Appendix F Noise

Western Rail Coal Unloader

ENVIRONMENTAL NOISE ASSESSMENT

March 2007

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1. Introduction

Delta Electricity is proposing to build a rail balloon loop and coal unloading facility to service the needs of Mount Piper Power Station in future years. The proposed rail loop, coal unloader and conveyor system would be built on land owned by Delta in the area known as Pipers Flat, located between Portland and Wallerawang townships. The Western Rail Coal Unloader project would involve the construction and operation of:

- A rail loop comprising a branch rail line off the Wallerawang – Mudgee Main Line;
- A coal unloader building which would allow coal to be delivered into a hopper located below the rail line;
- A conveyor system which would carry the coal to the existing coal handling facility at the Mt Piper Power Station.

Associated with the operations would be the potential for noise emissions to impact nearby residential receivers. The potential for these noise emissions to meet the relevant noise guideline recommendations for noise impacts has been assessed in this report.

2. Project Description

The Western Rail Coal Unloader will be accessed by a branch rail line off the Wallerawang – Mudgee Main Line. This diversion would allow coal trains from the north to continuously unload at the new coal receiver facility located on the balloon loop and exit the loop for the return journey to the north. Once the coal wagon is at this facility the coal would be released into a hopper housed in a located below the rail line. From the hopper the coal would be fed onto a conveyor that would traverse the terrain north to Mt Piper Power Station.

In the early years of operation (from 2009 to 2014), it is anticipated that the facility would not be required to handle more than 2 million tonnes per year, with generally two train services per day or 12 services per week. Typical train lengths would be 55 wagons, with each train carrying about 4,250 tonnes of coal, which would require a dumping time of approximately 1-2 hours at a dumping speed of between 0.6 to 1.0 km/h.

In the medium term (2015 to 2030) the coal requirements would be about 4 million tonnes per year, with up to 3 trains per day or 20 trains per week. Beyond 2030 volumes may reach 7-8 million tonnes per year, which could result in up to 5 trains per day or 40 trains per week.

The coal receiving facility would be designed to run seven days per week, with the potential for some deliveries during the night time hours. The existing schedule on the line provides slots for 5 trains running north and 5 running south over 24 hours.

3. Current Environment

In accordance with the NSW environmental policy (see **Section 4**) it is necessary to conduct noise monitoring for the project to enable the setting of appropriate criteria with respect to the existing environment. In general to categorise the range in the background noise levels, one week of ambient noise monitoring must be undertaken. The DEC further categorises one 24-hour monitoring period into the following three assessment periods:

- Day – 7:00 am to 6:00 pm;
- Evening – 6:00 pm to 10:00 pm; and
- Night – 10:00 pm to 7:00 am.

3.1 Existing Noise Environment

The proposed site for the rail loop and coal unloader is owned by Delta Electricity and is located at 708 Portland Road, Wallerawang, within Lots 1 and 2 of DP 800003, Lithgow City, Parish of Lidsdale, County of Cook. This property lies between Pipers Flat Road and the base of the ridgeline that forms Mount Piper. It comprises a cleared flat area that is traversed by Pipers Flat Creek, a tributary of the Cox's River. The Wallerawang – Mudgee Main Rail Line is located in close proximity to the project site, running almost parallel with Pipers Flat Road. The facility is proposed to be available for receipt of coal deliveries 24 hours a day on an as needs basis.

Existing noise influences in this area are mainly from road traffic along Pipers Flat Road. Occasional rail noise from the existing Gulgong to Wallerawang line is also a feature of the area. This line carries predominantly coal trains as well as daily freight trains.

Background noise levels were measured at locations near the proposed coal unloading facility between July and August 2006. The purpose of long term noise monitoring is to provide noise level data to help characterise the influence of the existing noise sources in the vicinity of the proposed unloader.

The sites selected for logging were based on availability of residents and their proximity to the proposed coal unloader. The locations of the noise loggers are shown in **Figure 1**. The Location and description of where the loggers were situated on the properties is given below.

Location ID	Location	
1	Irondale Road, Pipers Flat	Along the fence line near cattle yards
2	Turner Residence, Pipers Flat	40m from house along the access road

3.1.1 Unattended Noise Monitoring

The unattended monitoring was undertaken with automatic noise loggers that measure environmental noise and store the results in memory. The loggers used were ARL type 316 and 215 and had been NATA tested by the manufacturer within the last 12 months. The loggers were set to record a range of noise indices at 15 minute intervals. This data was used to determine the median values for the L_{Aeq}, L_{A90}, L_{A10} and L_{A1} descriptors for the day, evening and night time period.

The Rating Background Level (RBL) is the overall, single-figure, background level representing each of the day, evening or night assessment periods over the whole monitoring period. This is the level used for assessment purposes. It is defined as the median value of all the day, evening or night assessment background levels over the monitoring period. A summary of the noise data is shown in **Table 3-1** and the daily graphs are provided in **Appendix A**.

- **Table 3-1 Summary of unattended noise survey**

Location	Date	Rating Background Level (RBL)			L_{Aeq} over the assessment period		
		Day	Evening	Night	Day	Evening	Night
A	25/08/06	27	25	23	43	43	38
B	25/08/06	28	25	22	55	39	37

FIGURE 1
Location of Noise Monitor

Delta Electricity Western Rail Coal Unloader
GDA 94 MGA Zone 56

0 250 500
Meters

4. Assessment Guidelines

Legislative requirements for noise emissions for the coal unloader proposal have been drawn from three sources, which cover industrial noise and noise from rail operations. Rail noise is assessed on a different basis to industrial noise and noise goals can vary depending on the location of the rail corridor. The Coal Unloader Project has identified the following sources of noise guidelines:

- Existing Conditions in EPL No. 766 issued to Mount Piper and Wallerawang Power Stations.
- The infrastructure of rail track within NSW through the Rail Infrastructure Corporation (RIC) and operated by the Australian Rail Track Corporation (ARTC).
- The Department of Planning in consultation with agencies such as DEC.

Delta Electricity conditions

Delta Electricity's Mt Piper Power Station operates under an Environment Protection Licence No. 766. This licence covers a broad range of environmental issues but does not include specific reference to operational noise limits or rail noise for current operations.

ARTC Rail licence

Advice from RIC is that the infrastructure is owned by RIC and operated by ARTC. Noise emissions from rail traffic would therefore be the responsibility of ARTC which operates under an Environmental Protection Licence No. 3142 issued by the DEC (formerly the EPA).

This licence provides two separate criteria for rail noise emissions. The first is a Pollution Reduction Programme (PRP) goal which seeks to mitigate noise from existing rail operations. The second is a goal for new works to be applied at the planning stage of a rail project. The proposed coal unloader does not represent a significant new work to the ARTC controlled line as the unloader facility will be wholly within the Delta Electricity project site. The project noise goal for operations of trains on the rail corridor would therefore need to comply with the PRP noise level which is stipulated in **Condition U 1.1**:

U1.1 Objectives of PRP

In developing the PRP, the licensee must work towards the goals of:

- *65 dB(A)Leq, (day time - 7am-10pm),*
- *60 dB(A)Leq, (night time - 10pm-7am), and*
- *85 dB(A) (24hr) max pass-by noise, at 1 m facade of affected residential properties.*

If it is not possible for these goals to be reached by feasible and reasonable mitigation measures, the PRP must aim, through feasible and reasonable measures to:

- *reduce operational rail noise emissions and the associated noise impact on the community where traffic levels are anticipated to remain constant; or*
- *stabilise operational rail noise emissions and the associated noise impact on the community where traffic levels are anticipated to increase.*

Department of Planning – Director General's Requirements

On November 7 2006 the Department of Planning issued Key Assessment Requirements for the Western Rail Coal Unloader Project which specifically included noise impacts. An extract of the Director General's Requirements for noise assessment are provided here for reference:

***Noise Impacts** — the Environmental Assessment must include a noise impact assessment for the project, conducted in accordance with NSW Industrial Noise Policy (EPA, 2000).*

The assessment must include consideration of noise impacts of the development with particular focus given to noises associated with train operations in addition to engine noise such as wheel squeal, flanging, brake noise, bunching, stretching wagons and horn use. Consideration must also be given to scenarios under which meteorological conditions characteristic of the locality may exacerbate impacts at sensitive receivers. The probability of such occurrences must be quantified.

The Environmental Assessment must also include an assessment of the construction noise impacts of the project, against the criteria provided in Chapter 171 of the Environmental Noise Control Manual (EPA, 2004).

The Environmental Assessment must clearly outline the noise mitigation, monitoring and management measures the Proponent intends to apply to the project. An assessment of the effectiveness and reliability of the measures and any residual impacts after the implementation of such measures must be included.

The Department of Environment and Conservation, 2000 (DEC) *NSW Industrial Noise Policy* (INP) provides the framework and process for deriving project specific noise limits for impact assessments and (separately) limits for consents and licences that will enable the authority to regulate premises that are scheduled under the *Protection of the Environment and Operations Act, 1997*.

The INP has been developed to provide guidance specifically for the assessment of industrial noise sources such as industrial premises, extractive industries, commercial premises warehousing and maintenance facilities. The INP does not however cover noise from transportation corridors (such as rail or road) or from construction activities.

4.1 DEC Industrial Noise Policy

The INP requires that the noise from a development under assessment comply with the lower of the amenity or intrusive noise criteria. The intrusive criterion is determined by the difference between the industrial noise under assessment being no more than 5 dB(A) above the Rating Background Level (RBL). The RBL is the tenth percentile of the background noise environment evaluated in the absence of industrial noise from the development in question. This is usually assessed prior to the commencement of operations.

The amenity criterion is based on the zoning of the residences likely to be affected by noise, the general land use near the receiver location and the extent of the existing industrial noise in the area. Where there is an existing influence of industrial noise, the INP implements modifying factors to the criteria to account for cumulative noise impacts in order to minimise background creep and control the long term noise environment.

The amenity levels are more suited to planning of noise levels rather than the assessment of project specific impacts. The intrusive noise criteria are designed to account for shorter duration noise impacts and are often the most appropriate tool for assessing the effects of noise at a residential location.

4.1.1 Intrusive Noise Criteria

A noise source is considered to be non-intrusive if:

- the $L_{Aeq,\ 15\ minute}$ level does not exceed the RBL by more than 5 dB(A) for each of the day, evening and night-time periods,
- the subject noise does not contain tonal, impulsive, or other modifying factors as detailed in Chapter 4 of the INP.

From **Table 3-1** the lowest RBL noise levels for day, evening and night the intrusive noise limits have been applied to the monitoring locations as the assessment criteria. The corresponding intrusive noise criteria for the day, evening and night time periods are presented in **Table 4-1**.

The Industrial noise policy provides guidance in the application of setting the Rating Background Level in **Appendix B - Applying the background noise policy**. Part 3 of section **B1.3 Analysis procedure**, states in relation to an RBL:

"*Where this level is found to be less than 30 dB(A), the rating background level is set to 30 dB(A)*".

Although this is an important part of the noise policy, in rural areas this has the effect of setting the intrusive noise limit artificially higher than would be calculated using the background plus 5 dB(A) method. The assessment of the proposed coal unloader has included the INP guidance for a minimum RBL of 30 dB(A) at sensitive receivers, thus making the lowest intrusive noise criterion $L_{Aeq,\ 15\ minute}$ 35 dB(A) at both locations. As these locations are representative of noise impacts on both sides of the Gulgong- Wallerawang train line, it is expected that these noise level limits would apply to all the nearby sensitive receivers and have been adopted at all locations.

4.1.2 Amenity Noise Criterion

The amenity criteria apply to the L_{Aeq} Level determined for the period of assessment of day, evening or night. The definition of the noise amenity classification for the area around the proposed site is "Rural" based on the description for this type of location in the DEC Industrial Noise Policy.

The INP recommends that for a residence located in a rural area, an acceptable amenity criteria would be an $L_{Aeq\ (Period)}$ of 50, 45 and 40 dB(A) for day, evening and night periods respectively. In rural areas where there is an absence of industrial noise influences, existing background night time levels are consistently shown to be sub 30 dB(A). It is possible that sensitive receivers in these rural areas are not adequately protected by the amenity criteria limits and it is noted that the INP provides the same criteria for the evening and night time periods for cities having suburban metropolitan areas. It is therefore important to rural communities that industrial noise sources are not allowed to accumulate. To control this effect the INP requires the assessment of cumulative noise emissions.

4.1.3 Cumulative Noise Impact Criteria

The INP aims to control cumulative noise impacts resulting from the combined effects of a proposed project and existing industrial noise sources by modifying the amenity criteria depending on the level of existing impact. Where there is an existing industrial noise influence, the amenity criteria are decreased in accordance with Table 2.2 of the INP.

From **Table 3-1** the measured existing L_{Aeq} noise levels for day, evening and night range from 43-55, 39-43 and 37-38 dB(A) respectively.

SKM

Table 4-1 Derivation of Project Specific Industrial Noise Criterion

	Day	Evening	Night-time
Intrusiveness Criteria	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$
Project Intrusiveness Criteria	L_{A90} + 5 dB(A)	L_{A90} + 5 dB(A)	L_{A90} + 5 dB(A)
Project Specific RBL levels			
Location A	27 dB(A)	25 dB(A)	23 dB(A)
Location B	28 dB(A)	25 dB(A)	22 dB(A)
Amenity Criteria	$L_{Aeq\ 11hr}$	$L_{Aeq\ 4hr}$	$L_{Aeq\ 9hr}$
Acceptable Amenity Criteria	50 dB(A)	45 dB(A)	40 dB(A)
Modified Amenity Criteria	-	-	-
Project Amenity Criteria	50 dB(A)	45 dB(A)	40 dB(A)
Project Noise Criteria	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$	$L_{Aeq15\ min}$
All Locations	**35** dB(A)*	**35** dB(A)*	**35** dB(A)*

(*) Adjusted to meet the INP Minimum RBL Requirement (See **Section 4.1.1**)

As discussed the amenity criteria are primarily designed to control the long term growth of noise through planning goals. The intrusiveness criteria are better suited to control noise impacts that may potentially cause annoyance at nearby residences. Due to the low existing background noise levels, the intrusiveness criteria for the day time and night time are the most stringent of the noise goals, and these will be used to assess the potential for noise impacts as the result of the proposed Coal unloader. Under the INP, the intrusive impact of the combined operations of the unloader and rail loop operations from within the site will also be assessed against this criterion. The day, evening and night time limits would apply to noise generated by the Coal Unloader operations at any residential dwelling or sensitive receiver.

4.2 Sleep Disturbance Criteria

The DEC Environmental Noise Control Manual (ENCM) (NSW EPA 1994) provides guidance in assessing the likelihood of sleep arousal due to industrial noise impacts. The assessment of sleep disturbance varies between studies however it is commonly acknowledged that not all people are affected to the same degree or by the same noise exposure.

Findings from studies of sleep disturbance measured by an awakening, change in sleep state or after-effects, reflect the considerable variation in people’s response to noise. Suggested peak permitted noise levels vary from 45 to 68 dB(A), depending on ambient noise (Griefahn 1991), and disturbance is related to both the number and maximum level of noise events (Bullen *et al.* 1996). Appropriate internal design noise levels for various types of occupancy are detailed in the Australian Standard AS 2107-1987.

For assessment purposes, the ENCM uses the criteria based on L_{A1} noise level of the source being no more than 15 dB(A) above the L_{A90} (background) noise level, when measured outside a bedroom window. From the monitoring results in **Table 3-1** and based on the calculation L_{A90} + 15dB(A), the sleep disturbance noise criterion for sensitive receivers in the area would be an L_{A1} of approximately 37 dB(A). Measured levels at the residential locations indicate that the 50th percentile L_{A1} levels in the area are already at, or exceed 37dB(A). The measurement and application of this criterion may therefore be difficult to assess in the existing noise environment.

4.3 Construction Noise Criteria

The estimated construction period for the proposed Coal Unloader and Rail Line is 18 months. During this time there would be earthworks and building activities on the proposed site as well as truck movements to and from the site.

In general the acceptability of impacts from construction noise within a community depends on the potential for the noise to interfere with day-to-day activities, the duration of the event, and the extent of its emergence above the background noise level. The DEC recommends limiting the free-field $L_{A10\ (15\ minute)}$ noise levels arising from a construction site (or works) should not exceed criteria detailed in the DEC Environmental Noise Control Manual (ENCM, 1994), Chapter 171 Construction Site Noise. These noise criteria are dependent on the existing background noise levels and the expected duration of the works. The noise goals for construction activity are detailed in **Table 4-2**.

- **Table 4-2 DEC Construction Criteria Guidelines**

Criterion No.	Duration Of Works	DEC L_{A10} Guidelines
1	Construction period of 4 weeks and under	The L_{A10} 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 20 dB(A).
2	Construction period greater than 4 weeks and not exceeding 26 weeks	The L_{A10} 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 10 dB(A).
3	Construction period greater than 26 weeks	The EPA does not provide noise control guidelines for construction periods greater than 26 weeks duration. However, it is generally accepted that provided L_{A10} noise levels from the construction area do not exceed a level of 5 dB(A) above background, then adverse (intrusive) noise impacts are not likely to be experienced at nearest sensitive receptor locations.

Based on the expected duration of the works the criterion at number 3 in the table of background + 5dB(A) would be nominated as the construction noise goal for the Project.

Restrictions are also placed on the hours of construction to ensure that the acoustic amenity of the closest residences is protected. Hours of operation for construction works and associated road traffic for the Coal Unloader would follow standard construction times listed below. An allowance for negotiated variations to these times with the DEC will be necessary where construction works will need to take place at times outside these hours for operational, safety and access reasons.

- Monday to Friday: 7am to 6pm;
- Saturday: 8am to 1pm; and
- No audible construction work to take place on Sundays or public holidays.

4.4 Summary of Project Noise Goals

Table 4-3 summarises the project specific noise goals outlined above at the potentially most affected residence.

Table 4-3 Summary of Project Specific Noise Criteria

Description	Day	Evening	Night
DEC INP Operational Criteria All Locations	$L_{Aeq\ 15\ min}$ **35** dB(A)	$L_{Aeq\ 15\ min}$ **35** dB(A)	$L_{Aeq\ 15\ min}$ **35** dB(A)
ARTC Rail Traffic Criteria All Locations	$L_{Aeq\ 15hr}$ **65** dB(A)	N/A	$L_{Aeq\ 9h\ r}$ **60** dB(A)
	80 dB(A) (24hr) L_{Amax} pass-by noise		
DEC Sleep Disturbance Criteria All Locations	N/A	N/A	$L_{A1\ 15\ min}$ **37** dB(A)
DEC Construction Criteria All Locations	$L_{A10,\ 15\ min}$ **35** dB(A)		

5. Assessment Methodology

5.1 Operational noise

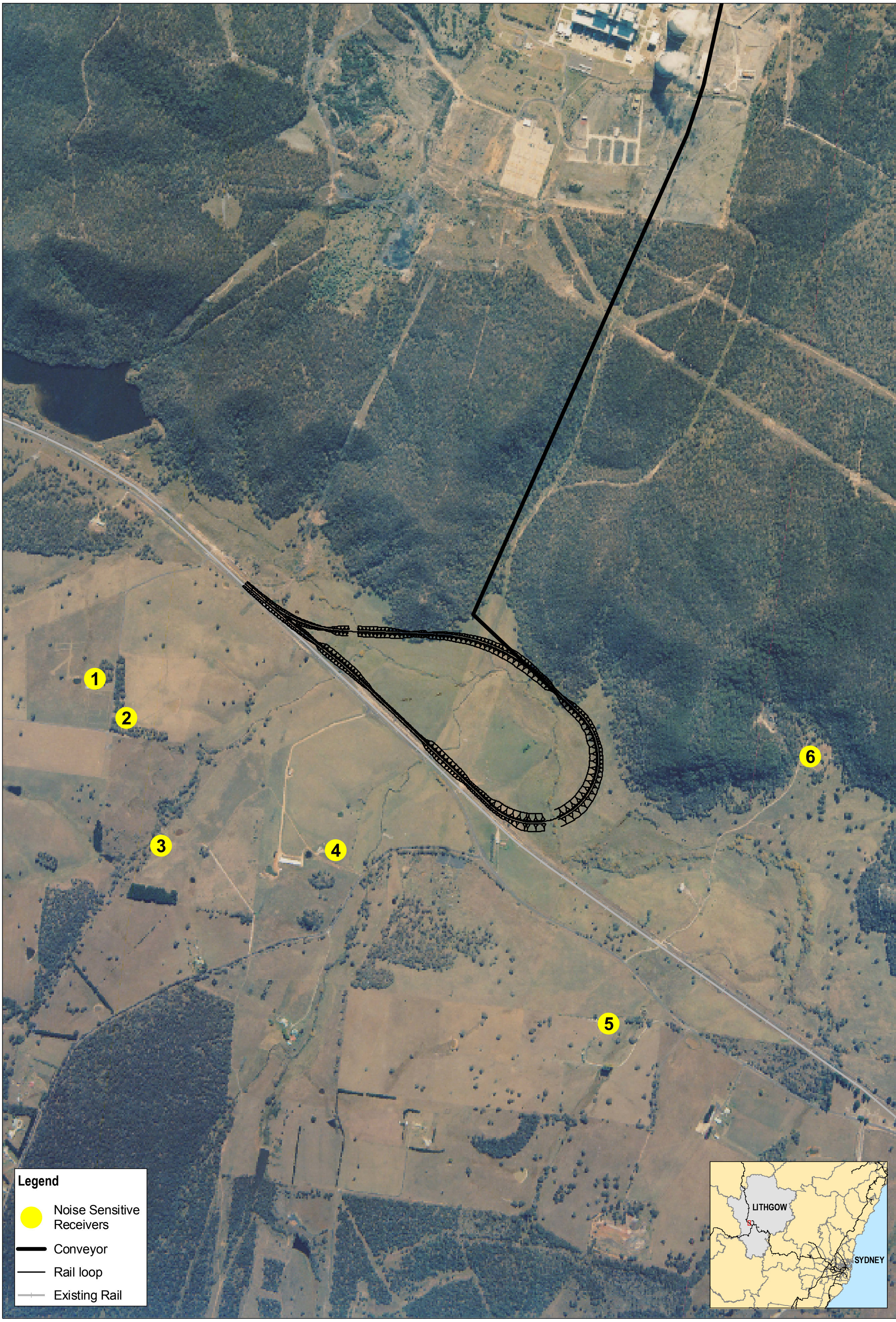
Sources of operational noise have been assessed in accordance with the Environmental Assessment Requirements. These sources include the operations of the coal unloader facility and the associated conveyor system as well as potential sources of rail noise. These issues have been identified and addressed in the assessment or mitigation of noise levels from the proposed coal unloader. The effect of local meteorological conditions may enhance the noise emission propagation from some sources. This assessment has also included a review of these conditions and where appropriate incorporation of the effect of adverse weather conditions in the prediction of noise levels.

5.1.1 Static sources of noise

Figure 2 shows the location of the proposed coal unloader and conveyor system and maintenance facility with respect to the nearby residential receivers. The unloader facility would only be operational during the times of coal delivery for a period of between 1-$1^{1}/_{2}$ hours depending on the unloading speed and the number of coal wagons per delivery.

The assessment has considered the likely noise emissions from the coal unloading facility when in operation and these include:

- The dump hopper building
- The conveyor system.



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December 1, 2006

FIGURE 2
Location of Noise Sensitive Receivers

Delta Electricity Western Rail Coal Unloader
GDA 94 MGA Zone 56

0 250 500
Meters

5.1.2 Sources of railway noise

This assessment has considered noise emissions from the following sources but not all of the impacts listed below can be adequately included in the noise modelling scenarios. The details of particular rail noise impacts are discussed below. The assessment of these impacts is likely to be against an L_{Amax} criteria and have been identified in **Section 6.3.2**.

- Engine noise from diesel engines includes exhaust noise and other equipment noise such as compressors, and ventilation fans from electrical equipment, brake resistors and engine radiators
- Rail and wheel noise is caused by excitation of these components and includes:
  - impact noise from rail defects, track joints, and wheel defects
  - wheel squeal from lateral or longitudinal "stick-slip"
  - flanging noise
- Aerodynamic noise is caused by the passage of the train through the air
- Bunching and stretching of wagons during starting and stopping of the train.

Diesel engine noise

Locomotives for freight and coal haulage are likely to be diesel electric engines that have a large diesel engine coupled to a generator which in turn supplies power for the traction motors. There are several sources of noise from an engine which combine to form the total noise signature.

Because the power to the traction motors is electric, these locomotives employ resistor banks to dynamically brake the train. These resistor banks are cooled by fans which have a distinctive character and can be heard over the general engine noise. The diesel engines themselves are exhausted through the top of the loco body and contribute significantly to the noise emissions from the loco. Other sources such as radiator cooling fans for the diesel engines and ventilation fans for the electrical equipment also contribute to the locomotive noise emissions. Because of the height of the exhaust stack at the top of the locomotive it is not always possible to provide effective noise mitigation through the use of noise mounds or barriers.

Rail and wheel noise

Rail and wheel noise is the greatest contribution to the pass-by noise level of most trains and is an emission that increases with increasing speed. There are several types of rail and wheel noise from a train consist that can be broadly grouped into two categories.

- Normal rolling noise: This type of noise is evident on all types of track but is the main type of noise emission on straight track and comes from wheel flats, joints in the rail, rail corrugations and wheel flanging.

- Curving noise: This type of noise is generated specifically on radius track by either wheel flanging as the result of wheel/track misalignment in tight curves and/or the stick slip phenomenon whereby the wheel creeps laterally as the train moves forward around the curve. The stick-slip mode is the most likely form of noise generated by trains on radius track.

For both types of noise generation the rail and the wheel are radiators of the sound with the rail being capable of propagating sound waves over large distance depending on the form of rail fixing and track bed design.

Non standard trackwork

Non standard track work often called "special trackwork" such as switches and crossovers create higher levels of noise and vibration than normal trackwork. At these locations the wheels impact with the gaps in the track creating noise impulses as the wheels pass over them.

Aerodynamic noise

Aerodynamic noise from trains is generally only generated at speeds higher than about 200km/h.

Start Stop noises

Braking, bunching and stretching of the wagons can also cause noise emissions from the train consist. Bunching and stretching occurs when a train accelerates from rest or slows to a stop and creates impulsive forces on the coupling which then generate an audible emission from the wagon.

5.2 Local meteorological conditions

The meteorological conditions specific to the Mount Piper and surrounding environment were reviewed in accordance with INP guidelines to determine the frequency of adverse weather conditions that may enhance noise from the site at the nearest residences.

As part of the INP noise assessment procedure, the DEC recommends:

- An occurrence of winds greater than 3 m/s for 30% of the time for any season during each of the assessment periods of day, evening and night is required before the effects of wind are considered significant for an area; and
- The significance of temperature inversions on the propagation of noise emission from an industrial site must be considered where the occurrence of “F” stability class (characteristic of temperature inversion conditions) is 30% or more during the night time winter months. In accordance with the INP, night time is considered to be between 6pm and 7am, i.e. generally 1 hour before sun down and one hour after sun up.

The following sections provide a review of prevailing wind and atmospheric stability conditions in the vicinity of Mount Piper Power Station to determine whether the effects of adverse meteorological conditions should be considered as part of the impact assessment process.

Wind Effects

An assessment of occurrence of the winds above 3 m/s for the each season has not been undertaken for the project. The DEC recommended default assessment for adverse wind conditions is a 3 m/s wind blowing from the source to the receiver and this has been adopted for the prediction of noise levels enhanced by wind for the project.

Temperature Inversions

The percentage occurrence of Pasquill – Gifford stability classes has been assessed from 2001 meteorological data from Mt Piper Power Station. A summary of the percentage occurrence of the various stability classes, during the winter night-time (6pm - 7am) met assessment period, is presented in **Table 5-4**.

- **Table 5-4 Night-time Stability Class Occurrence (Winter Months)**

	Stability Classes						
	A	B	C	D	E	F	Total
Number	0	0	0	467	233	497	1197
Percent	0	0	0	39	19.5	41.5	**100**

The meteorological assessment indicates that temperature inversions occur for approximately 42% of the time between the hours of 6pm to 7am during the winter months and therefore an assessment of adverse conditions, i.e. temperature inversions, is required. The temperature inversion parameters recommended in the INP have been used in the modelling and are based on a $3^{o}C/100m$ inversion strength and a wind speed of 2m/s in the direction of the receiver.

6. Operational Noise Impacts Assessment

6.1 Assessment parameters

The operation of the coal unloading facility is proposed for a 24 hour as needs basis.

This assessment has incorporated into the modelling only those noise sources that can be reasonably assessed and that represent normal operational impacts. The modelling has not considered some of the defects and impacts outlined in **Section 5.1.2** from rail traffic such as wheel squeal or flanging noise, bunching and stretching or aerodynamic noise. These impacts are not part of an ideal design for the rail loop and where possible have been designed out by careful planning and good management of the proposed rail system.

Factors considered for the estimate of rail noise emissions from the balloon loop include:

- normal operational noise from the diesel engines
- normal operational noise from the rail/wheel interface

Factors not included in the modelling of impacts are:

- Rail/wheel squeal due to curving or flanging
- Impact noise from bunching and stretching of wagons
- Aerodynamic noise
- Horn noise
- Rail or track defects

The noise sources not included in the modelling are discussed in more detail in **Section 6.3.2**.

6.2 Assessment scenarios

The potential for noise impacts at nearby residential locations has been assessed by comparing the predicted results from three operational scenarios with the noise goals identified in **Section 4**. The assessment scenarios account for stationary as well as moving noise sources associated with the proposed facility for both day and night time periods. An outline of each assessment scenario is given below.

1. Combined operations of the coal unloading dump hopper and coal conveyor. This scenario is assessed against the Industrial Noise Policy criteria.

2. Combined train movements on the existing rail line and forecast train movements for the Delta Electricity coal unloading loop for 15 hr day and 9 hr night periods. This scenario is

assessed against the ARTC Environmental Protection Licence at nominal distances from the existing track.

3. The combined effect of dump hopper, coal conveyor and coal train movements on the balloon loop. This scenario is assessed against the Industrial Noise Policy intrusiveness criteria.

While the noise levels in scenario 1 and 2 are assessed against separate criteria they will, in reality, combine to form a cumulative impact when coal deliveries occur. This case is then assessed in scenario 3 above against a 15 minute criterion to identify intrusive noise impacts. In practice the noise from train movements is likely to mask other operational noise emissions from the coal unloader and the conveyor during a dumping cycle.

Scenario 1 assesses the operational levels of the dump hopper and the coal conveyor without the influence of rail noise. While it is not envisaged that the dump hopper and coal conveyer would be operational without a train present, this assessment predicts the level of contribution of the proposed infrastructure. Conveyor noise emissions have been estimated based on a low-noise conveyor having an enclosure constructed of custom orb sides and roof and a concrete base.

Additional noise may be produced by the drive motor and conveyor belt take up. However, the location of these items will be within the power station thereby eliminating noise emissions to residential receivers in the Pipers Flat community.

For Scenario 2, movements on the Gulgong - Wallerawang line were considered in combination with additional train movements on the main line. The existing daily timetable below indicates an average number of train movements on the line over any given 24 hour period. It should be noted that while there is provision for trains in the timetable at given times on the main line, these slots are not always filled therefore existing train numbers are approximate only.

	Day		**Night**	
	Up	**Down**	**Up**	**Down**
Existing movements	2	2	1	1
Proposed movements	4	4	3	3

In Scenario 3, the combined effect of coal dumping, coal conveyor and train movement on the rail balloon loop for a 15 minute period have been assessed against the Industrial Noise Policy Intrusiveness Criteria.

6.3 Predicted noise levels

The prediction of noise levels at nearby residential receivers resulting from the operation of the rail unloader has been estimated at 6 different residential locations for each of the scenarios. The Sound Power Level data used to predict the noise levels at these receivers has been derived from measurements of similar operations collected for the project as well as other data taken from the SKM noise database.

Item	L_{Aeq} Sound Power Level
2 x Locomotives	114 dB(A)
Coal Unloading facility (shed)	68 dB(A) / metre^2
Transfer Chute (enclosed)	68 dB(A) / metre^2
Conveyor (enclosed)	77 dB(A) / metre

These measurements represent realistic values of slow speed train movements (1km/h) and noise emissions from a slow speed dumping cycle. The trains measured and modelled for the proposed rail unloader were two 40 class locomotives. While the class of locomotive may vary depending on the location of the coal supply, the estimated locomotive noise levels would be similar.

The assessment of adverse meteorological conditions has been undertaken using the temperature inversion parameters of an F class atmospheric stability and winds from the source to the receiver of 2 m/s. The assessment of adverse winds of 3 m/s provides the same level of increase as the temperature inversion scenario and therefore the two may be considered to be interchangeable for the values shown in the table of results.

6.3.1 Operations

The SoundPLAN noise model has been used to predict the noise impact from the operations of proposed coal unloading facility. **Table 6-1** presents the results of the noise level predictions at the nearest residences for the operation of the static plant and buildings. The night time operations have also been assessed for adverse meteorological weather conditions. The assessment locations around the proposed rail loop and unloading facility are shown in **Figure 1**.

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Table 6-1 Scenario 1 - predicted noise levels dB(A) from unloading facility only

Location	Predicted Operational Noise Level $L_{Aeq\ 15min}$		Predicted Operational Noise Levels $L_{Aeq\ 15min}$ + Adverse Weather		Project Specific Criteria $L_{Aeq\ 15\ min}$	
	Day	Night	Day	Night	Day	Night
1	24	24	-	28	35	35
2	24	24	-	29	35	35
3	21	21	-	26	35	35
4	23	23	-	28	35	35
5	23	23	-	28	35	35
6	<20	<20	-	<20	35	35

Predictions for the operational scenario of coal unloader and coal conveyor only, for both day time and night time, indicate that at the nearest residential receivers the noise levels would be below the INP criteria of L_{Aeq} 35 dB(A). Specific mitigation for these items of plant includes acoustic design considerations in the buildings and structures to minimise the transmission of noise from equipment to the local environment. The assumption of acoustic treatments to the conveyor, dump hopper buildings and transfer chute for the conveyor have been included in the noise modelling.

The noise from train movements has been predicted for nominal distances from the track to indicate the potential for train movements to impact on sensitive receivers (**Table 6-2**). The receivers identified in Scenarios 1 and 3 for the coal loop are not likely to be impacted upon by the additional trains within the rail corridor as these train movements will occur prior to the balloon loop. Once on the balloon loop the rail noise is assessed in conjunction with other noise sources against the industrial noise policy criteria.

Table 6-2 Scenario 2 - predicted noise levels from rail operations

Nominal Distance From Track	Predicted Noise Level Existing Train movements $L_{Aeq\ 15hr,\ 9hr}$ dB(A)		Predicted Noise Level Increase + Loop Train movements $L_{Aeq\ 15hr,\ 9hr}$ dB(A)		Project Specific Criteria $L_{Aeq\ 15hr,\ 9hr}$ dB(A)	
	Day	Night	Day	Night	Day	Night
75 metres	62	59	+2	+2	65	60
130 metres	55	54	+2	+2	65	60
500 metres	42	41	+2	+2	65	60

Movements for the proposed rail facilities combined with existing rail movements on the Gulgong - Wallerawang rail line were modelled for both day and night time scenarios. Predicted noise emissions from the combined operations indicate that there will be an increase of approximately

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2 dB(A) over the existing noise levels. The predicted noise levels indicate that receivers less than 75 metres from the rail corridor may have experience noise levels that are marginally above the ARTC Environmental Protection Licence goals as the result of increased movements on the rail line. An increase of this magnitude is not considered significant and is unlikely to be discernable by most people.

For the combined activities which include dump hopper, conveyor and train noise, the results of the predicted noise levels for neutral weather conditions, when compared to the project criteria, indicate that day time noise emissions would meet the requirements of the INP intrusiveness criterion at all locations (**Table 6-3**). At location 5 the predictions indicate that compliance with these criteria is marginal. The main contribution to the 15 minute L_{Aeq} noise level is the train engine noise form the site. The night time operational levels under adverse meteorological conditions are likely to exceed the INP guidelines Locations 4 and 5 with compliance being marginal at the other locations.

- **Table 6-3 Scenario 3 - predicted noise levels from combined activities**

Location	Predicted Noise Level Operational Levels $L_{Aeq\ 15\ min}$ dB(A)		Predicted Noise Level Operational Levels + Adverse Weather $L_{Aeq\ 15\ min}$ dB(A)		Project Specific Criteria $L_{Aeq\ 15\ min}$ dB(A)	
	Day	Night	Day	Night	Day	Night
1	28	28	-	34	35	35
2	29	29	-	35	35	35
3	29	29	-	35	35	35
4	32	32	-	37	35	35
5	34	34	-	39	35	35
6	<20	<20	-	<20	35	35

6.3.2 Other train noise sources

Other sources of noise have been assessed individually as directed in the requirements from noise by the Minister for Planning. Most of these noise sources cannot be predicted with respect to timing or duration and have several parameters that are reliant on the types of locomotives and wagons.

Horn Noise

The primary use of a train horn is for warning people with a train corridor that a train is approaching and for areas other than crossings is generally not a part of regular operations. The most likely impact from horn noise will be to sleep disturbance noise levels at nearby residential receivers. Train horns are typically measured by an L_{Amax} level which can range between 90 and

110 dB(A) at 15 metres, with average values being about 105 dB(A). Train horns also exhibit a great degree of directionality to ensure that most of the sound energy is projected in front of the train. The maximum level expected at any of the nearby residential receivers from a horn blast would be on average between 60 dB(A) at the furthest and 70 dB(A) at the closest. These levels may cause sleep arousal at some of the closer residences, depending on the duration of the horn blast.

Flanging and curving squeal

The presence of flanging and curving squeal cannot be effectively determined without detailed knowledge of the factors that make up the rail system and the train consist. Even with this detail the level of squeal noise cannot be accurately predicted. It is recognised that flanging and curving noise are a potential risk for the project as the curve radius is less than that recommended by empirical analysis. Mitigation for this impact is centred on the design of the balloon loop as any occurrence of squeal is considered unacceptable for the project. To eliminate the potential for wheel squeal, an extensive mitigation strategy is outlined in **Section 8** below.

Bunching and stretching (shunting)

Bunching and stretching noise, like the locomotive horn is predicted as an L_{Amax} noise level. This type of impact is unpredictable but will mostly occur when locos stop or decelerate quickly. The L_{Amax} level at 15 metres is estimated to be 90 dB(A). This would produce a level at the furthest receivers of approximately 45 dB(A) and a level of approximately 55 dB(A) at the closest receivers. This level of impact would be above the nominal level of Sleep Disturbance of 45 dB(A) at the closest residences and marginal at the furthest residences. Physical mitigation of this type of noise impact is discussed in **Section 8.**

6.4 Discussion of results

In scenarios 1 and 2 the noise level predictions for individual operations of both the static and moving noise sources are in all cases lower than the INP and ARTC noise requirements for daytime and night time scenarios at the identified receivers. For the rail assessment, noise level increases would occur further up the corridor away from the loading facility. The individual assessment of these impacts is aided by the specific nature of each of the noise sources. That is to say that only train noise is assessed against the train noise criteria and similarly the industrial noise is assessed against the industrial noise criteria.

To a noise sensitive receiver, however, the unloader facility will have a noise output that is the combination of noise emissions, even though they may be able to be distinguished as being predominantly from one source. The combined noise experienced from site has therefore been assessed in scenario 3 where the 15 minute INP intrusiveness noise criteria is applied to both daytime and night time noise levels. In this assessment there is no distinction between the types of noise sources and all emissions from the site are treated as industrial noise.

The sensitive receivers near to the proposed coal unloader currently experience noise levels in the low 20 dB (A)range at night. While the assessment shows that noise emissions could comply with environmental requirements of the INP, large noise increases above existing levels may still be the cause of ongoing concern with nearby residents.

The impact of the predicted noise levels is likely to be more significant during the night time period than through the daytime even though the criteria in scenario 3 are the same for both periods. It should however, be noted that the coal unloading facility is only to be operational during the dumping cycle for a period of between 1-$1^{1}/_{2}$ hours.

Control of potential noise emissions from the site should be developed through careful design thus providing lower intrusive noise emissions than those identified under the INP.

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7. Construction Noise

The construction programme and methodology for the proposed coal loader has not been fully determined at this stage and therefore a detailed assessment of noise impacts is not possible. A general assessment of noise from construction actives that are likely to occur has been made based on typical levels from construction equipment.

During construction activities, the resulting noise levels at a sensitive receiver will vary according to distance from the works, the type of equipment in operation and any available topographical shielding. General site works will involve daytime construction activities as well as transport to site of construction materials. Night construction works are not envisaged for this project.

To better assess the potential for noise impacts due to normal construction activities during daytime hours, the noise emissions from general works at the site have been modelled using the SoundPLAN noise prediction software with the CONCAWE assessment method. Predictions of the $L_{A10,\ 15minute}$ construction noise levels from these scenarios are detailed in **Table 7-1.**

▪ **Table 7-1 Equipment Sound Power Level, L_{A10} dB(A)**

Item #	Description	Sound Power Level L_{A10} dB(A)	Approximate Sound Pressure Level @ 7m
	Asphalt Pavers	100	75
2	Compressor	103	78
3	Excavator	108	83
4	Grader	108	83
5	Mobile Crane	108	83
6	Vibratory Roller	110	85
7	Back Hoe	111	86
8	Cement/ Concrete Agitator	112	87
9	Tip Truck	112	87
10	Bulldozer	113	88
11	Front End Loader,	114	89
12	Water Cart	115	90
13	Compactor	118	93
14	Pile Driver	120	95

The list of equipment in **Table 7-1** is based on generic types, which provides an estimated sound pressure level at seven metres used in this assessment. Equipment that is to be used on this Project is to have a sound pressure level equivalent or less than that detailed in the table in order to remain consistent with this assessment. To account for equipment that has a directional noise component, the sound pressure level at seven metres will be the average of sound pressure readings taken on all sides of the equipment when operational.

7.1.1 Predicted Construction Noise Levels

The predictions listed in **Table 7-2** are considered representative of anticipated noise levels based on a projected "typical" construction scenario. Based on the sound power levels in the table above , this typical scenario consisted of a haul truck x 2 , compactor x 2, dozer x 3 and watercart x 2 with all equipment operating simultaneously. The predicted noise levels are not necessarily the worst case impacts but should be used as a guide to the level of impact expected.

Table 7-2 Predicted $L_{A10,\ 15\ minute}$ Noise Levels from Construction Activities at Key Receivers

Location	Predicted Construction Noise Level $L_{A10\ 15\ min}$ dB(A)	Project Specific Criteria $L_{A10\ 15\ min}$ dB(A)
	Day	Day
1	52	35
2	52	35
3	51	35
4	52	35
5	50	35
6	30	35

The noise from general works has been assessed and at all receivers except Location 6 the estimated construction noise levels would exceed DEC construction noise goals. Specific noisy activities such as impulsive or explosive noise emissions or night time works would require a more detailed assessment however, these works are not identified at this stage. Noise attenuation by noise walls and other forms of physical barrier are not likely to be effective in the reduction of construction noise. Alternative noise mitigation measures are recommended through the implementation of appropriate noise management strategies during construction. A Construction Noise Management Plan (CNMP) addressing potential noise impacts and mitigation measures should be included in the project Construction Environmental Management Plan (CEMP). A list of general mitigation measures in **Table 8-1** has been provided in **Section 8** as an initial indication of mitigation measures for the project.

8. Mitigation of noise impacts

Operational Noise for Unloader

General operational noise emissions would be required to be controlled by implementing appropriate enclosure design for equipment within the dump hopper building. The dump hopper building itself would also require acoustic design input to ensure noise emissions are minimised.

Take up rollers for the conveyors and coal transfer towers should be designed with acoustic buildings and enclosures for drive motors so as to reduce the transmission of noise from equipment and operations to external environment. Gearbox whine is also a readily identifiable source of noise from some equipment and therefore large reductions of electric motor speeds through gearboxes are not conducive to low noise emission environments. It is recommended that applications and motor speeds should be matched as closely as possible through the correct pole rating of a motor. Any further speed control should then be achieved through the use of gearbox reductions.

Operational Train Noise

The majority of the operational noise is generated by the locomotives during the dumping cycle and therefore the reduction of train engine noise will be a key issue for the project. However, due to the nature of the noise and the source at the top of the locomotive this would not be easily achieved. Generally barriers or natural topographic cuttings are used to reduce noise from the train exhaust however these barriers must be of a significant height, given the height of the source. In addition noise barriers for this project are not likely to provide sufficient benefit to the nearby sensitive receivers due to the local topography. Many of the potentially affected residences are located on properties that look down onto the site which reduces the effectiveness of a noise barrier.

To reduce the likelihood of rail/wheel noise, the inclusion of wooden sleepers, track ballast, rail head profiling and cambering of the track should be included in the design considerations. Even with these mitigation measures, estimates of the potential for wheel squeal issues indicate that there remains the possibility for this type of impact to occur, despite the optimisation for the design of the rail loop. The provision for trackside lubricators should therefore be made in the early stages of the project. While these units are not initially expected to be operational, rapid implementation would be possible if they prove to be necessary.

In order to address other sources of rail operational noise, the following recommendations should be considered.

– Rail/wheel noise caused by track joints or rail corrugations. The track is to be constructed using welded joints and maintained to avoid rail corrugations which would reduce or eliminate the potential noise emissions from this mechanism. Low train speeds exiting the rail loop would minimise the noise impacts from the turn out onto the main line.

– Wheel squeal from stick-slip actions on tight radius curves. Impacts from this effect are not easily predicted but in general the rule of thumb suggests curves of >300 metres radius are associated with acceptable wheel performance. In contradiction to this, studies by Anderson [1] identify wheel squeal issues on tracks with radius of greater than 300m. This study also indicates that the damping provided by wooden sleepers over concrete reduces the severity of the squeal. Rudd [2] suggests that train speed, curve radius and fixed wheel base length are related and that the rule of thumb is given by, minimum curve radius > 100 x (fixed wheel length). The proposed track has been designed to include a bend radius of 250 metres for the loop, which is the maximum available for the lot size. Estimates based on the rolling stock type and using the Rudd method indicated that a minimum radius of 190 metres would be needed to avoid squeal issues where pivoting bogies are used on the coal wagons. In addition to providing the maximum diameter on the loop combined with low train speeds, the recommended design parameters would also include:
  – correct rail head profiling
  – cambering the track
  – the use of ballast on the track bed
  – wooden sleepers

  A combination of the above mitigation methods is likely to significantly reduce the potential for wheel squeal in the balloon loop. Should these methods prove to be insufficient, the implementation of track side lubricators would occur.

– Aerodynamic noise caused by high train speeds. During the unloading cycle the train would operate at speeds of 0.6 - 1.0 km/h. At these speeds there would be no ability for the train to generate aerodynamic noise. Once the last wagon exits the dump station the train speed should remain low at approximately 25 km/h.

– Bunching and stretching of wagons during starting and stopping of the train. The loop has been designed to include a flat grade through the dumping station and loop, with an increase in grade towards the end of the loop to promote a positive traction force in the train consist during dumping and departure. There remains the possibility of bunching and stretching to occur prior to the dump station as the rail line has a negative grade coming from the existing

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[1] Anderson D "Wheel Squeal Measurement, Management and Mitigation on the NSW Rail Network" Proceedings of AAS Conference 2004

[2] Rudd M.J. "Wheel/rail noise—Part II: Wheel squeal", Journal of Sound and Vibration Volume 46, Issue 3 , 8 June 1976, Pages 381-394

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rail line. Bunching and spreading are usually related to stop start events and may not ordinarily occur while the train is moving unless a sudden acceleration or deceleration occurs. To reduce the risk of shunting noise the train will not normally be permitted to stop at any time during the unloading process, unless required to do so for safety reasons. The rail line should have a positive grade throughout, although given the constraints of the site it is recognised that this may not be practical.

The mitigation measures identified above should be considered during detailed design and in consultation with the potentially affected community.

Construction Noise

Mitigation methods should be identified by the construction contractor through the development of a comprehensive noise management plan once a clear understanding of construction methodology and scheduling is known.

■ **Table 8-1 Construction noise and vibration mitigation and management**

Timing	Action Required
Pre construction	■ Acoustic enclosures should be constructed around fixed plant during the site establishment works;
Pre and during construction	■ Other General Planning considerations — Maximise the offset distance between noisy plant items and nearby noise sensitive receivers, where possible, using the effects from the following to reduce noise; — Purpose built barriers; — Materials stockpiles; and — Site sheds and material and/or equipment handling areas;
During construction	■ Orient equipment with directional noise characteristics away from noise sensitive areas;
During construction	■ Carry out loading and unloading as far away from noise sensitive areas as possible;
During construction	■ Avoid the coincidence of noisy plant working at the same time close together and adjacent to sensitive receivers;
Pre and during construction	■ Reduce impact of construction traffic noise by considering: — site road maintenance; — traffic management including limitations on vehicle speeds both on and off site;
Pre construction	■ Ensure that traffic flow through the site is one direction to prevent delays and to avoid the use of reversing alarms as much as possible.
Pre construction	■ Use 'smart', reversing alarms (levels vary with changing background noise levels) on plant and equipment such as bulldozers, cranes, graders, excavators, trucks, etc where practicable;
Pre and during construction	■ Consult with the local community as an important part of the noise management of the site.
Pre construction	■ Mitigate noise through the appropriate selection of plant. The unit with the lowest noise rating which meets the requirement of the job should be used;

Timing	Action Required
Pre and during construction	▪ Appropriate selection of construction processes / methodologies, which minimise the generation of construction noise;
Pre and during construction	▪ Fit particularly noisy equipment with noise suppression measures, where practicable;
During construction	▪ Employ respite periods for particularly noisy activities where possible;
Pre and during construction	▪ Train staff to ensure awareness of noise targets and potential community noise issues with the project;
Pre and during construction	▪ Where possible metal surfaces should be lined with rubber impact protection where there is potential for contact;
Pre and during construction	▪ Use quieter hydraulic hammers or the lowest possible energy level to complete any given task;
Pre and during construction	▪ Conduct regular and effective maintenance of both stationary and mobile plant and equipment;
Pre and during construction	▪ No equipment associated with the work should be left standing with its engine running for extended periods;
Pre and during construction	▪ Ensure that vehicles required within compounds do not "queue" outside the worksite close to residential areas. This particularly applies in the morning where sleep disturbance issues may arise;
Pre and during construction	▪ Entry and departure of heavy vehicles to and from the site are restricted to the standard daytime construction times;
Pre and during construction	▪ All construction activities to be restricted to daytime operational hours;
Pre and during construction	▪ Rock breaking, rock hammering, sheet piling and any other activities which result in impulsive or tonal noise generation are only to be conducted during normal operational hours;

9. Conclusion and summary

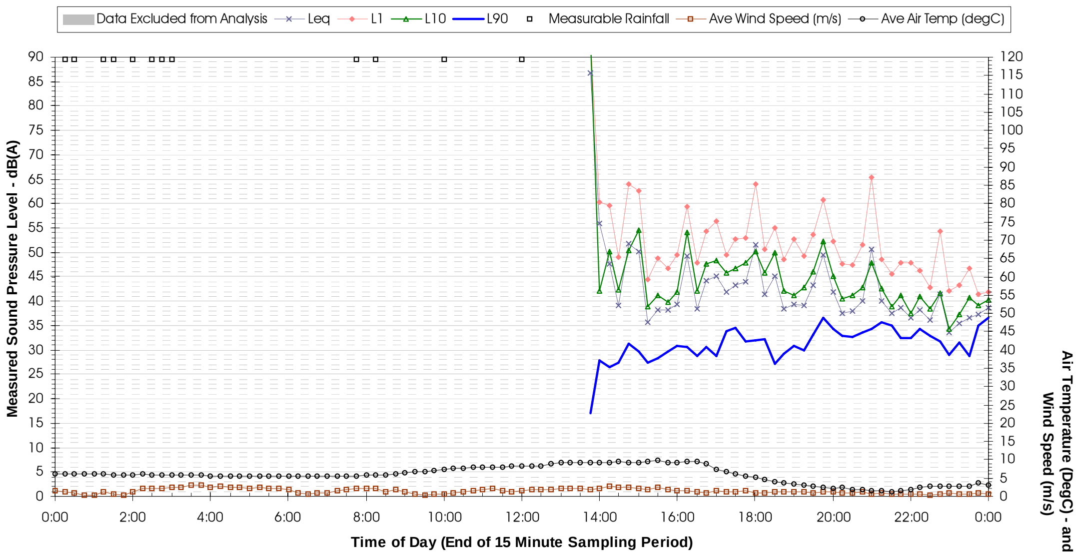
Sinclair Knight Merz has carried out an assessment of the potential for noise impacts to the nearby residential receivers. The assessment has included a comparison of predicted noise levels from both operational noise emissions from the proposed infrastructure and rail related operations with the appropriate noise criteria. The assessment found that noise emissions from various activities when assessed as a combination of noise from the proposed site, would comply with the Department of Environment and Conservation, Industrial Noise policy guidelines. At some locations this compliance is marginal.

The major source of potential noise emissions would be from the train locomotive operating around the balloon loop for extended periods of time during a dump cycle. There is also the potential risk that wheel squeal may occur as the result of curving of the wagons and locomotive around the balloon loop, which has a radius of less than 300 metres, the minimum recommended diameter to avoid this type of impact.

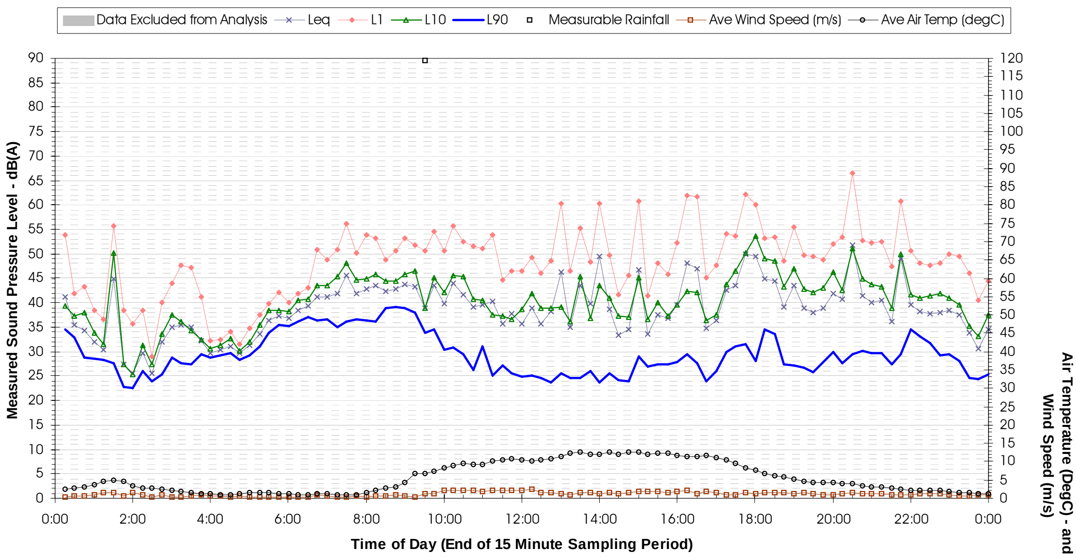
Mitigation in the form of attenuation and design and management measures would be required for several aspects of the project, however reduction in the locomotive operational noise levels are not likely to be possible due to the height above ground and nature of the noise source. Specific mitigation for the conveyor and dump hopper building includes the enclosure of external noise sources and the reduced transmission of noise from with these structures with the proper materials of construction. Mitigation for potential train operational noise issues should be undertaken, in consultation with potentially affected residents, during the detailed design phase to ensure that potential noise risks are minimised or eliminated.

Appendix A Noise Data

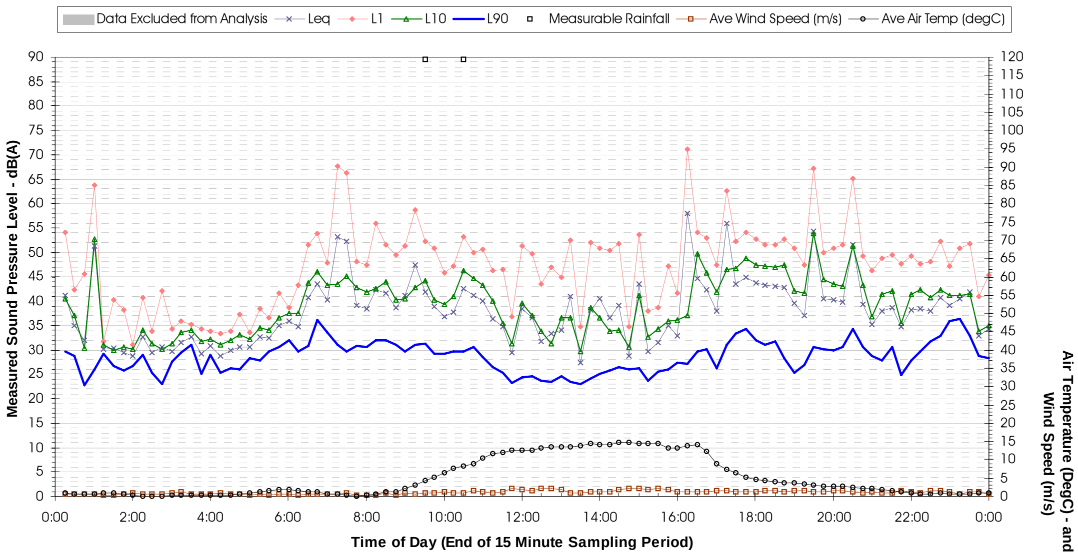
Profile of Noise Environment - Irondale Road - Pipers Flat
Tuesday 25 July 2006



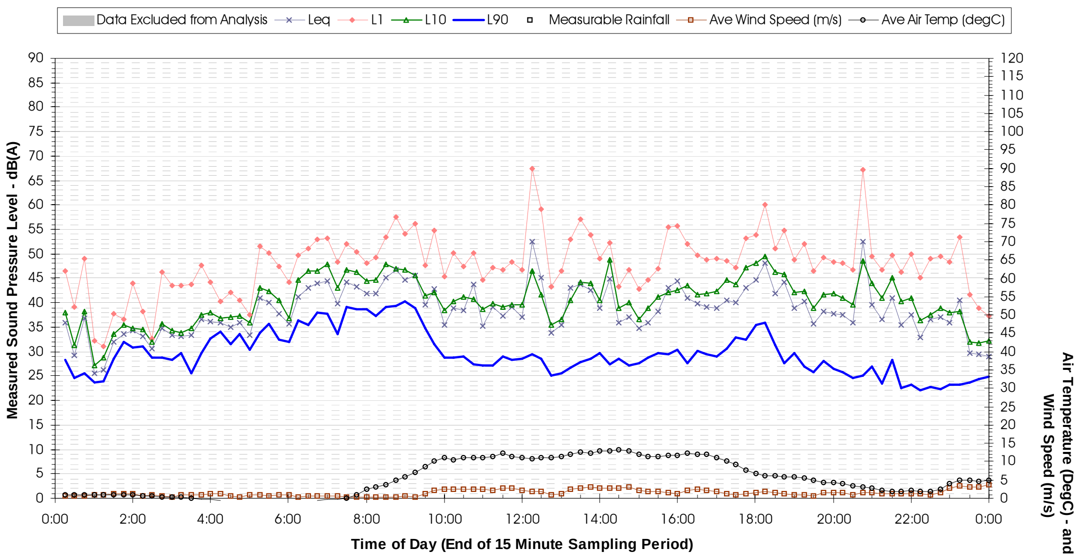
Profile of Noise Environment - Irondale Road - Pipers Flat
Wednesday 26 July 2006



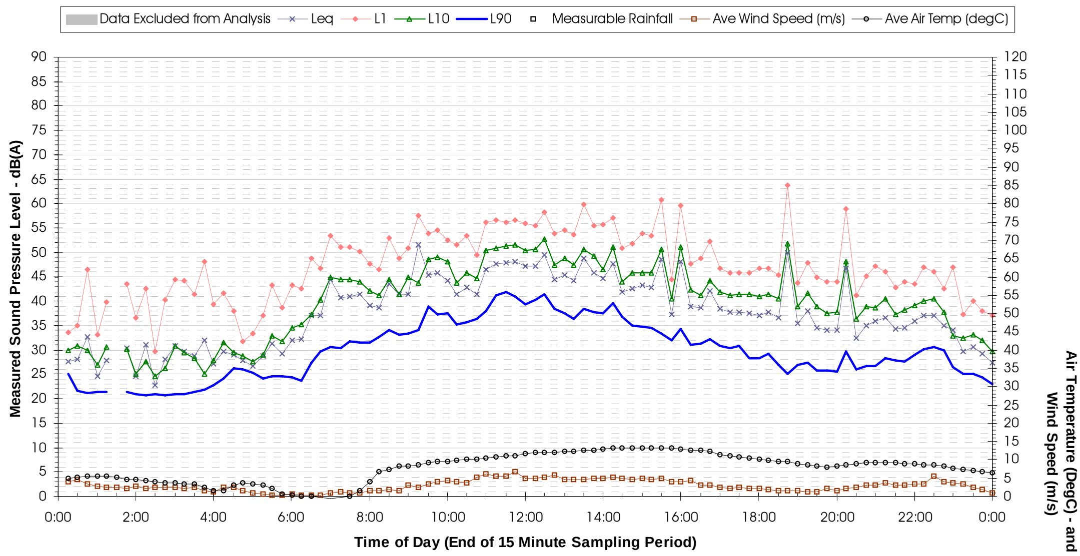
Profile of Noise Environment - Irondale Road - Pipers Flat
Thursday 27 July 2006



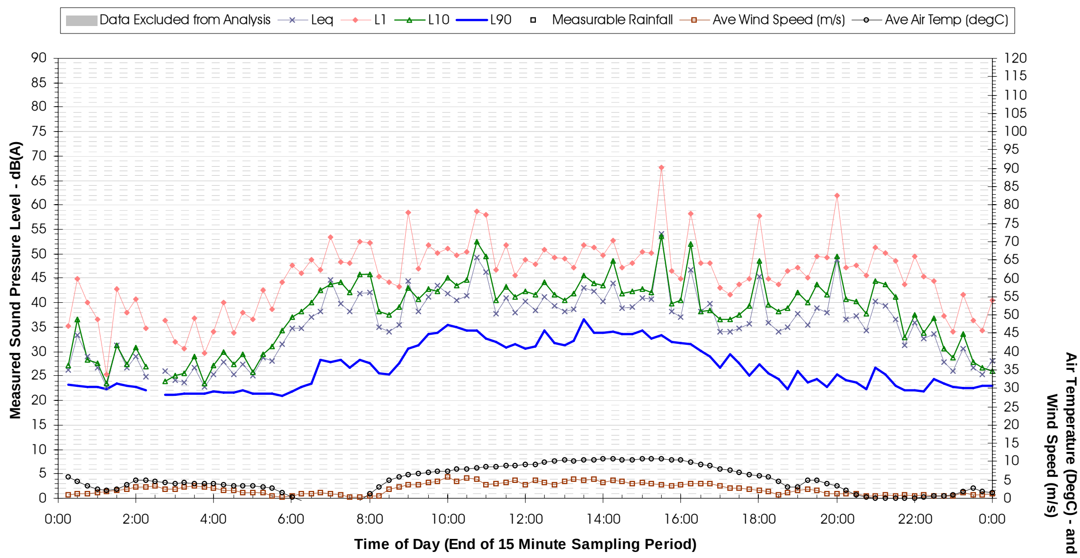
Profile of Noise Environment - Irondale Road - Pipers Flat
Friday 28 July 2006



Profile of Noise Environment - Irondale Road - Pipers Flat
Saturday 29 July 2006



Profile of Noise Environment - Irondale Road - Pipers Flat
Sunday 30 July 2006



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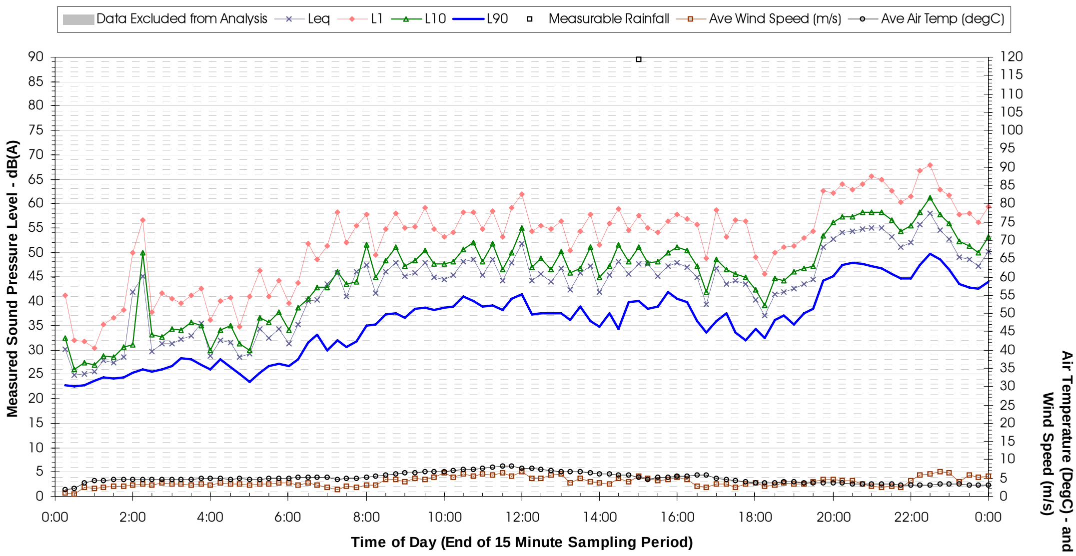

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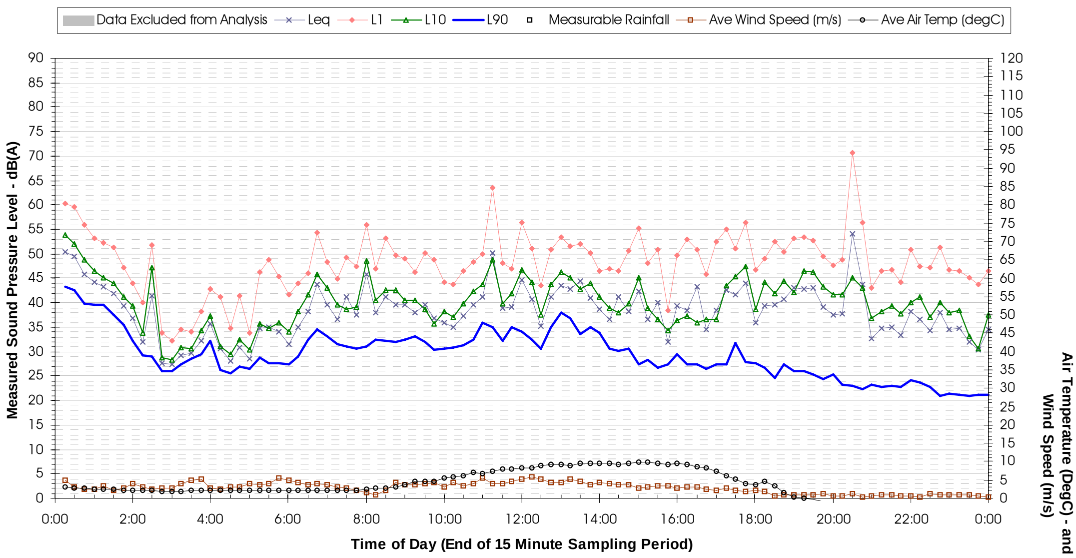

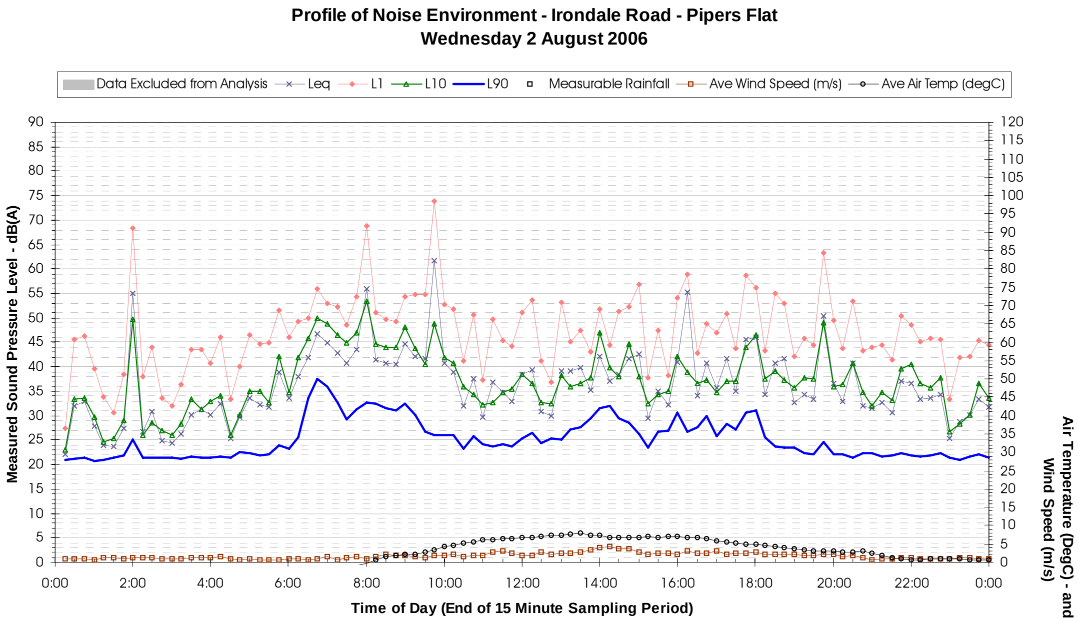
Profile of Noise Environment - Irondale Road - Pipers Flat
Wednesday 2 August 2006
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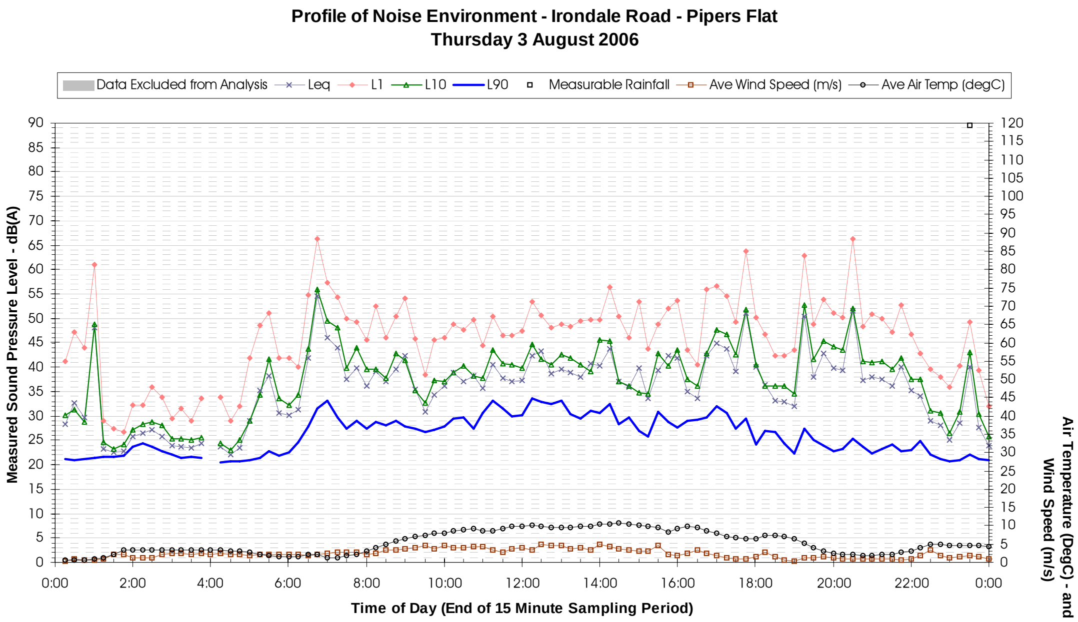
Leq
L1
L10
L90
Measurable Rainfall
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)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Thursday 3 August 2006
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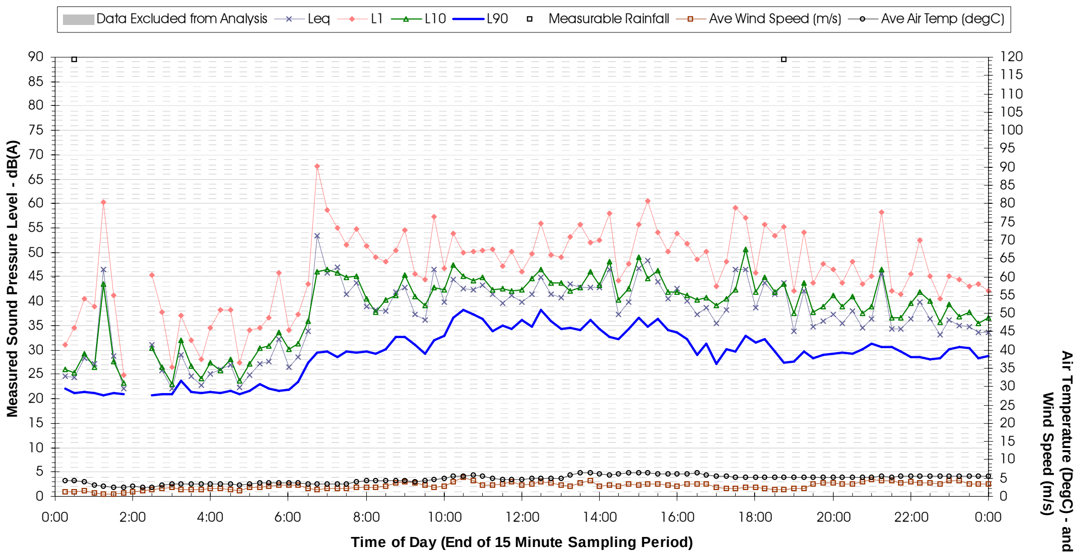
L1
L10
L90
Measurable Rainfall
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measured Sound Pressure Level - dB(A)
Air Temperature (DegC) - and Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

Profile of Noise Environment - Irondale Road - Pipers Flat
Friday 4 August 2006



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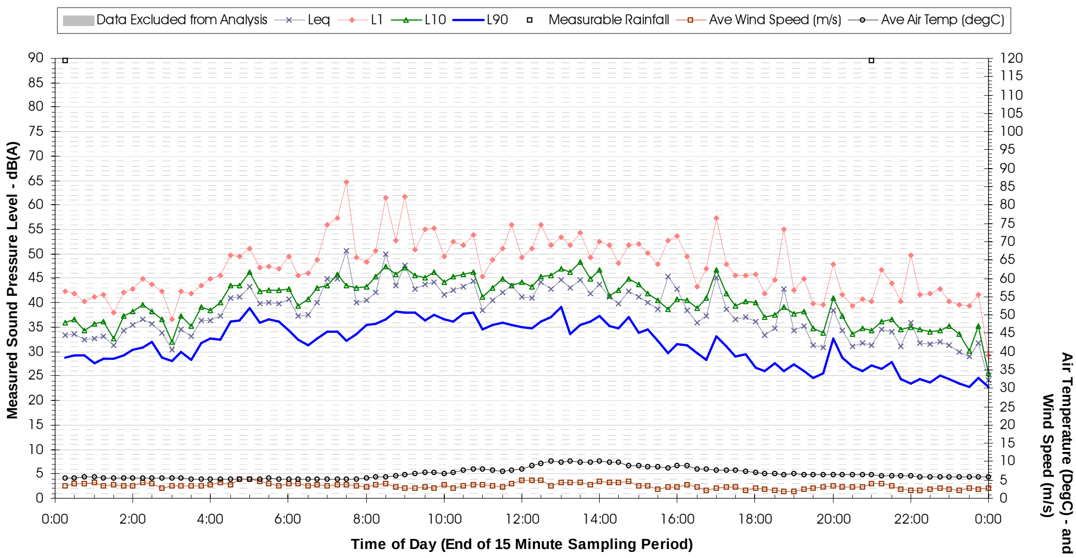
Saturday 5 August 2006



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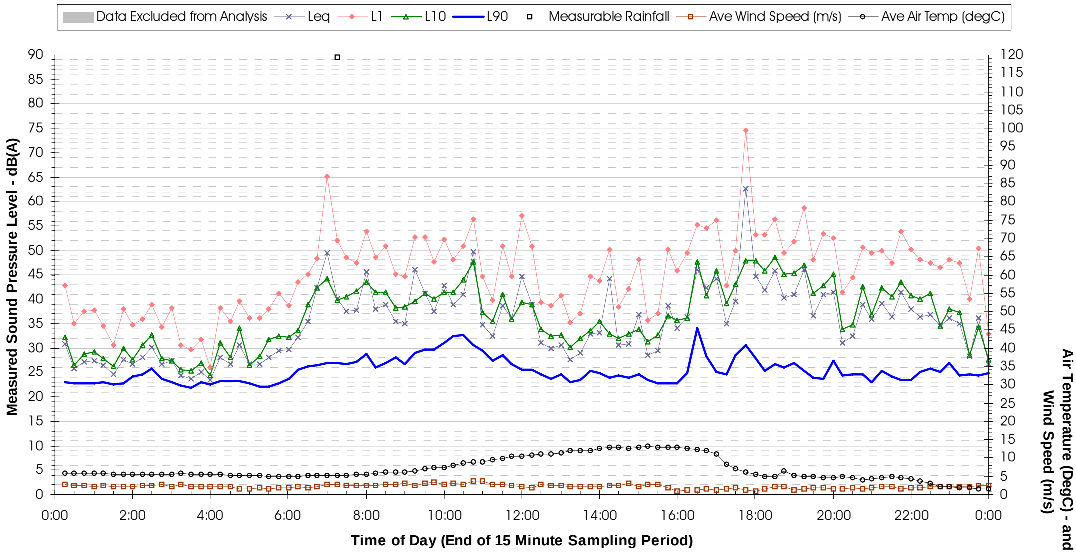
Sunday 6 August 2006



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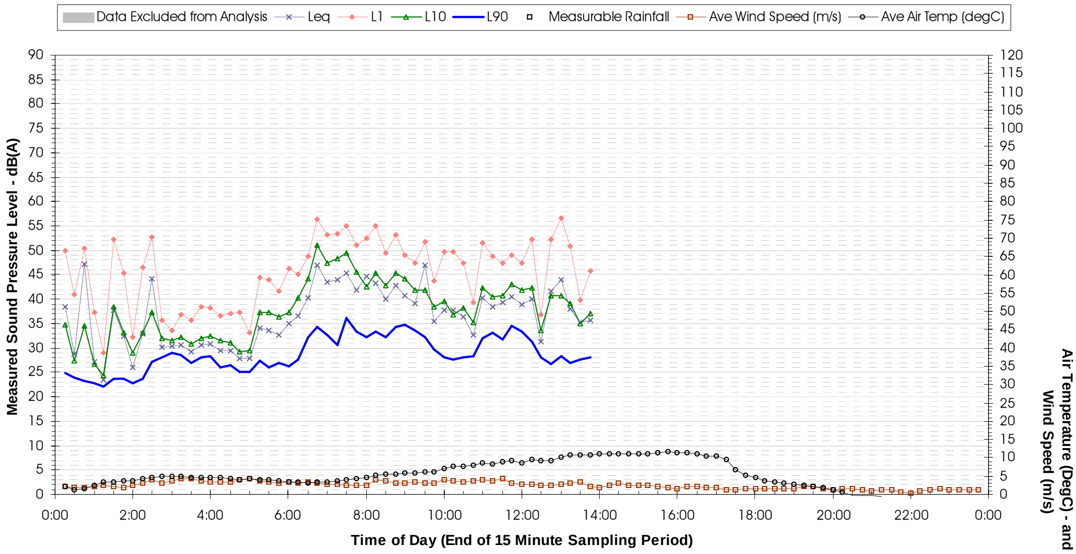
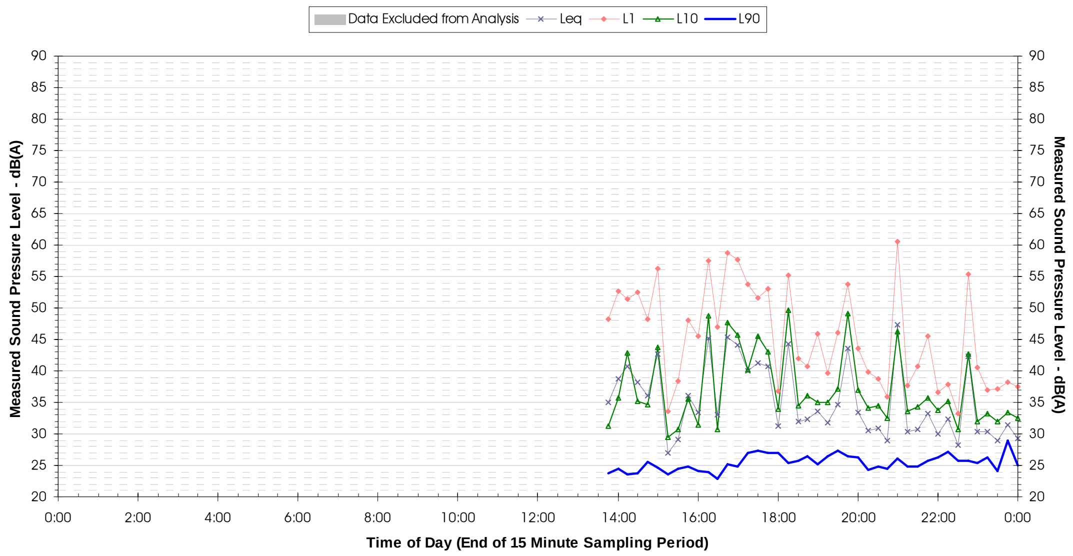
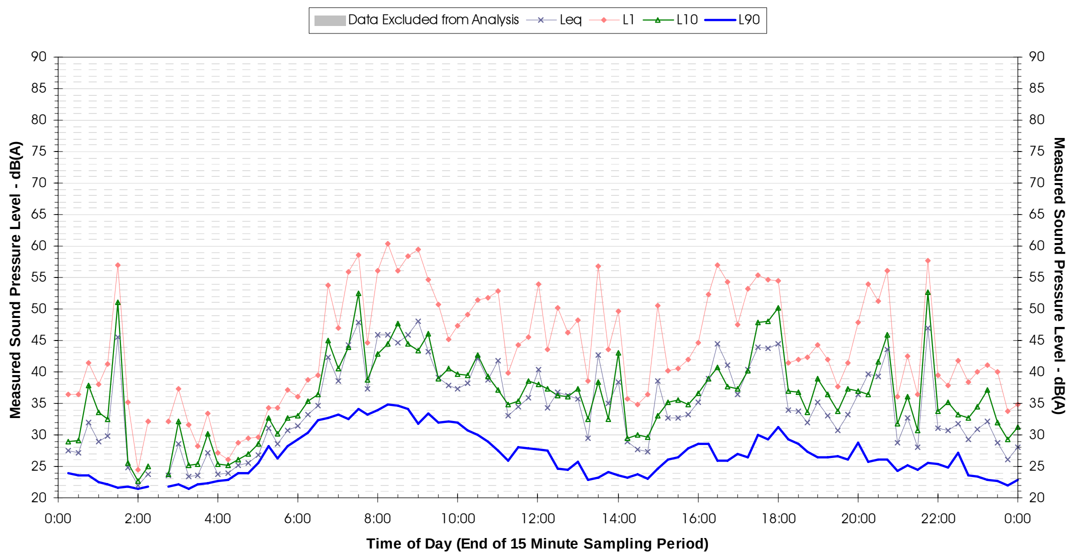
Monday 7 August 2006



Profile of Noise Environment - Turner Farm
Tuesday 25July 2006



Profile of Noise Environment - Turner Farm
Wednesday 26July 2006



Profile of Noise Environment - Turner Farm
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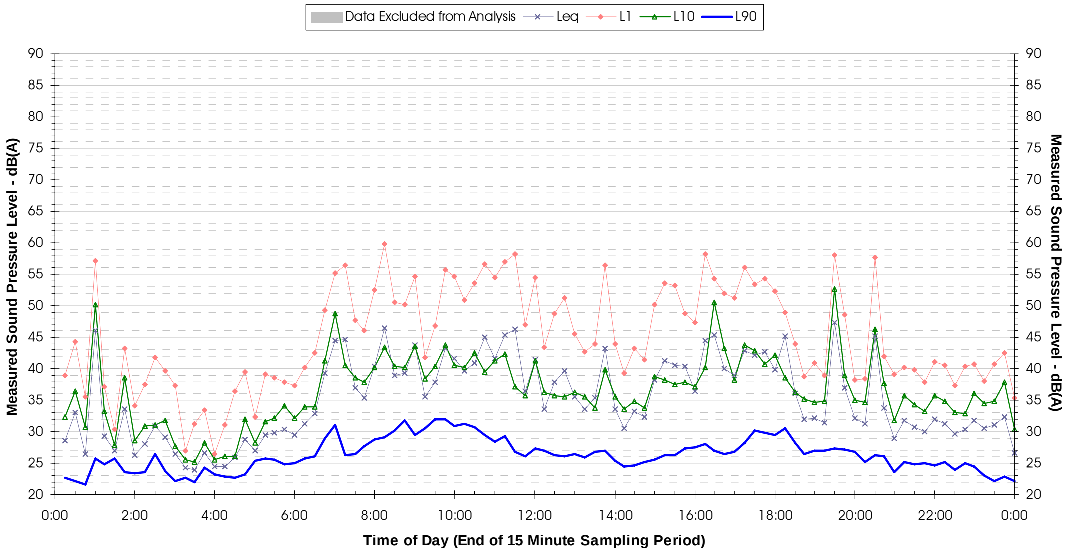

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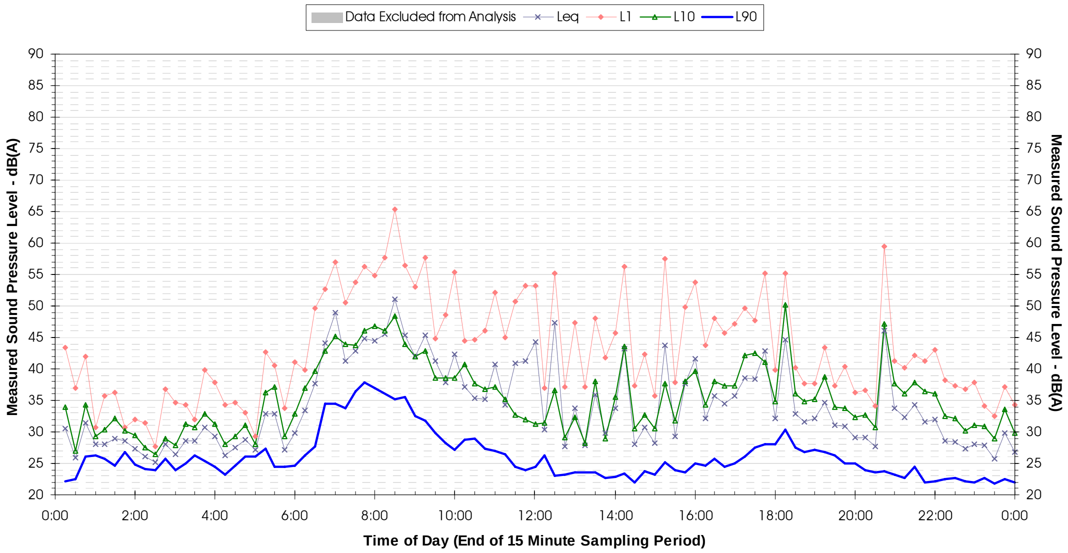

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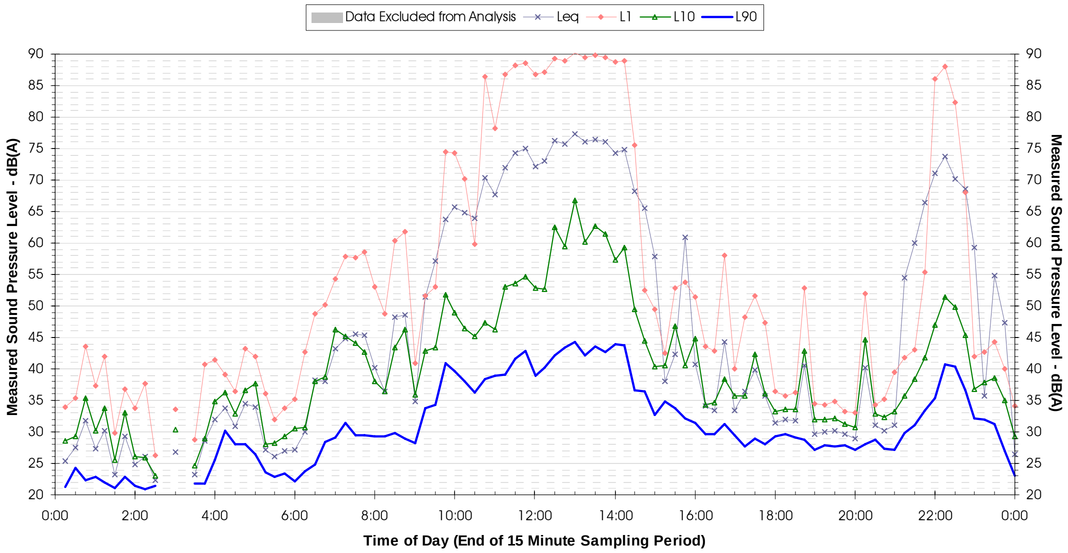
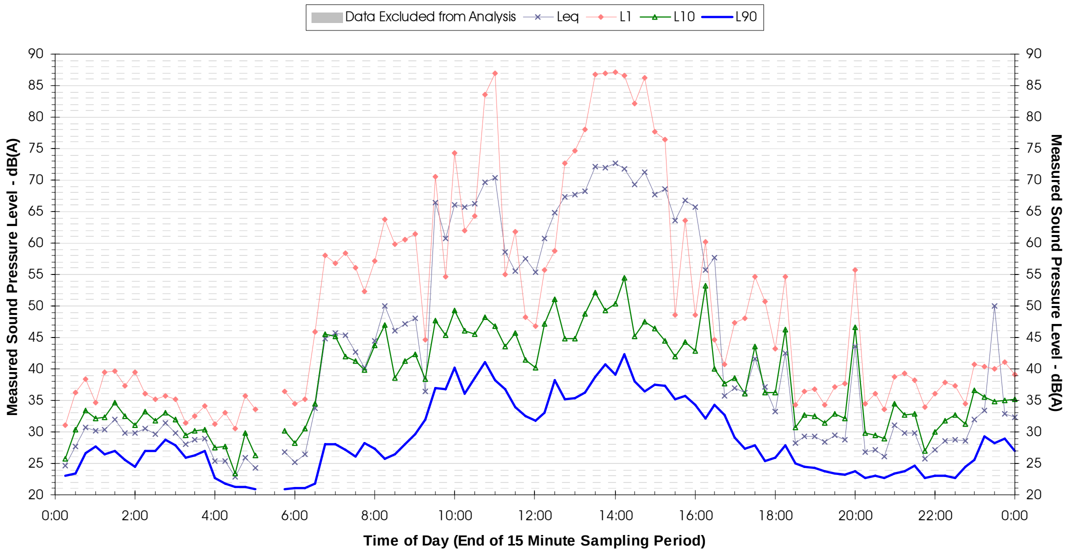
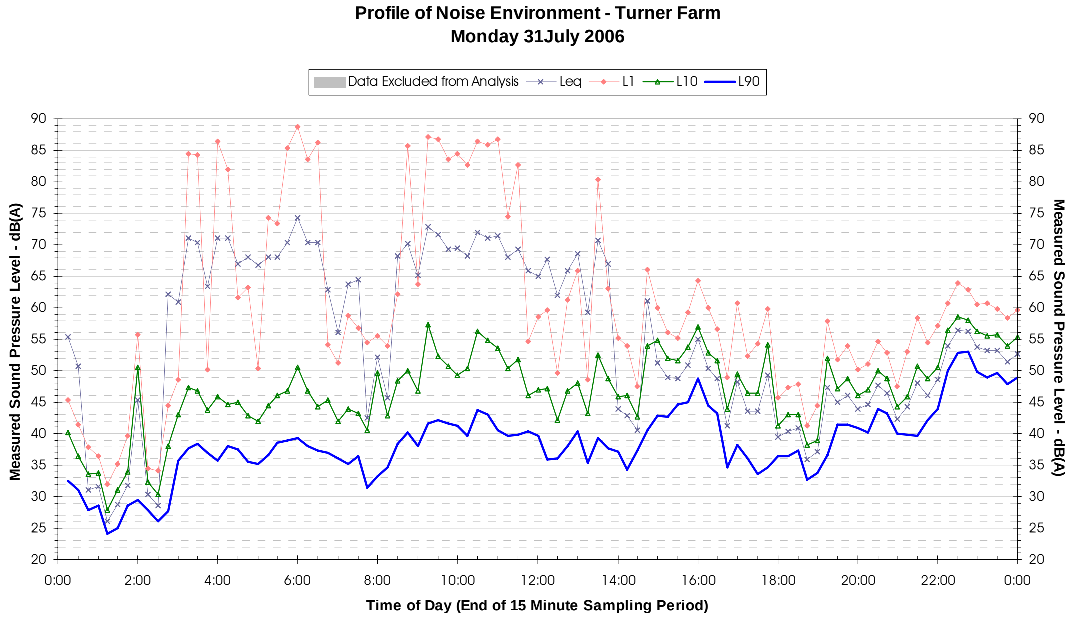
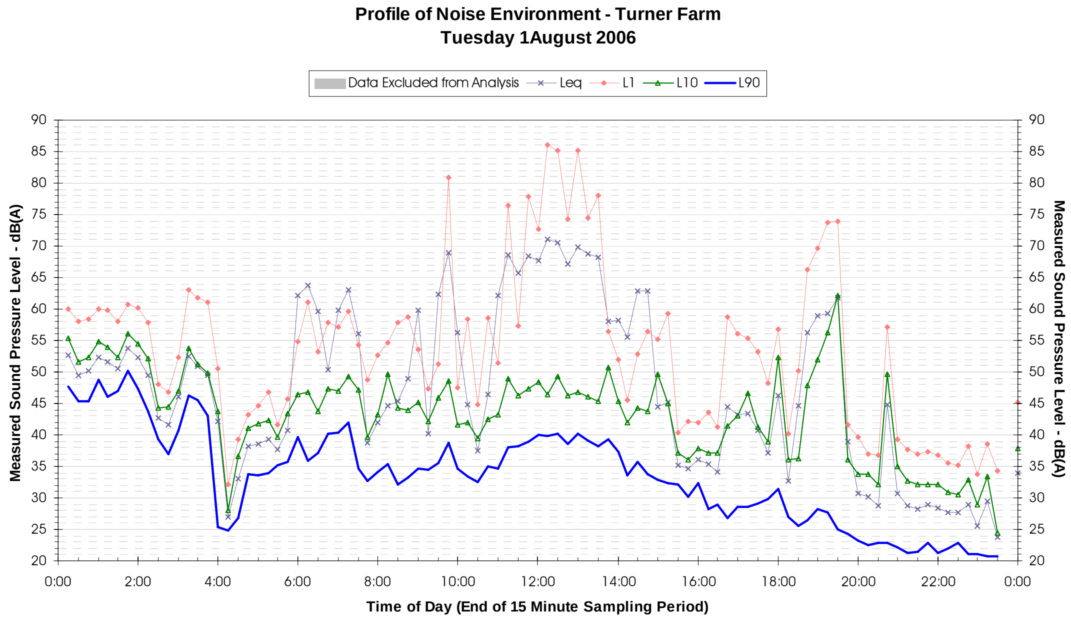
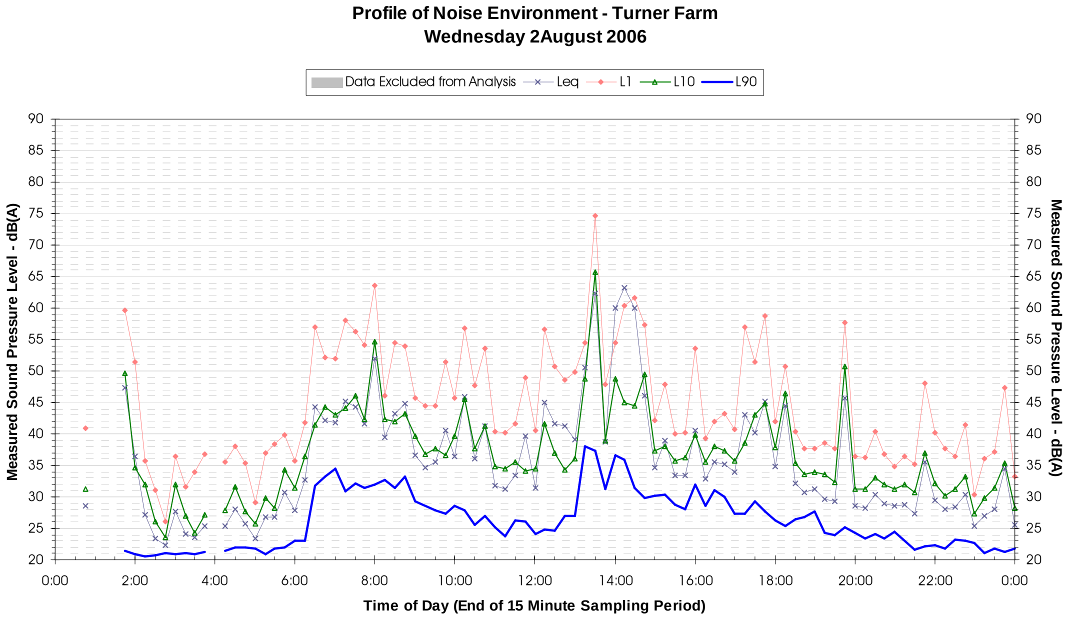


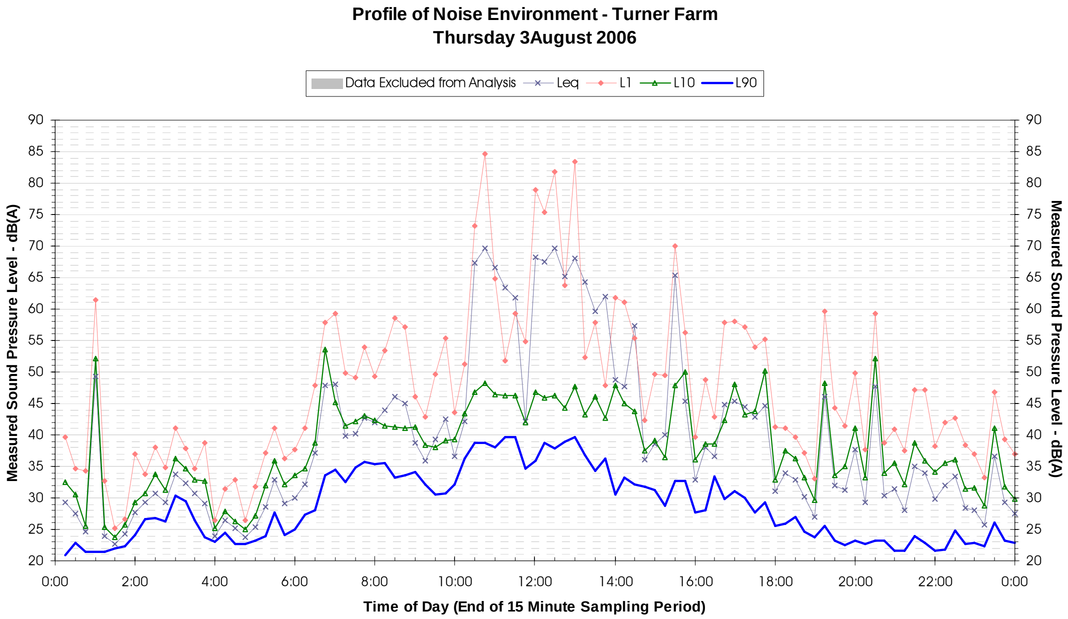
Profile of Noise Environment - Turner Farm
Sunday 30July 2006



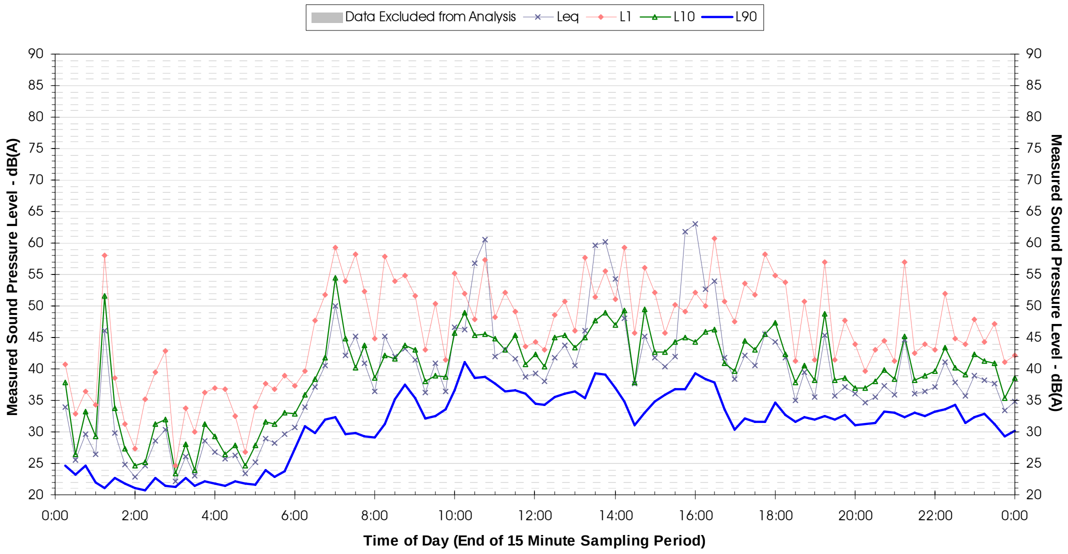

Profile of Noise Environment - Turner Farm
Monday 31July 2006
Data Excluded from Analysis
Leq
L1
L10
L90
Measured Sound Pressure Level - dB(A)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90


Profile of Noise Environment - Turner Farm
Tuesday 1August 2006
Data Excluded from Analysis
Leq
L1
L10
L90
Measured Sound Pressure Level - dB(A)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

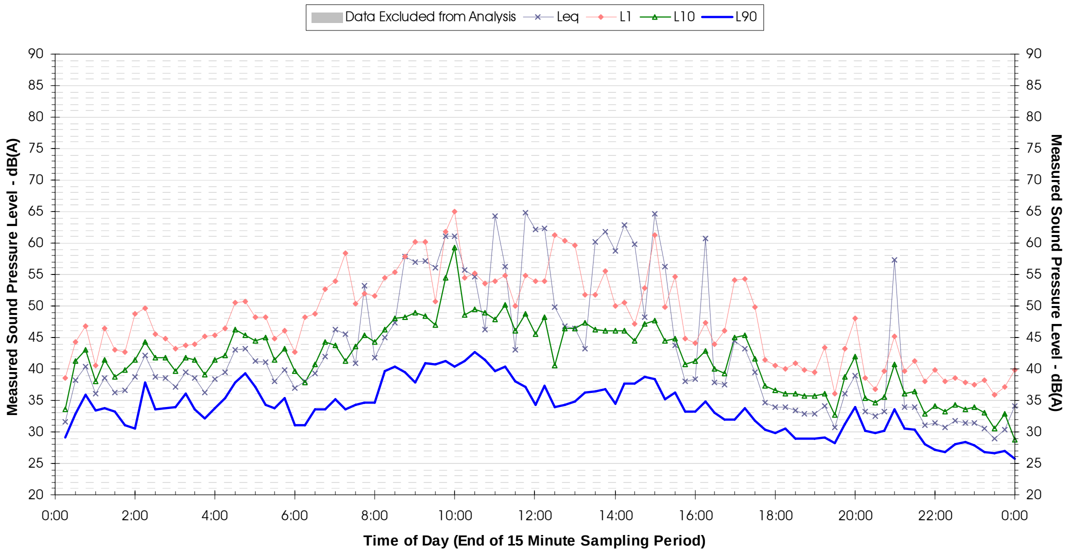

Profile of Noise Environment - Turner Farm
Wednesday 2August 2006
Data Excluded from Analysis
Leq
L1
L10
L90
Measured Sound Pressure Level - dB(A)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

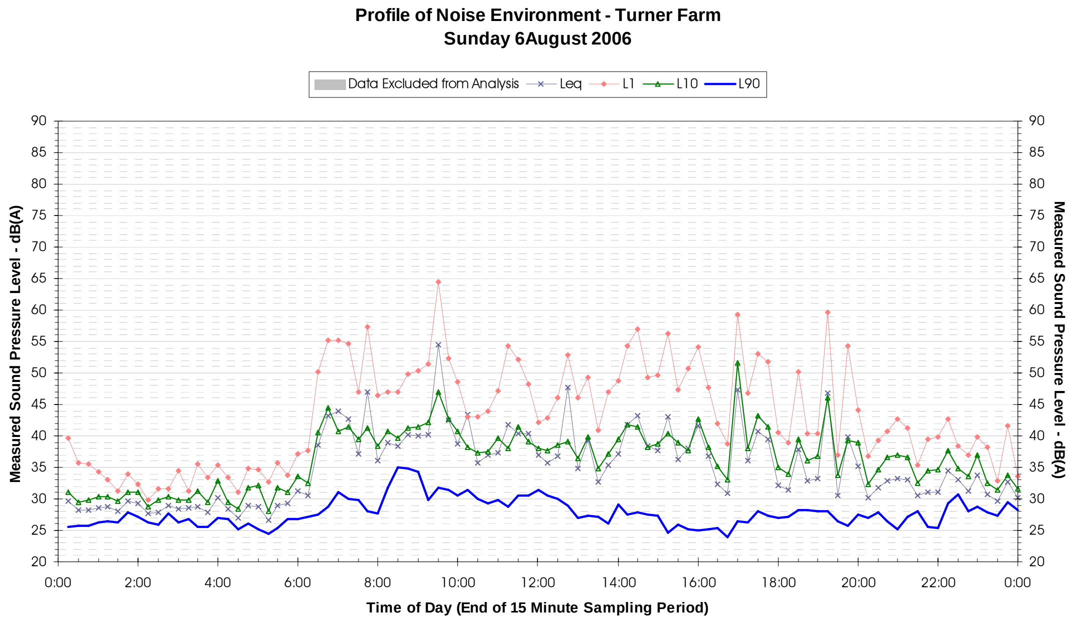

Profile of Noise Environment - Turner Farm
Thursday 3August 2006
Data Excluded from Analysis
Leq
L1
L10
L90
Measured Sound Pressure Level - dB(A)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90

Profile of Noise Environment - Turner Farm
Friday 4August 2006



Profile of Noise Environment - Turner Farm
Saturday 5August 2006





Profile of Noise Environment - Turner Farm
Sunday 6August 2006
Data Excluded from Analysis
Leq
L1
L10
L90
Measured Sound Pressure Level - dB(A)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
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85
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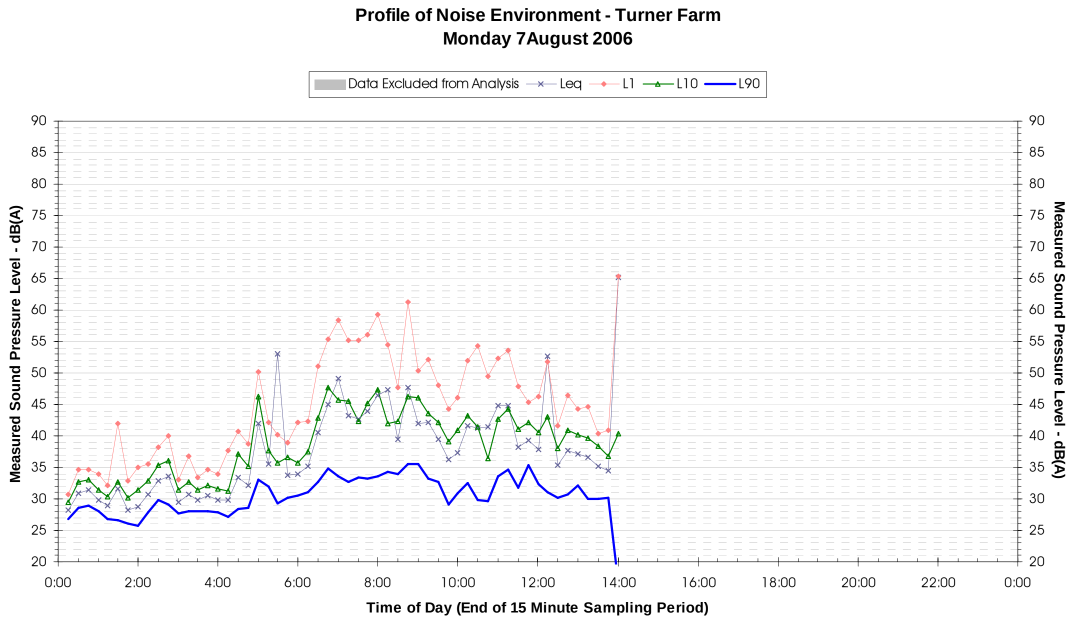

Profile of Noise Environment - Turner Farm
Monday 7August 2006
Data Excluded from Analysis
Leq
L1
L10
L90
Measured Sound Pressure Level - dB(A)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90