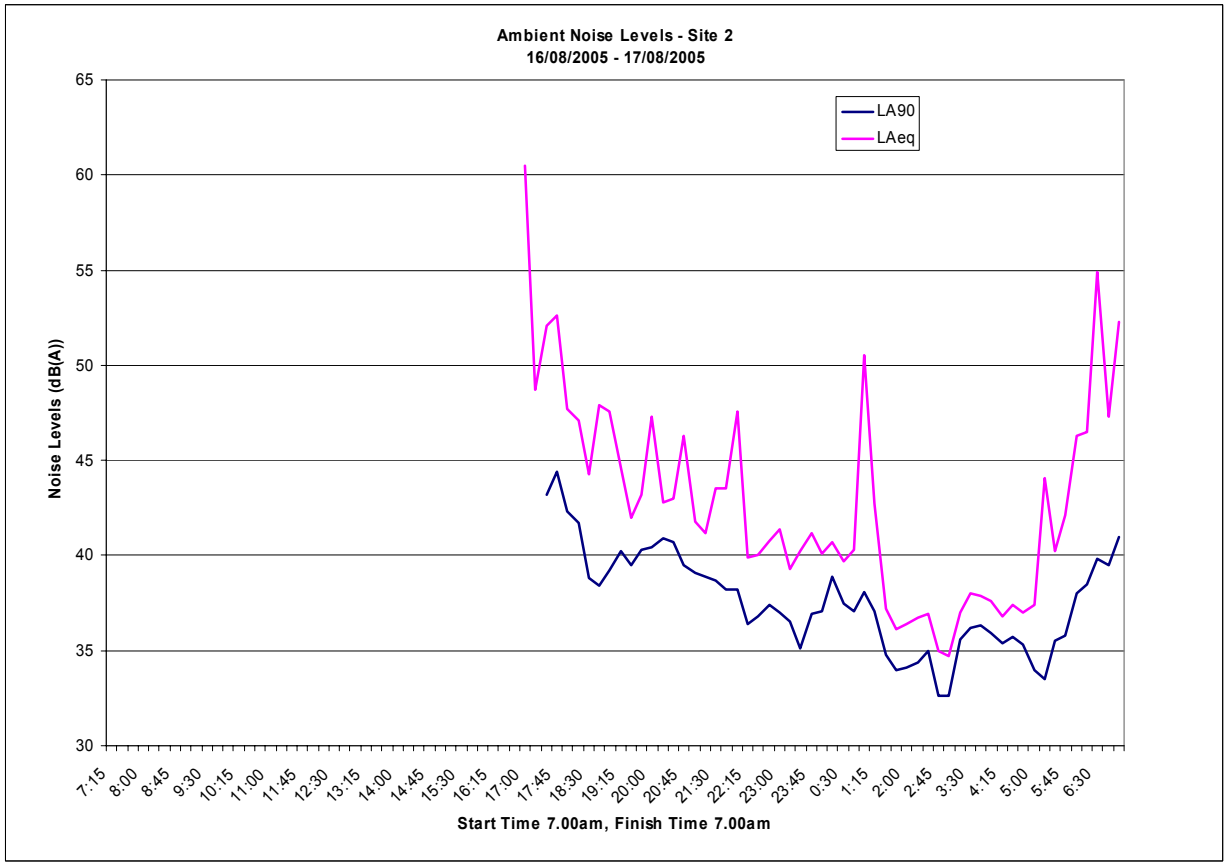
Start Time 7.00am, Finish Time 7.00am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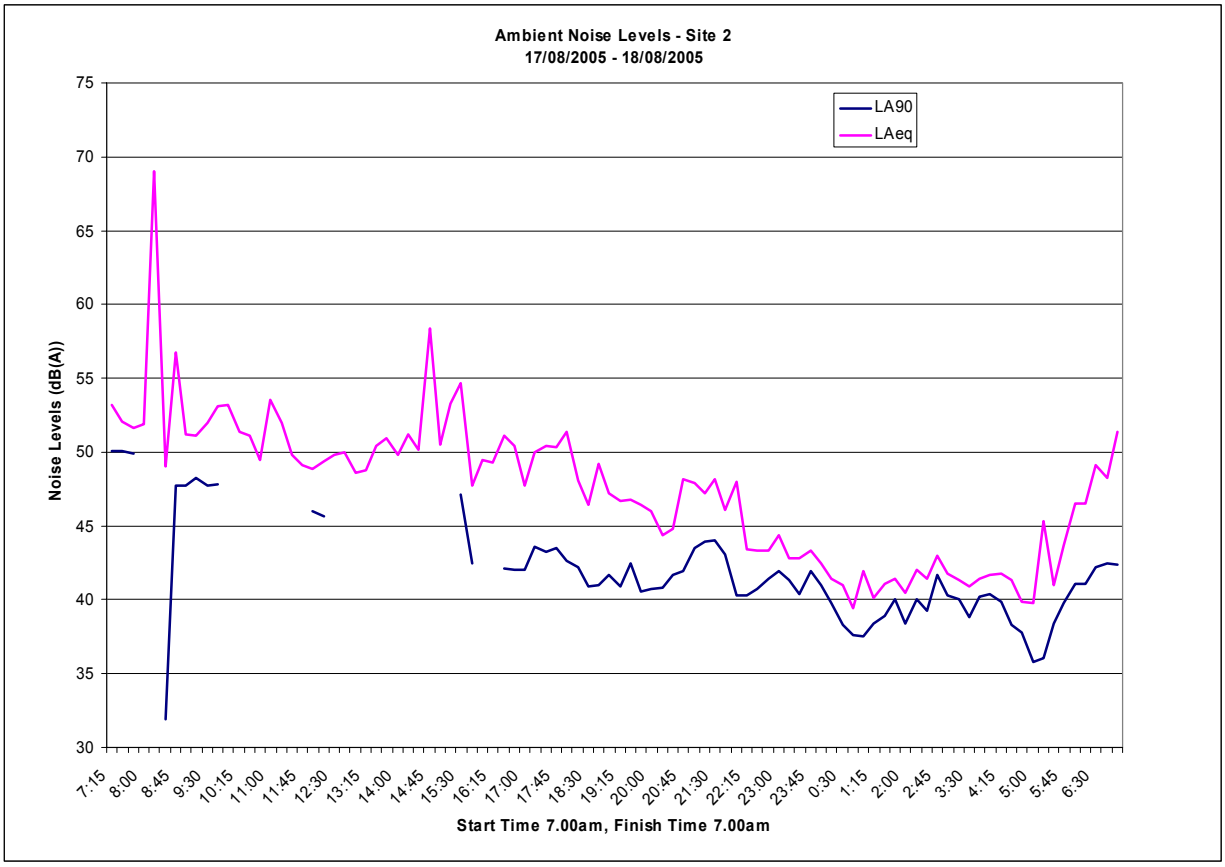
Start Time 7.00am, Finish Time 7.00am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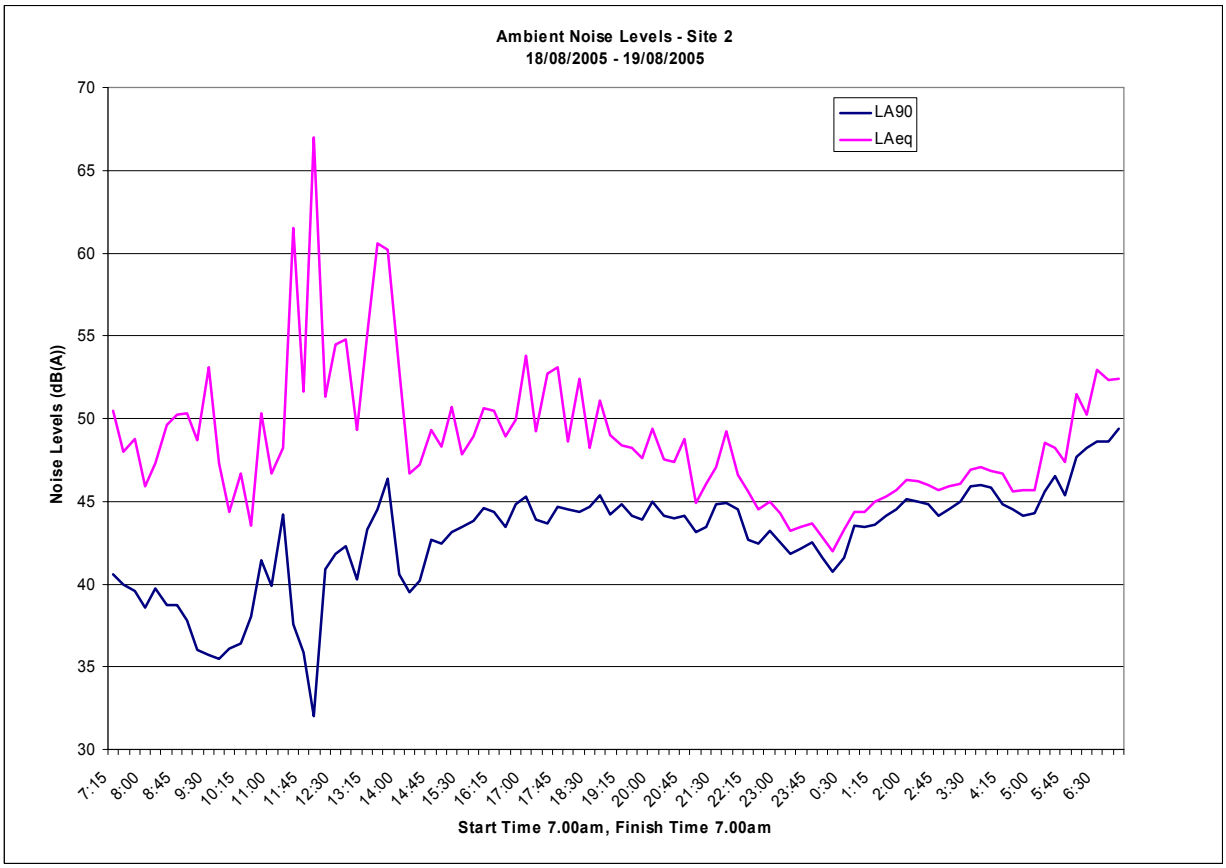
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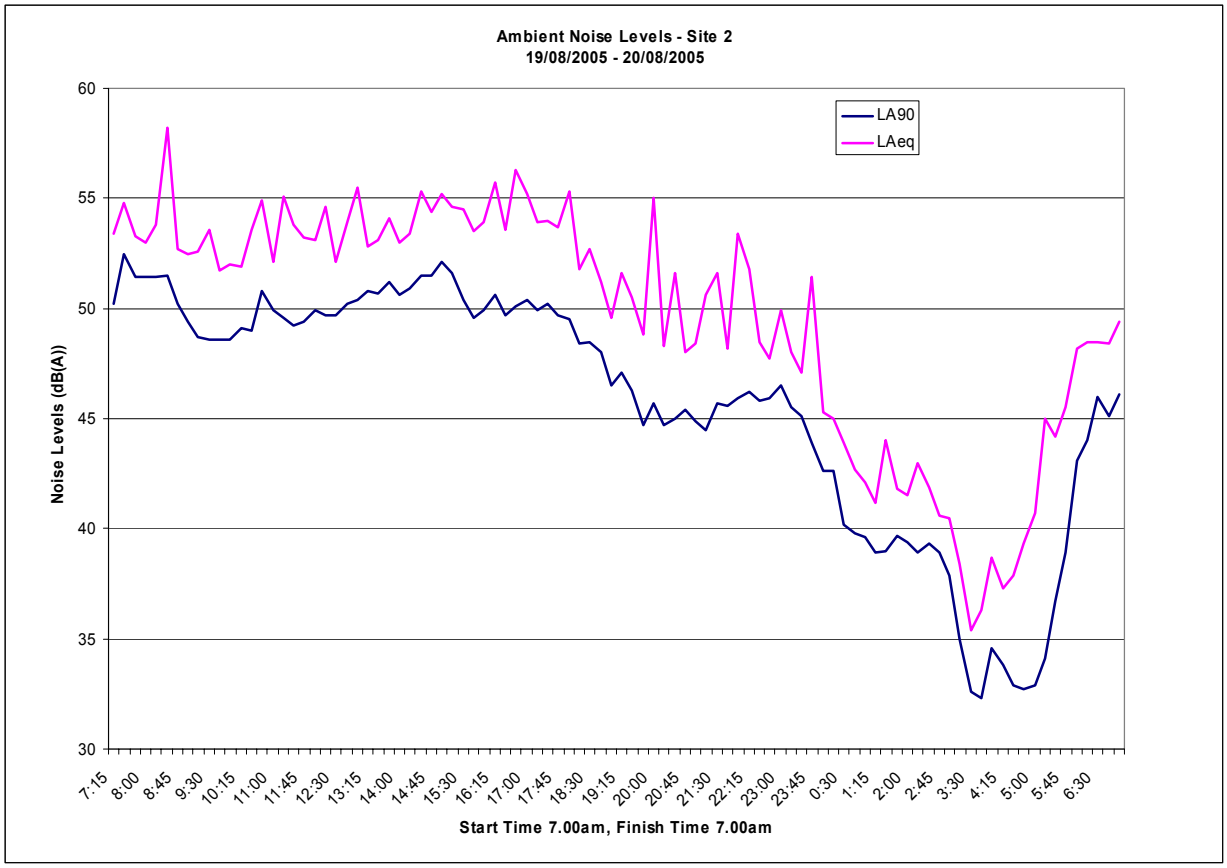
Ambient Noise Levels - Site 2
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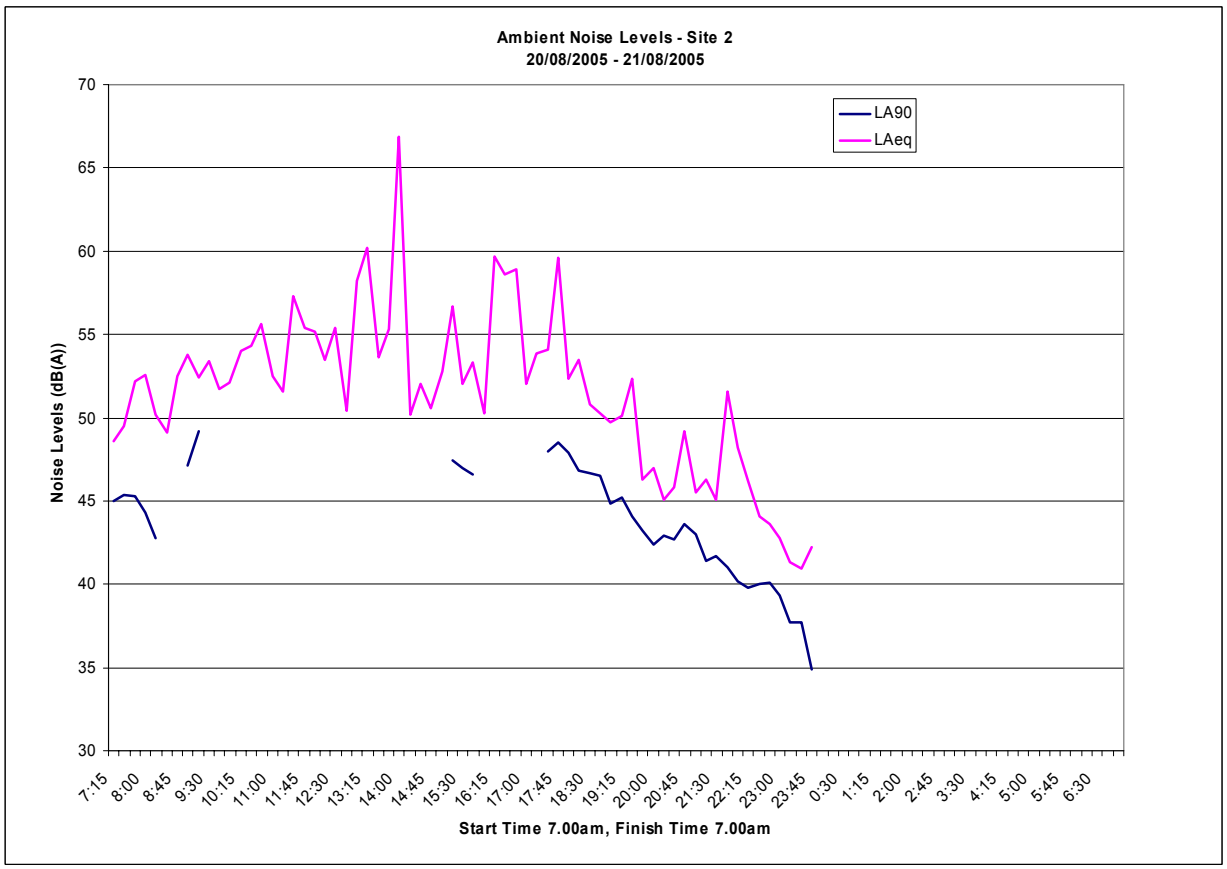
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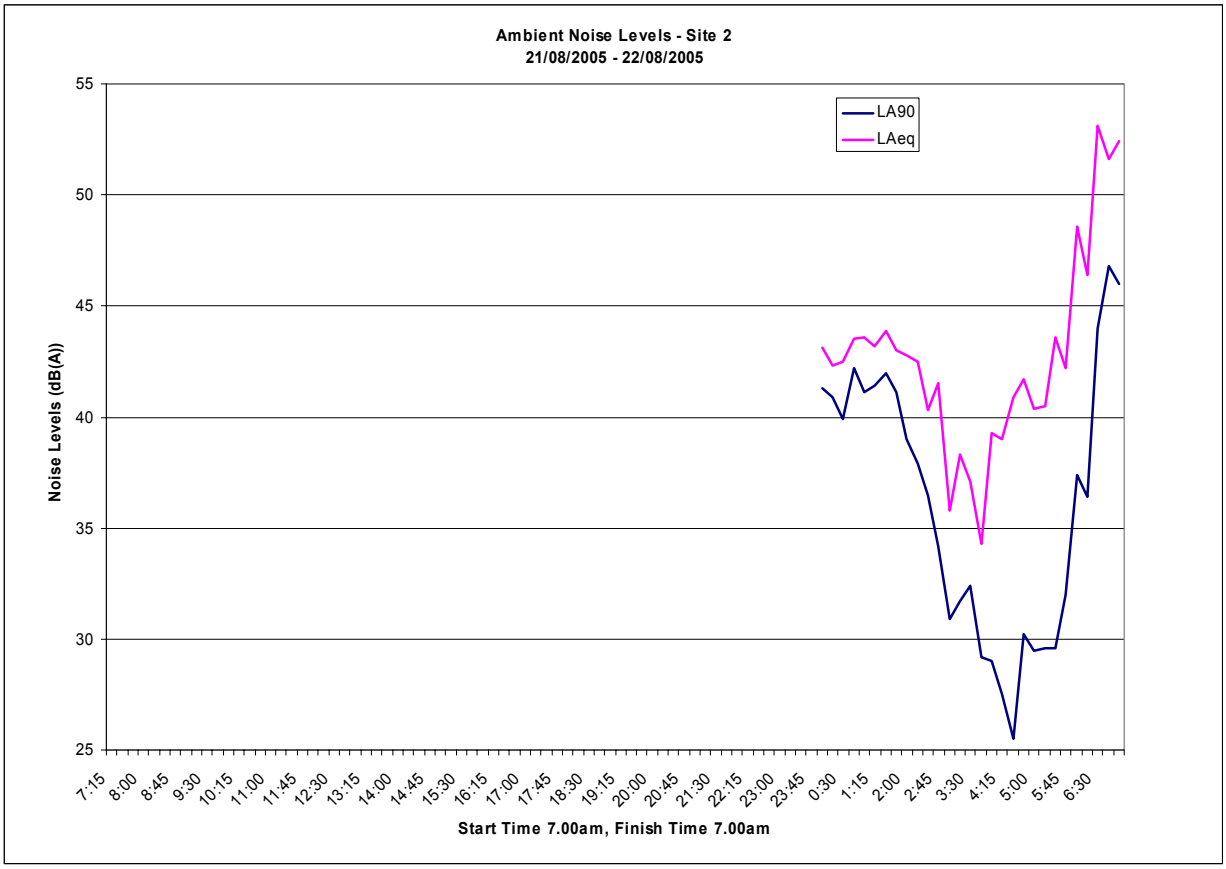
Ambient Noise Levels - Site 2
21/08/2005 - 22/08/2005
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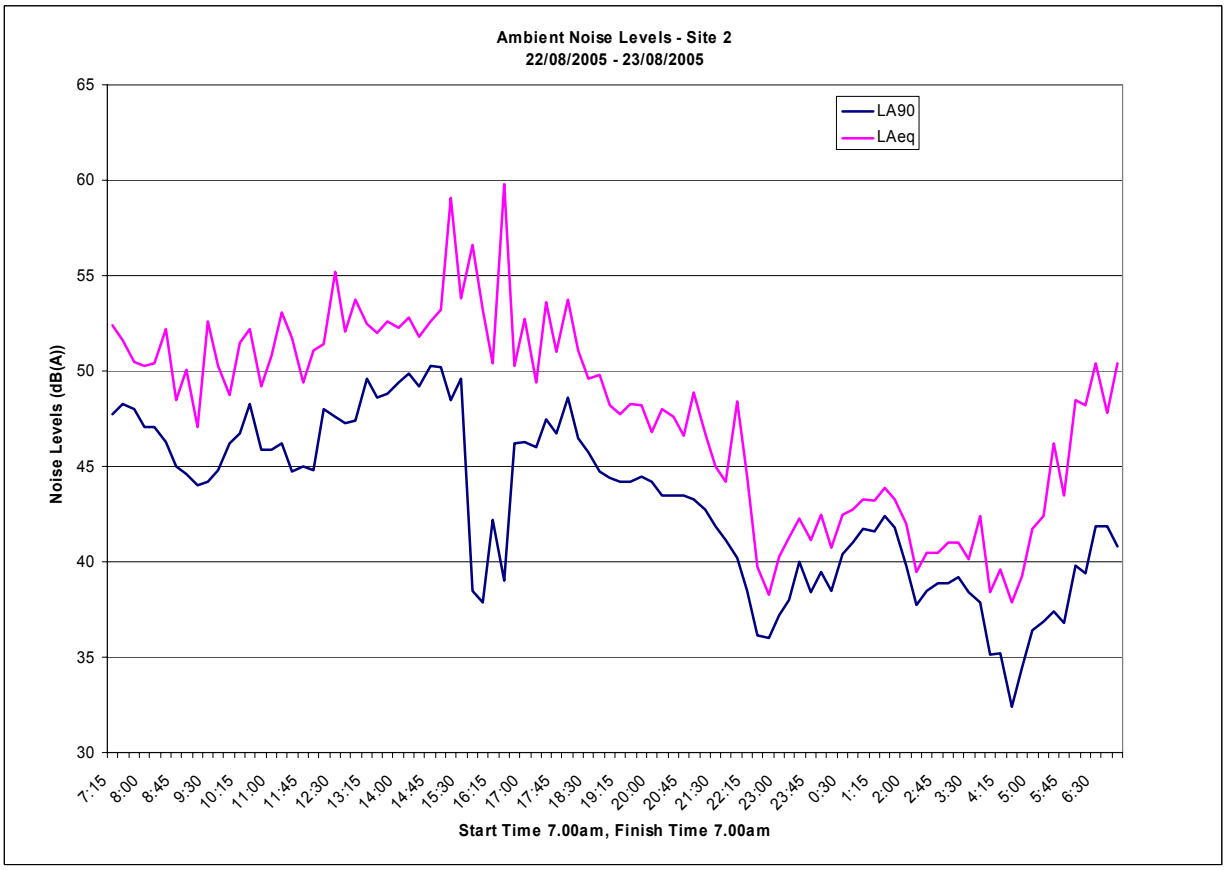
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 2
22/08/2005 - 23/08/2005
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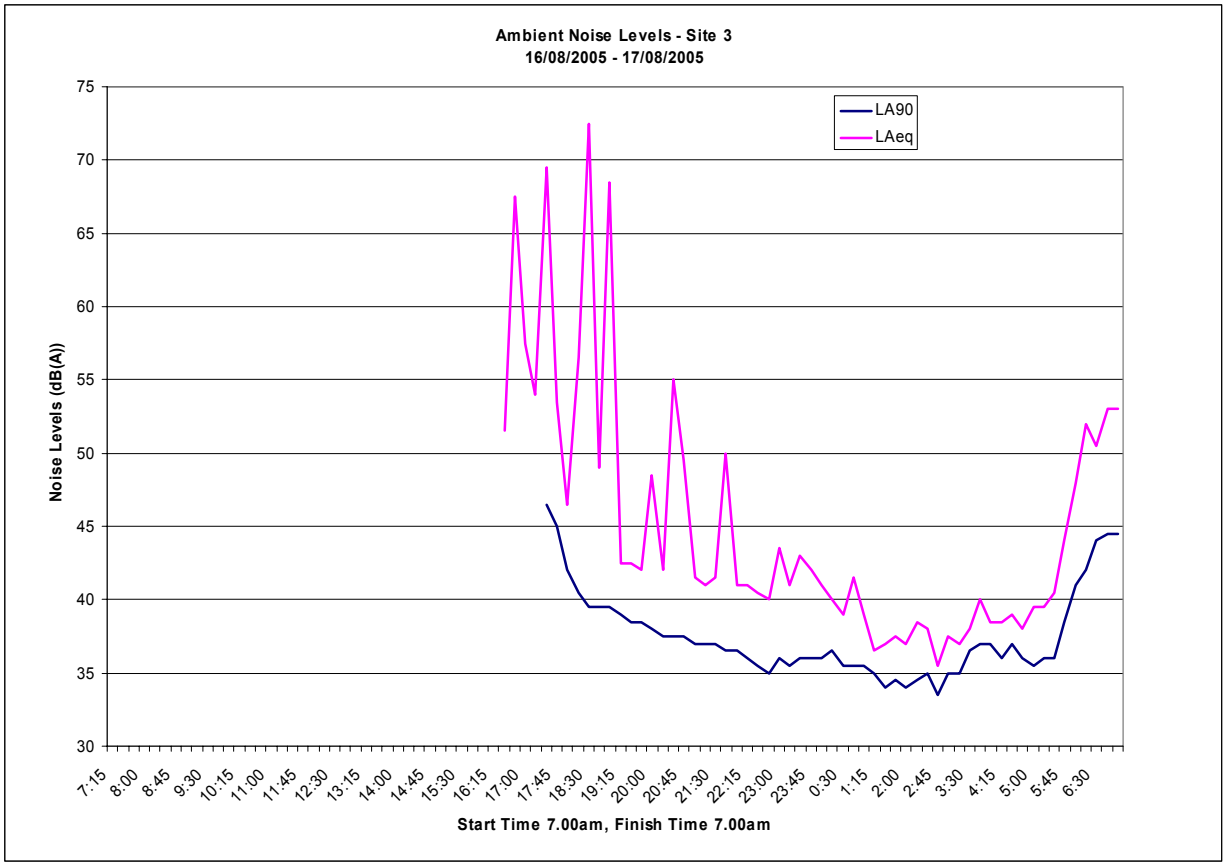
Start Time 7.00am, Finish Time 7.00am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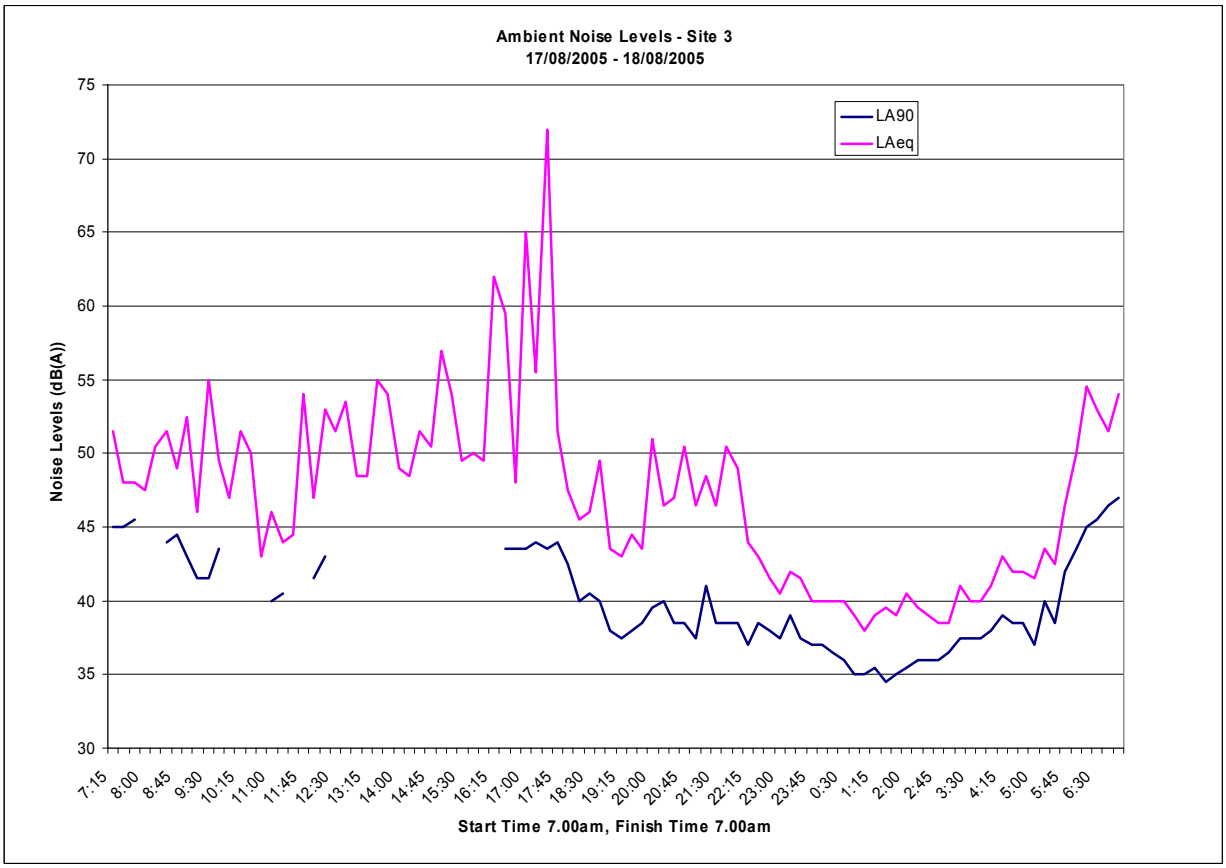
Start Time 7.00am, Finish Time 7.00am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17/08/2005 - 18/08/2005
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Noise Levels (dB(A))
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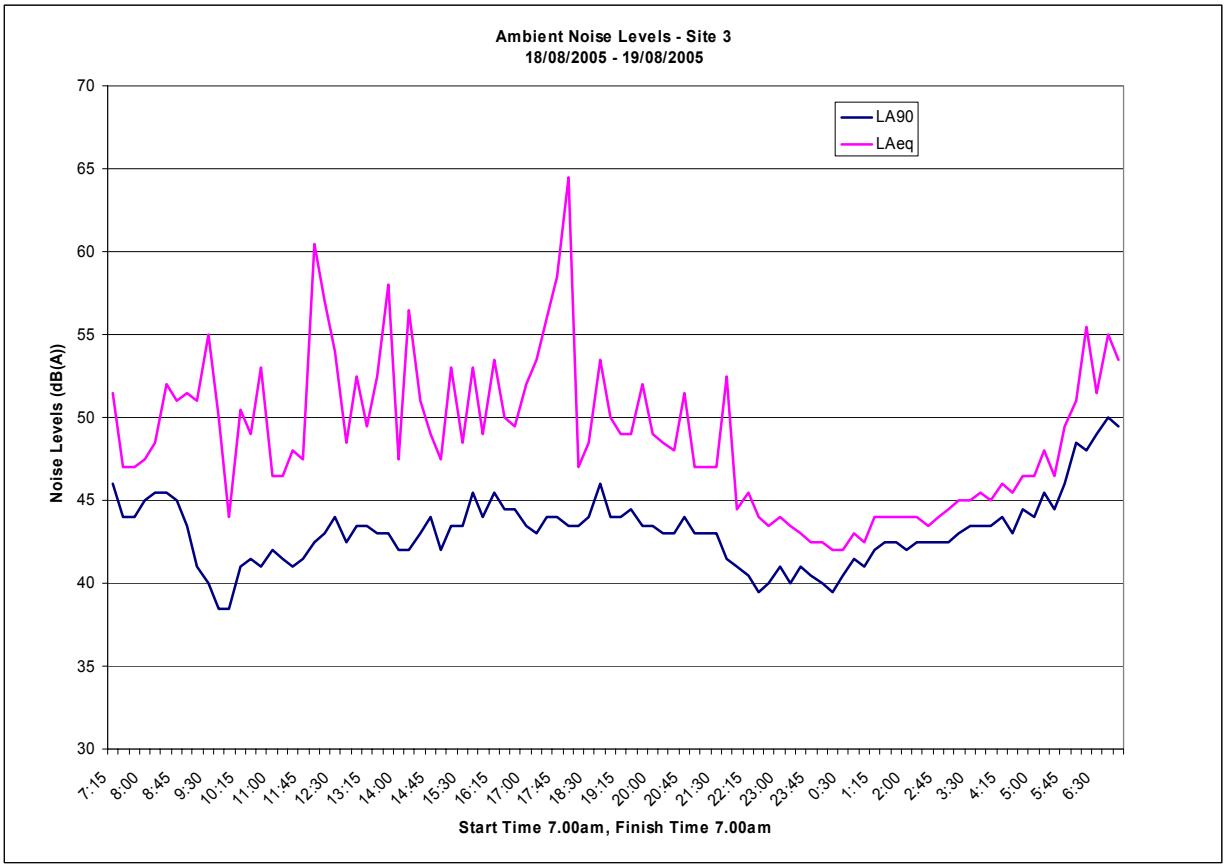
Ambient Noise Levels - Site 3
18/08/2005 - 19/08/2005
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Noise Levels (dB(A))
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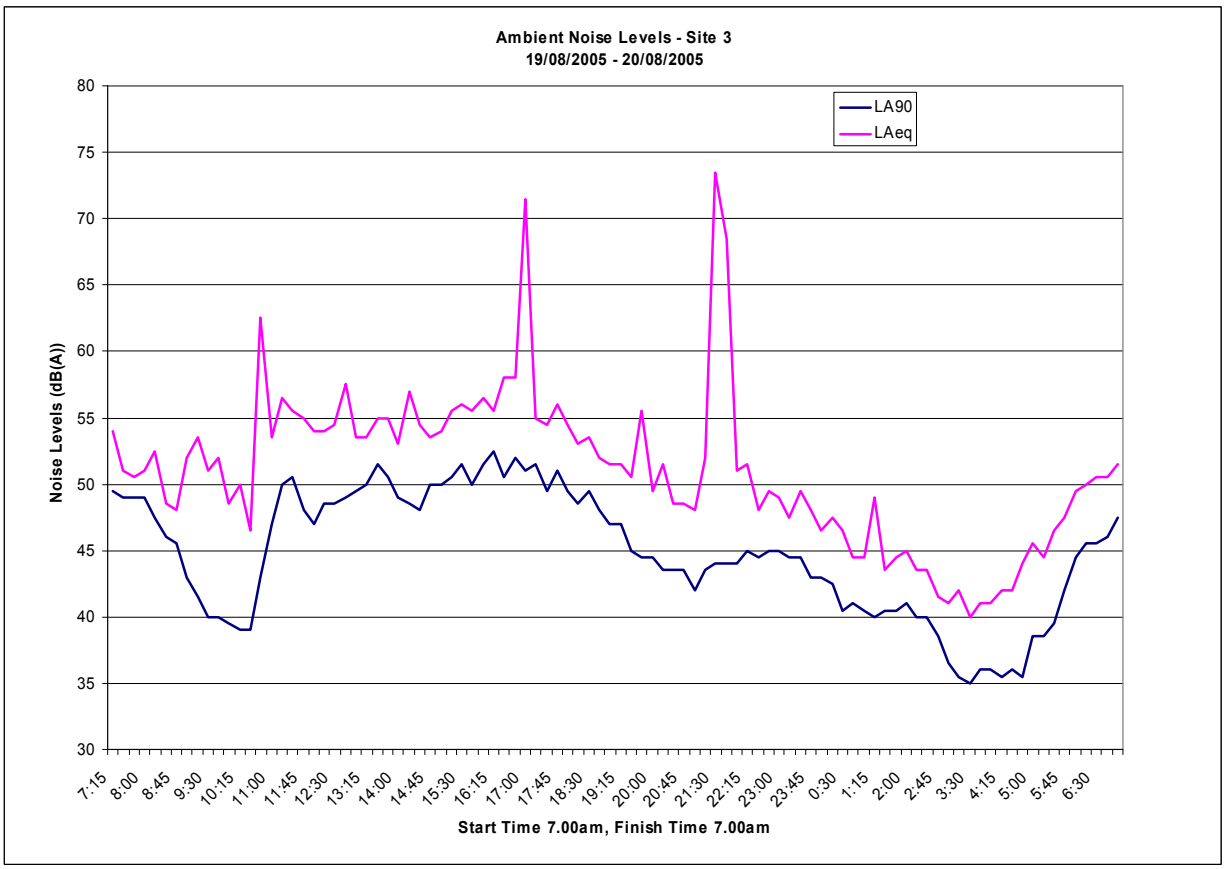
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 3
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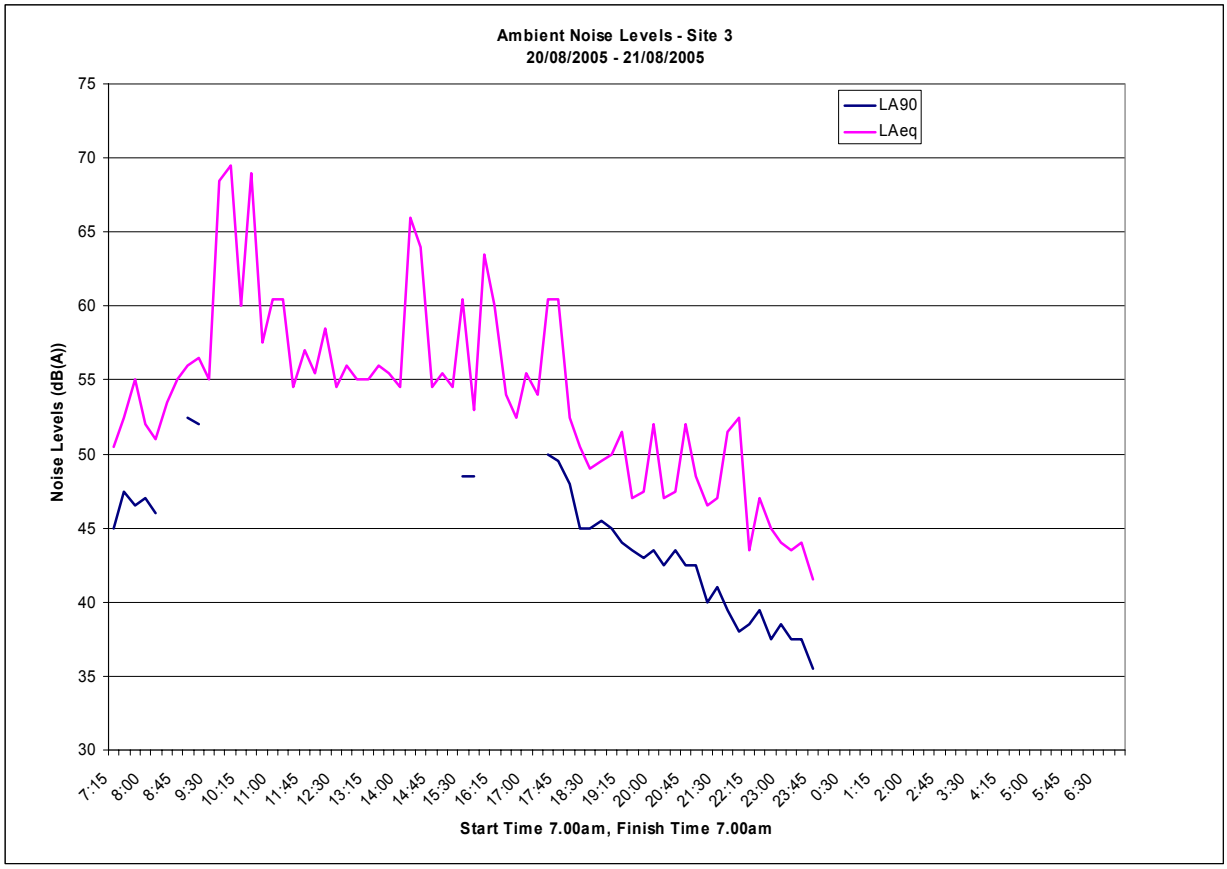
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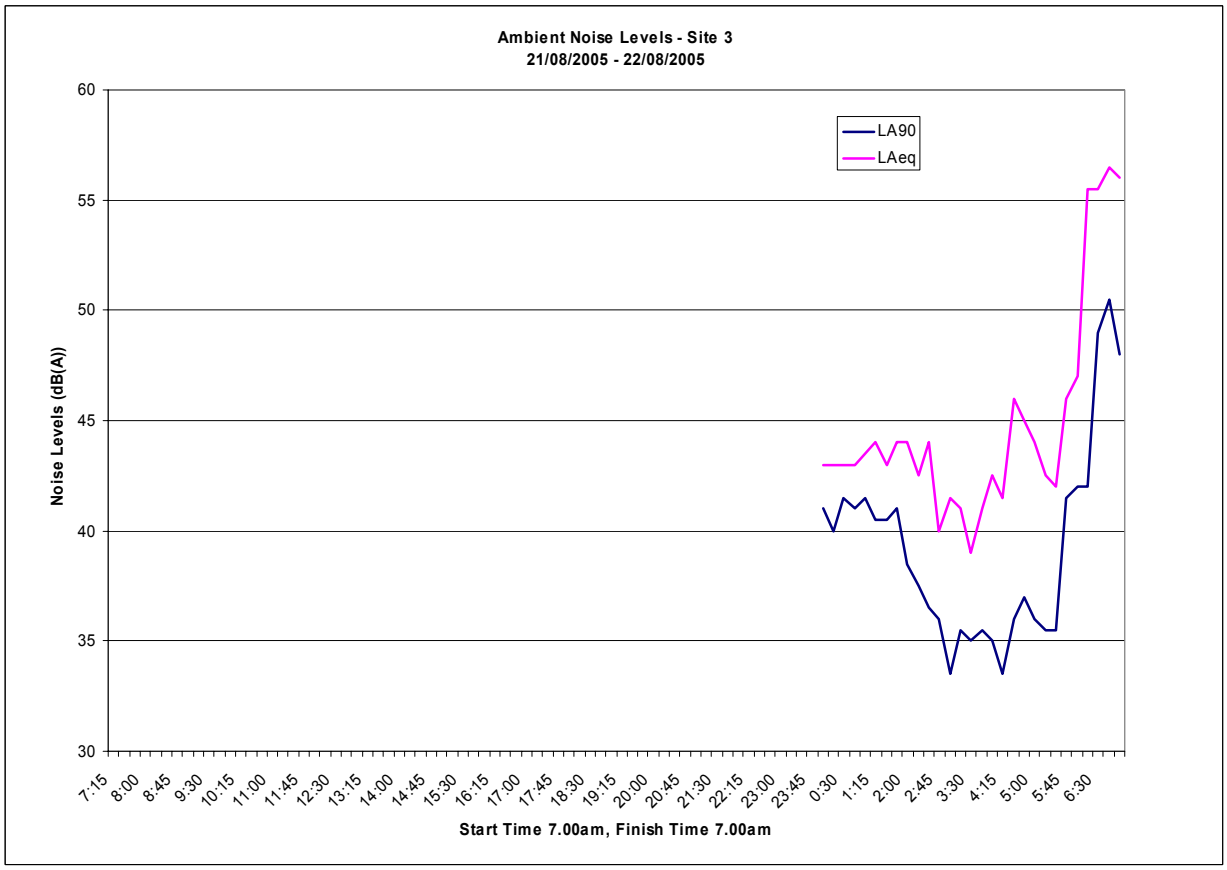
Ambient Noise Levels - Site 3
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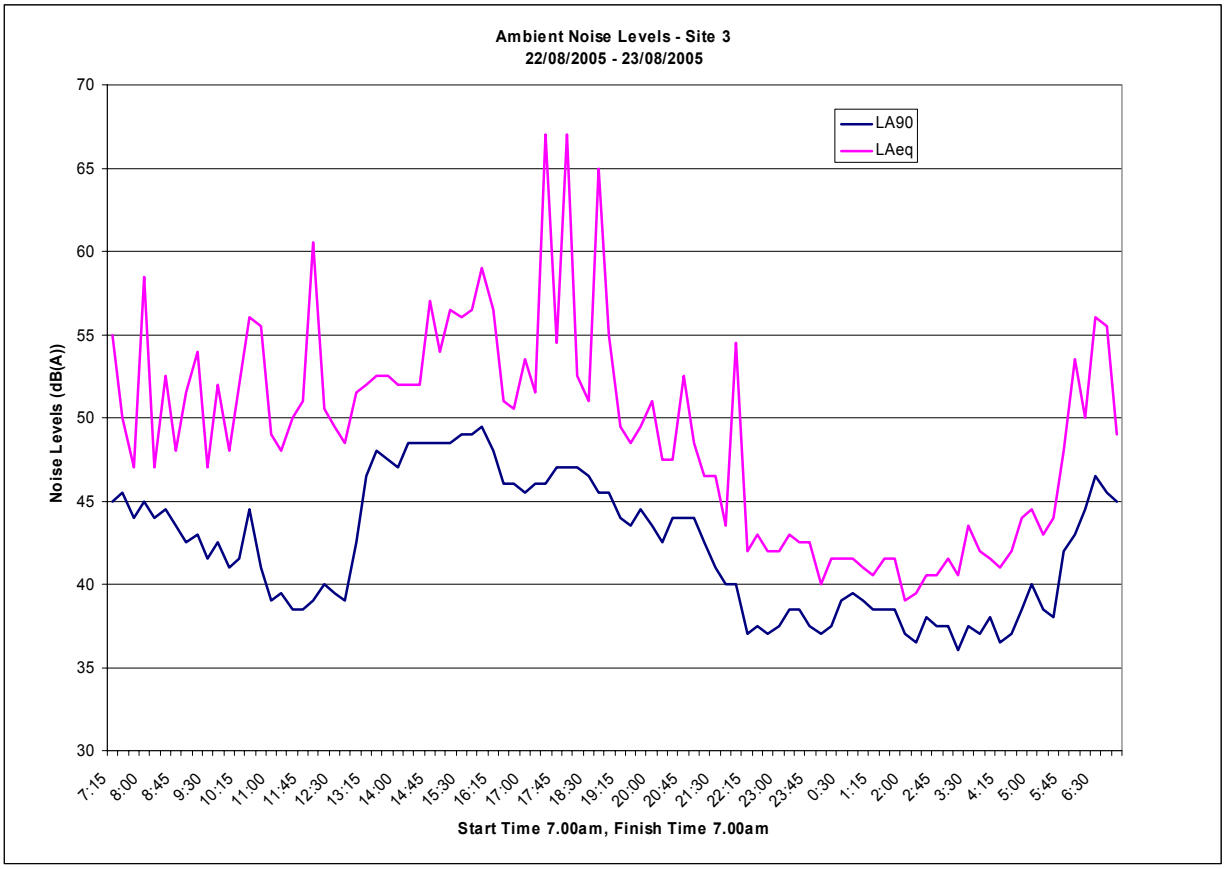
Ambient Noise Levels - Site 3
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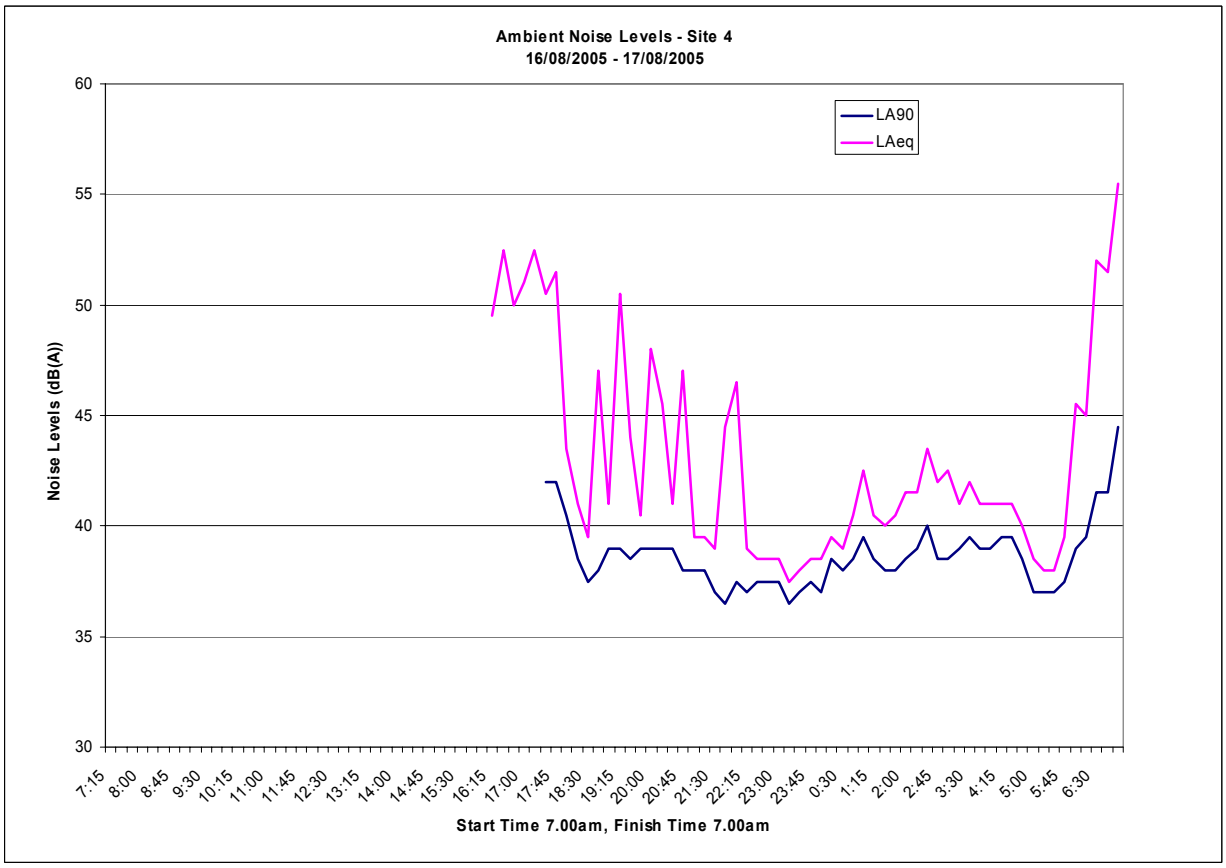
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16/08/2005 - 17/08/2005
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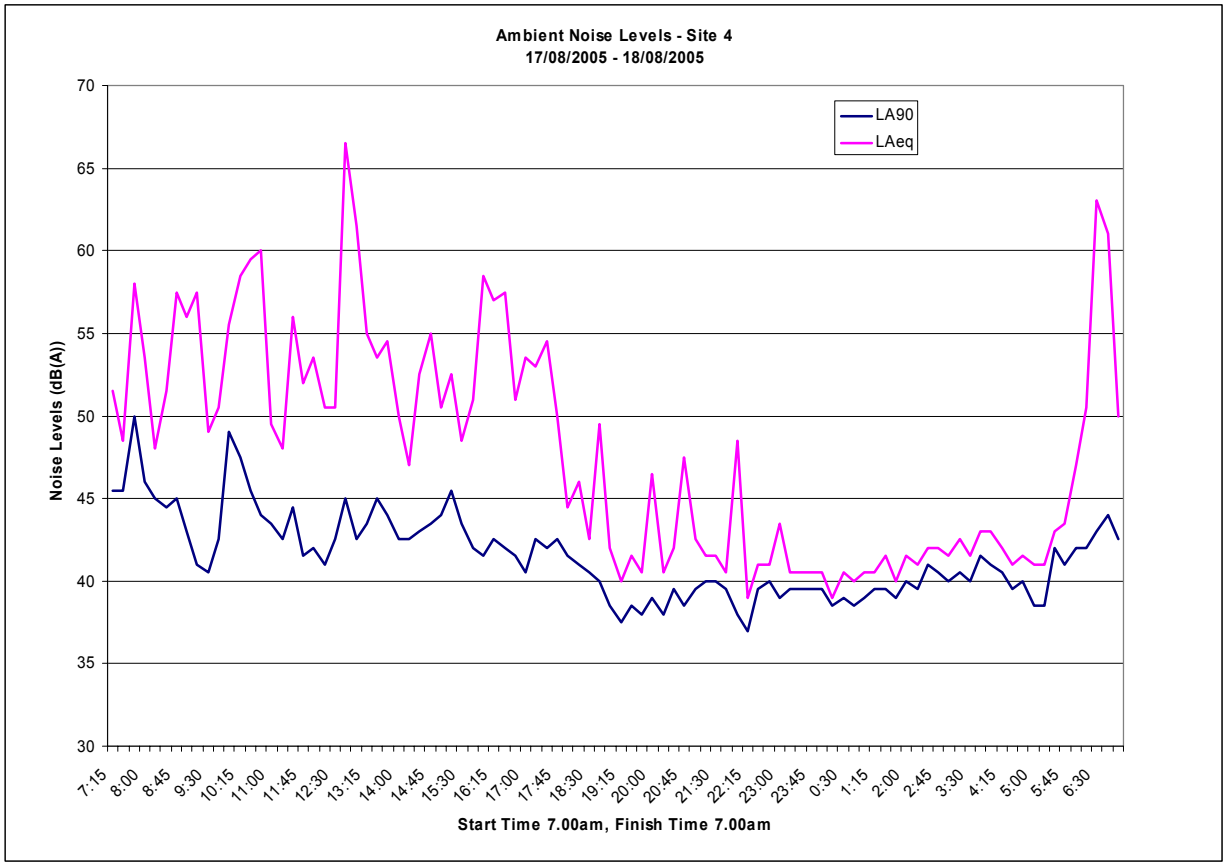
Start Time 7.00am, Finish Time 7.00am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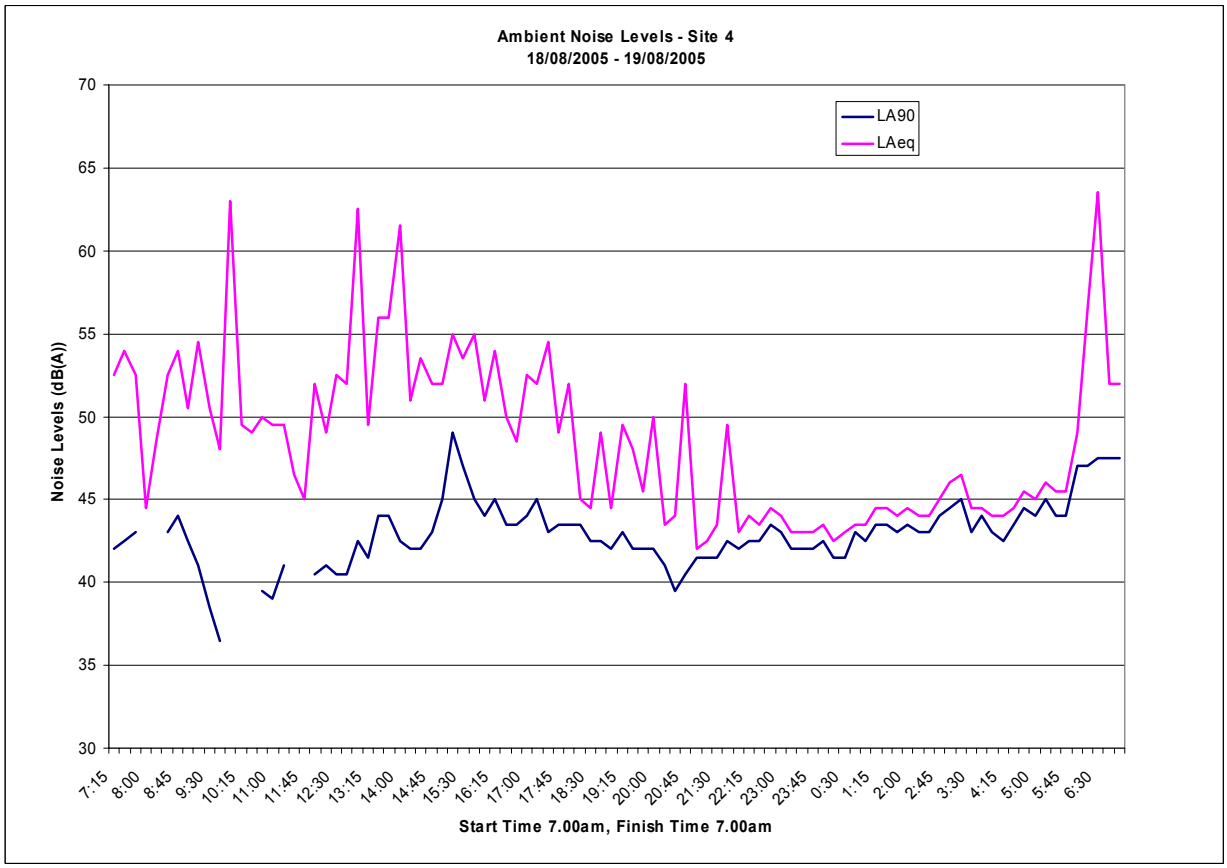
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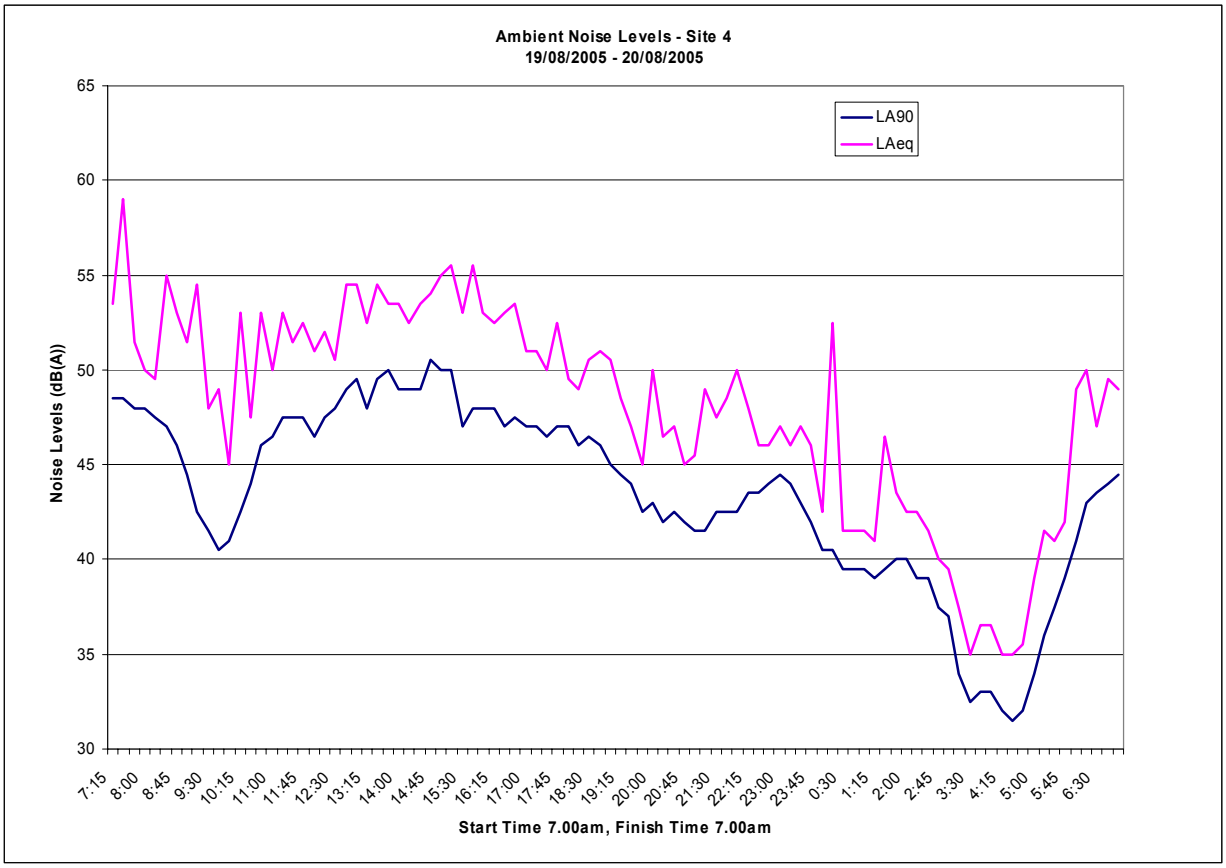
Ambient Noise Levels - Site 4
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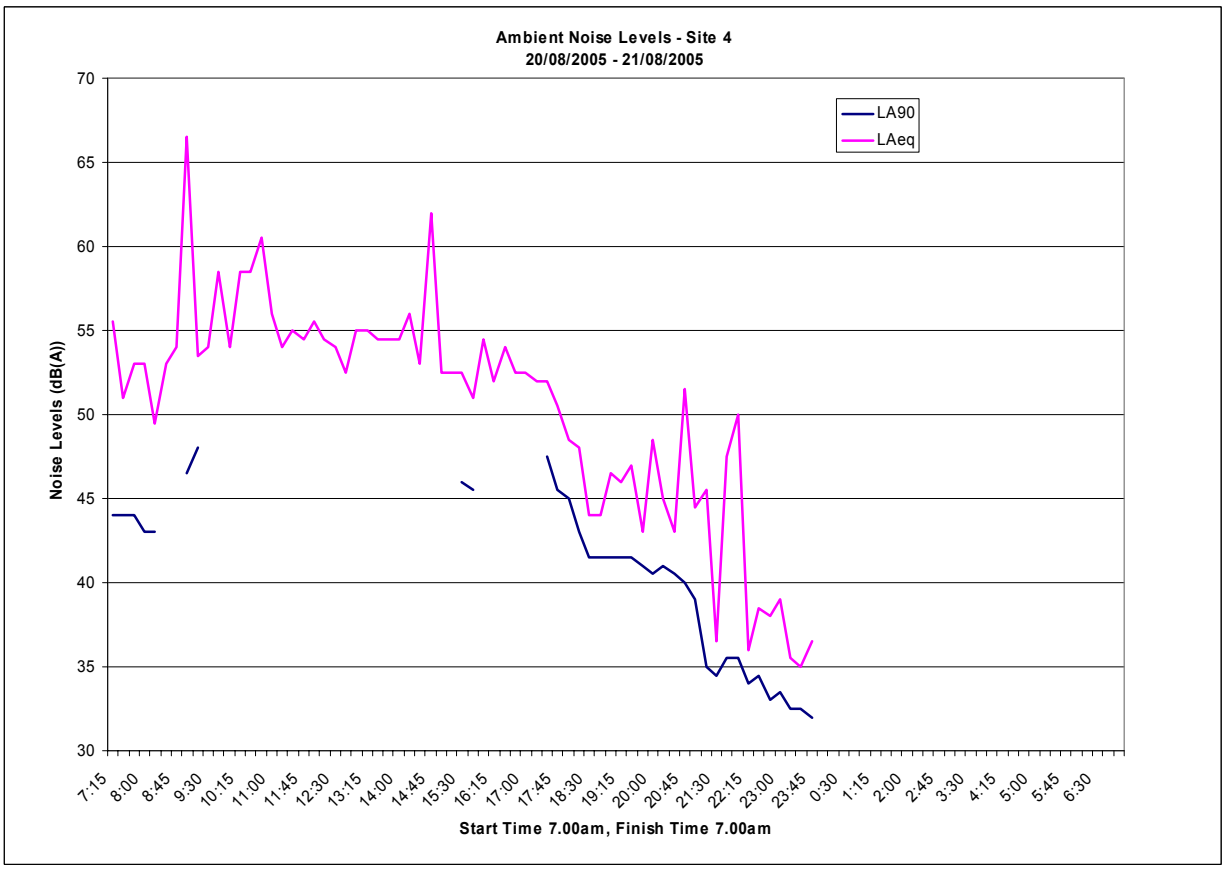
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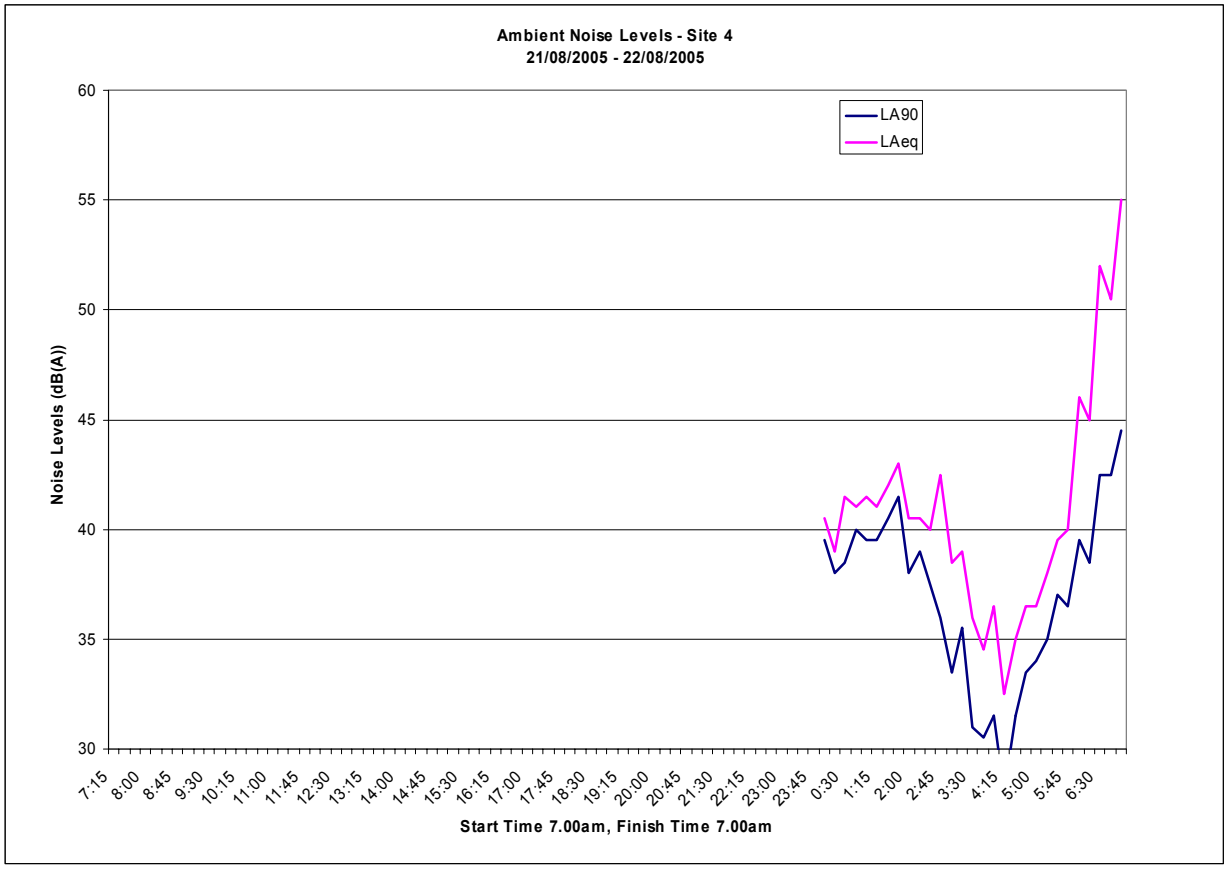
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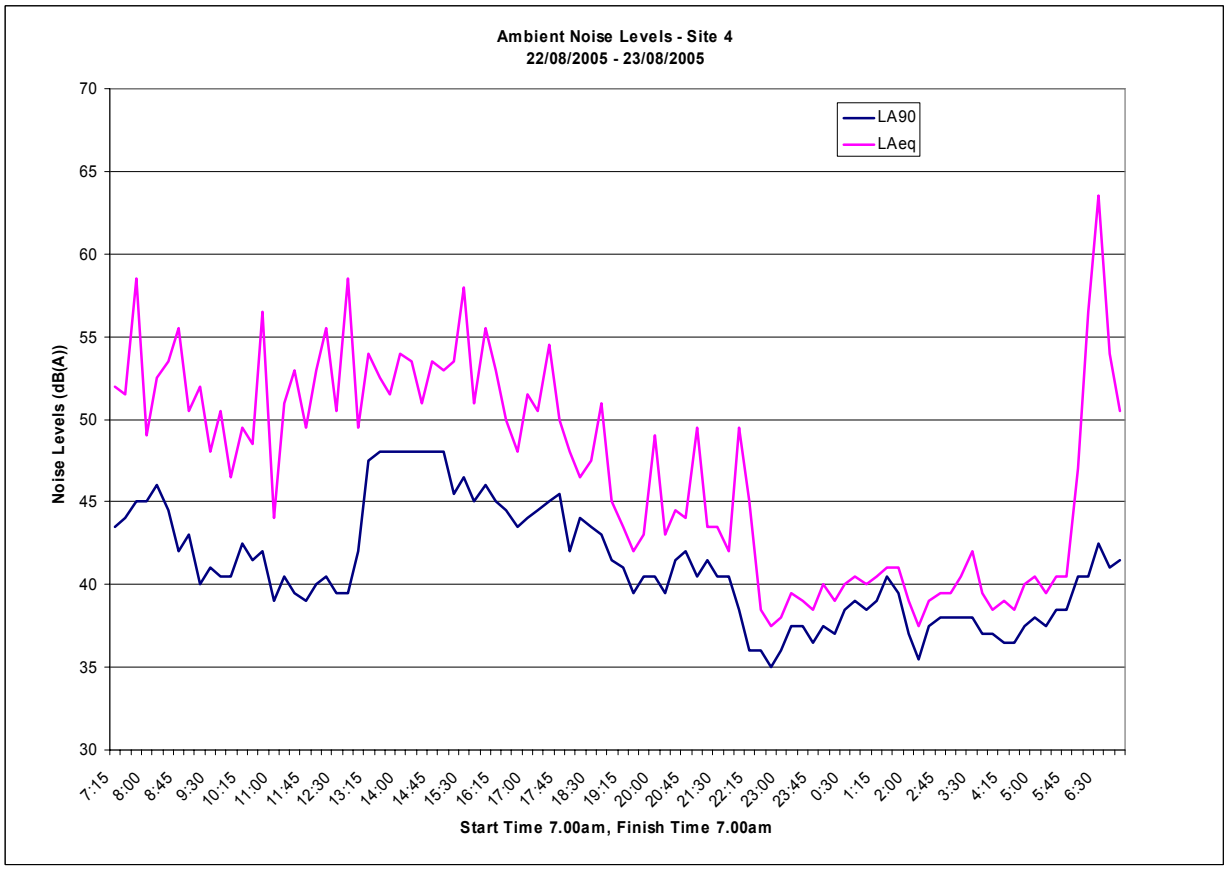
7:15 8:00 8:45 9:30 10:15 11:00 11:45 12:30 13:15 14:00 14:45 15:30 16:15 17:00 17:45 18:30 19:15 20:00 20:45 21:30 22:15 23:00 23:45 0:30 1:15 2:00 2:45 3:30 4:15 5:00 5:45 6:30
Start Time 7.00am, Finish Time 7.00am


Ambient Noise Levels - Site 4
22/08/2005 - 23/08/2005
LA90
LAeq
Noise Levels (dB(A))
70
65
60
55
50
45
40
35
30
7:15 8:00 8:45 9:30 10:15 11:00 11:45 12:30 13:15 14:00 14:45 15:30 16:15 17:00 17:45 18:30 19:15 20:00 20:45 21:30 22:15 23:00 23:45 0:30 1:15 2:00 2:45 3:30 4:15 5:00 5:45 6:30
Start Time 7.00am, Finish Time 7.00am

Appendix C

Coverage of Environmental Assessment Requirements and Environmental Issues

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Table C-1 Coverage of Environmental Assessment Requirements and Environmental Issues in the Noise Assessment

ENVIRONMENTAL REQUIREMENTS RAISED BY THE DIRECTOR-GENERAL RELATING TO NOISE	
	Relevant Section(s)
• The Assessment must: – be scientifically rigorous, and prepared in accordance with best practice;	Section 7 and 8
– be certified by the author;	Section 15
– include an executive summary; and	Executive Summary
– assess the following potential impacts of the Project (including any potential cumulative impacts that may arise from the combined operation of the Project with the existing or approved operations at the Bolster Quarry), and describe what measures would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor these impacts:	Section 9 to 12
– refer to the NSW Industrial Noise Policy and Environmental Criteria for Road Traffic Noise (Department of Environment and Conservation).	Section 7
ENVIRONMENTAL ISSUES RAISED BY GOVERNMENT AGENCIES RELATING TO NOISE	
	Relevant Section(s)
Department of Environment and Conservation	
• Provide maps showing the locality of the proposed development in a regional and local context. Base local context maps on 1:25 000 topographic plans.	Figure 1
• Provide a description of: – the existing environment on the subject and surrounding land; – the proposed development and ancillary works; and – the manner in which the environment will be modified by the proposal.	Section 3 and 6
• Clearly identify on an appropriately scaled plan the area subject to development.	Figure 2
• Consult the general requirements from the EIS Guidelines Extractive Industries – Dredging and other extraction in riparian and coastal areas during the preparation of the EIS.	All
• Document surveys and assessments that have been undertaken by suitably qualified persons and provide the qualifications and experience of the person(s) undertaking the work.	Section 2
• Describe dates, site locations, design, methodology, analysis techniques, and weather conditions at the time of the assessments and surveys. The limitations of surveys should be identified and the results interpreted accordingly.	Section 6, Appendix A
• Substantiate conclusions drawn in surveys and assessments with evidence resulting from those surveys and assessments.	Section 6, 10 and 14
• Assess noise from sand transfer pumps (especially at night), plant and equipment onsite and heavy vehicles (particularly when empty) assessing the site in accordance with the NSW *Industrial Noise Policy*.	Section 10 and 13
• Identify all noise sources from the development, both construction and operation phases. Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.	Section 8.4, 12 and 13

Table C-1 Coverage of Environmental Assessment Requirements and Environmental Issues in the Noise Assessment (Cont'd)

Department of Environment and Conservation (Cont'd)	
• Specify the times of operation for all phases of the development and for all noise producing activities.	Section 3 and 8.2
• Provide details of road alignment and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks where there would be a significant potential traffic noise impact.	Section 4 and Figure 7
• Identify noise sensitive locations likely to be affected by activities at the site and include on a map of the locality.	Section 4 and Figure 2
• Determine the existing background (L_{A90}) and ambient (L_{Aeq}) noise levels in accordance with the *NSW Industrial Noise Policy.*	Section 6 and 7
• Determine the existing road traffic noise levels in accordance with the *NSW Environmental Criteria for Road Traffic Noise*.	Section 12
• Provide details of all monitoring of existing ambient noise levels including: – a statement justifying the choice of monitoring site, including the procedure used to choose the site; – graphs of the measured noise levels for each day; – a record of periods of affected data (due to adverse weather and extraneous noise); and – determination of L_{Aeq} noise levels from existing industry.	Section 6 and 7 and Appendix B
• Determine the Project specific noise levels for the site. This should include: – determination of the intrusive criterion; – selection and justification of the appropriate amenity category; – determination of the amenity criterion for each receiver; and – determination of the appropriate sleep disturbance limit.	Section 7.3
• Maximum noise levels during night-time period (10pm to 7am) assessed.	Section 7
• Determine expected noise level and noise character during: – site establishment; – construction; – operational phase; – transport including traffic noise generated by the proposal; and – other services.	Section 9 and 10
• Determine the noise levels likely to be received at the most sensitive locations. Potential impacts determined for any identified significant adverse meteorological conditions.	Section 9 and 10

Table C-1 Coverage of Environmental Assessment Requirements and Environmental Issues in the Noise Assessment (Cont'd)

Department of Environment and Conservation (Cont'd)	
• The noise impact assessment report should include: – a plan showing the assumed location of each noise source;	Figure 4, 5 and 6
– a list of the number and type of noise sources;	Table 18
– any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography;	Section 8
– methods used to predict noise impacts;	Section 8
– an assessment of appropriate weather conditions for the noise predictions;	Section 8.3
– the predicted noise impacts from each noise source as well as the combined noise;	Section 9 and 10
– for developments where a significant level of noise impact is likely to occur, nose contours for the key prediction scenarios should be derived; and	NA – no significant impacts
– an assessment of the need to include modification factors.	Section 11
• Discuss the findings from the predictive modelling, and where relevant, recommend additional mitigation measures.	Section 10 and 11
• Include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.	Section 11
• Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying: – locations where the noise level exceeds the criteria and extent of exceedance; – numbers of people (or areas) affected; – times when criteria will be exceeded; – likely impact on activities (speech, sleep, relaxation, listening, etc); – change on ambient conditions; – the result of any community consultation or negotiated agreement.	Not Applicable
• Assess existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process.	Section 12
• Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. Blast design should include: – bench height, burden spacing, spacing burden ratio; – blast hole diameter, inclination and spacing; and – type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.	Not Applicable
• Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts.	Section 11

Table C-1 Coverage of Environmental Assessment Requirements and Environmental Issues in the Noise Assessment (Cont'd)

Department of Environment and Conservation (Cont'd)	
• For traffic noise impacts, provide a description of the ameliorative measures considered, reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Ameliorative measures may include: – use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage; – control of traffic; – resurfacing of the road; – use of (additional) noise barriers or bunds; – treatment of a façade; – more stringent limits for noise emission from vehicles; – driver education; – appropriate truck routes; – limit usage of exhaust breaks; – use of premium mufflers on trucks; – reducing speed limits for trucks; – ongoing community liaison and monitoring of complaints; and – phasing in the increased road use.	Section 12
Department of Primary Industries (Mineral Resources)	
• Provide an assessment of noise, vibration, dust and visual impacts, and proposed measures to minimise these impacts.	Section 10, 11 and 12