Wallarah 2
COAL PROJECT

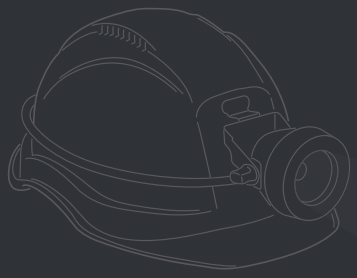
Wallarah 2 Coal Project

Environmental Impact Statement

April 2013

Appendix N

Noise and Vibration Impact Assessment



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

ATKINS ACOUSTICS

Postal Address
P.O. Box 432
Gladesville
N.S.W. 1675
AUSTRALIA
A.C.N. 068 727 195
A.B.N. 19 068 727 195
Telephone: 02 9879 4544
Fax: 02 9879 4810
Email: AtkinsAcoustics@bigpond.com.au

Atkins Acoustics and Associates Pty Ltd.
Consulting Acoustical & Vibration Engineers

WALLARAH 2 COAL PROJECT
NOISE AND VIBRATION IMPACT ASSESSMENT

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Prepared for: Wyong Areas Coal Joint Venture.
25 Bryant Drive
TUGGERAH NSW 2259

Prepared by: Atkins Acoustics and Associates Pty Ltd.
8-10 Wharf Road
GLADESVILLE NSW 2111

March 2013

8-10 Wharf Road, Gladesville NSW 2111 AUSTRALIA Tel: (02) 9879 4544 Fax: (02) 9879 4810

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1.0 INTRODUCTION

The Wyong Areas Coal Joint Venture (WACJV) seeks a Development Consent under Division 4.1 in Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Wallarah 2 Coal Project (the Project). This noise and vibration impact assessment supports 'The Wallarah 2 Coal Project Environmental Impact Statement' (Wallarah EIS) prepared by Hansen Bailey Environmental Consultants to support the application.

The noise and vibration impact assessment has been prepared in accordance with the Director-General's Environmental Assessment Requirements (DGRs) for the Project issued 12 January 2012 in accordance with the requirements in Part 2 in Schedule 2 to the *Environmental Planning & Assessment Regulation 2000* (EP&A Regs). A summary of the relevant sections of the DGR's Environmental Assessment (EA) requirements addressed in this report is presented in *Attachment 1*.

Development Consent is sought to mine coal within the Extraction Area for a period of 28 years. The majority of this resource lies beneath the Wyong State Forest and surrounding ranges (including the Jilliby State Conservation Area (SCA)) while a proportion, to be extracted first, lies beneath a section of the Dooralong Valley and the Hue Hue area.

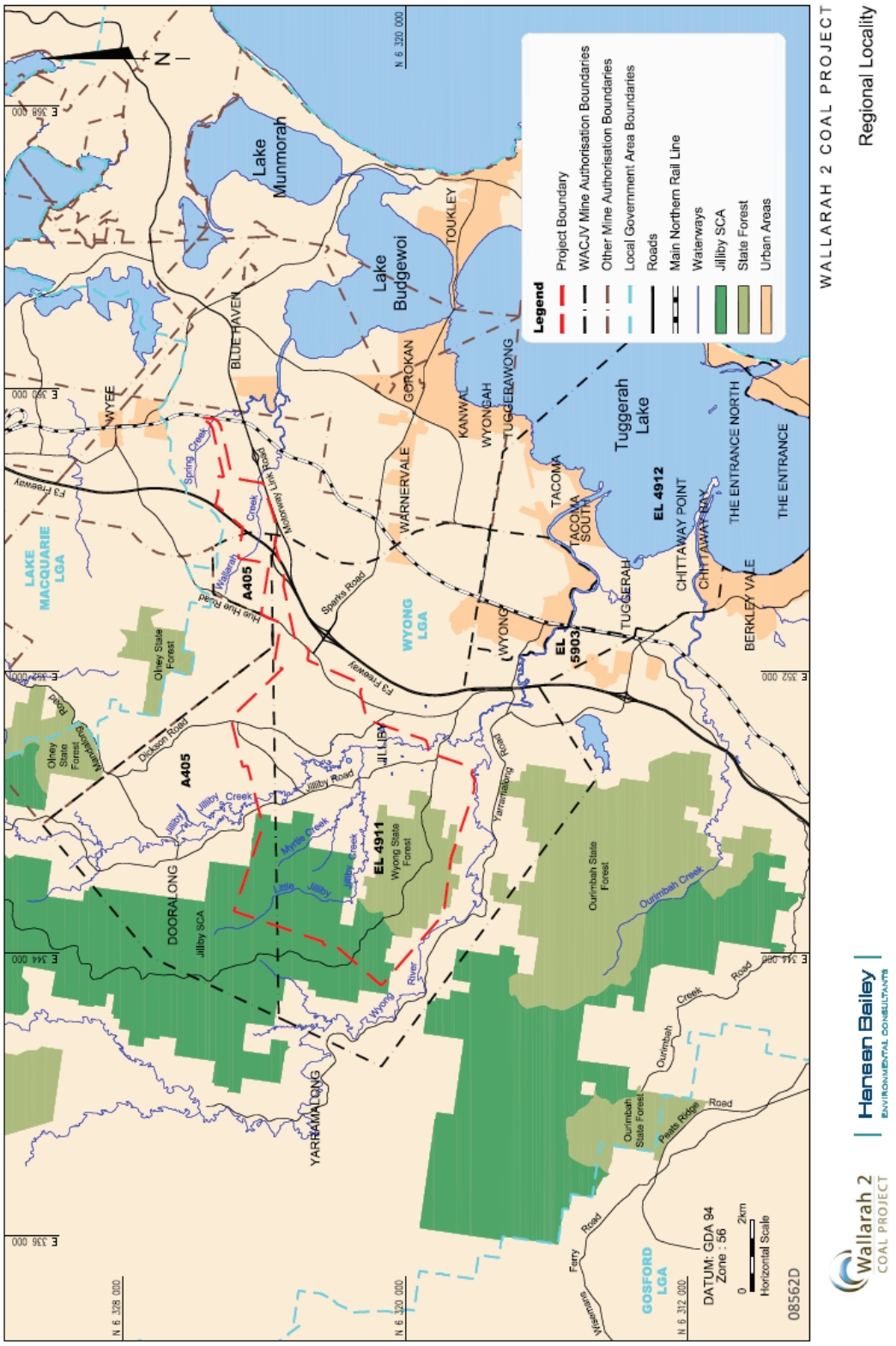
The Project Boundary is located approximately 4.7 km north-west of central Wyong and approximately forty five (45) km south-west of Newcastle within the Wyong Local Government Area (LGA). *Figure 1* illustrates the regional locality of the Project.

Key features of the Project include:

- The construction and operation of an underground mining operation extracting up to 5.0 Mtpa of export quality thermal coal by longwall methods at a depth of between 350 m and 690 m below the surface within the underground Extraction Area;
- Mining and related activities will occur 24 hours a day 7 days a week for a Project period of 28 years;

- Tooheys Road Site surface facilities on company owned and third party land (subject to a mining lease) between the Motorway Link Road and the F3 Freeway which will include (at least) a rail loop and spur, stockpiles, water and gas management facilities, workshop and offices;
- Buttonderry Site surface facilities on company owned land at Hue Hue Road between Sparks Road and the Wyong Shire Council's (WSC) Buttonderry Waste Management Facility. This facility will include (at least) the main personnel access to the mine, main ventilation facilities, offices and employee amenities;
- An inclined tunnel (or "drift") constructed from the coal seam beneath the Buttonderry Site to the surface at the Tooheys Road Site;
- Construction and use of various mining related infrastructure including water management structures, water treatment plant (reverse osmosis or similar), generator, second air intake ventilation shaft, boreholes, communications, water discharge point, powerlines, and easements to facilitate connection to the WSC (after July 2013, the Central Coast Water Corporation) water supply and sewerage system;
- Capture of methane for treatment initially involving flaring as practicable for greenhouse emission management and ultimately for beneficial use of methane such as electricity generation at the Tooheys Road Site;
- Transport of coal by rail to either the Newcastle port for export or to domestic power stations;
- A workforce of approximately 300 full-time company employees (plus an additional 30 contractors); and
- Rehabilitation and closure of the site at cessation of mining operations.

Figure 1: Regional Locality



This report presents the findings and recommendations of ambient background noise monitoring, field investigations, noise modelling, an assessment of noise and vibration from the Project, mitigation measures and the management required.

The main aims of the assessment are to:

- Identify residential dwellings and other sensitive areas potentially exposed to noise/vibration impacts from the Project;
- Measure, assess and comment on the ambient background noise levels and background noise creep post 2006;
- Establish target noise and vibration assessment goals in accordance with NSW Office of Environment and Heritage (OEH) Industrial Noise Policy (INP), Environmental Noise Control Manual (ENCM), OEH Environment Criteria for Road Traffic Noise (ECRTN) replaced with the OEH NSW Road Noise Policy (2011) (RNP) and the Interim Construction Noise Guideline (ICNG), and Assessing Vibration: a technical guideline (AVTG).
- Model noise and vibration impacts from the Project; and
- Assess the predicted noise and vibration levels at sensitive receivers.

The information presented in this report has been prepared for the investigation described herein, and should not be used in any other context or for any other purpose without agreement and written approval from Atkins Acoustics and WACJV.

2.0 PROJECT OPTIONS

Several surface infrastructure options were considered for the Project. The options covered various coal handling infrastructure arrangements, all of which provided advantages and disadvantages to the overall operation and noise impacts. Some of the options were impractical and determined to be operationally infeasible.

Option 1 – Base Case

This option involved standard building wall cladding, dozers without secondary noise controls, standard conveyor belt idlers and motor drives, untreated conveyor transfer chutes, mine ventilation fans without noise attenuation as well as three (3) active dozers, two (2) working the Project stockpile with the third operating the ROM stockpile.

Option 2 – 1 ROM stockpile dozer with a fully automated reclaim product stockpile

This option looked at replacing the two (2) dozers on the product stockpile (as described in Option 1) with a fully automated stackout and reclaim system. This option would require additional surface conveyors and luffing stackout conveyor coupled with a bucket wheel style reclaim system. The train loading conveyor would remain relatively unchanged.

Option 3 – ROM stockpile dozer with a fully enclosed product stockpile with two operating dozers

This theoretical option is a modification of the base case but incorporated a concrete enclosure over the entire product stockpile. The enclosure would provide around 15dB reduction in noise from the product stockpile dozers. The stockpile enclosure was not feasible due to being unable to provide the necessary stockpile operational flexibility including emergency stockpiling capability.

Option 4a – No dozer on ROM stockpile and fully enclosed product stockpile operating two dozers

This is a modification of Option 3 whereby the dozer operating the ROM stockpile was replaced with an automated stacking reclaim system. A dozer would therefore only be required to undertake minor cleanup around the ROM stockpile.

Option 4a (2) – No Dozer on ROM stockpile and a fully automated product stockpile

This option represented a combination of Option 4a and Option 2 where the fully automated product stockpile system is coupled with an automated ROM stockpile system.

Option 4b – No dozer on ROM stockpile and one dozer on product stockpile

This option, which has been adopted for the Project, included the automated ROM stockpile management system and one (1) dozer on the product stockpile. The coal handling system remained unchanged including the train loading system.

Option 4c – No dozer on ROM stockpile and two dozers on product stockpile

A variation of Option 4b, this option provided for two (2) dozers on the product stockpile coupled with an automated ROM stockpile management system. All other aspects of the coal handling system would remain unchanged.

Option 5 – Fully enclosed ROM stockpile with 1 dozer and 1 dozer on the product stockpile

It was found that one of the controlling influences on noise impacts was the use of a dozer on the ROM stockpile. This option sought to refine the cost/benefit of using a dozer on the ROM stockpile compared with fully enclosing the ROM stockpile or to stay with an automated system.

Option 6a – ROM Bin, 2 conveyors, 2 crushers with 1 dozer on product stockpile

With the incorporation of a coal bin instead of a stockpile for the ROM coal, there needs to be a doubling of the conveying system from the bin to the product stockpile to cater for peak underground coal production. All option 6 scenarios included upgrading the coal handling system at the surface to match to peak coal production from the longwall.

Option 6b – ROM Bin, 2 conveyors, 2 crushers plus 2 dozers in an enclosed product stockpile

A variation to Option 6a, this option allows for two (2) dozers to work on the product stockpile within a concrete enclosure. The enclosure would be the same as previously assessed to provide 15dB noise reduction.

Option 6c – ROM Bin, 2 conveyors, 2 crushers and fully automated product stockpile

This theoretical option provides the ultimate automated surface coal handling system whereby the surface system capacity meets the underground capacity and allows direct loading of coal from the underground mine to trains. This option was dismissed as rail operations, cargo assembly and port access cannot practically operate in this manner.

Option 7 – 1 dozer on ROM stockpile, no dozer on product stockpile

This option looked at a further refinement to the noise model and understanding of dominant noise sources. It is not a real option as it does not allow coal to be loaded from the product stockpile. However it was used in order to verify the potential for Option 4b to be used as a real option, that is, should only one dozer be available for use, it can be used on the ROM stockpile by itself when trains are not being loaded.

2.1 Assessment of Options

A detailed analysis was undertaken for each option to determine their cost and suitability to meet the needs of the Project. Several of the options assessed met operating requirements and train loading times as well as being able to handle expected peak coal production from the longwall. A comparison was made of the expected noise impacts of each option. It was noted that some of the highly mechanised options provided little if any reduction in noise impacts.

2.2 Proposed Option

During site planning, consideration was given to minimising noise impacts. The preferred option in consideration of the principles of *feasible* and *reasonable* from a cost and operational perspective was Option 4b. This option also provided a lower noise emission case.

Design features incorporated into Option 4b include the site layout, finished site levels, alignment of the rail line to ensure trains are loaded on an upgrade, optimisation of on-site rail track curvatures to minimise wheel/rail interface noise, removal of at grade rail crossing to reduce the need for horn use, cuttings to maximise screening effects for residential properties, cladding of structures, laminated *(soft loading)* transfer steel chutes, low noise rated conveyor rollers, low noise rated motor/gearboxes, enclosed upcast mine ventilation fans, orientating the fan discharges to the north and noise attenuated mine ventilation fans.

3.0 SITE DESCRIPTION AND PROPOSAL

The Project Boundary is located approximately 4.7 km north-west of central Wyong and approximately forty five (45) km south-west of Newcastle within the Wyong Local Government Area (LGA). *Figure 1* illustrates the regional locality of the Project.

As part of the planning land at Warnervale has been set aside and identified as the Warnervale Town Centre and Wyong Employment Zone. The Warnervale Town Centre is bounded by Hakone Road to the North, Hiawatha Road to the east, Sparks Road to the south and extends west of the Great Northern Railway Line to include land that is owned by the NSW Department of Planning, adjacent to the Sydney-Newcastle Railway. The Warnervale Town Centre is located approximately 2.6 kilometres to the south of the Tooheys Road Site. The Wyong Employment Zone is approximately 1.9 kilometres southwest of the Tooheys Road Site and to the east of the Buttonderry Site on Hue Hue Road.

The Project involves the development of three surface facility sites known as Tooheys Road Site *(Figure 2),* Buttonderry Site *(Figure 3),* and the Western Ventilation Shaft *(Figure 4)* that would be required around Year 10. Potential noise and vibration impacts associated with the Project and addressed in this report include construction activities, operational activities including train loading, road traffic and off-site rail traffic.

3.1 Tooheys Road Site

The Tooheys Road Site will be developed with an automated ROM stockpile management system and operate with one (1) dozer on the product stockpile. All coal would be transported from the site by rail. The assumed schedule of plant and equipment for Tooheys Road includes:

* A 4,000 tonne per hour receival system;
* A 50,000 tonne raw coal surge stockpile;
* A 2,000 tonne per hour raw coal underground reclaim, crushing and stacking system;

- A 2,000 tonne per hour overhead tripper to stack crushed coal on the 250,000 tonne product stockpile. Additional emergency stockpile capacity would be achieved using dozer push out;
- A tunnel reclaim system under the product stockpile;
- A 4,500 tonne per hour train loading system with a loading bin of approximately 250 tonnes; and
- A rail loop that would be able to hold three (3) of the anticipated 3,400 tonne capacity trains.

It is envisaged that the construction would be undertaken over a period of approximately twenty four (24) months. The site infrastructure *(Figure 2)* includes:

- Rail spur and loop;
- Conveyors, crusher and rail loading facilities;
- Office facility, inclusive of administration offices, bathrooms, training facilities;
- Car parking and site access roads;
- Mine access drift and portal;
- Coal stockpiles and material handling facilities;
- Train loading facilities;
- Surface workshop and compressed air installation;
- Vehicle wash down bay, incorporating water treatment plant;
- Mine water treatment plant; and
- Gas management extraction and treatment plant.

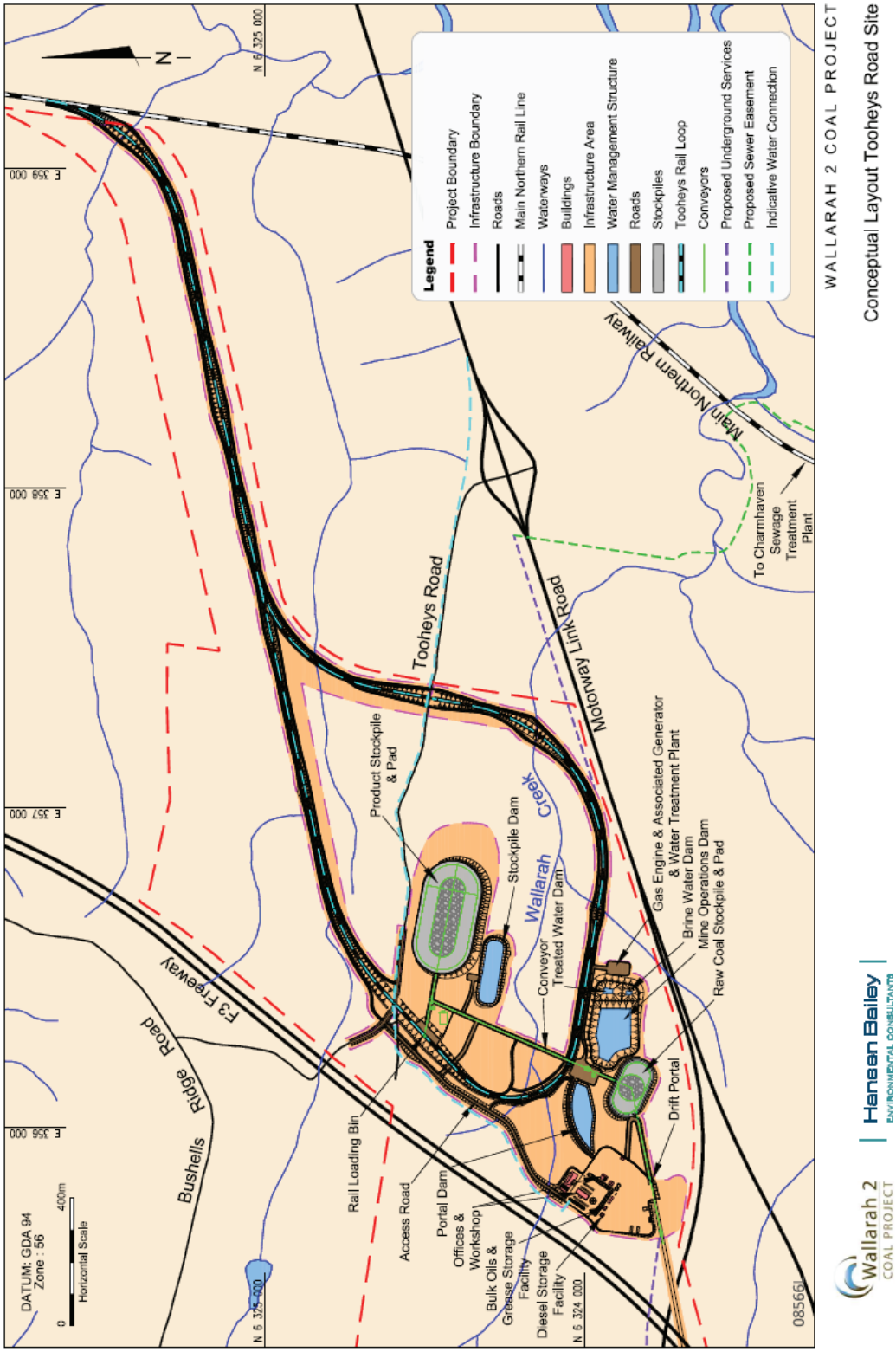
3.1.1 Noise Sources

The main noise sources at Tooheys Road Site include conveyors, crusher, train loader and mobile plant. To ameliorate noise from the site, the following strategies have been adopted for noise modelling:

- Double skin insulated cladding of crushing plant;
- Low noise rated conveyors and motor drives;
- Conveyor structures with side and roof screens to provide effective directional noise amelioration (preference for fully enclosed conveyors);
- Concrete coal loading bin;

- Acoustically isolated vibrating screens/transfers;
- Acoustically insulated conveyor head/transfer plates;
- Design of the product stockpile coal reclaim system to minimise dozer reliance for train loading;
- Selection of mobile plant with secondary noise control kits;
- Mobile plant reversing alarms to have low level alarms;
- Low noise rated enclosed gas flare/s;
- Conveyor motor drives and gearboxes on conveyors specified to achieve a noise level of less than 85dBA measured at one (1) metre;
- North-western portion of rail loop located in cutting to maximise shielding for train loading facility noise source;
- The on-site rail spur/loop track alignment designed to ensure trains are loaded on an upgrade; and
- Curves within the rail loop and spur line designed with radii not less than 200m. Investigations and observations at similar coal handling facilities (Kooragang Island Coal Loader (200m), Wallsend Colliery (200m), Tahmoor Colliery (200m); Baal Bone Colliery (200m); Charbon Colliery (200m)) have shown for rail curves greater than 200m rail/wheel interface noise (rail squeal) was not identified and would not be described as a component of the overall site noise.

Figure 2: Tooheys Road Site



3.2 Buttonderry Site

The Buttonderry Site will be accessed from Hue Hue Road via a sealed private access road. It is envisaged that the construction would be undertaken over a period of approximately 24 months. The Buttonderry site layout is shown in *Figure 3* and consists of:

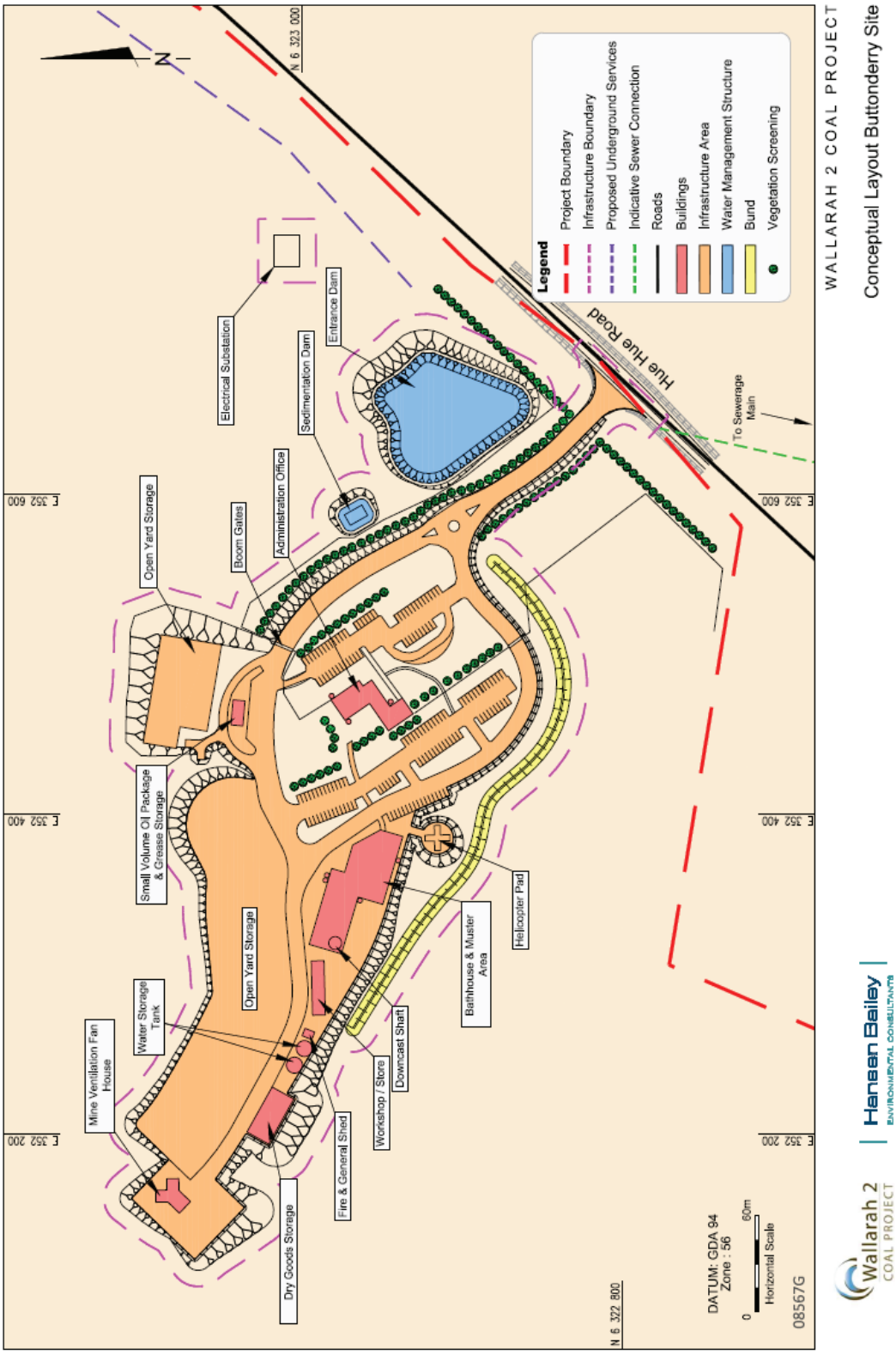
- An upcast ventilation shaft;
- Mine ventilation system which includes enclosed fan housing and orientated fan evasee;
- Downcast ventilation shaft for mine ventilation and man-riding;
- Administration offices, training rooms and bathroom; and
- Car parking and access roads.

3.2.1 Noise Sources

The main noise sources at the Buttonderry Site include infrastructure and workshops, the mine winder (man access) and mine ventilation. Noise control strategies incorporated into the Project include:

- Enclosing the mine winding motor/gearbox;
- Enclosing the mine ventilation fans in a purpose built acoustic structure with inline attenuators installed on the fan discharges; and
- Earth mounding 1.5-2m high along the southern alignment of the car park to provide noise reduction of 8-10dB from the car park activities to the residents to the south.

Figure 3: Buttonderry Site

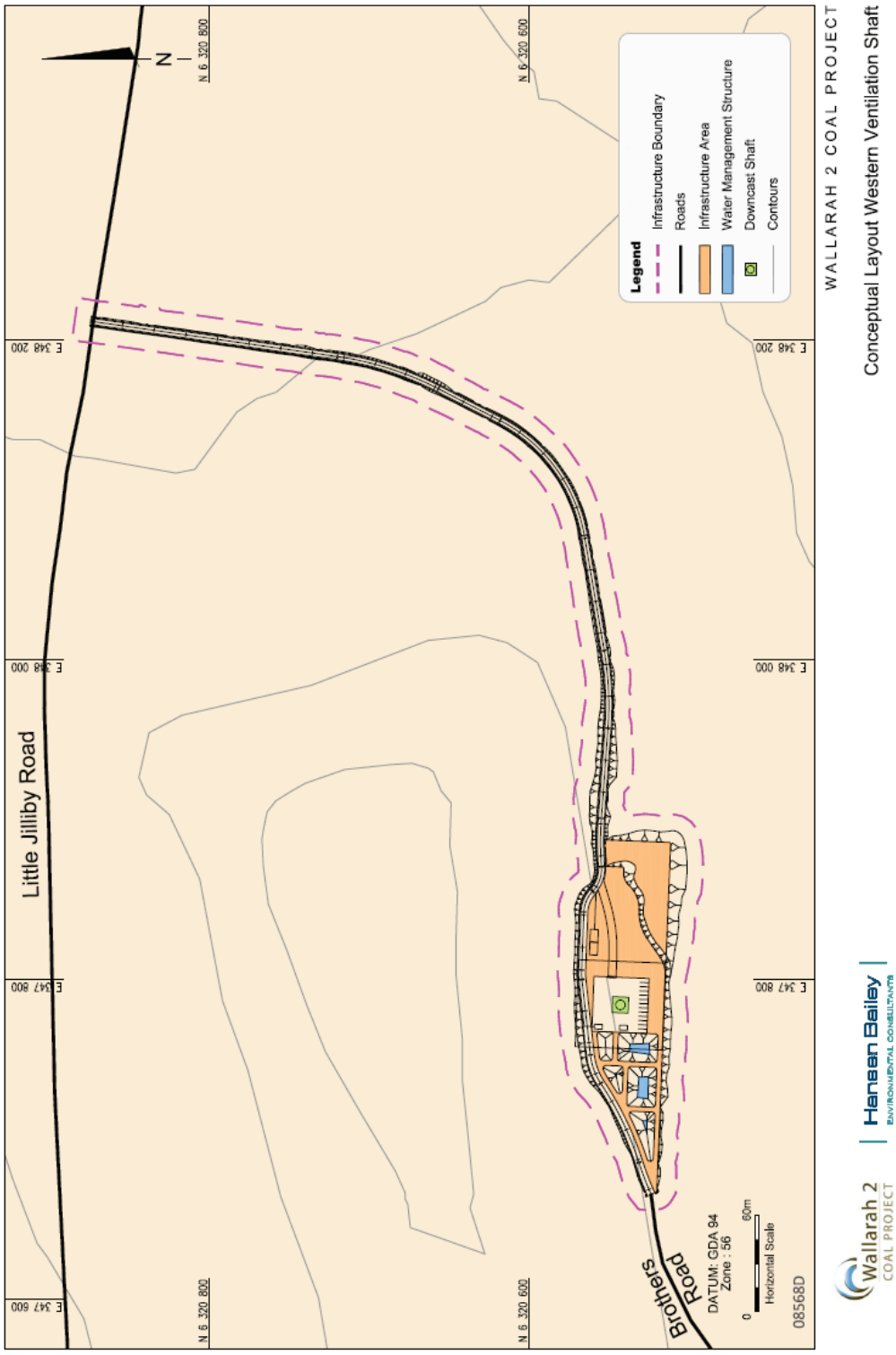


3.3 Western Ventilation Shaft

A second ventilation shaft would be required around Year 10 and located in the Wyong State Forest *(Figure 4)* alongside Brothers Road with access from Little Jilliby Road. This future shaft facility would be a downcast shaft (for air intake to the underground). Only limited facilities would be required at the Western Ventilation Shaft, however the shaft would also serve as a secondary emergency access/egress point. No fans are required for ventilation support. The shaft would be approximately 5 metres in diameter and about 485 metres deep.

It is envisaged that the construction would be undertaken over a period of approximately fourteen (14) months.

Figure 4: Western Ventilation Shaft



3.4 Road Traffic Generation

The likely routes taken by construction vehicles, employee traffic, delivery and service vehicles during construction and operating phases are shown in *Table 1*.

Table 1. Site Access and Travel Routes

Site	Access point	Access to/from via			
		North	South	East	West
Tooheys Road (construction and operations)	Off Tooheys Road, south of F3 overpass	F3 Freeway, turn back via Sparks Road, Motorway Link Road, Tooheys Road	F3 Freeway, Motorway Link Road, Tooheys Road	Sparks Road, F3 Freeway, Motorway Link Road, Tooheys Road	Wyee Road, Hue Hue Road, Bushells Ridge Road and Tooheys Road
Buttonderry (construction and operations)	Off Hue Hue Road, north of the Hue Hue Road/ Sparks Road intersection	F3 Freeway, Sparks Road, Hue Hue Road	F3 Freeway, Sparks Road, Hue Hue Road Old Maitland Road or Alison Road, Hue Hue Road	Motorway Link Road, Sparks Road, Hue Hue Road	Wyee Road, Hue Hue Road
Western Ventilation Shaft (construction only)	Off Brothers Road	F3 Freeway, Sparks Road, Hue Hue Road, Jilliby Road, Little Jilliby Road, Brothers Road	F3 Freeway, Sparks Road, Hue Hue Road, Jilliby Road, Little Jilliby Road, Brothers Road Old Maitland Road or Alison Road, Hue Hue Road, Jilliby Road, Little Jilliby Road, Brothers Road	Sparks Road, Hue Hue Road, Jilliby Road, Little Jilliby Road, Brothers Road	Wyee Road, Hue Hue Road, Jilliby Road, Little Jilliby Road, Brothers Road

During operation, the main traffic would be associated with mine personnel arriving and departing the Tooheys Road and Buttonderry Sites at shift changes. *Table 2* presents a summary of the likely staff numbers attending the sites on any given week day based on a roster involving three (3) daily work shifts.

Table 2. Predicted Peak Daily Staff Numbers (Three Shift Week Days Operation)

Shift	Times	Number of Staff	
		Buttonderry Site	Tooheys Road Site
Daytime Office	8:00am to 5:00pm	20	0
Day	6.00am to 3.00pm	90	15
Afternoon	2.00pm to 11.00pm	70	3
Night	10.00pm to 7.00am	70	3

In order to enable continuous, seven day operations, approximately 300 employees (including permanent contractors) would be located at the Buttonderry Site and 30 employees at the Tooheys Road site when all the shift roster arrangements are taken into account.

3.5 Rail Traffic Generation

All coal from the Project will be transported from the operation by rail.

Coal produced and out loaded from the Tooheys Road Site would be transported to the Port of Newcastle or power stations accessed from the Main Northern Rail Line (MNRL). The Tooheys Road Site would be developed with a rail loop serviced from the MNRL. The rail loop would be designed to permit continuous controlled train loading and parking for two (2) additional trains.

Residential development along the rail corridor to the Port varies in density and offset distances. *Table 3* presents a summary of typical offset distances for the main townships along the MNRL rail line.

Table 3. Typical Residential Development Off-set Distances

Residential Area	Off-set Distance (metres)
Wyee	50
Morisset	50
Dora Creek	50
Awaba	50
Fassifern	25
Boorgul	15
Teralba	15
Cockle Creek	15
Cardiff	15
Kotora	15
Adamstown	15
Broadmeadow	10
Waratah	15

North of Wyee, the MNRL services Vales Point Colliery, Eraring Colliery, Newstan Colliery and Teralba Colliery. For the purpose of assessing train noise impacts from the Project, the existing scheduled freight and commuter train movements between Wyee and Wyong have been considered.

A review of the Freight Standard Timetable for the MNRL between Sydney and Newcastle (effective from Sunday 11 October 2009) identified that the scheduled average weekday freight train movements between Wyee and Wyong is 25. Commodities carried by existing freight trains include general freight, coal and grain. Train lengths vary from around 450 metres to 1,500 metres. It is understood that the future MNRL freight train growth could increase to between 50 to 80 movements per day in the long term. Additionally, the MNRL services express and all station passenger commuter trains. The published commuter train timetable for north of Wyong shows 59 train movements per day (NSW Transport City Rail Sept 2012).

The Project coal haulage is anticipated to be undertaken in campaigns of six trains per day. These trains would normally consist of 3 locomotives and 38 x 120 tonne coal wagons.

3.6 Operating Hours

The mine and infrastructure would be operate 24 hours, 7 days per week.

3.7 Construction Hours

Normal surface construction activities would be undertaken between 7.00am and 6.00pm Monday to Friday, and 7.00am to 1.00pm Saturday. Works outside these hours would only be undertaken where it could be demonstrated that noise would not impact on residential receivers.

4.0 EXISTING AMBIENT NOISE ENVIRONMENT

For the purpose of assessing the existing ambient noise, attended and unattended audits were undertaken during November 2006, April 2007 and March 2012 *(Attachment 2)*. The measurement results have been evaluated in accordance with the INP assessment procedures to confirm existing Rating Background Levels (RBLs) and ambient noise levels, and establish the Project Specific Noise Criteria (PSNC).

Initially nine (9) reference measurement locations (*Figure 5*) were selected for noise monitoring. *Table 4* presents a description of the locations and the existing noise environment. Locations M8 and M9 were located on the Buttonderry Site adjacent to the referenced property boundaries. Following preliminary noise modelling, an additional three (3) sites were selected for additional noise monitoring undertaken during April 2007. To assist with the evaluation of noise trends post 2006, ambient background noise monitoring was conducted at six (6) locations during March 2012. One (1) additional measurement location was located at Blue Haven.

Site attended audits confirmed that the local acoustic environments are influenced by road traffic, natural sources and localised domestic activities. Traffic noise exposure for each site is dependent on the location and proximity to either the F3 Freeway (Sydney to Newcastle), Motorway Link Road, Hue Hue Road and Bushells Ridge Road. Locations not directly influenced by local road traffic noise included Bruce Crescent (M1) and Sandra Street (M9). However, distant road traffic noise was audible at both locations during source (road) to receiver wind conditions. Industrial activities in the vicinity of the Project Boundary include the Boral Quarry and Manufacturing Facility on Tooheys Road and the Council Waste Management Centre on Hue Hue Road. Audits during the 2012 measurements confirmed that no industrial noise was audible at the monitoring locations and road traffic generally controlled the ambient noise.

4.1 Instrumentation

The instrumentation selected for the ambient noise measurements comprised RTA Technology Pty Ltd (RTA) Environmental Noise Loggers. Each instrument was set to A-weighting, fast response and 15 minute sampling periods. The reference level of each instrument was checked in the field prior to and after the measurements with a National Association of Testing Authorities (NATA) calibrated Bruel & Kjaer Sound Level Calibrator Type 4230, Serial No. 623590, with no significant drift recorded.

Figure 5: Reference Measurement and Assessment Locations

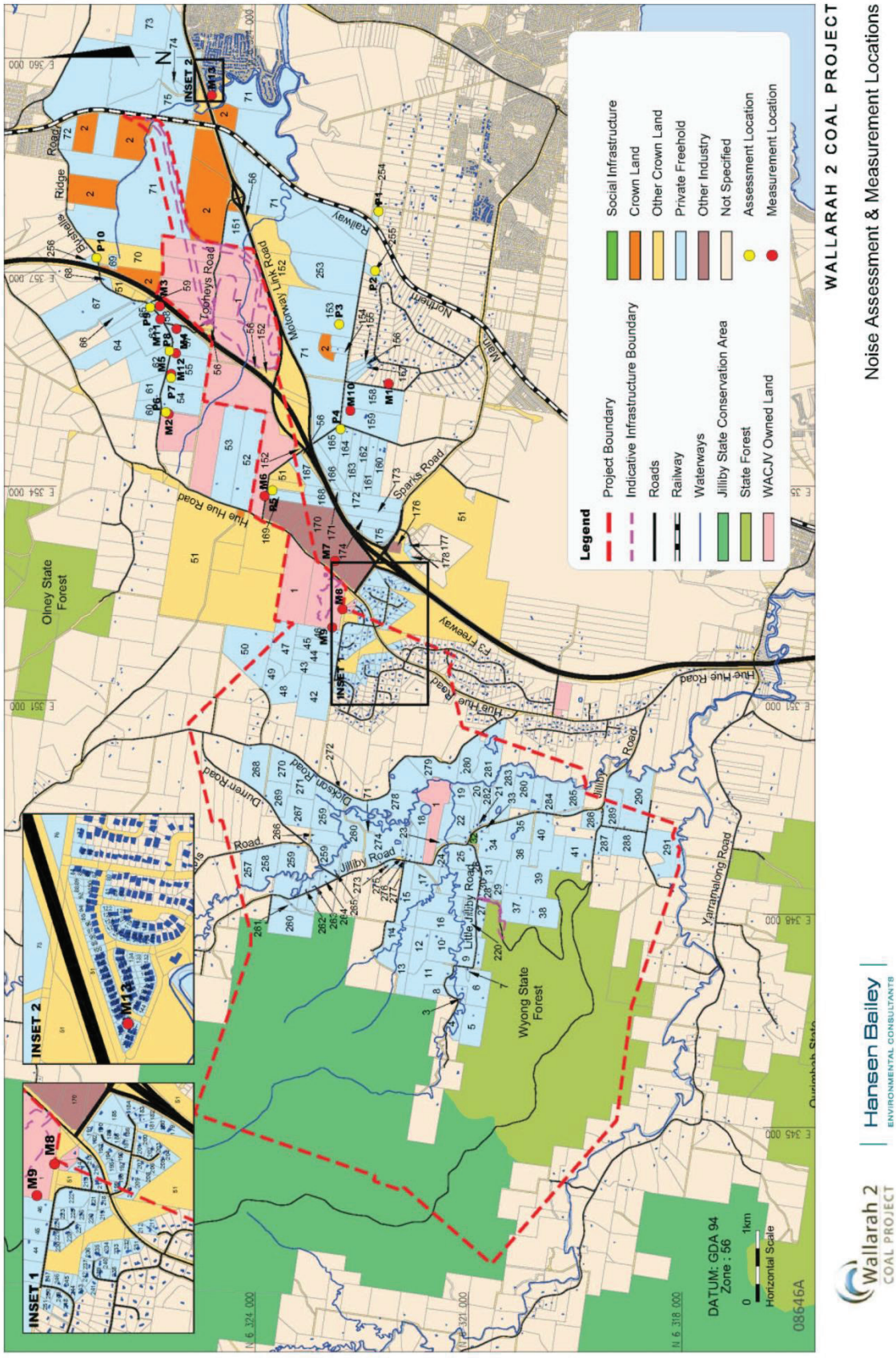


Table 4. Reference Measurement Locations

2006/7 Reference Locations	2012 Reference Locations	Reference Property	Measurement Location	Description of Ambient Noise Sources
M1	M1	250/260 Bruce Crescent, Wallarah	Rear of house	Local rural amenity and distant traffic
M2	-	118 Bushells Ridge Road, Kiar	Vacant lot west of house	Local rural amenity, passing road traffic, distance freeway traffic
M3	-	235 Bushells Ridge Road, Kiar	Rear of house	Freeway road traffic
M4	M4	209 Bushells Ridge Road, Kiar	Rear of house	Freeway road traffic
M5	M5	Lot 97 131 Bushells Ridge Road, Kiar	Rear of house	Local rural amenity, passing road traffic, distance freeway traffic
M6	M6	9 Kiar Ridge Road, Jilliby	Front of house	Hue Hue Road traffic and distant freeway traffic
M7	-	Hue Hue Road, Jilliby	Front of house	Hue Hue Road traffic and distant freeway traffic
M8	M8	3 Amberwood Close, Jilliby*	Site boundary	Hue Hue Road traffic and distant freeway traffic
M9	-	40 Sandra Street, Jilliby	Eastern property boundary	Local rural amenity and distant traffic
M10	-	113A Mountain Road, Wallarah	Front of house	Local rural amenity and distant traffic
M11	-	20 Bushells Ridge Road, Kiar	Front of house	Local rural amenity, freeway traffic, passing road traffic
M12	-	Bushells Ridge Road, Kiar	Vacant land opposite house	Local rural amenity, passing road traffic, distance freeway traffic
-	M13	19 Popran Way, Blue Haven	Rear of House	Link Road traffic, rail traffic; localised domestic activities

*WACJV Owned property

The ambient noise levels were measured and assessed as percentile A-weighted sound levels. The parameters regarded as being the most important amongst these for environment noise assessment purposes, are the:

- "L_{A90}", the level exceeded for 90% of the sample period and referenced as the "background or average minimum noise level"; and
- "L_{Aeq}", which is the A-weighted energy equivalent continuous (constant) sound level.

4.2 Results

From the measurement results and INP assessment procedures, the Rating Background Level (RBL) and ambient $L_{Aeq, (Period)}$ levels were established. The RBL is the median of the tenth percentile background levels for each assessment period. The $L_{Aeq, (Period)}$ level represents the measured energy averaged noise level for each assessment period. *Table 5* presents a summary of the RBLs and ambient $L_{Aeq, (Period)}$ levels for the daytime, evening and night-time assessment periods.

Table 5. Assessment RBLs and LAeq Noise Levels

Date	Assessment Background Level RBL			Equivalent Continuous Level $L_{Aeq, (Period)}$		
	Day	Evening	Night	Day	Evening	Night
Location M1: 250/260 Bruce Crescent						
RBL	36	41	37			
Ambient L_{Aeq}				50	48	47
RBL	37	42	38			
Ambient L_{Aeq}				49	47	46
RBL	36	41	43			
Ambient L_{Aeq}				51	52	50
Location M2: 118 Bushells Ridge Road						
RBL	38	40	33			
Ambient L_{Aeq}				51	50	48
Location M3: 235 Bushells Ridge Road						
RBL	52	52	44			
Ambient L_{Aeq}				61	60	58
RBL	53	52	43			
Ambient L_{Aeq}				61	61	58
Location M4: 209 Bushells Ridge Road						
RBL	58	57	47			
Ambient L_{Aeq}				64	63	63
RBL	58	56	46			
Ambient L_{Aeq}				64	63	62
RBL	58	52	47			
Ambient L_{Aeq}				63	61	59
Location M5: Lot 97 131 Bushells Ridge Road						
RBL	37	43	36			
Ambient L_{Aeq}				48	59	49
RBL	44	49	42			
Ambient L_{Aeq}				56	56	56
RBL	41	46	47			
Ambient L_{Aeq}				54	57	58
Location M6: 9 Kiar Road						
RBL	41	40	39			
Ambient L_{Aeq}				52	51	49
RBL	39	42	41			
Ambient L_{Aeq}				58	47	47
Location M7: Hue Hue Road						
RBL	43	46	43			
Ambient L_{Aeq}				57	54	55
Location M8: Amberwood Close						
RBL	41	46	41			
Ambient L_{Aeq}				50	51	50

Date	Assessment Background Level RBL			Equivalent Continuous Level $L_{Aeq, (Period)}$		
	Day	Evening	Night	Day	Evening	Night
RBL	42	49	47			
Ambient L_{Aeq}				51	52	51
Location M9: Sandra Road						
RBL	33	36	33			
Ambient L_{Aeq}				44	42	42
Location M10: 113A Mountain Road						
RBL	39	41	39			
Ambient L_{Aeq}				49	48	49
Location M11: 20 Bushells Ridge Road						
RBL	44	44	42			
Ambient L_{Aeq}				64	57	54
Location M12: Bushells Ridge Road						
RBL	44	49	42			
Ambient L_{Aeq}				59	58	56
Location M13: 19 Popran Way Blue Haven						
RBL	51	46	37			
Ambient L_{Aeq}				59	57	55

1. Daytime: 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays.
2. Evening: 6.00pm to 10.00pm, Monday to Sunday and Public Holidays
3. Night: 10.00pm to 7.00am Monday to Saturday and 10.00pm to 8.00am Sundays and Public Holidays.

4.3 Meteorological Conditions

Meteorological conditions for the period from 9 to 17 March 2012 recorded during the noise monitoring were typified by generally low wind speeds (<3m/s). Air temperatures ranged from 12°C at night to 34°C during the day. The meteorological conditions during the measurement periods were considered to be acceptable for outdoor noise measurement.

4.4 Road Traffic Noise

Residential dwellings on Bushells Ridge Road and Hue Hue Road have the potential to be exposed to road traffic noise associated with the Project. Dwellings on the eastern end of Bushells Ridge Road are exposed to traffic noise from the F3 Freeway.

At the eastern end of Bushells Ridge Road (M3) the measured $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ levels were 61dBA and 58dBA, respectively. At the western end of Bushells Ridge Road (M2) the measured $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ noise levels were 51dBA and 48dBA, respectively. For Hue Hue Road (M7) the measured $L_{Aeq\ 15\ hour}$ and $L_{Aeq\ 9\ hour}$ noise levels were 56dBA and 54dBA, respectively.

4.5 Rail Traffic Noise

The measurement of noise from commuter and freight rail traffic on the MNRL was undertaken north of Wyong during December 2009. For assessment purposes, three (3) setback distances were selected. Unmanned measurements were conducted at the three (3) locations together with site attended measurements to assess the existing L_{Amax} and $L_{Aeq, 24\ hour}$ levels. The results are summarised in *Table 6.*

Table 6. Measured Existing Rail Traffic Noise Levels

Off-set Distance (metres)	Measured Sound Pressure Levels dBA		
	LAeq, 24 hr	LAmax	LAmax (95%)
25	59.2	80-88	86
50	-	75-81	79
100	53.2	64-75	73

5.0 PROJECT SPECIFIC NOISE CRITERIA

Noise was identified by the Director General (DG) of the Department of Planning and Infrastructure as a key issue with respect to the Project. Accordingly as part of the DGRs a quantitative assessment of potential construction, operational and transport noise impacts offsite road noise impacts was requested. In relation to noise, the DGRs refer to specific issues from the NSW Office of Environment and Heritage and assessment guidelines that should be addressed.

Guidelines and policies referred to by the NSW Office of Environment and Heritage, (OEH) for assessing environmental noise and vibration from industrial activities and transport infrastructure include Industrial Noise Policy (EPA 2000) (INP), Interim Construction Noise Guideline (DECC. 2009) (ICNG); Road Noise Policy (OEH 2011) (RNP) and Assessing Vibration: a technical guideline (OEH, 2006) (AVTG).

5.1 Operational Noise

Procedures for establishing operational noise criteria from industrial sources including coal mines are documented in the INP. The assessment procedures have two (2) components and were developed for the purpose of:

(1) controlling intrusive noise; and

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

The intrusiveness of a noise is considered to be acceptable if the $L_{Aeq,\ 15\ minute}$ level from the source does not exceed the RBL by more than 5dBA. In order to assess noise amenity, the source $L_{Aeq,\ Period}$ levels should not normally exceed the recommended acceptable noise levels *(Table 7)*.

When assessing noise impacts of industrial sources for residential receivers, both the intrusive and amenity limits are taken into account. In most situations the lowest level becomes the limiting criterion and used to determine the PSNC.

The OEH recognises (INP Section 1.4.1) that in setting noise criteria the levels established in accordance with the INP assessment procedures are best regarded as planning tools and not mandatory. The OEH recognises that an application for a noise producing development is not determined purely on the basis of compliance or otherwise of noise criteria.

For preservation of acoustic amenity, the INP requires industrial noise in residential areas to be within acceptable levels for the locality and land-use. The existing land uses in the vicinity of the Tooheys Road Site and Buttonderry Site would be defined as *Rural, Suburban* or *Urban* by the INP. *Table 7* presents a summary of the INP amenity noise criteria for industrial noise sources at residences in rural, suburban and urban settings.

Table 7. INP Noise Policy Amenity Criteria

Receiver Description	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq.\ Period}$ Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban (1)	Day	55	60
		Evening	45	50
		Night	40	45
	Urban (2)	Day	60	65
		Evening	50	55
		Night	45	50

NOTES: Daytime: (7.00am to 6.00pm); Evening: (6.00pm to 10.00pm); Nighttime: (10.00pm to 7.00am)

(1) Rural
- an agricultural area, except those used for intensive agricultural activities
- a rural recreational area such as resort areas
- a wilderness area or national park
- an area generally characterised by low background noise levels (except in the immediate vicinity of industrial noise sources

This area may be located in either a rural, rural-residential, environment protection zone or scenic protection zone as defined on a council LEP or other planning instrument

(2) Suburban

an area that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:
- decreasing noise levels in the evening period (1800-2200); and/or
- evening ambient noise levels defined by the natural environment and infrequent human activity.

This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument.

(3) Urban
- an area with an acoustical environment that:
- is dominated by 'urban hum' or industrial source noise
- has through traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above
- where 'urban hum' means the aggregate sound of many unidentifiable, mostly traffic related sound sources.

This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument, and also includes mixed land-use zones such as mixed commercial and residential uses.

Considering the measured noise levels *(Table 5)* and the INP procedures, *Table 8* presents a summary of the assessment RBLs, the ambient $L_{Aeq,\ Period}$ levels and operational noise criteria. When determining noise criteria, the INP recommends that the intrusive night time noise criteria should be set no higher than the intrusive noise criteria for day or evening, and the evening no higher than the intrusive daytime criteria.

In accordance with INP guidelines, operational noise is assessed at the most affected point on or within the residential property boundary, or if this is more than 30m from the residence, at the most affected point within 30m of the residence (INP Section 2.2.1).

Table 8. Noise Criteria for Measurement Locations
dBA re: 20 x 10^{-6} Pa

Period	Recommended Noise Criteria[1]	Existing RBL	Existing	Operational Noise Criteria	
	$L_{Aeq,\ Period}$		$L_{Aeq,\ Period}$	Intrusive $L_{Aeq,\ 15\ min}$	Amenity $L_{Aeq,\ Period}$
Location M1: 250/260 Bruce Crescent (*)					
Day[2]	50	36	49	41	50
Evening[3]	45	41	47	41[7]	45
Night[4]	40	37	46	41[7]	40
Location M2: 118 Bushells Ridge Road (**)					
Day	55	38	51	43	55
Evening	45	40	50	43[7]	45
Night	40	33	48	38	40
Location M3: 235 Bushells Ridge Road (***)					
Day	60	53	61	58	60
Evening	50	52	60	57	50
Night	45	43	58	48	48[6]
Location M4: 209 Bushells Ridge Road (***)					
Day	60	58	63	63	60
Evening	50	52	61	57	52[6]
Night	45	47	59	52	52[6]
Location M5: 97 Bushells Ridge Road (**)					
Day	55	37	48	42	55
Evening	45	43	50[5]	42[7]	45
Night	40	36	48	41	40
Location M6: 4 Kiar Road (**)					
Day	55	41	52	46	55
Evening	45	40	51	45	45
Night	40	39	49	44	40
Location M7: Hue Hue Road (**)					
Day	55	43	57	48	55
Evening	45	46	54	48[7]	45
Night	40	43	55	48	45[6]
Location M8: Amberwood Close (**)					
Day	55	41	50	46	55

Period	Recommended Noise Criteria[1] $L_{Aeq, Period}$	Existing RBL	Existing $L_{Aeq, Period}$	Operational Noise Criteria	
				Intrusive $L_{Aeq, 15\ min}$	Amenity $L_{Aeq, Period}$
Evening	45	46	51	46[7]	45
Night	40	41	50	46	40
Location M9: Sandra Road (*)					
Day	50	33	44	38	50
Evening	45	36	42	38[7]	45
Night	40	33	42	38	40
Location M10: 113A Mountain Road (*)					
Day	50	39	49	44	50
Evening	45	41	48	44[7]	45
Night	40	39	49	44	40
Location M11: 20 Bushells Ridge Road (**)					
Day	55	44	64	49	55
Evening	45	44	57	49	47[6]
Night	40	42	54	47	44[6]
Location M12: Bushells Ridge Road (**)					
Day	55	44	59	49	55
Evening	45	49	58	49[7]	46[6]
Night	40	42	56	47	46[6]
Location M13: Popran Way (***)					
Day	60	51	59	56	60
Evening	50	46	57	51	47[6]
Night	45	37	55	42	45[6]

1. OEH. INP Land Zoning (*) Rural
   (**) Suburban
   (***) Urban
2. Daytime: 7.00am to 6.00pm, Monday to Saturday and 8.00am to 6.00pm Sundays and Public Holidays.
3. Evening: 6.00pm to 10.00pm, Monday to Sunday and Public Holidays
4. Night: 10.00pm to 7.00am, Monday to Saturday and 10.00pm to 8.00am Sundays and Public Holidays.
5. Adjusted to account for localised noise sources.
6. Adjusted to account for existing traffic noise as per INP (Section 2.2.3)
7. Adjusted in accordance with OEH Application Notes

5.2 Sleep Disturbance

Procedures for assessing sleep disturbance from short-term noise events are referenced in the EPA Environmental Noise Control Manual (ENCM) *(Section 19.3)*. The ENCM states that the $L_{A1,\,1min}$ level measured over a one (1) minute period outside a residential bedroom window should not exceed the repeated L_{A90} background level by more than 15dBA. Based on the night-time (10.00pm to 7.00am) RBLs *(Table 5), Table 9* presents the sleep disturbance assessment criteria.

Table 9. Sleep Disturbance Criteria for Measurement Locations

Assessment Period	Existing RBL	Sleep Disturbance Assessment Criteria $L_{A1,\,min}$
Location M1: 250 Bruce Crescent		
Night	36(1)	51
Location M2: 118 Bushells Ridge Road		
Night	33	48
Location M3: 235 Bushells Ridge Road		
Night	43	58
Location M4: 209 Bushells Ridge Road		
Night	46	61
Location M5: 97 Bushells Ridge Road		
Night	36	51
Location M6: 4 Kiar Road		
Night	39	54
Location M7: Hue Hue Road		
Night	43	58
Location M8: Amberwood Close*		
Night	41	56
Location M9: Sandra Road		
Night	33	48
Location M10: 113A Mountain Road		
Night	39	54
Location M11: 20 Bushells Ridge Road		
Night	42	57
Location M12: Bushells Ridge Road		
Night	42	57
Location M13: Popran Way		
Night	37	52

(1) Adjusted in accordance with OEH Application Notes

** WACJV owned property.*

5.3 Project Specific Noise Criteria for Noise Assessment Locations

For assessment purposes, residential receptor locations with similar acoustic environments have been grouped together. *Table 10* presents a summary of the referenced measurement locations and grouped assessment locations with similar noise environments (*Figure 5*).

Table 10. Summary of Measurement and Assessment Locations

Reference Measurement Locations	Reference Assessment Locations	INP Indicative Noise Amenity
M1	P1, P2, P3	Rural
M2	P6	Suburban
M3	P10	Urban
M4	-	Urban
M5	P7	Suburban
M6	P5	Suburban
M7	-	Suburban
M8*	-	Suburban
M9	-	Rural
M10	P4	Rural
M11	P9	Suburban
M12	P8	Suburban
M13	-	Urban

** WACJV owned property.*

5.3.1 Operational Project Specific Noise Criteria

Considering the above intrusive and amenity noise criteria for the measurement locations *(Table 8* and *Table 9)* and the referenced residential locations selected for assessing noise from the Project, *Table 11* provides a summary of the PSNC. Where the amenity criterion is less than the intrusive criterion, the amenity criterion was adopted and assessed as an $L_{Aeq,\ 15\ min}$ level. *Attachment 14* presents a summary of night-time operational noise criteria for properties in the vicinity of the Project Boundary *(Figure 5)* developed from the results in *Table 11*.

Table 11. Operational Project Specific Noise Criteria

Period	Recommended Noise Criteria $L_{Aeq, Period}$	Existing RBL	Existing $L_{Aeq, Period}$	Project Specific Noise Criteria	
				Operational Noise Criteria $L_{Aeq, 15\ min}$	Sleep Disturbance $L_{A1, 1\ min}$
Assessment Location P1					
Day	50	36	49	41	-
Evening	45	41	47	41	-
Night	40	37	47	40	52
Assessment Location P2					
Day	50	36	49	41	-
Evening	45	41	47	41	-
Night	40	37	47	40	52
Assessment Location P3					
Day	50	36	49	41	-
Evening	45	41	47	41	-
Night	40	37	47	40	52
Assessment Location P4					
Day	50	39	49	44	-
Evening	45	41	48	44	-
Night	40	39	49	40	54
Assessment Location P5					
Day	55	41	52	46	-
Evening	45	40	51	45	-
Night	40	39	49	40	54
Assessment Location P6					
Day	55	38	51	43	-
Evening	45	40	50	43	-
Night	40	33	48	38	48
Assessment Location P7					
Day	55	37	48	42	-
Evening	45	43	50[(5)]	42	-
Night	40	36	48	40	51
Assessment Location P8*					
Day	55	44	56	49	-
Evening	45	49	56	48	-
Night	40	42	56	46	57
Assessment Location P9					
Day	55	44	64	49	-
Evening	45	44	57	47	-
Night	40	42	54	44	57
Assessment Location P10					
Day	60	52	61	57	-
Evening	50	52	60	50	-
Night	45	43	58	48	58

** WACJV owned property.*

5.4 Discussion

The OEH recognises that it does not always follow that all people exposed to noise levels that exceed the PSNC would find the noise unacceptable. Subjectively, an increase in noise of less than 1dBA would not be noticeable and generally classified as negligible; increases of 1 to 2dBA would not be noticeable by most people and classified as marginal; increases of 3 to 5dBA would be moderate and noticeable by some people; while increases greater than 5dBA would be classified as noticeable. For situations where the PSNC are not achieved, the following criteria have been considered.

5.4.1 Undesirable Noise Impacts

For residences where the predicted noise levels exceed the PSNC, the affectation could be described as undesirable. For these situations and where all feasible and reasonable mitigation has been applied to the Project, it is recommended that consideration is given to acoustic treatments to exposed private receivers or discussions with identified property owners with respect to negotiated agreements. For properties identified in the *noise management zone*, agreements would be attempted to be entered into with each of the private property owners.

For undeveloped areas which can include land greater than 25% of a private property that is or could be developed for a private residence, where the predicted noise levels exceed the PSNC, the impact could be described as undesirable.

5.5 Road Traffic Noise

Procedures for assessing road traffic noise from new land use developments are documented in the OEH Road Noise Policy (RNP). *Table 12* presents a summary of the traffic noise assessment criteria recommended for new land use developments.

Table 12. Road Traffic Noise Criteria

Land Use Development	Traffic Noise Criteria		Where Criteria is already Exceeded
	Daytime (7.00am to 10.00pm)	Nighttime (10.00pm to 7.00am)	
Land use developments with potential to create additional traffic on local roads	$L_{Aeq, 1\ hour}$ 55	$L_{Aeq, 1\ hour}$ 50	In all cases, the redevelopment should not increase existing noise levels by more than 2dBA Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria. In many instances this may be achievable only through long-term strategies.
Land use developments with potential to create additional traffic on collector roads	$L_{Aeq, 1\ hour}$ 60	$L_{Aeq, 1\ hour}$ 55	

5.6 Rail Traffic Noise

Licences issued by the OEH regulate rail traffic noise in NSW. As part of licence conditions, the OEH is progressively incorporating requirements for implementation of Pollution Reduction Programs (PRP). The noise levels recommended by OEH for the assessment of rail noise exposure are that the cumulative noise levels (ie. the existing plus proposed) should not exceed $L_{Aeq, 24\ hour}$ 60dBA and $L_{Amax\ (95th\ percentile)}$ 85dBA, assessed at residential building facades.

6.0 METEOROLOGICAL EFFECTS

Research in the Hunter Valley identified that areas are subject to temperature inversions and seasonal winds. The effects of meteorological conditions can enhance or reduce noise propagation and noise perceived at distant receptors. In the near field wind has minimal influence on measured downwind sound levels. Wind effects become more important as distances increase. Downwind effects depending on wind speed and distance can increase noise by 1-5dB. Depending on wind speed and distance from a noise source, upwind noise levels can drop by 5-10dB. Temperature gradients create similar enhancement effects to wind, except that the effects are generally uniform in all directions.

Meteorological information for the Project Boundary *(Attachment 3)* has been supplied by PAE Holmes. The data includes annual and seasonal wind speed, wind direction and night stability classes for 2010-2011 (*Table 13* and *Table 14)*. Where conditions occur for greater than 30% of the time, these weather conditions have been modelled and are shown in bold in *Table 13*.

The meteorological data shows that the percentage occurrence of winds with speeds of less than 3m/s during daytime and evening hours are predominantly from the south to north-east during spring and summer and south to west during winter and autumn. During night-time hours the predominant winds are from the south-west to north-west. The meteorological data identifies that E and F Stability Class conditions during night hours occur for more than 30% of the time.

Considering the above and the INP assessment procedures, the noise modelling has considered the effects of meteorological conditions.

Table 13. Predominant Wind Direction and Percentage Occurrence

Reference: PAE Holmes

Time Period	Wind Direction ± 45°	Percentage Occurrence (%)		
		Day	Evening	Night
Summer	N	25	28	10
	NE	**38**	**39**	16
	E	**42**	**35**	14
	SE	**37**	20	10
	S	**30**	22	21
	SW	22	17	**31**
	W	15	7	24
	NW	15	7	11
Autumn	N	10	11	1
	NE	11	11	1
	E	21	8	3
	SE	29	13	5
	S	**37**	24	9
	SW	**43**	**34**	**46**
	W	**36**	**30**	**47**
	NW	18	15	19
Winter	N	14	16	16
	NE	10	8	6
	E	8	3	2
	SE	16	7	6
	S	28	10	8
	SW	**42**	**32**	**38**
	W	**46**	**49**	**57**
	NW	**33**	**38**	**44**
Spring	N	21	**30**	13
	NE	**34**	**33**	12
	E	**40**	26	6
	SE	**34**	11	6
	S	29	13	15
	SW	25	17	26
	W	21	15	26
	NW	15	13	20

Table 14. Stability Classes and Percentage Occurrence

Reference: PAE Holmes

Stability Class	Percentage Frequency
A	0.7
B	0.4
C	1.1
D	28.5
E	34.6
F	34.8

6.1 Conditions Adopted for Noise Modelling

From the above meteorological data the conditions adopted for noise modelling are summarised in *Table 15*.

Table 15. Meteorological Conditions for Noise Modelling

Assessment Period	Meteorological Conditions
Day	North East wind 3m/sec, 20°C, 60%RH
	South East wind 3m/sec, 20°C, 60%RH
	South wind 3m/sec, 20°C, 60%RH
Night	Calm, 20°C, 60%RH,
	TI 3°/100m, 20°C, 60%RH,
	East wind 3m/sec, 20°C, 60%RH
	South West wind 3m/sec, 20°C, 60%RH
	West wind 3m/sec, 20°C, 60%RH

TI = Temperature Inversion
RH = Relative Humidity

7.0 SCHEDULE OF SITE PLANT AND NOISE SOURCES

7.1 Operational Noise Sources

Noise modelling for the Tooheys Road and Buttonderry sites has considered fixed plant, mobile plant and train loading. A summary of the sound power levels adopted for noise modelling is presented in *Table 16*. The data was developed from reference data and site audits and represents the L_{Aeq} levels and octave band sound power levels (SWL).

Table 16. Equipment Sound Power Levels

dB re: 10^{-12} Watts

Plant Description	Sound Power Level dB re: 10^{-12} Watts									
	dBA	**32**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Tooheys Road										
Drift Conveyor	91	88	95	97	93	89	86	80	73	58
Drift Conveyor Drive	97	93	92	91	93	92	95	88	78	67
ROM Stockpile Conveyor	100	97	104	106	102	98	95	89	82	67
ROM Stockpile Conveyor Drive	97	93	92	91	93	92	95	88	78	67
ROM Coal Stockpile	103	102	109	106	102	97	96	96	95	86
Stockpile Dozer D11	111	106	108	117	107	108	107	102	96	86
ROM –Crusher Conveyor	96	93	100	102	98	94	91	85	78	63
ROM –Crusher Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Crusher Building	105	107	106	108	110	105	96	87	79	65
Crusher- Transfer Bl'd. Conveyor	103	100	107	109	105	101	98	92	85	70
Crusher- Transfer Bl'd. Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Transfer Building	102	101	102	101	103	104	87	77	63	54
Incline Stockpile Conveyor	96	93	100	102	98	94	91	85	78	63
Incline Stockpile Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Stockpile Conveyor	101	98	105	107	103	99	96	90	83	68
Stockpile Conveyor Drive	97	93	92	91	93	92	95	88	78	67
Coal Stockpile	103	102	109	106	102	97	96	96	95	86
Rail Bin Transfer Conveyor	96	93	100	102	98	94	91	85	78	63
Rail Bin Transfer Conveyor Drive	87	83	92	81	83	82	85	78	68	57
Coal Train per 30 metres	97	99	108	99	90	93	92	89	84	82
Rail Loading	87	93	86	86	84	81	81	80	78	73
Gas Flare Module	86	89	87	85	82	79	78	80	68	59
Buttonderry										
Fan Discharge No. 1	85	108	98	91	85	79	76	78	76	77
Fan Discharge No. 2	85	108	98	91	85	79	76	78	76	77
Fan House	72	100	91	78	77	68	54	49	37	27
Winder Building	73	84	87	85	82	81	79	73	65	54

7.1.1 Intermittent Noise Sources

Based on experience in the coal industry, engineered noise mitigation controls have been developed and introduced as part of site developments and PRPs for controlling impact noise. A number of these recommendations have been considered and recommended for the Project and include:

- An inclined rail track for train loading,
- Removal of at grade rail crossings,
- Laminated transfer chutes at conveyor transfer points,
- A concrete coal storage bin, and
- Insulated wall cladding for the crusher building.

With the effective incorporation of noise controls it is not envisaged that site related activities would give rise to maximum noise events resulting in exceedances of the sleep disturbance criteria *(Table 9)*.

7.2 Off Site Road Traffic Noise

The projected daily traffic generation during operation and construction is summarised in *Table 17* and *Table 18.* Construction at Tooheys Road and Buttonderry sites would be undertaken at the same time, while the Western Ventilation Shaft is not expected to be under construction until around year 10 of mining.

7.2.1 Operational Traffic

Assuming each employee during the operational phase drives to the site, there would be a daily traffic generation of 500 two-way car movements at Buttonderry Site and 42 two-way car movements at Tooheys Road Site, occurring at different times when shift changes occur. It was assumed employees would arrive at the site one (1) hour prior to the start of each shift, and depart within an hour of ending the shift.

Table 17. Projected Operational Traffic Volumes (Three Shift Operation)
(Ninth year of operation)

Shift	Times	Vehicle Numbers per Day	
		Buttonderry Site	Tooheys Road Site
Daytime Office	8:00am to 5:00pm	20	0
Day	6.00am to 3.00pm	90	15
Afternoon	2.00pm to 11.00pm	70	3
Night	10.00pm to 7.00am	70	3
	Total	**250**	**21**

7.2.2 Construction Traffic

Assuming each of the construction workers drive to the site, there would be a daily traffic generation of 440 two-way car movements at Buttonderry Site, 800 two-way car movements at Tooheys Road Site and 90 at the Western Ventilation Shaft as detailed in *Table 18.*

Table 18. Projected Construction Traffic Volumes
(Second year of construction)

Site	Vehicle Type	Vehicle Numbers per day	Vehicle Trips per day
	Light (employees – construction for surface facilities)	270	540
	Light (employees – drift construction)	30	60
Tooheys Road	Light(deliveries)	60	120
	Rigid Truck	20	40
	Articulated Truck	20	40
		Total	**800**
	Light (employees – construction for surface facilities)	120	240
	Light (employees – shaft construction)	30	60
Buttonderry	Light(deliveries)	40	80
	Rigid Truck	10	20
	Articulated Truck	20	40
		Total	**440**
	Light (employees)	25	50
	Light(deliveries)	10	20
Western Shaft	Rigid Truck	5	10
	Articulated Truck	5	10
		Total	**90**

7.3 Rail Traffic Noise

Passenger train schedule information available for the MNRL north of Wyong shows that the average daily usage is comprised of V-set (50 per day), XPT (6 per day) and Explorer (4 per day) commuter trains. Effective from October 2009, the scheduled freight train passbys were in the order of twenty five (25) for weekdays and sixteen (16) for weekends. The Project is planned to generate six (6) additional coal train return movements per day during the haulage campaigns. *Table 19* presents a summary of the existing and projected train movements for the MNRL north of Wyong.

Table 19. Existing and Projected Train Movements

Description	Daily Train Movements	
	Existing	Additional Return Movements
V-Set Commuter	50	
XPT	6	
Explorer	4	
Existing Freight weekdays weekends	 25 16	
Wallarah 2 Coal	-	6

Pass-by measurements for freight trains have shown that noise levels are dependent on the rolling stock, train length, train speed, track design and distance from the track. The main noise sources identified include locomotive engine/exhaust, wheel/rail noise and wagon radiated noise. Rail wheel squeal on curves in the rail track is a source of potential noise annoyance to residents adjacent to rail lines. Wheel noise can be caused by wheel to rail-top interaction and the wheel flange interaction with the face of the rail. Dominant squeal frequencies appear to mainly occur around 1400 to 2500 Hz, depending on wheel and track geometry. Investigations reported by RailCorp (Anderson 2004) confirmed that only freight trains generated rail squeal, and that wheel squeal noise levels can exceed 110dBA at 25m from the track, while typical levels are between 95dBA and 105dB at 25m.

Rolling stock noise measurements and performance observations reported (Anderson 2004) that a high proportion of container and steel product trains generated squeal noise on curved track, whereas coal and grain trains rarely squeal. About 2% of the train axles seem to be responsible for the majority of the squeal noise. Reported results confirmed that there was no identifiable difference in squeal noise from loaded and unloaded trains.

For modelling noise from train passbys, the measurements have been normalised to 15 metres and 75-80 kilometres per hour. *Table 20* presents a summary of typical rolling stock free field LAmax and sound exposure levels (SEL) adopted for modelling. The SEL is a parameter related to LAeq and is the value that contains the same amount of acoustic energy over a 'normalised' one second period as the actual noise event under consideration. i.e. a train passby.

Table 20. Rolling Stock Noise Levels
dB re: $20x10^{-6}$ Pa

Description	Sound Pressure Levels @ 15 metres dBA	
	SEL	LAmax
NR Class Locomotive	96	91
81 Class Locomotive	95	90
Passenger (XPT)	94	90
Explorer	93	88
V-Set	92	86
Freight Wagons	98	90
Coal Wagons	98	89

8.0 NOISE MODELLING PROCEDURE AND ASSESSMENT

Noise for each site was modelled with the OEH approved Environmental Noise Model (ENM) computer model. The ENM is based on digital topographical data for each site and surrounding area, and calculates attenuation factors including distance, shielding from structures, ground vegetation, atmospheric absorption, topographical features and weather effects.

8.1 Tooheys Road Site

The INP *(Section 5.3.1)* recommends that wind effects be assessed when wind speeds of 3m/s or below occur for at least 30 percent of the time in any assessment period or season. Considering the meteorological and seasonal wind data *(Section 6.0*) noise modelling was undertaken for a number of wind scenarios and temperature inversions.

The noise modelling assumed that the fixed and mobile plant (one (1) stockpile dozer) were operating simultaneously, train loading with locomotives and wagons on the rail loop and two (2) locomotives stationary on the rail spur. *Table 21* and *Table 22* present a summary of the Project Specific Noise Criteria (PSNC) and predicted noise levels to the reference assessment locations *(Figure 3)*.

Table 21. Predicted Operational Noise Levels (Day/Evening)
L_{Aeq} dBA re: 20 x 10^{-6} Pa

Assessment Location	Predicted Sound Pressure Levels dBA							
	Meteorological Conditions							
	PSNC	Calm	NE 3m/sec	E 3m/sec	SE 3m/sec	S 3m/sec	SW 3m/sec	W 3m/sec
Assessment Location P1	41/41	22	29	18	16	17	20	32
Assessment Location P2	41/41	31	35	30	27	26	28	33
Assessment Location P3	41/41	34	40	36	29	28	30	34
Assessment Location P4	44/44	19	31	27	20	16	15	16
Assessment Location P5	46/45	14	27	31	22	14	14	14
Assessment Location P6	43/43	32	34	38	39	37	30	30
Assessment Location P7	42/42	35	37	41	42	40	36	36
Assessment Location P8	49/46	34	34	42	45	43	37	37
Assessment Location P9	49/47	31	27	32	39	42	39	39
Assessment Location P10	57/50	27	22	25	32	37	36	36

Table 22. Predicted Operational Noise Levels (Night)
L_{Aeq} dBA re: 20 x 10^{-6} Pa

Assessment Location	Predicted Sound Pressure Levels dBA					
	Meteorological Conditions					
	PSNC	Calm	TI 3°/100m	S 3m/sec	SW 3m/sec	W 3m/sec
Assessment Location P1	40	22	31	17	20	32
Assessment Location P2	40	31	34	26	28	33
Assessment Location P3	40	34	38	28	30	34
Assessment Location P4	40	19	23	16	15	16
Assessment Location P5	40	14	19	14	14	14
Assessment Location P6	38	32	36	37	30	30
Assessment Location P7	40	35	39	40	36	36
Assessment Location P8	46	34	39	43	37	37
Assessment Location P9	44	31	35	42	39	39
Assessment Location P10	48	27	32	37	36	36

The results in *Table 21* and *Table 22* for Tooheys Road Site show that the PSNC *(Table 9)* are satisfied. Operational noise levels predicted at the Blue Haven Estate and the Warnervale Town Centre are less than 35dBA under adverse wind and temperature inversion conditions at the nearest closest receivers.

For descriptive purposes, noise contours plots are presented in *Attachments 5 to 12.* The noise plots are presented for visual purposes only, compliance with the recommended PSNC should be confirmed against the predicted levels in *Table 21* and *Table 22*. The noise contour plots in the *Attachments 5 to 12* show that for private receivers identified as Receiver 56 (The Commissioner for Main Roads), Receiver 57 (K. R. Drake) Receiver 58 (K. L. Norman) and Receiver 152 (Roads and Traffic Authority of NSW) *(Figure 5)* predicted noise levels exceed the PNSC for more than 25% of the land. Of these, Receiver 57 and Receiver 58 are privately owned.

8.2 Buttonderry Site

Noise contour plots for the Buttonderry Site are presented in *Attachments 5-12*. The predictions show that the PSNC *(Table 11)* are not predicted to be exceeded at any private residential receiver or more than 25% of the land.

8.3 Sleep Disturbance

Sleep disturbance has been addressed by considering plant and activities identified as likely to generate short term noise impacts. Sources assessed included train horns, coal wagon bunching, train loading bin and coal transfer chutes. Source sound power levels used to predict noise level contributions at the reference receiver locations include train horn L_W 130dBA, wagon bunching L_W 120dBA, coal bin loading L_W 125dBA and transfer chute plates L_W 115dBA. Without secondary noise mitigation modelling *(Table **23**)* identified that sources could give rise to noise levels that exceed the recommended sleep disturbance criteria.

With the application of effective noise controls there should be no requirement to sound train horns onsite, wagon bunching would be controlled, the impact noise from product/ steel coal bin contact would reduce by 15-20dBA, product/plate contact noise at the head of conveyors and transfer points would reduce by 5-10dBA. The assessment and modelling have shown with the application of noise controls (Section 7.1.1), noise levels are predicted *(Table 24)* to below the recommended sleep disturbance criteria.

Table 23. Predicted $L_{A1, 1min}$ Noise Levels (Without Noise Mitigation)
dB re: 20 x 10^{-6} Pa

Assessment Location	Predicted Sound Pressure Levels dBA					
	Meteorological Conditions					
	PSNC	Calm	TI 3°/100m	S 3m/sec	SW 3m/sec	W 3m/sec
Train Horn						
Assessment Location P1	52	37	49	32	34	47
Assessment Location P2	52	42	49	37	38	41
Assessment Location P3	52	45	**53**	41	40	38
Assessment Location P4	54	29	31	25	26	26
Assessment Location P5	54	21	26	19	17	17
Assessment Location P6	48	42	**50**	**49**	40	39
Assessment Location P7	51	46	42	50	44	42
Assessment Location P8	57	47	52	53	46	43
Assessment Location P9	57	45	48	53	50	45
Assessment Location P10	58	40	47	57	55	45
Wagon Bunching						
Assessment Location P1	52	28	39	24	25	37
Assessment Location P2	52	32	39	28	29	32
Assessment Location P3	52	34	42	31	30	31
Assessment Location P4	54	21	22	17	16	17
Assessment Location P5	54	14	19	13	-	-

Assessment Location	Predicted Sound Pressure Levels dBA					
	Meteorological Conditions					
	PSNC	Calm	TI 3°/100m	S 3m/sec	SW 3m/sec	W 3m/sec
Assessment Location P6	48	32	40	39	31	29
Assessment Location P7	51	36	43	40	34	33
Assessment Location P8	57	38	41	46	37	34
Assessment Location P9	57	36	39	43	40	36
Assessment Location P10	58	31	37	46	46	36
Train Load Bin						
Assessment Location P1	52	26	39	20	22	41
Assessment Location P2	52	39	42	20	21	41
Assessment Location P3	52	39	46	29	30	38
Assessment Location P4	54	24	31	22	21	22
Assessment Location P5	54	16	33	14	12	12
Assessment Location P6	48	44	47	**48**	21	19
Assessment Location P7	51	49	**52**	**54**	49	47
Assessment Location P8	57	47	51	**58**	50	35
Assessment Location P9	57	44	49	56	55	46
Assessment Location P10	58	34	43	46	47	43
Transfer Tower Chutes						
Assessment Location P1	52	12	25	-	-	26
Assessment Location P2	52	26	28	-	-	28
Assessment Location P3	52	30	34	10	16	28
Assessment Location P4	54	-	17	-	-	-
Assessment Location P5	54	-	-	-	-	-
Assessment Location P6	48	35	36	32	-	-
Assessment Location P7	51	39	41	37	39	35
Assessment Location P8	57	39	44	43	42	22
Assessment Location P9	57	34	41	40	44	37
Assessment Location P10	58	22	31	28	34	31

Table 24. Predicted $L_{A1, 1min}$ Noise Levels (With Noise Mitigation)

dB re: 20 x 10^{-6} Pa

Assessment Location	Predicted Sound Pressure Levels dBA					
	Meteorological Conditions					
	PSNC	Calm	TI 3°/100m	S 3m/sec	SW 3m/sec	W 3m/sec
Train Load Bin						
Assessment Location P1	52	11	24	5	7	26
Assessment Location P2	52	24	27	5	6	26
Assessment Location P3	52	24	31	14	15	23
Assessment Location P4	54	9	16	7	6	7
Assessment Location P5	54	1	18	-	-	-
Assessment Location P6	48	29	32	33	6	4
Assessment Location P7	51	34	37	39	34	32
Assessment Location P8	57	32	36	43	35	20
Assessment Location P9	57	29	34	41	40	31
Assessment Location P10	58	19	28	31	32	28
Transfer Tower Chutes						
Assessment Location P1	52	7	20	-	-	21

Assessment Location	Predicted Sound Pressure Levels dBA					
	Meteorological Conditions					
	PSNC	Calm	TI 3°/100m	S 3m/sec	SW 3m/sec	W 3m/sec
Assessment Location P2	52	21	23	-	-	23
Assessment Location P3	52	25	29	5	11	23
Assessment Location P4	54	-	12	-	-	-
Assessment Location P5	54	-	-	-	-	-
Assessment Location P6	48	30	31	27	-	-
Assessment Location P7	51	34	36	32	34	30
Assessment Location P8	57	34	39	38	37	17
Assessment Location P9	57	29	36	35	39	32
Assessment Location P10	58	17	26	23	29	26

8.4 Road Traffic

Table 25 presents the predicted peak hour traffic noise levels, assuming a 50-50 split in traffic on Hue Hue Road from the Buttonderry Site and a 50-50 split on Bushells Ridge Road from the Tooheys Road Site.

Table 25. Predicted Operational Road Traffic Noise Levels

Shift	Times		Predicted Road Traffic Noise Levels LAeq, 1 hour			
		Criteria	10m	30m	50m	100m
Buttonderry Site (Hue Hue Road)						
Day	6.30am to 8.30am	55	58.1	54.1	52.1	49.2
Afternoon	1.30pm to 3.30pm	60	58.1	54.1	52.1	49.2
Night	9.30pm to 11.30pm	55	57.5	53.6	51.5	48.7
Tooheys Road Site (Bushells Ridge Road)						
Day	6.30am to 8.30am	55	48.6	44.6	42.6	39.7
Afternoon	1.30pm to 3.30pm	60	48.6	44.6	42.6	39.7
Night	9.30pm to 11.30pm	55	43.8	39.9	37.8	35.0

The predicted $L_{Aeq\ 1\ hour}$ traffic noise levels for Hue Hue Road at 30 metres satisfy the daytime 60dBA and night time 55dBA criteria for collector roads. Existing dwellings constructed along Hue Hue Road between Bushells Ridge Road and Sparks Road are set back approximately 200 - 250 metres. On Bushells Ridge Road the predicted traffic noise levels satisfy the PSNC at 10 metres from the road. Existing dwellings constructed along Bushells Ridge Road are set back approximately 20 - 60 metres.

8.5 Rail Traffic

Modelling for the existing and projected rail traffic noise has been undertaken assuming no allowance for attenuation from shielding provided by cuttings, buildings, etc. *Table 26* presents a summary of predicted existing levels for comparison with measured levels referenced to 25 metres.

Table 26. Predicted Existing Rail Traffic Noise Levels

Train Type	Measured Sound Levels @ 25 metres (dBA)		Daily Weekday Train Movements	Predicted Sound Levels* (dBA)	
	LAmax	SEL		LA max	LAeq, 24hr
XPT	90	94	6	85.6	48.0
Explorer	88	93	4	83.6	45.2
V-Set	86	92	50	81.6	55.2
Freight Loco's	91	96	25	88.8	58.4
Freight Wagons	90	98	25	85.6	58.2
			Overall Level	**88.8**	**62.5**

* Free field conditions without facade correction (+2.5dBA)

The noise levels in *Table 26* show that the $L_{Aeq, 24\ hour}$ and $L_{Amax\ (95\%)}$ levels are within 3dBA of the measured levels *(Table 6)* and acceptable for noise modelling.

8.5.1 Predicted Existing and Future Rail Traffic Noise Levels

Table 27 presents a summary of the predicted existing and predicted future noise levels with the Project coal trains at offset distances referenced to 15, 25, 50 and 100 metres with a building facade correction of 2.5dBA (Reference: DECC, Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects. Tables 1 and 2 (Technical Notes) (April 2007)). The modelling is based a direct line of sight between the trains and receptor, a train speed of 75-80 kph and no acoustic shielding.

Table 27. Predicted Existing and Future Rail Traffic Noise Levels

Sound Pressure Levels (dBA re: $20x10^{-6}$ Pa)			
Existing		**Future with Project Coal Trains**	
LAeq, 24hr	**LA, max**	**LAeq, 24hr**	**LA, max**
Off-set 15 metres			
68.7	93.5	70.0	93.5
Off-set 25 metres			
65.0	91.3	66.3	91.3
Off-set 50 metres			
60.4	88.3	61.9	88.3
Off-set 100 metres			
56.3	85.3	57.9	85.3

The predicted level in *Table 27* show that the additional coal trains would not increase the existing L_{Amax} levels along the MNRL, while the existing $L_{Aeq, 24\ hour}$ levels increase by up to 1.6dBA. The DECC LAeq 24 hour 60dBA criteria is shown to be satisfied at approximately 70 metres from the rail line. The $L_{Amax\ 85dBA}$ level is predicted to be satisfied at approximately 100 metres.

9.0 CONSTRUCTION

For the purpose of noise modelling, an indicative construction plan and works method is outlined in this report for civil and construction works envisaged for the surface infrastructure.

Detailed construction staging plans and works methods will be prepared should Development Consent be granted. The actual construction method and staging may vary from the description presented in this report; however methods employed will ensure noise levels do not exceed the predictions in this assessment.

9.1 Construction Sites

Surface construction will occur at Tooheys Road Site, Buttonderry and the Western Ventilation Shaft.

9.1.1 Tooheys Road Site

Civil and construction activities at Tooheys Road Site include site establishment, infrastructure development and commissioning. For modelling and assessment purposes four (4) elements of constructions were considered:

* Decline ('drift');
* Civil infrastructure and water infrastructure;
* Rail loop and spur; and
* Administration buildings and surface facilities.

9.1.1(a) Decline

The major plant and equipment that is likely to be used during this element includes excavators with hydraulic hammers, dozers, road headers, concrete trucks and concrete pumps, trucks and cranes. The majority of the decline construction activity will occur underground.

9.1.1(b) Civil Infrastructure and Water Infrastructure

The works will commence with the clearing and grubbing of the site followed by the topsoil strip and stockpiling. Excess topsoil will be spread on site in other areas of work. Bulk earthworks for the proposed stockpile pads, internal access roads, dams and related water management infrastructure and rail loop would commence soon after.

The plant and equipment likely to be used during these works includes excavators, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, compactor, asphalt pavers and water carts.

9.1.1(c) Rail Loop and Spur

Construction of the rail loop and spur will be carried out in three (3) phases. The preparatory phase work will isolate the construction zone from the operating RailCorp rail tracks and relocate or protect existing services and utilities. The second phase comprising major civil works will include earthworks and the construction of culverts and bridges. The third phase will include track construction and installation of signalling and communications facilities.

The plant and equipment likely to be used during these works include excavators, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, concrete trucks and pumps, cranes, asphalt pavers, rail grinding machines and compactor and water carts.

9.1.1(d) Administration Buildings and Surface Facilities

This construction work covers the construction of offices and workshops and related service provisions including pipe laying, landscaping, communications, etc.

The plant and equipment likely to be used during these works include cranes, concrete tucks, cement mixers, material deliveries, etc.

9.1.2 Buttonderry Site

During the Buttonderry Site construction phase the main site activities will be associated with the site establishment, internal roads, drainage, erection of buildings, installation of equipment, the establishment of underground drifts and the ventilation shaft.

The plant and equipment that is likely to be used during these works will include excavators, shaft boring machine, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, compactor, asphalt pavers and water carts.

9.1.3 Western Ventilation Shaft

During the Western Ventilation Shaft construction the main site activities will include site establishment, internal roads, drainage, and the establishment of the ventilation shaft.

The plant and equipment likely to be used during these works include excavators, shaft boring machine, rock breakers, dozers, scrapers, tippers, trucks, graders, vibratory rollers, compactor, asphalt pavers and water carts. The majority of the shaft construction activity will occur underground.

10.0 CONSTRUCTION NOISE AND VIBRATION CRITERIA

For major construction projects undertaken in NSW the OEH recommend procedures for assessing noise and vibration impacts. Publications released and referred to by the OEH with reference to the assessment of construction noise and vibration impacts include the *ENCM (Chapter 171)* and the *Interim Construction Noise Guideline (2009)* and *Assessing Vibration: a technical guideline* (ICNG*)*. The ICNG recommends that construction noise associated with mining be assessed under the *Industrial Noise Policy* (INP).

Albeit not directly related to construction noise from mining proposals, the ENCM and the ICNG were developed in response to concerns raised with respect to construction noise impacts. The primary objective of the ICNG is aimed at managing noise from construction works regulated by the OEH. The guideline deals with procedures to:

- Promote a clear understanding of ways to identify and minimise noise from construction works;
- Focus on applying all 'feasible and reasonable' work practices to minimise construction noise impacts;
- Encourage construction to be undertaken during recommended hours;
- Streamline the assessment and approval stages;
- Reduce time spent dealing with complaints at the Project implementation stage; and
- Provide flexibility in selecting site-specific feasible and reasonable work practices in order to minimise noise impacts.

The OEH recognise that feasible work practices are practical to implement, while reasonable work practices take into account the balance of costs and benefits and community views. Work practices recommended by the OEH can include notifying the community of expected noise impacts and when they are expected to occur.

It is recognised that the procedures and recommendations published in the ICNG for assessing noise from construction activities are best regarded as planning tools. They are not mandatory, and their application for assessing construction noise is not determined purely on the basis of compliance or otherwise with numerical noise levels.

For the purpose of assessing and managing construction noise impacts, the ICNG refers to the proposed construction hours and the duration of the works. For construction works extending more than three (3) weeks a 'quantitative assessment method' is recommended. For construction works that are unlikely to affect an individual or sensitive land use for more than three (3) weeks in total, the ICNG refers to a 'qualitative assessment method'.

Therefore the Project construction, lasting approximately three years, will be assessed under the 'qualitative assessment method'.

10.1 Standard Construction Hours

The OEH recommended standard hours for construction are summarised in *Table 28*. Albeit the OEH recognise that the recommended hours are not mandatory and that there would be situations where construction works are undertaken outside of these hours (if inaudible at any private receiver).

Table 28. Recommended Standard Construction Hours

Work Type	Recommended Standard Hours of Work*
Normal Construction	Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No works on Sundays or public holidays
Blasting	Monday to Friday 9.00am to 5.00pm Saturday 9.00am to 1.00pm No blasting on Sundays or public holidays

* The relevant authority (consent, determination or regulatory) may impose more or less stringent construction hours

10.2 Quantitative Noise Assessment Method

The ICNG refers to quantitative assessment methods involving predicted noise levels and comparing them with levels developed from Chapter 4 of the ICNG. For assessment purposes the RBL is used when determining the management assessment level.

Table 29 sets out noise management levels at private receivers and how they are applied. Restrictions to construction hours may apply to activities that generate noise at residences above the 'highly noise affected ' noise management level.

Table 29. Noise at Residences (Quantitative Assessment)

Time of Day	Management Level LAeq, 15 min	How to Apply
Recommended standard hours: Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No works on Sundays or public holidays	Noise affected RBL+10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq 15min is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details
	Highly noise affected	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences). 2. If the community is prepared to accept longer period of construction in exchange for restrictions on construction times
Outside recommended standard hours	Noise affected RBL+5dB	• A strong justification would typically be required for works outside the recommended standard hours • The proponent should apply all feasible and reasonable work practices to meet the noise affected level • Where feasible and reasonable practices have been applied and noise is more than 5dB above the noise affected level, the proponent should negotiate with the community

* Noise levels apply at the residential property boundary that is most exposed to construction noise. If the property boundary is more than 30m from the residence the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence.

For other noise sensitive land uses, such as schools, hospitals, etc; *Table 30* presents management levels based on the principle that the characteristic activity for each of these land uses should not be unduly disturbed. Internal levels referenced in *Table 30* are assessed at the centre of the occupied room. External levels are assessed at the most affected point within 50m of the area boundary. Where internal noise levels cannot be measured adjusted external levels are recommended.

Table 30. Noise at Other Sensitive Receptors (Quantitative Assessment)

Land Use	Management Level LAeq, 15 min	
	Internal	External*
Classrooms at schools and other educational institutes	45	55
Hospital wards and operating theatres	45	55
Places of worship	45	55
Active recreation areas	-	65
Passive recreation areas	-	60
Industrial premises	-	75
Office, retail outlets		70
Community centres	Refer to AS2107**	

* External levels measured within 50m of property boundary.
** Refer to recommended 'maximum' internal levels in AS2107 for specific uses.

10.3 Sleep Disturbance at Residences

Where construction works are planned to extend over more than two consecutive nights and a quantitative assessment method is used, the ICNG recommends that the analysis include the assessment of maximum noise levels and the extent and number of times that the maximum noise level are likely to exceed the RBL.

10.4 Project Construction Noise Criteria

Considering the recommendations of the ICNG, the INP and the measured RBL's, the PSNC recommended for evaluating construction noise are summarised in *Table 31*.

For assessment purposes construction noise is assessed a residential property boundary or 30 metres from a residential dwelling, if the boundary is more than 30 metres from the dwelling.

Table 31. Construction Project Specific Noise Criteria
dBA 20 × 10^{-6} Pa

Period	Existing RBL	Existing L_{Aeq}	Project Noise Assessment Criteria (Day) L_{Aeq}
Location M1: 250 Bruce Crescent			
Day	36	49	41
Location M2: 118 Bushells Ridge Road			
Day	38	51	43
Location M3: 235 Bushells Ridge Road			
Day	52	61	57
Location M4: 209 Bushells Ridge Road			
Day	58	64	60
Location M5: 97 Bushells Ridge Road			
Day	37	48	42
Location M6: 4 Kiar Road			
Day	41	52	46
Location M7: Hue Hue Road			
Day	43	57	48
Location M8: Amberwood Close			
Day	41	50	46
Location M9: Sandra Road			
Day	33	44	38
Location M10: 113A Mountain Road			
Day	39	49	44
Location M11: 20 Bushells Ridge Road			
Day	44	64	49
Location M12: Bushells Ridge Road			
Day	44	56	49
Location M13: Popran Way			
Day	51	59	56

Notes: Monday to Friday 7.00am to 6.00pm; Saturday 8.00am to 1.00pm
No works on Sundays or public holidays without prior approval

10.5 Ground Vibration

As part of the site preparation rock may be encountered and accordingly rock hammers and or small explosive charges may be required. The effect of vibration on humans and structures is normally considered and evaluated in terms of annoyance and structural damage.

10.5.1 Annoyance

The OEH, *Assessing Vibration: a technical guideline* recommends criteria for assessing human response and potential disturbance to the occupants of private residences.
Table 32 presents a summary of vibration levels (mm/s) referenced to specific frequency bands weighted for residential receivers referenced to human response *(BS 6472-1992).*

Table 32. Vibration Levels for Assessment of Human Comfort

Frequency (Hz)	Vibration Level (mm/s)			
	Continuous Vibration		Intermittent Vibration	
	Day (2)	Night (1.4)	Day (60)	Night (20)
1	3.2	2.2	95	31
1.25	2.3	1.6	68	22
1.6	1.6	1.1	47	15
2	1.1	0.8	33	11
2.5	0.8	0.6	24	8.0
3.15	0.6	0.4	17	5.8
4	0.4	0.3	19	4.0
5	0.3	0.2	9.5	3.2
6.3	0.3	0.2	7.6	2.5
8	0.2	0.1	6.0	2.0
10	0.2	0.1	6.0	2.0
12.5	0.2	0.1	6.0	2.0
16	0.2	0.1	6.0	2.0
20	0.2	0.1	6.0	2.0
25	0.2	0.1	6.0	2.0
31.5	0.2	0.1	5.4	1.8
40	0.2	0.1	6.0	2.0
50	0.2	0.1	6.0	2.0
63	0.2	0.1	6.0	2.0
80	0.2	0.1	6.0	2.0

( ) Multiplying factors with respect to human response

10.5.2 Structural Damage

German Standard DIN4150 Part 3 (1986) provides guidelines for evaluating the effects of vibration on structures. The values recommended in the standard are summarised in *Table 33*. The values are the maximum levels measured in any direction at the building foundation.

Table 33. Safety Limits for Structural Damage

Type of Structure	Vibration Level (mm/s)		
	< 10Hz	10Hz to 50Hz	50Hz to 100Hz
Commercial/industrial buildings or buildings with similar design	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20
Structures of great intrinsic value (eg. buildings under preservation)	3	3 to 8	8 to 10

Ref: German Standard DIN4150

10.6 Construction Plant and Equipment

The construction plant schedule and sound power levels summarised in *Table 34* were adopted for the purpose of predicting noise levels. The sound power levels were established from Table D2 of Australian Standard 2436 1981 *"Guide to Noise Control on Construction Maintenance and Demolition Sites",* site attended measurements and manufacturer's data.

Table 34. Construction Plant Sound Power Levels

dBA re: 10^{-12} Watts

Plant Description	Sound Power Level dBA	
	Range	Average Level
Dozers	104-111	108
Water Cart	104-106	105
Front End Loaders	105-112	107
Haul Trucks	102-113	110
Scrapers	110-115	113
Track Excavators	105-115	110
Graders	105-110	107
Excavator with Hydraulic Breaker	112-122	120
Rollers	100-113	106
Backhoe	100-108	104
Concrete Truck	108-110	109
Concrete Pump	100-110	105
Truck Mounted Crane	100-106	102

10.6.1 Construction Traffic Generation

The projected daily traffic generation for each site during construction is summarised in *Table 35*. . It should be noted that construction at Tooheys Road and Buttonderry Sites will be undertaken at the same time, and the Western Ventilation Shaft site will not be constructed until around Year 10 of mining.

Assuming each of the construction workers drive to the site, there would be a daily traffic generation of 440 two-way car movements at Buttonderry Site, 800 two-way car movements at Tooheys Road Site and 90 at the Western Ventilation Shaft.

Table 35. Projected Construction Traffic Volumes
(Second year of construction)

Site	Vehicle Type	Vehicle Numbers per day	Vehicle Trips per day
	Light (employees – construction surface facilities)	270	540
	Light (employees – drift construction)	30	60
Tooheys Road	Light(deliveries)	60	120
	Rigid Truck	20	40
	Articulated Truck	20	40
		Total	**800**
	Light (employees – construction surface facilities)	120	240
	Light (employees – shaft construction)	30	60
Buttonderry	Light(deliveries)	40	80
	Rigid Truck	10	20
	Articulated Truck	20	40
		Total	**440**
	Light (employees)	25	50
	Light(deliveries)	10	20
Western Shaft	Rigid Truck	5	10
	Articulated Truck	5	10
		Total	**90**

10.6.2 Construction Equipment Vibration Emission Levels

During excavation and construction activities associated with access roads and trenches, it may be necessary to use plant and equipment that generates ground vibration. To evaluate the likely effects of these activities, the following vibration levels have been considered.

Table 36. Typical Plant Vibration Levels
mm/sec

Plant Description	Vibration Levels mm/sec		
	@ 5m	@ 20m	@ 40m
Dynamic impact roller	9-20	2-4	<1.5
Vibrating roller compactor	20	1.5	<1.0
Rock-breaker (large)	5	0.5	0.3
Rock breaker (light)	1	0.3	0.1
Dozer	2	0.2	0.02
Truck	1	0.05	0.02

10.7 Modelling and Assessment of Construction Noise

Noise from construction activities was modelled with the ENM computer model. The model considers attenuation factors such as distance, ground vegetation, atmospheric absorption and local topographical features. *Attachment 13* presents noise contour plots for Tooheys Road and Buttonderry for the envisaged worst case scenario for earth works.

The noise predictions *(Attachment 13)* demonstrate that construction noise levels have the potential to exceed the PSNC at Amberwood Close. The predicted noise levels of 50-55dBA exceed the daytime PSNC of 46dBA by 4-9dBA. To minimise noise impacts during construction preference will be given to contractors able to use low noise emission equipment and all site personnel will be inducted and educated with best practice work methods to minimise noise.

A Construction Noise and Vibration Management Plan and Monitoring Programme will be implemented. Considering the transient nature of the construction works and exposure to road traffic noise from Hue Hue Road, the short-term noise exceedances are capable of being managed to acceptable levels. The noise modelling shows that the PSNC are not predicted to be exceeded at any other residential receivers.

10.8 Construction Road Traffic

Table 37 presents a summary of predicted hourly construction traffic noise levels during the morning and afternoon peaks assuming a 75/25% split on Bushells Ridge Road from the Tooheys Road Site and 50/50% split on Hue Hue Road from the Buttonderry Site.

Table 37. Predicted Construction Traffic Noise Levels
dBA 20 × 10^{-6} Pa

Site	Vehicle Type	Vehicle Movements	Criteria	Predicted Facade Sound Pressure Levels $L_{Aeq\ 1\ hour}$			
				10m	30m	50m	100m
Tooheys Road	Light (employees)	67	60	57.3	53.4	51.3	48.5
Buttonderry	Light (employees)	60	60	56.8	52.9	50.8	48.0
West Shaft	Light (employees)	25	60	53.0	49.1	47.0	44.2

The predicted $L_{Aeq\ 1\ hour}$ traffic noise levels at 10 metres satisfy the daytime 60dBA target noise assessment goals for collector roads. Typically residential dwellings on Bushells Ridge Road and Hue Hue Road are set back more than 30 metres from the centre road alignment.

10.9 Vibration Levels from Construction Activities

The main source of ground vibration that has been identified and assessed is associated with dynamic impact rollers. Ground vibration levels predicted from dynamic impact rollers typically range between 2-4mm/sec at 20 metres, and below 1.5mm/sec at 40 metres. Vibration levels are predicted to satisfy the structural damage assessment criteria *(Table 33*) at distances greater than 20 metres and acceptable from a human disturbance point of view at the nearest private receivers on the corner of Tooheys Road and Bushells Ridge Road, Kiar Ridge Road (Tooheys Road Site), Sandra Street and Amberwood Close, Jilliby (Buttonderry Site).

10.10 Blast Criteria and Assessment

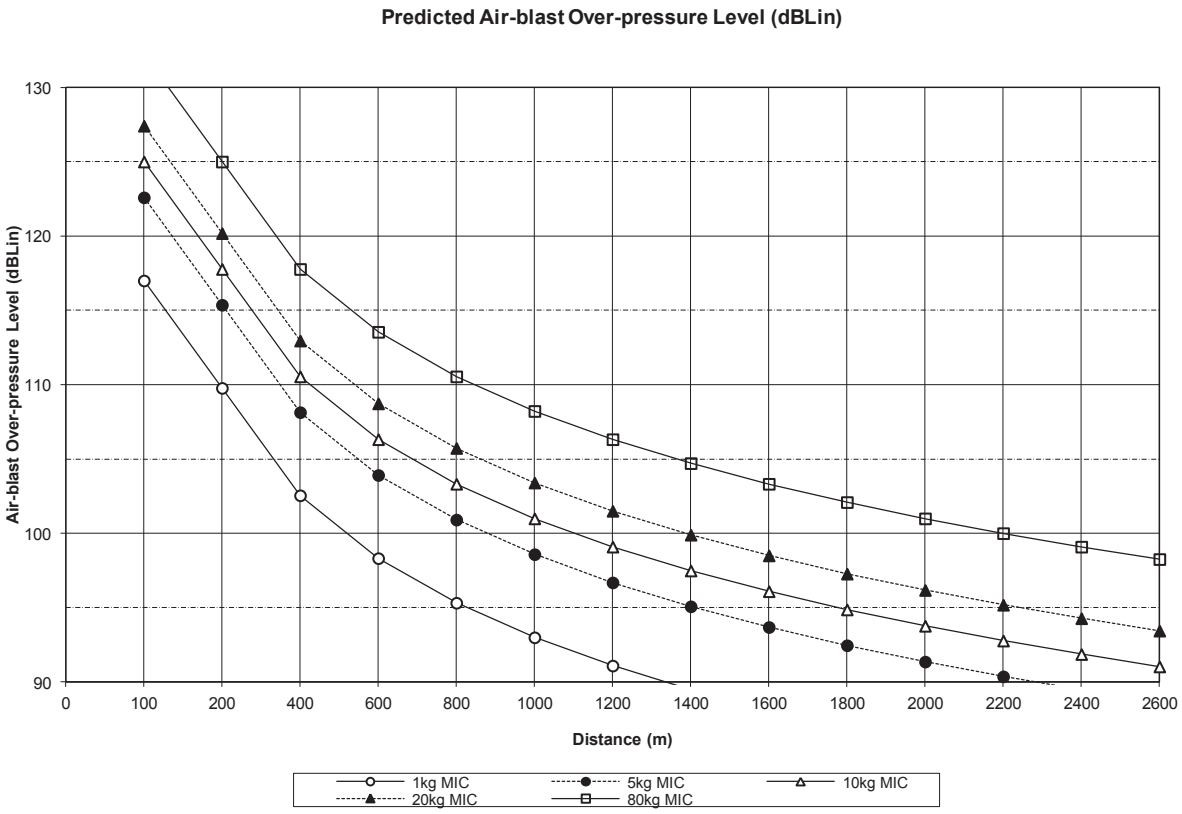
To promote uniform environmental standards throughout Australia the Australian and New Zealand Environment and Conservation Council (ANZECC) released a number of Technical Bases. With respect to blasting the ANZECC published the 'Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration'. The ANZECC recommended airblast overpressure level for 95% of blasts is 115dB (Lin Peak) over 12 months, with a maximum level of 120dB (Lin Peak). For ground vibration the ANZECC recommended level for 95% of blasts is 5mm/sec (peak particle velocity) over 12 months, with a maximum level of 10mm/sec. Confined blasting may be required largely underground to remove rock outcrops.

Some confined surface blasting may be required at the Tooheys Road Site. Blast holes would be drilled and filled with an explosive charge and detonated with the aid of primers and detonators. Impacts associated with blasting normally relate to airblast overpressure and ground vibration.

10.10.1 Airblast Overpressure Prediction Model

Airblast overpressure is a function of maximum instantaneous explosive charge and the distance between the receiver and blast location. *Figure 6* presents a summary of the maximum instantaneous charge (MIC) blast design data used to predict airblast overpressure.

Figure 6: Air-blast Overpressure v Distance



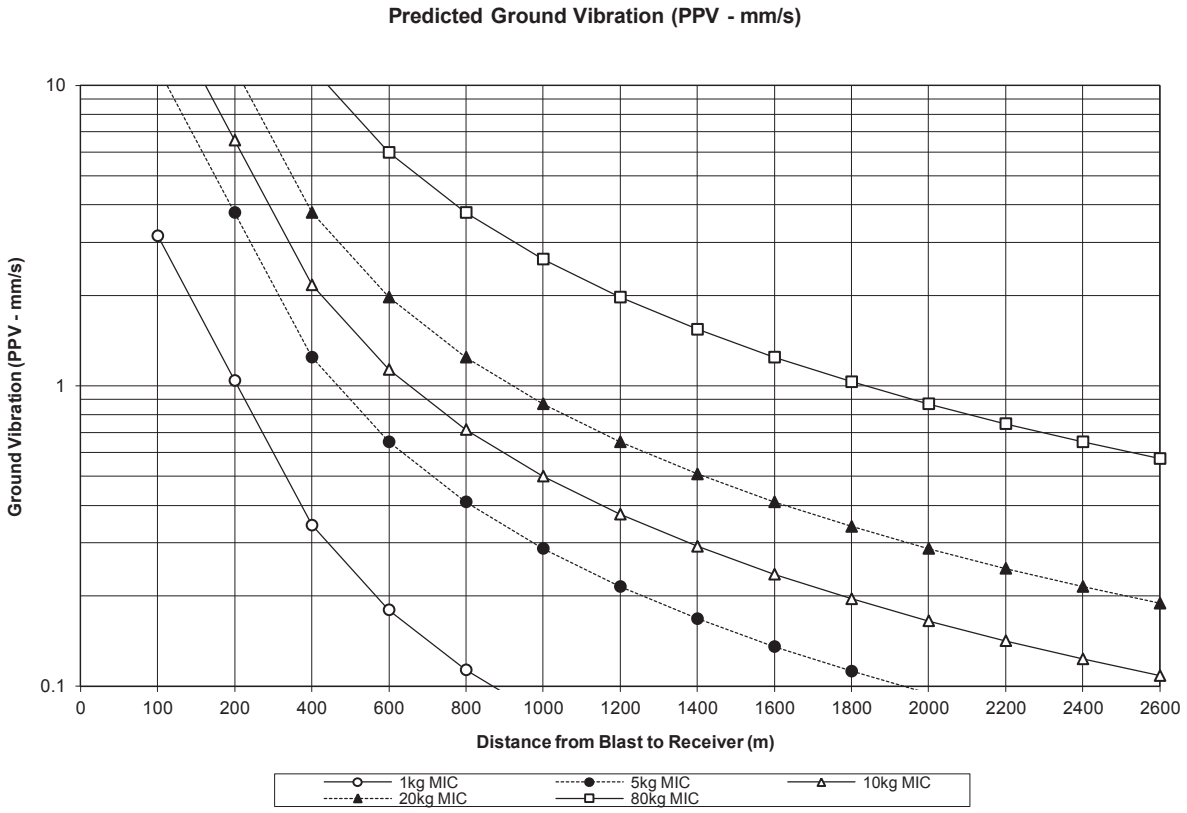
The results in *Figure 6* show that the OEH/ANZECC air-blast overpressure criteria of 115dBLin can be satisfied at the closest private receiver with the employment of controlled MIC's (1-5kg) at 200 metres. The closest private receiver being off Dakara Road, Wallarah being approximately 1000m to the south.

10.10.2 Ground Vibration Prediction Model

Ground vibration is a function of maximum instantaneous charge, the distance between receiver and blast location and ground condition. The predictive formula adopted for the peak particle velocity (PPV) assessment is based on the site law data provided in Australian Standard AS2187: Part 2 (1993). provides the predicted PPV v distance vibration levels for confined blast conditions.

The results in show that the OEH/ANZECC ground vibration criteria of 5mm/sec is satisfied at the closest private receiver with the employment of controlled MIC's (1-5kg) at 200 metres. The closest private receptor being off Dakara Road, Wallarah approximately 1000m to the south.

Figure 7: Ground Vibration v Distance



11.0 RECOMMENDATIONS

The following operational management strategies should be adopted to assist in controlling noise emissions from the Project:

- Implementation of a proactive strategy to engage predicted noise impacted residences identified in *Section 8.1* to achieve a management outcome agreed to by all parties;
- Development of a Noise Management Plan outlining a noise monitoring program. The program will include attended and continuous real time noise monitoring at strategic locations to enable evaluation of compliance with relevant criteria;
- Continuous noise monitoring will be continued at strategic off site locations to provide real time feedback to the Project. This will allow operations to be modified, as required to prevent exceedance of PSNC. Locations and trigger levels will be determined through consultation with the OEH, and will be outlined in the Noise Management Plan;
- Monitoring of real time meteorological conditions and forecasts. Operations may be modified in advance of adverse weather conditions that are reasonably expected to cause an unacceptable increase in offsite noise levels.
- Selection of quiet plant for use in construction activities. When using contractors for construction, preference will be given to contractors able to use low noise emission equipment. All construction personnel will be educated in best practice work methods to minimise noise; and
- Implementation of reasonable and feasible noise mitigation measures such as double glazing, insulation and/or air conditioning will be made available to affected landowners, upon request.

To minimise noise level creep from the trains along the MNRL where feasible and reasonable, it is recommended that locomotives approved to operate on the New South Wales rail network are selected in accordance with the noise limits L6.1 to L6.4 in RailCorp and ARTC Environmental Licences.

12.0 CONCLUSION

The WACJV proposes to develop an underground coal mine with surface processing facilities with a rail loop north of Wyong. The Project would involve the extraction of up to 5 million tonnes per annum of export quality coal.

Site attended background monitoring confirmed that the local acoustic environments at residential properties in the vicinity of the Project are controlled by road traffic noise, natural elements and local domestic activities. Traffic noise exposure for individual properties is dependent on location and exposure to the F3 Freeway (Sydney to Newcastle), Motorway Link Road, Hue Hue Road or Bushells Ridge Road.

12.1 Operational Noise

The main operational noise sources at the Tooheys Road Site are associated with infrastructure and include conveyors, crusher, train loading with locomotives on the rail loop and spur line and mobile plant. Plant at the Buttonderry Site includes ventilation fans and the mine winding building. It is not proposed to install any fixed plant at the Western Ventilation Shaft that would exceed PSNC.

From the measured existing ambient noise levels *(Table 2)* and INP procedures, *Table 11* presents a summary of the assessment RBL's, the L_{Aeq} noise levels and PSNC.

Noise modelling for the Project assumed that the fixed and mobile plant was operating simultaneously together with train loading. *Table 20* and *Table 21* present a summary of the predicted noise levels at the reference assessment locations for each meteorological scenario.

The noise modelling for the existing private residential dwellings exposed to the Tooheys Road Site and Buttonderry Site show that the PSNC are satisfied Noise levels predicted at Blue Haven Estate and the proposed Warnervale Town Centre are less than 35dBA under adverse wind and temperature inversion conditions.

The noise contour plots in the *Attachments 5 to 12* show that for private receivers identified as Receiver 56 (The Commissioner for Main Roads), Receiver 57 (K. R. Drake) Receiver 58 (K. L. Norman) and Receiver 152 (Roads and Traffic Authority of NSW) *(Figure 5)* predicted noise levels exceed the PNSC for more than 25% of the land. Of these Receiver 57 and Receiver 58 are privately owned. Noise modelling for the Buttonderry site shows that the PSNC *(Table 11)* are not predicted to be exceeded at any private residential receiver or more than 25% of their land.

12.2 Operational Road Traffic Noise

The predicted $L_{Aeq\ 1\ hour}$ road traffic noise levels for the Tooheys Road (Bushells Ridge Road) and Buttonderry sites (Hue Hue Road) during the operational phase satisfy the daytime 60dBA and nighttime 55dBA PSNC at setback distances of 10 metres and 30 metres, respectively. Passby L_{Amax} noise levels from cars at 30 metres are predicted to be in the order 64-65dBA. Existing dwellings constructed along Hue Hue Road between Bushells Ridge Road and Sparks Road are set back approximately 200 - 250 metres. Existing dwellings constructed along Bushells Ridge Road are set back approximately 20 - 60 metres.

12.3 Rail Traffic Noise

Noise modelling for peak annual production output of 5 million tonne per year shows that the additional rail traffic would marginally increase (1-2dBA) the existing $L_{Aeq,\ 24\ hour}$ rail traffic noise levels on the MNRL. With respect to the LAmax noise levels the Project is not expected to increase the existing levels.

12.4 Construction Noise and Vibration

An indicative construction plan and method is outlined in this report for the civil and construction works associated with the surface infrastructure.

Noise from the construction activities was modelled with the ENM computer model. *Attachment 13* presents the Tooheys Road and Buttonderry noise contour plots for a worst case scenario for earth works. The predicted levels show that construction noise impacts have the potential to exceed the PSNC at the closest residences on Amberwood Close (Project-owned residences). The predicted noise levels of 50-55dBA exceed the daytime PSNC of 46dBA by 4-9dBA. To minimise noise impacts during construction preference will be given to contractors able to use low noise emission equipment and all site personnel will be inducted and educated with best practice work methods to minimise noise. A Construction Noise and Vibration Management Plan and Monitoring Programme will be implemented.

The main source of ground vibration that has been identified and assessed is associated with dynamic impact rollers. Ground vibration levels predicted from dynamic impact rollers typically range between 2-4mm/sec at 20 metres, and below 1.5mm/sec at 40 metres. Vibration levels are predicted to satisfy the structural damage assessment criteria *(Table 33*) at distances greater than 20 metres and acceptable from a human disturbance point of view at the nearest private receivers on the corner of Tooheys Road and Bushells Ridge Road, Kiar Ridge Road (Tooheys Road Site), Sandra Street and Amberwood Close, Jilliby (Buttonderry Site).

If blasting is required, modelling has shown that the ground vibration goal and air blast over pressure can be satisfied with the employment of controlled MIC's.

ATTACHMENT 1: DIRECTORS GENERALS REQUIREMENTS

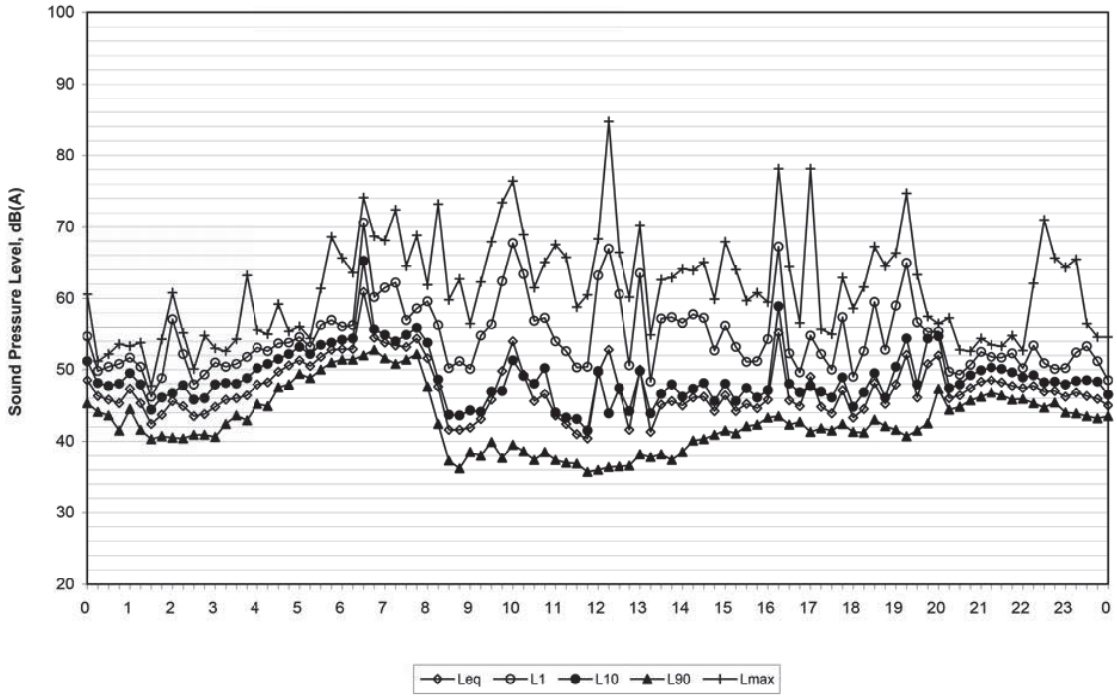
Ref	Issue	Sections of Report
DEPARTMENT OF PLANNING & INFRASTRUCTURE – KEY ISSUES		
14	Noise - including a quantitative assessment of potential: • construction, operational and transport noise impacts; • offsite road noise impacts; and • reasonable and feasible mitigation measures, including evidence that there are no such measures available other than those proposed; and - monitoring and management measures, in particular real-time and attended noise monitoring;	7, 8, 10 8.3 2
TRANSPORT FOR NSW - NOISE AND VIBRATION		
35	Quantitative assessments of the potential construction, operation, and off-site road noise impacts of the project on existing and proposed development in the vicinity of the site, including the proposed Warnervale Town Centre and the Wyong Employment Zone	3, 7, 8, 8.1, 10
36	Quantitative assessments of the potential construction, operation, and off-site rail noise impacts including noise and vibration from rail track and rail rolling stock, including an indication of rolling types and steps to mitigate wheel/rail interface noise.	7, 7.3, 8, 8.4, 10
OFFICE OF ENVIRONMENT & HERITAGE – ENVIRONMENTAL IMPACTS OF THE PROJECT		
206	1. In relation to noise the following matters should be addressed (where relevant) as part of the EIS General 2. Construction noise associated with the proposed development should be assessed using the *Interim Construction Noise Guideline* (DECC. 2009) http://www.environment.nsw.gov.au/noise/constructnoise.htm	10.5
207	3. Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in the *Assessing Vibration: a technical guideline* (OEC, 2006). http://www.environment.nsw.gov.au/noise/vibrationguide.htm	10.6.1
208	4. If blasting is required for any reasons during the construction or operational stage of the proposed development, blast impacts should be demonstrated to be capable of complying with the guidelines contained in *Australian and New Zealand Environment Council- Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration* (ANZECC, 1990). http://www.environment.nsw.gov.au/noise/blasting.htm	10.11
209	Industry 5. Operational noise from all industrial activities (including private haul roads and private railway lines) to be undertaken on the premises should be assessed using the guidelines contained in the *NSW Industrial Noise Policy* (EPA. 2000) and *Industrial Noise Policy Application Notes.* http://www.environment.nsw.gov.au/noise/industrial.htm	5.1

Ref	Issue	Sections of Report
210	Road 6. Noise on public roads from increased road traffic generated by land use developments should be assessed using the guidelines contained in the Environmental *Criteria for Road Traffic Noise* (EPA, 1999). http://www.environment.nsw.gov.au/noise/traffic.htm	5.5
211	7. Noise from new or upgraded public roads should be assessed using the *Environmental Criteria for Road Traffic Noise* (EPA, 1999). http://www.environment.nsw.gov.au/noise/traffic.htm	5.5
212	Railway Noise from increased rail traffic on the NSW Rail Network resulting from rail traffic generating development (e.g. an extractive industry) should be assessed using the environmental assessment requirements for rail traffic-generating developments available at http://www.environment.nsw.gov.au/noise/railnoise.htm	5.6
WYONG SHIRE COUNCIL – ACOUSTIC AND VIBRATION		
270	Issues: There is significant potential for the generation of noise and vibration arising from construction, operation and coal transport. • This is occurring in a quiet rural setting. • Potential for noise impacts on local fauna. • Potential for vibration impacts on local fauna. What is needed: • Detailed acoustic and vibration modelling including the impacts of the construction and operation of the additional rail line. • A dilapidation report for all structures in the area of mining operations, infrastructure and the rail link. • Mitigation measures proposed. • Extensive baseline data. Monitoring for the duration of the project.	8.1,8.2, 8.3, 8.4 N/A 2.2, 3.1.1 4.2

ATTACHMENT 2: MEASURED AMBIENT NOISE LEVELS

Ambient Sound Pressure Levels

Friday 10 November 2006



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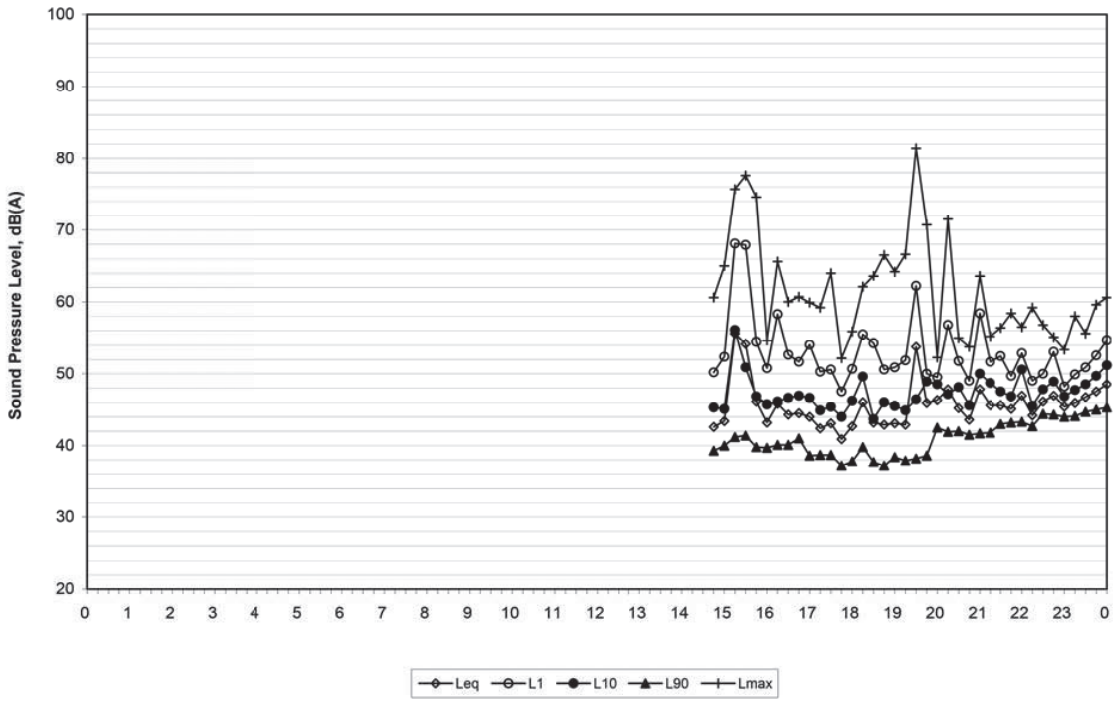
Ambient Sound Pressure Levels

Thursday 09 November 2006



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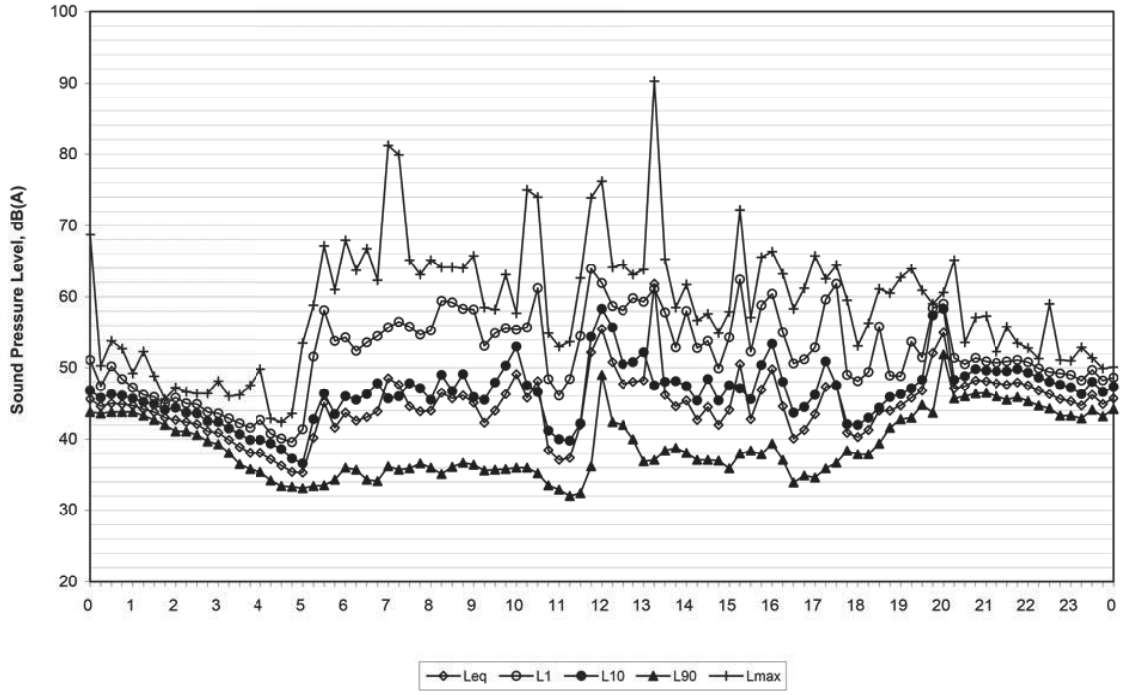
Ambient Sound Pressure Levels

Sunday 12 November 2006



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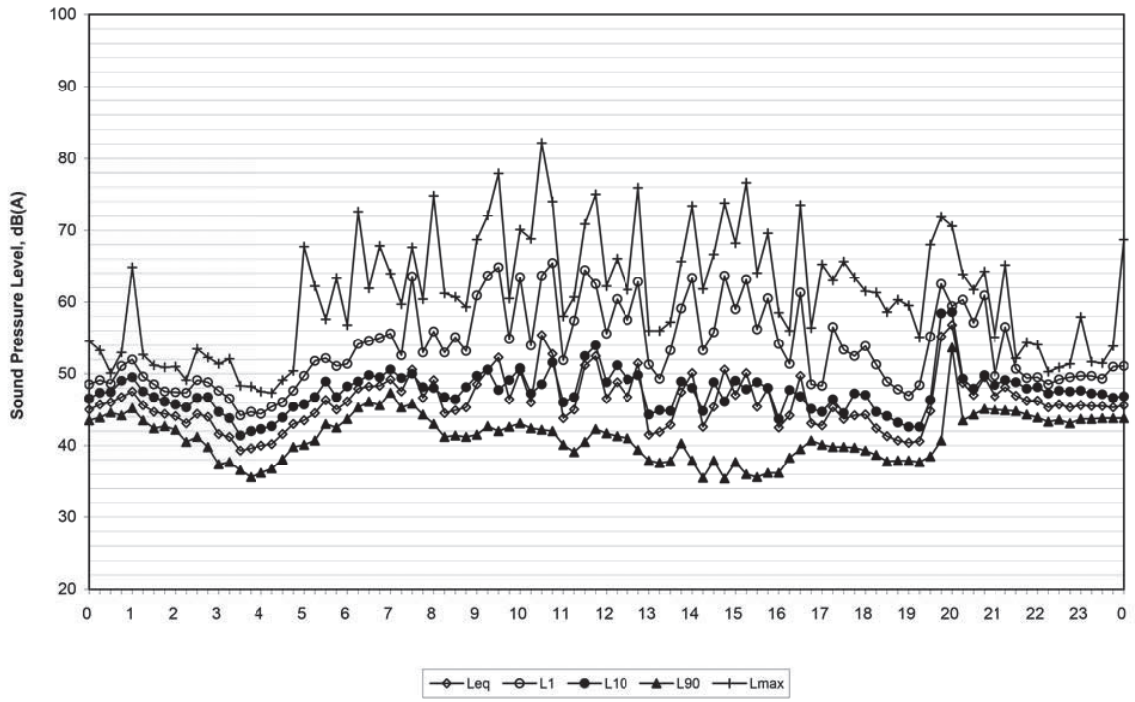
Ambient Sound Pressure Levels

Saturday 11 November 2006



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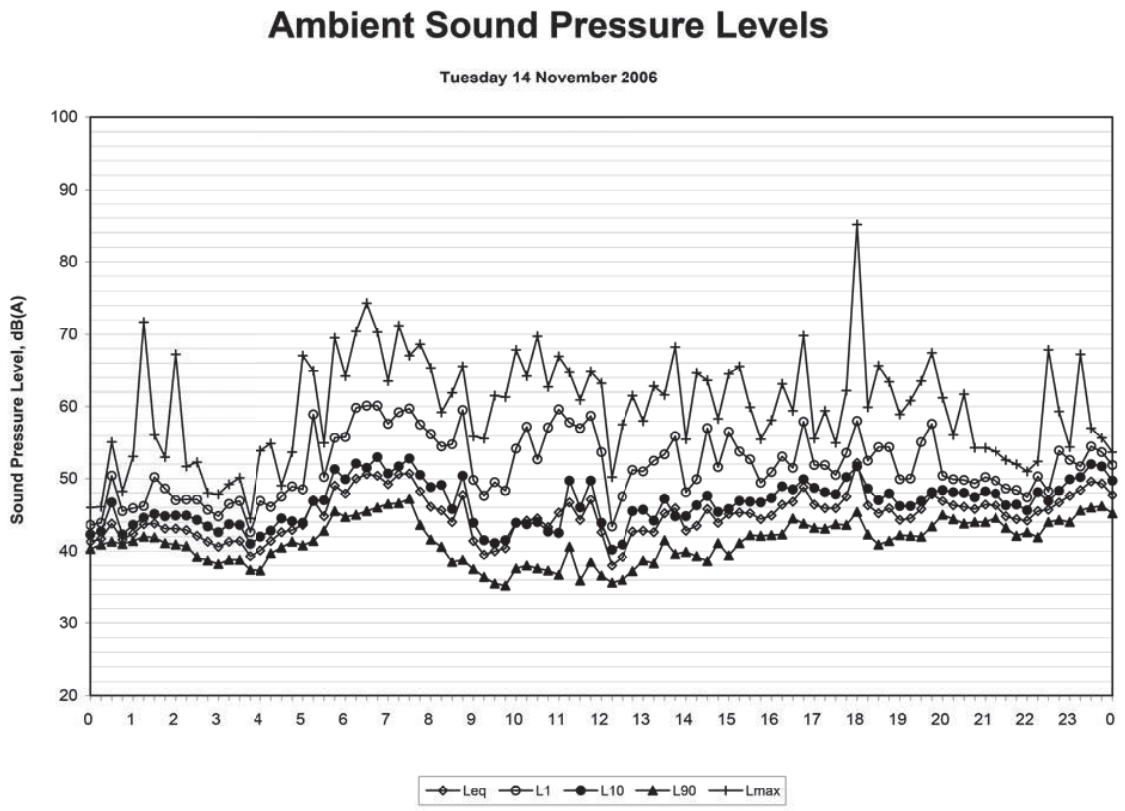

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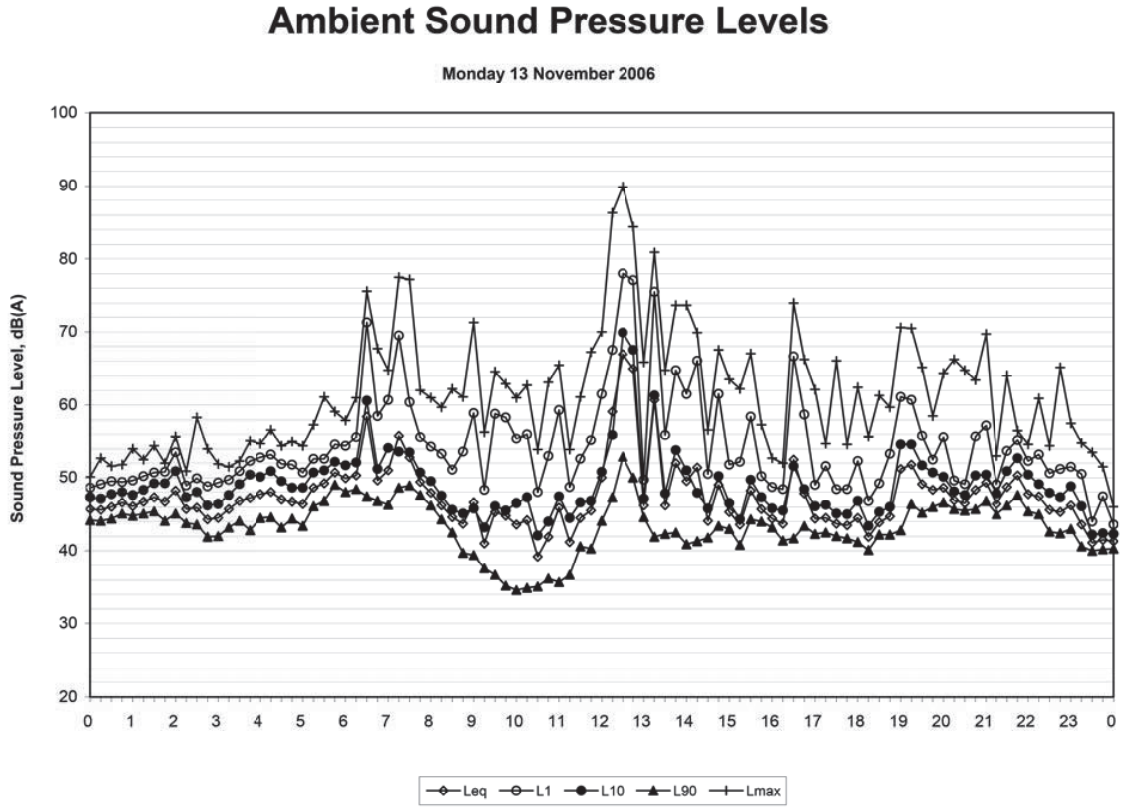

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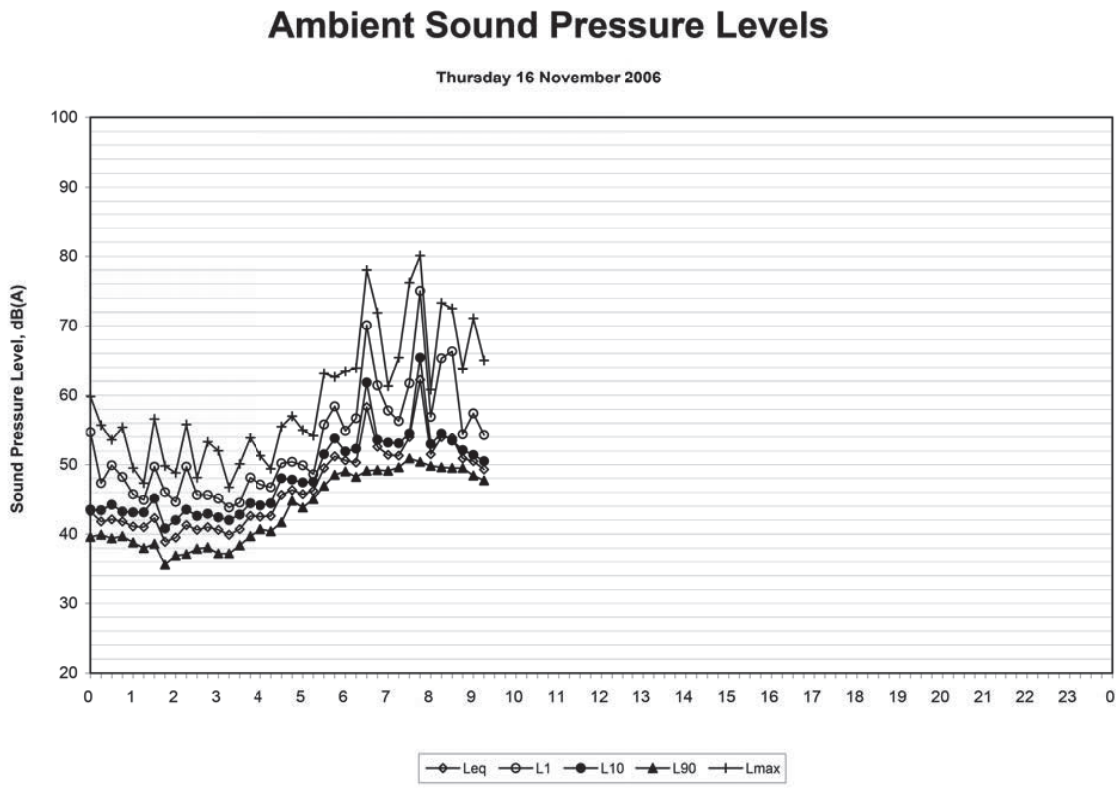

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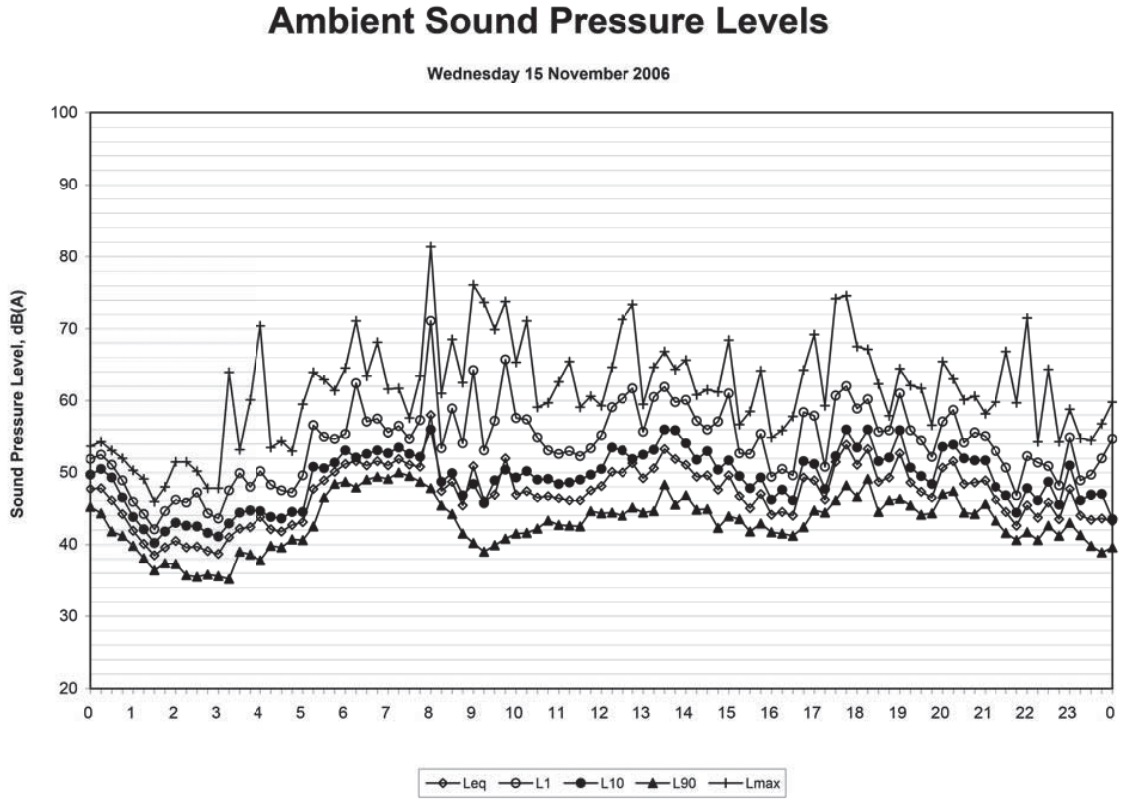

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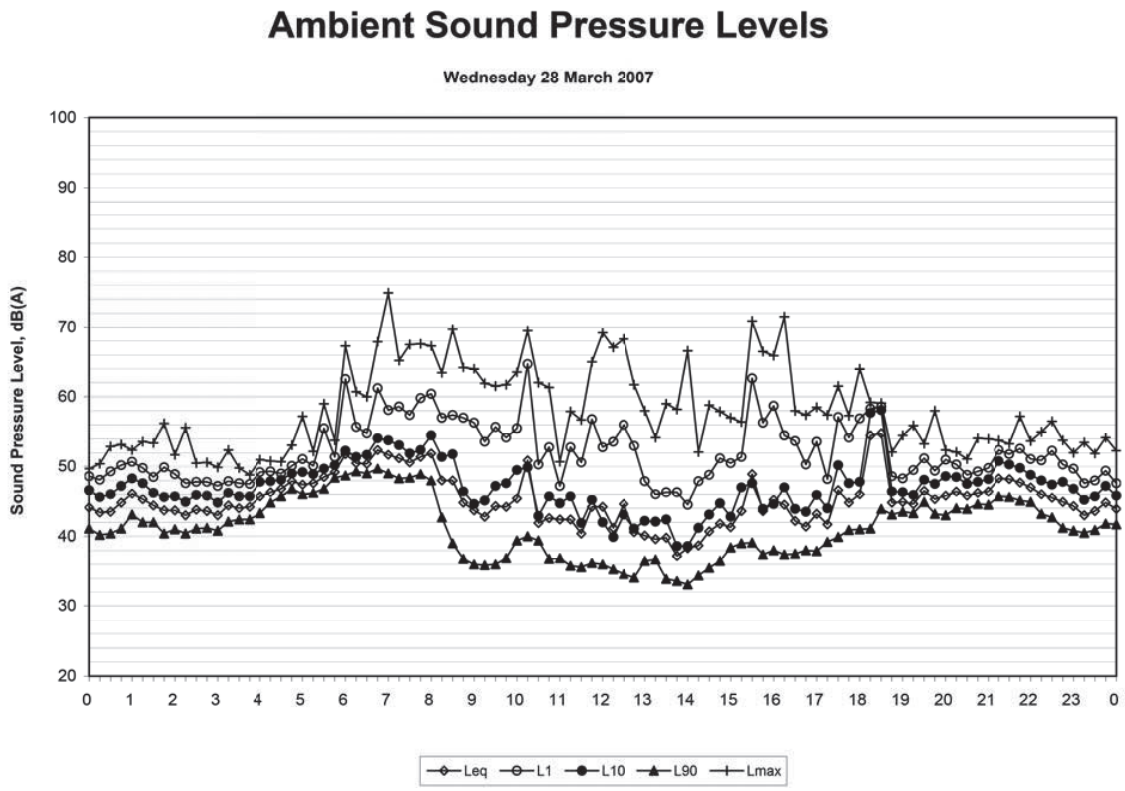

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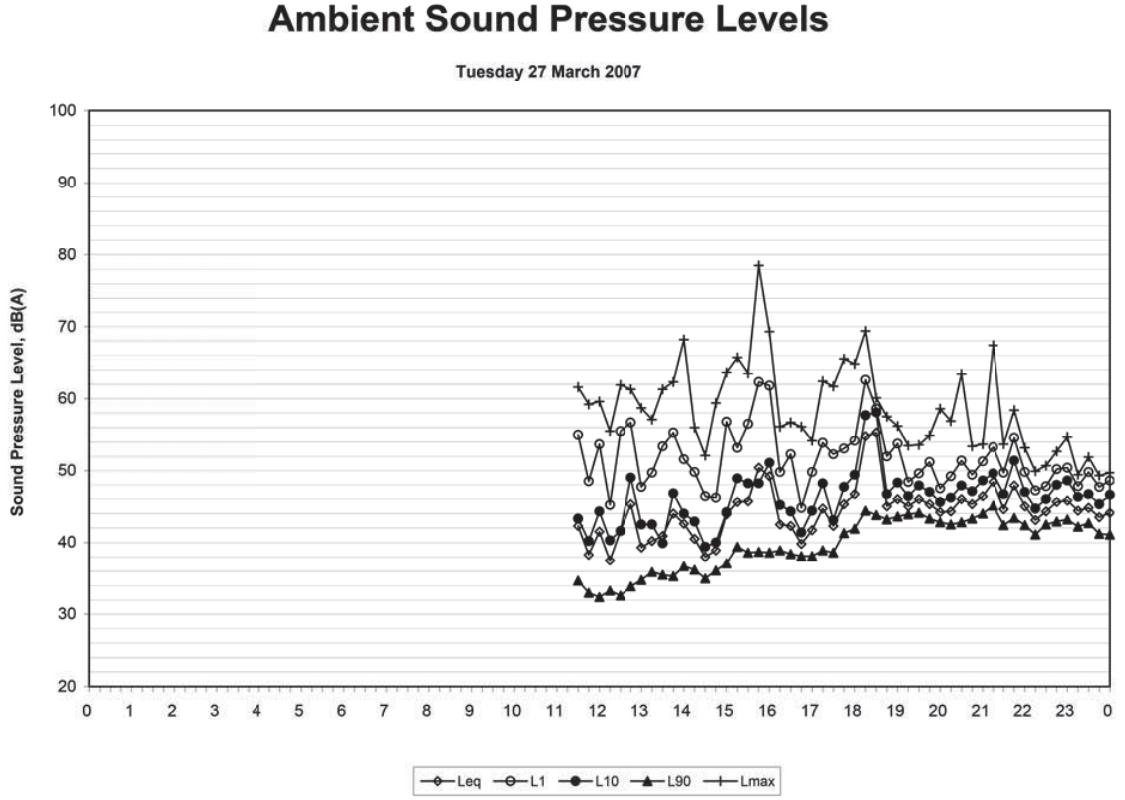

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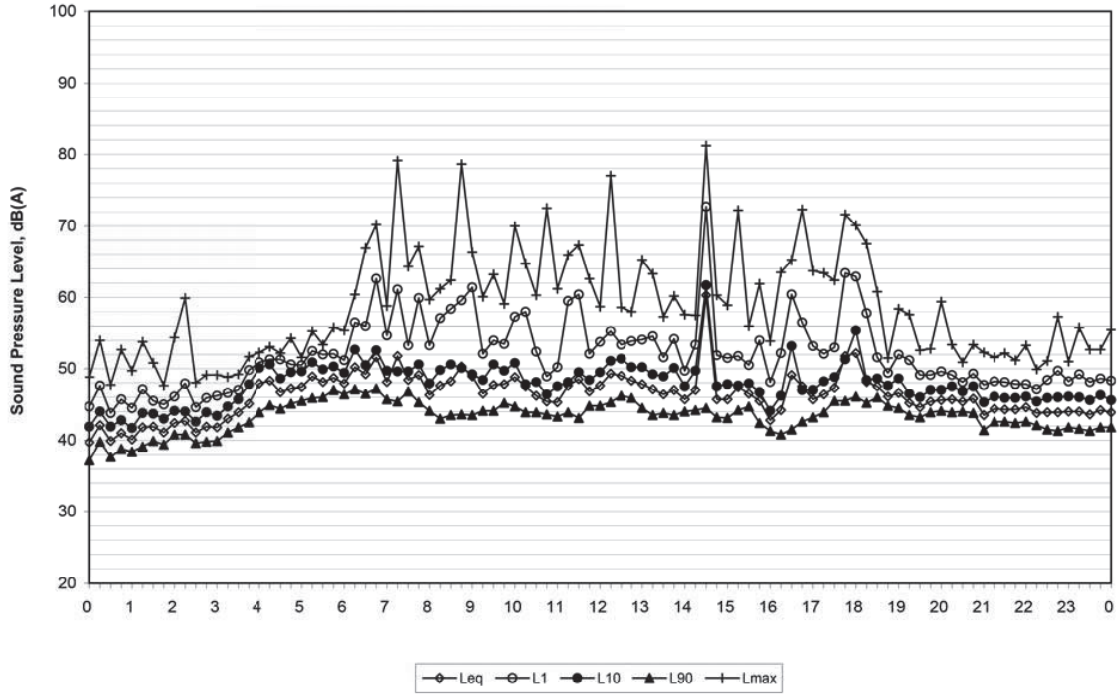
Ambient Sound Pressure Levels

Friday 30 March 2007



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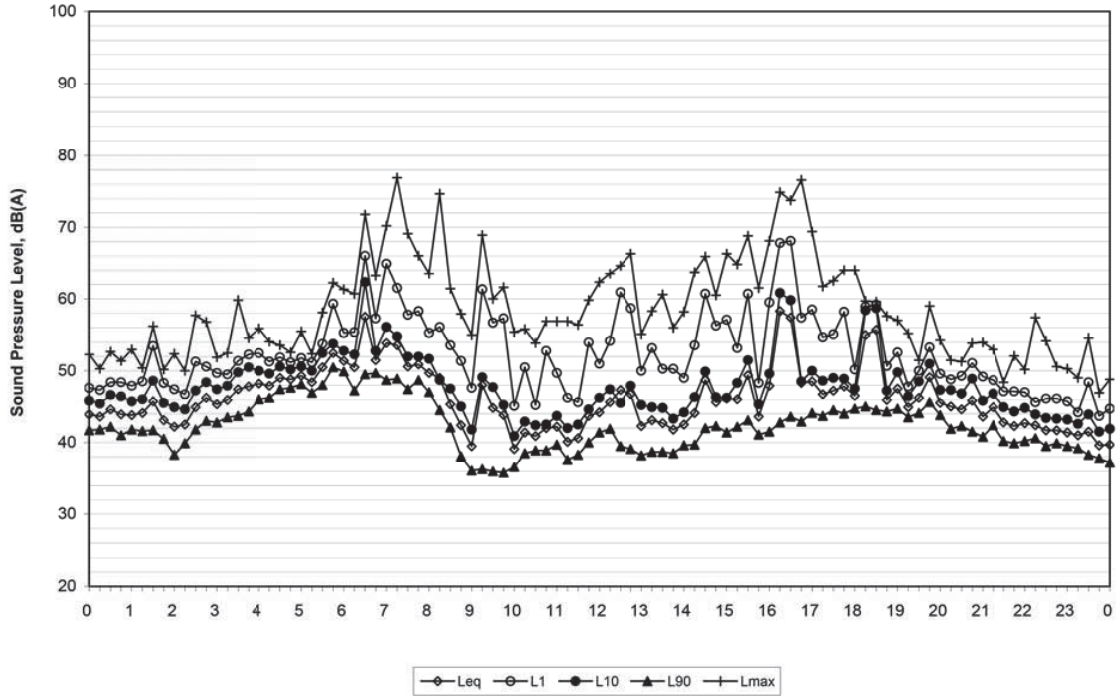

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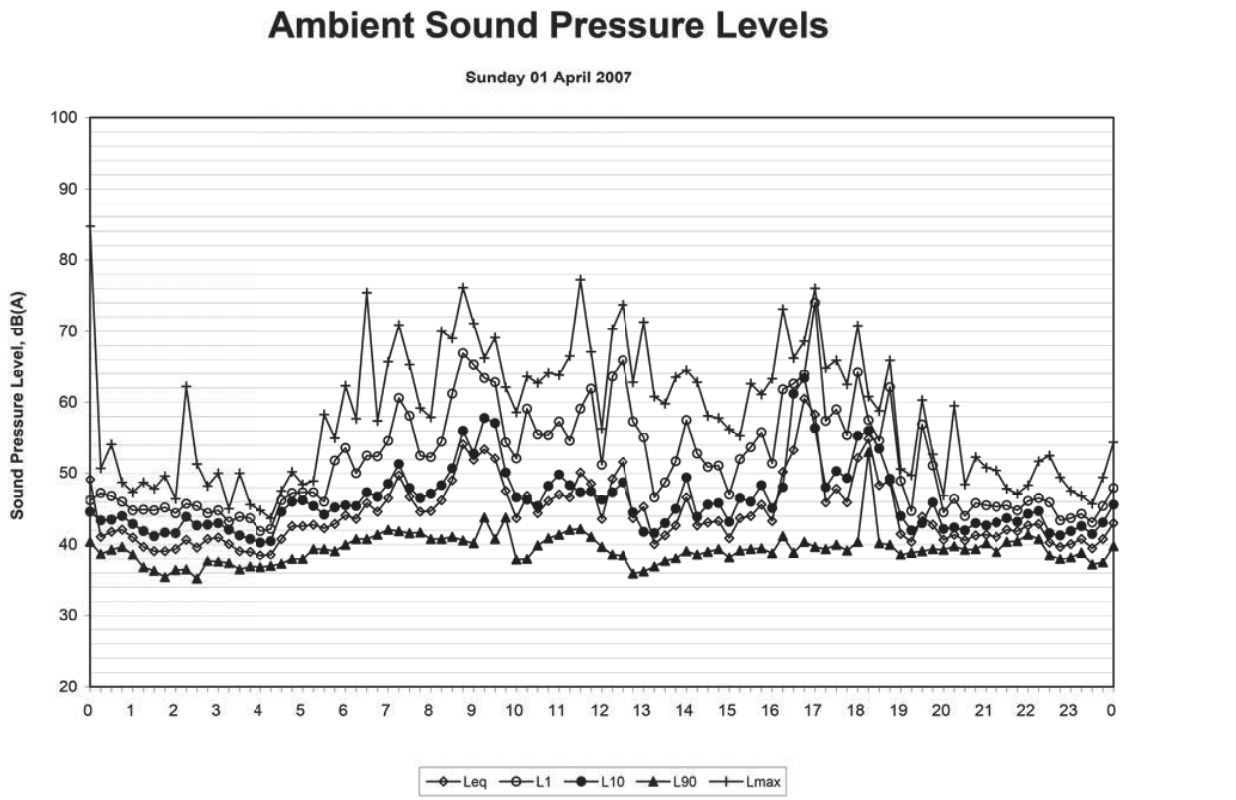

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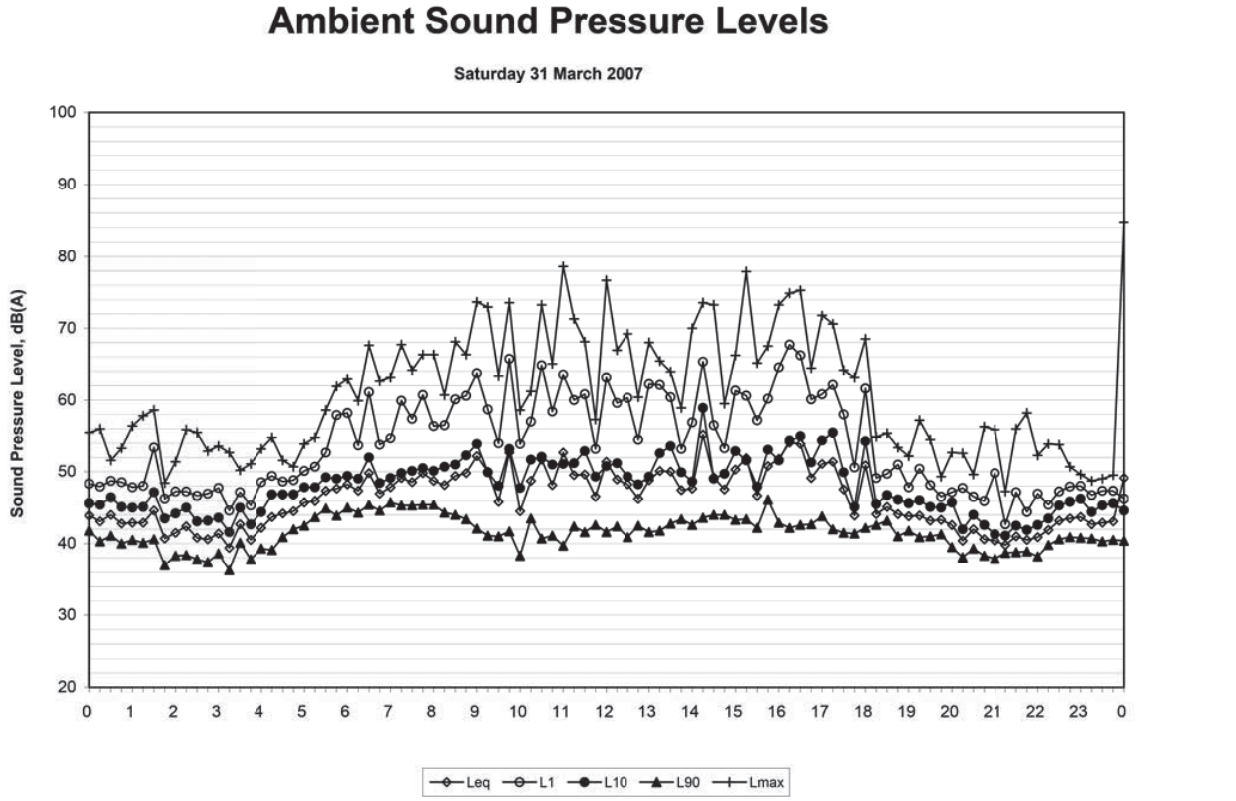

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Ambient Sound Pressure Levels

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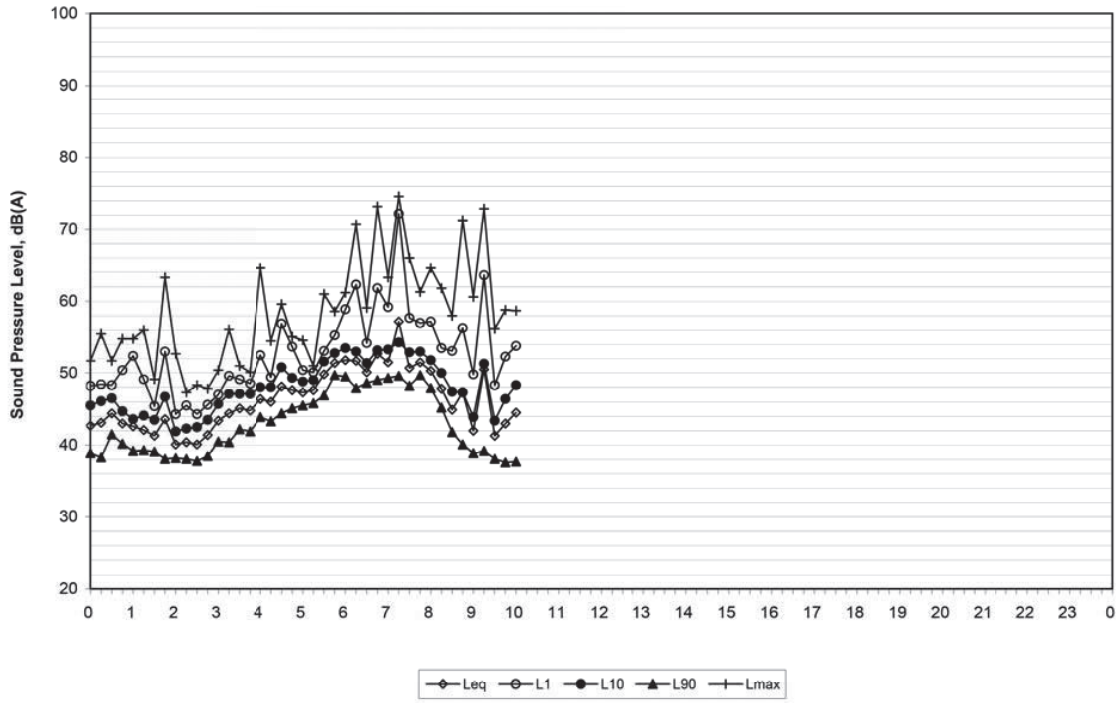

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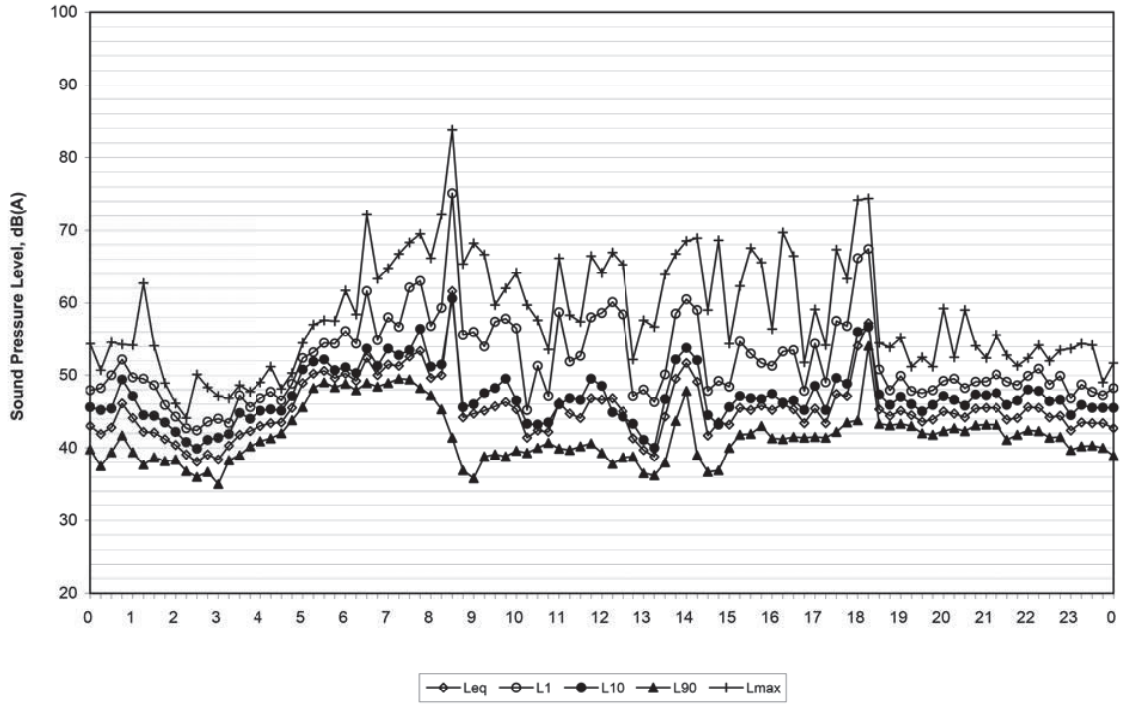

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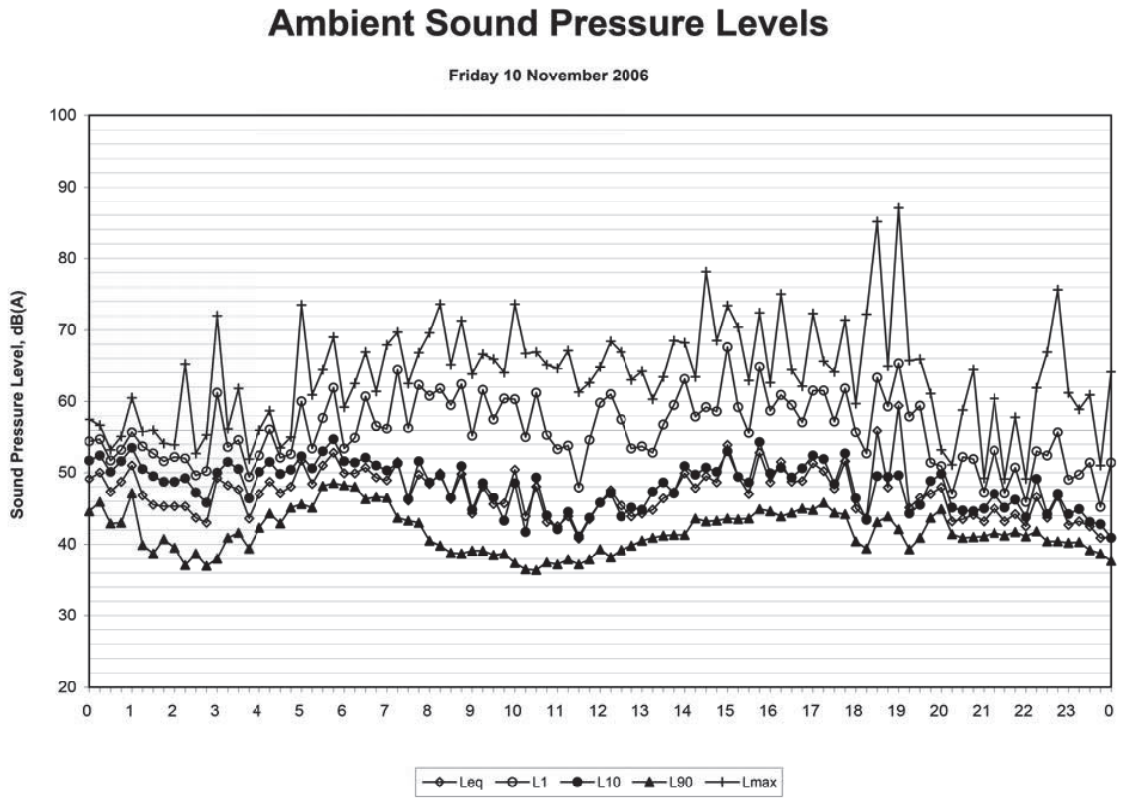

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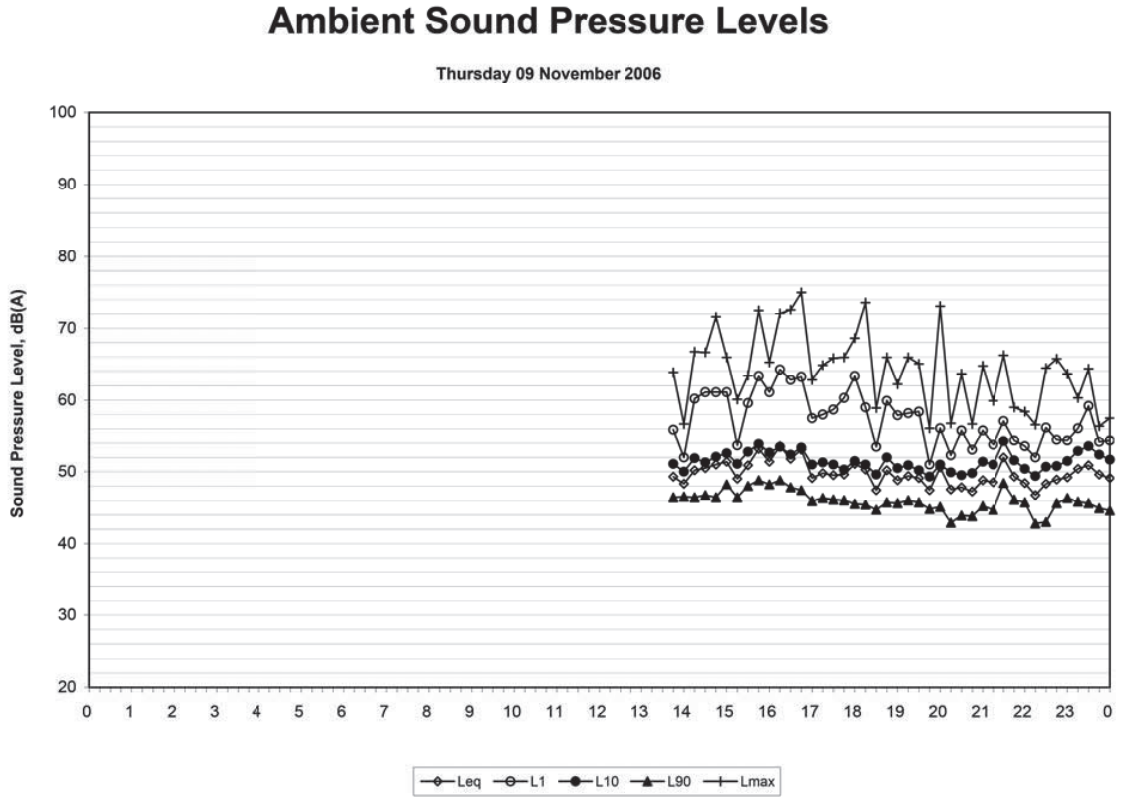

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Ambient Sound Pressure Levels

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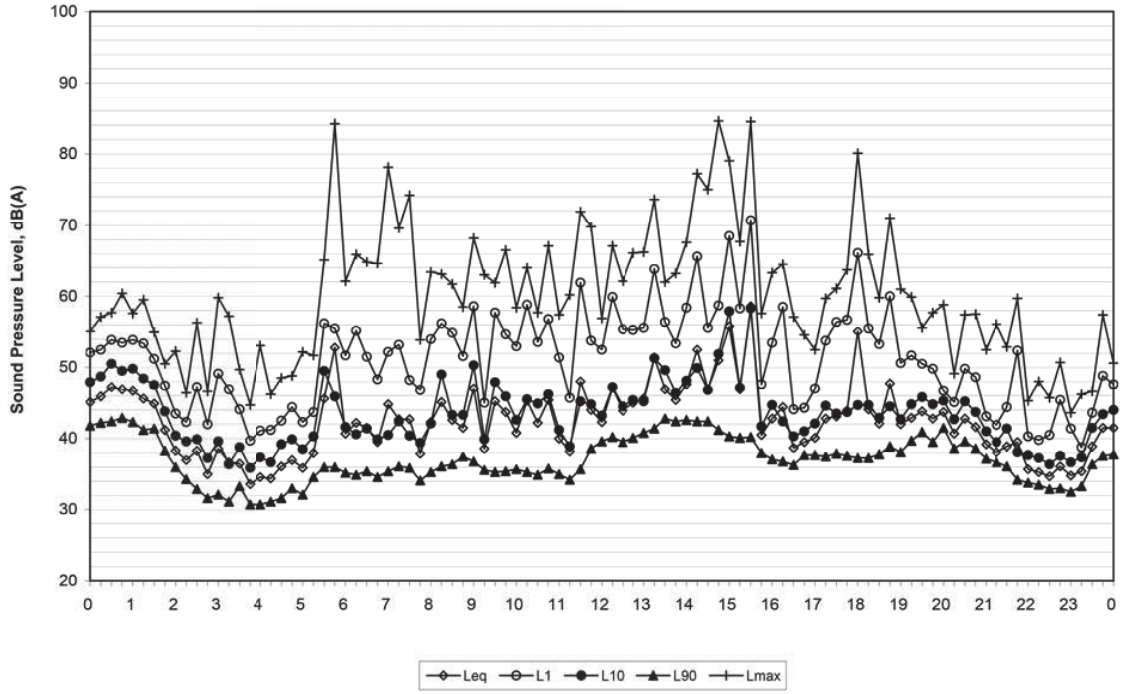

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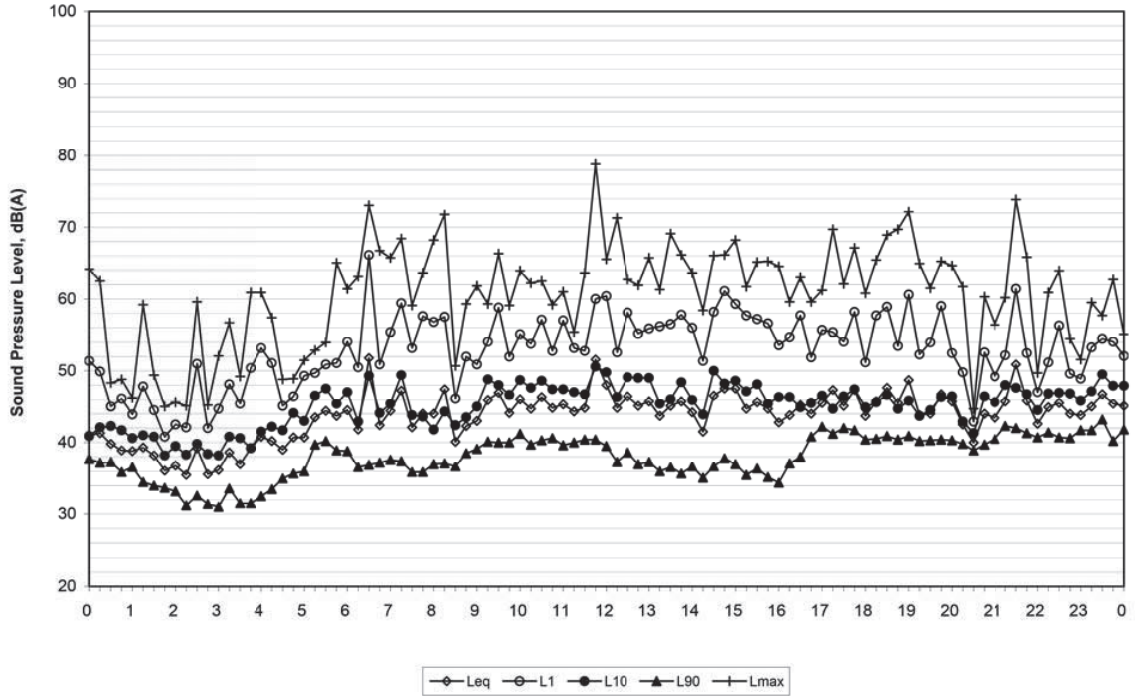
Ambient Sound Pressure Levels

Saturday 11 November 2006



Reference Location M2
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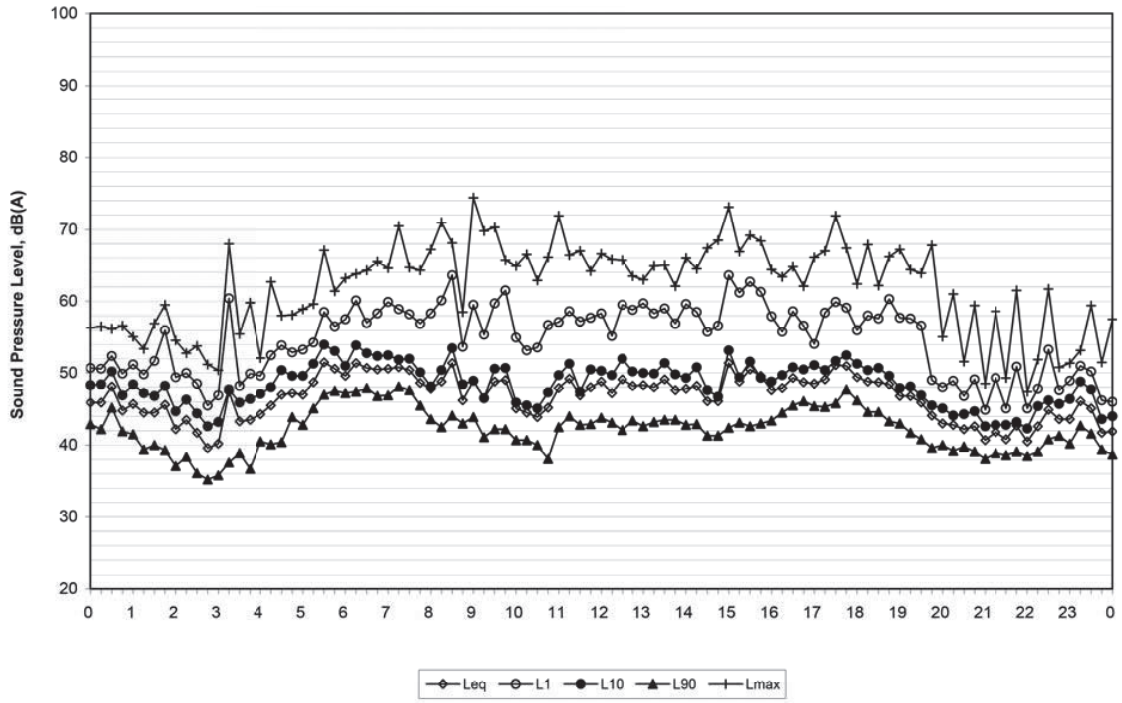
5987R2.xls

Ambient Sound Pressure Levels

Tuesday 14 November 2006

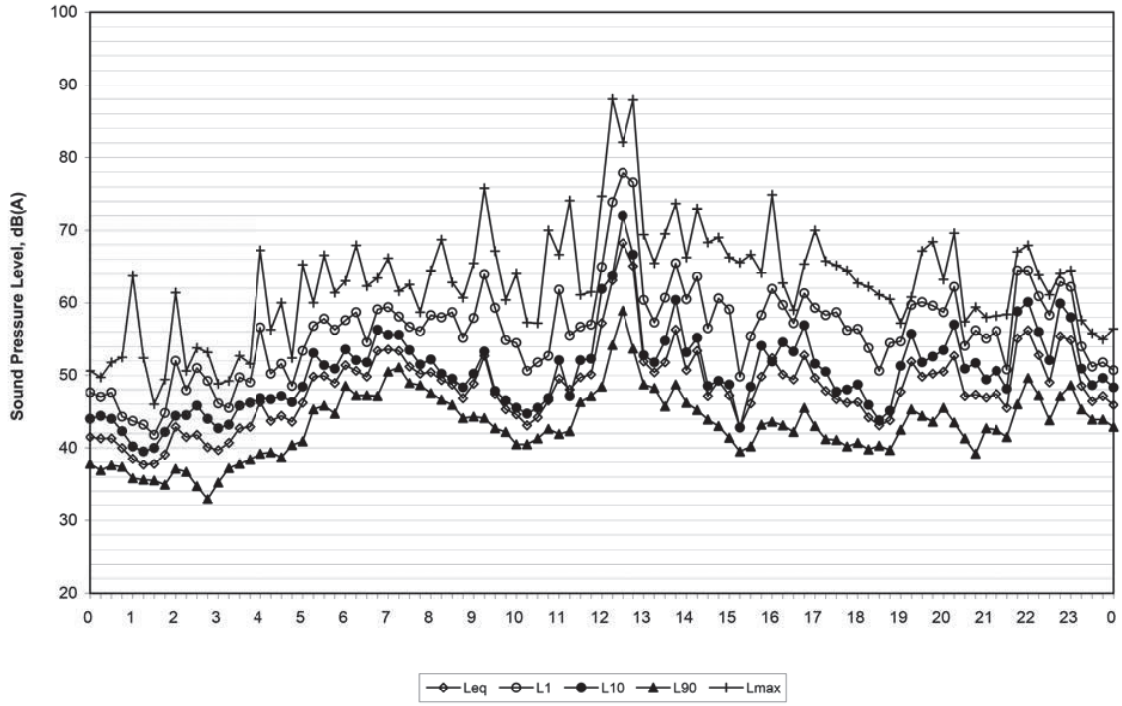


Reference Location M2
118 Bushells Ridge Road

5987R2.xls

Ambient Sound Pressure Levels

Monday 13 November 2006

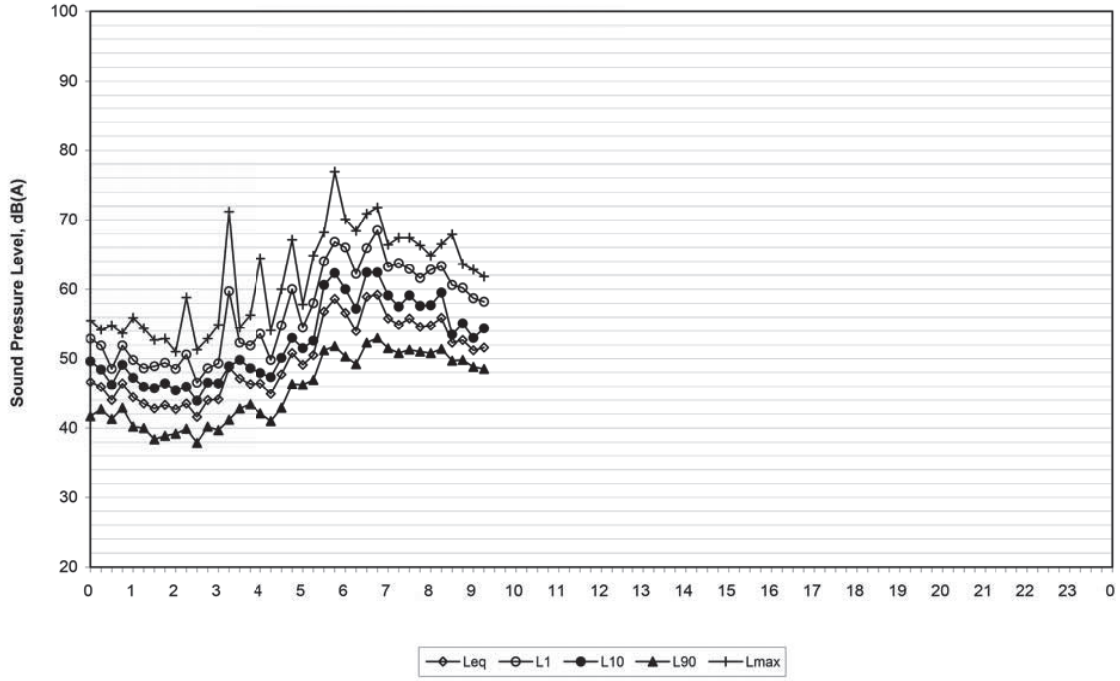


Reference Location M2
118 Bushells Ridge Road

5987R2.xls

Ambient Sound Pressure Levels

Thursday 16 November 2006

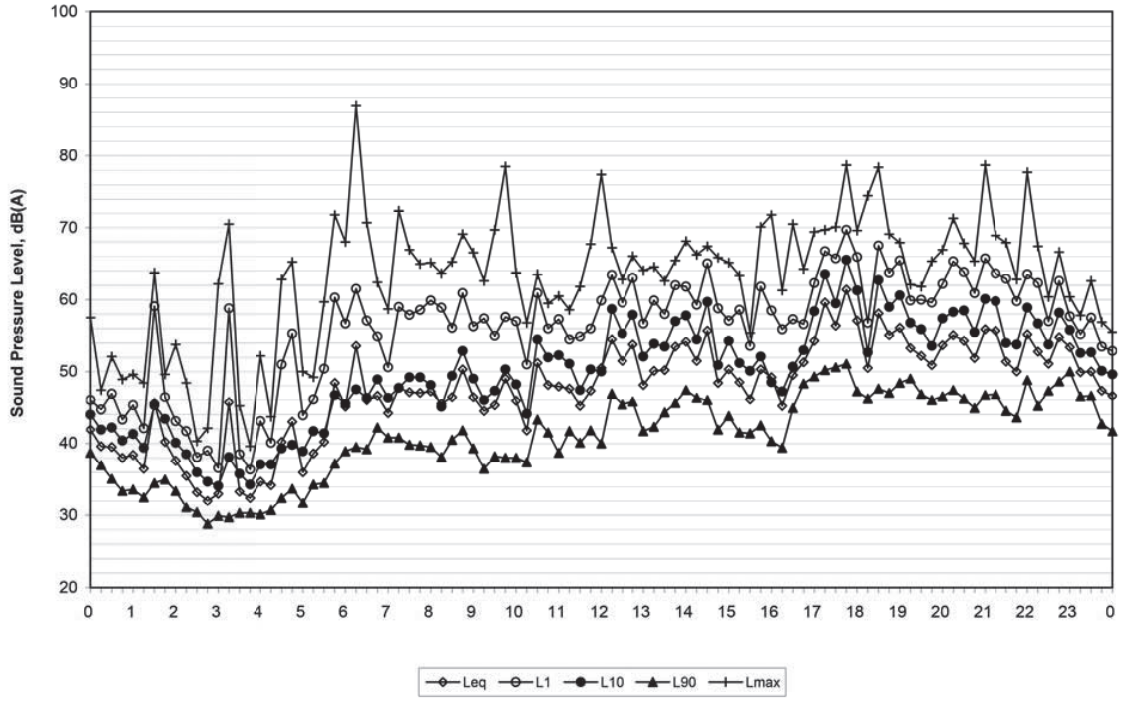


Reference Location M2
118 Bushells Ridge Road

5987R2.xls

Ambient Sound Pressure Levels

Wednesday 15 November 2006

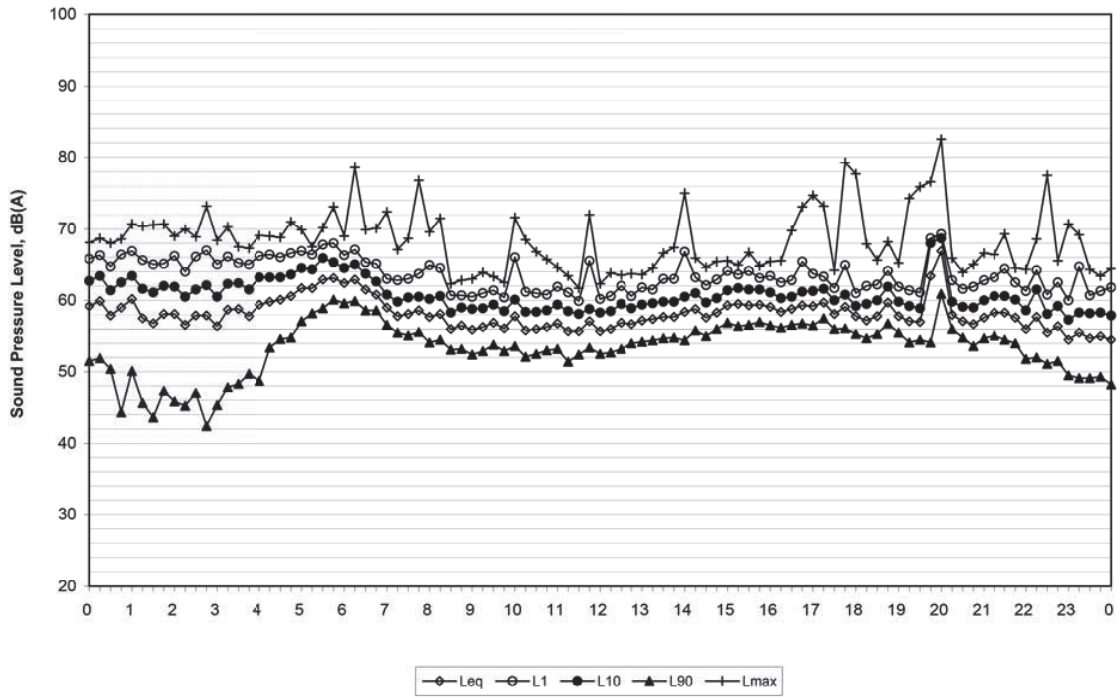


Reference Location M2
118 Bushells Ridge Road

5987R2.xls

Ambient Sound Pressure Levels

Friday 10 November 2006

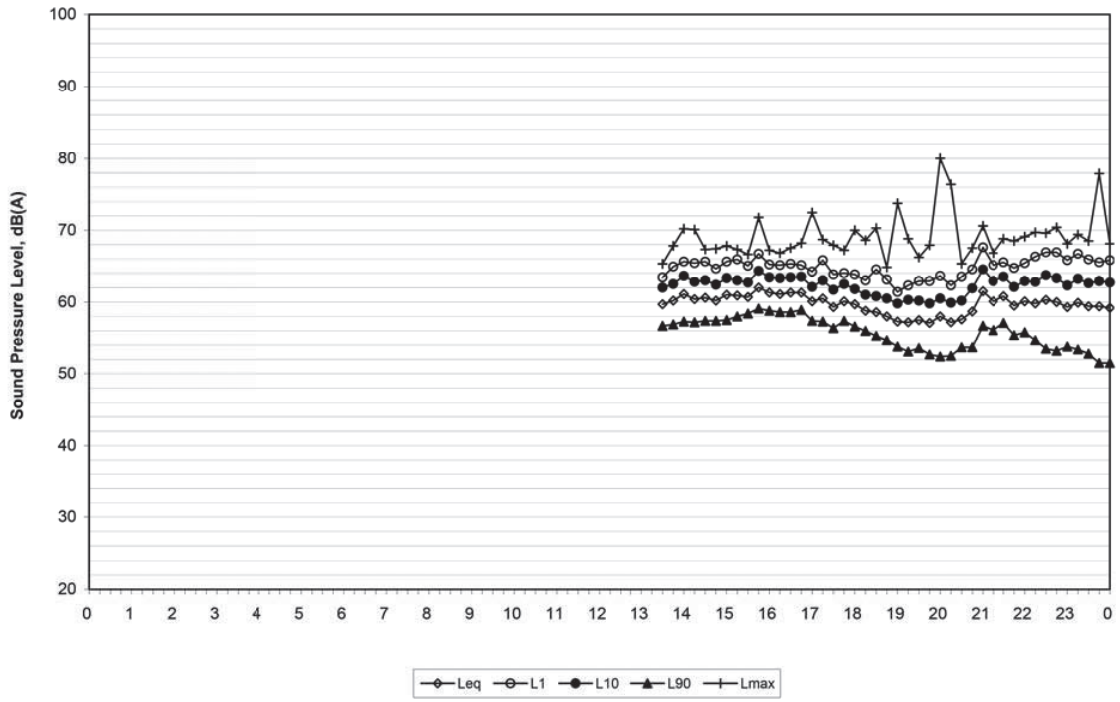


Reference Location M3
235 Bushells Ridge Road

5987R3.xls

Ambient Sound Pressure Levels

Thursday 09 November 2006

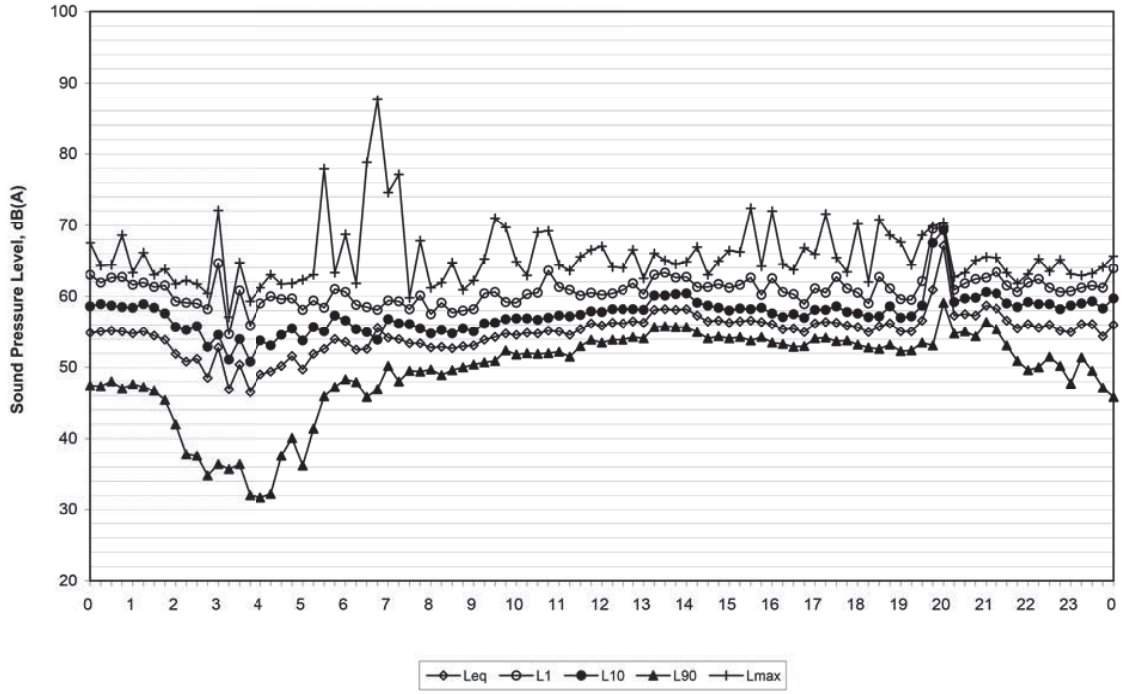


Reference Location M3
235 Bushells Ridge Road

5987R3.xls

Ambient Sound Pressure Levels

Sunday 12 November 2006

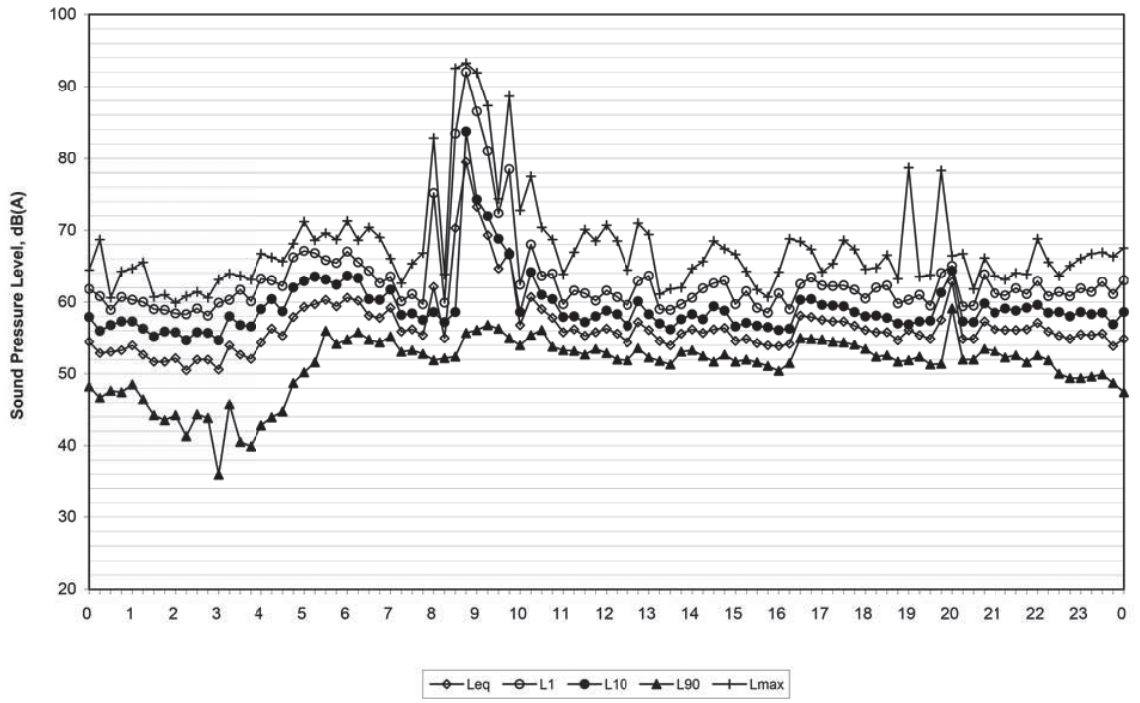


Reference Location M3
235 Bushells Ridge Road

5987R3.xls

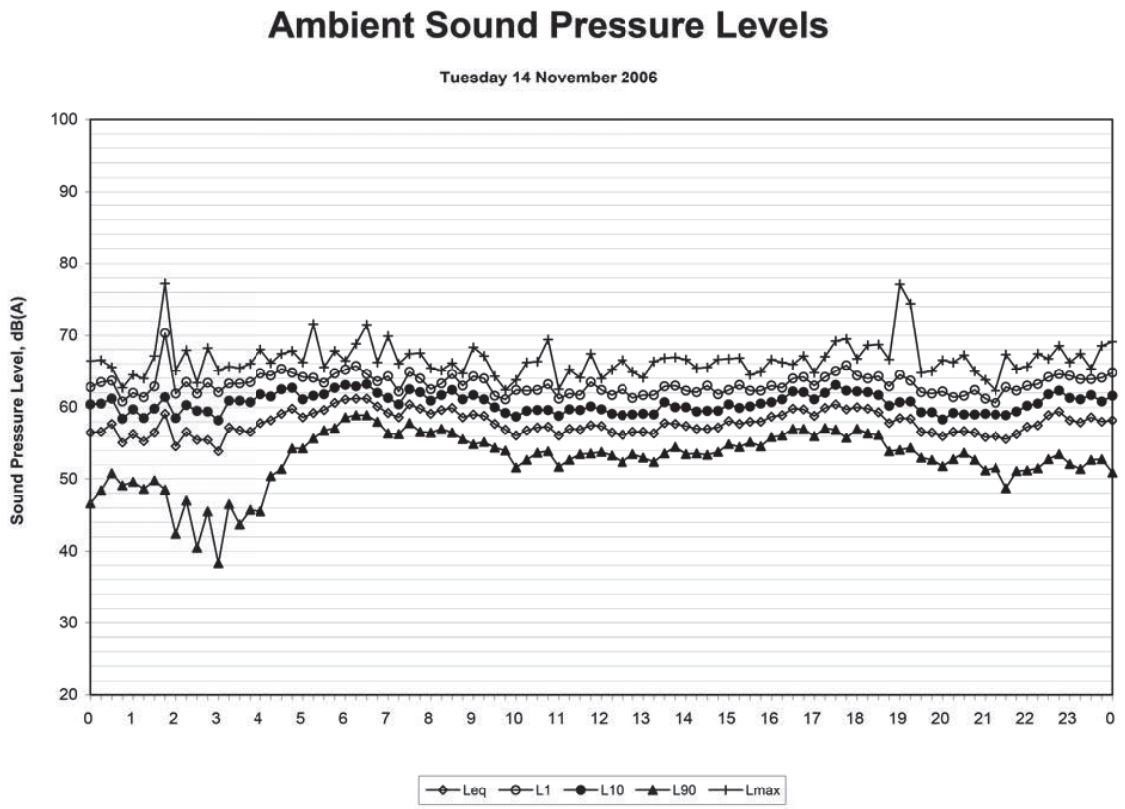
Ambient Sound Pressure Levels

Saturday 11 November 2006



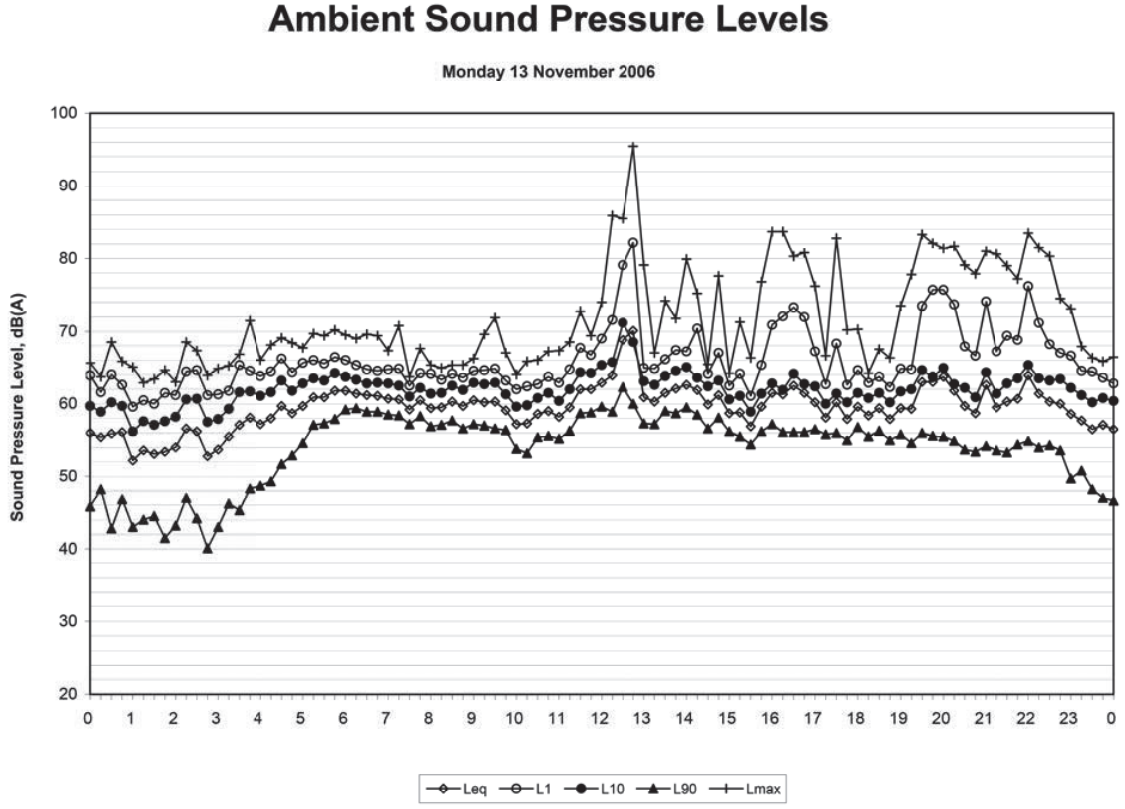
Reference Location M3
235 Bushells Ridge Road

5987R3.xls



Reference Location M3
235 Bushells Ridge Road

5987R3.xls

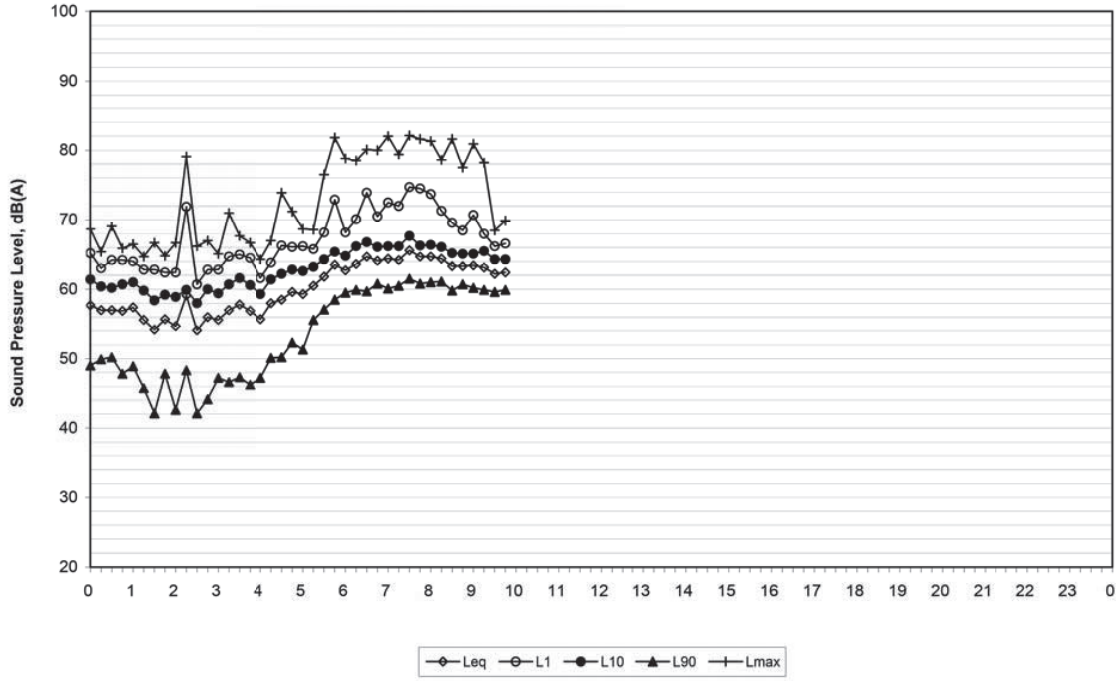


Reference Location M3
235 Bushells Ridge Road

5987R3.xls

Ambient Sound Pressure Levels

Thursday 16 November 2006

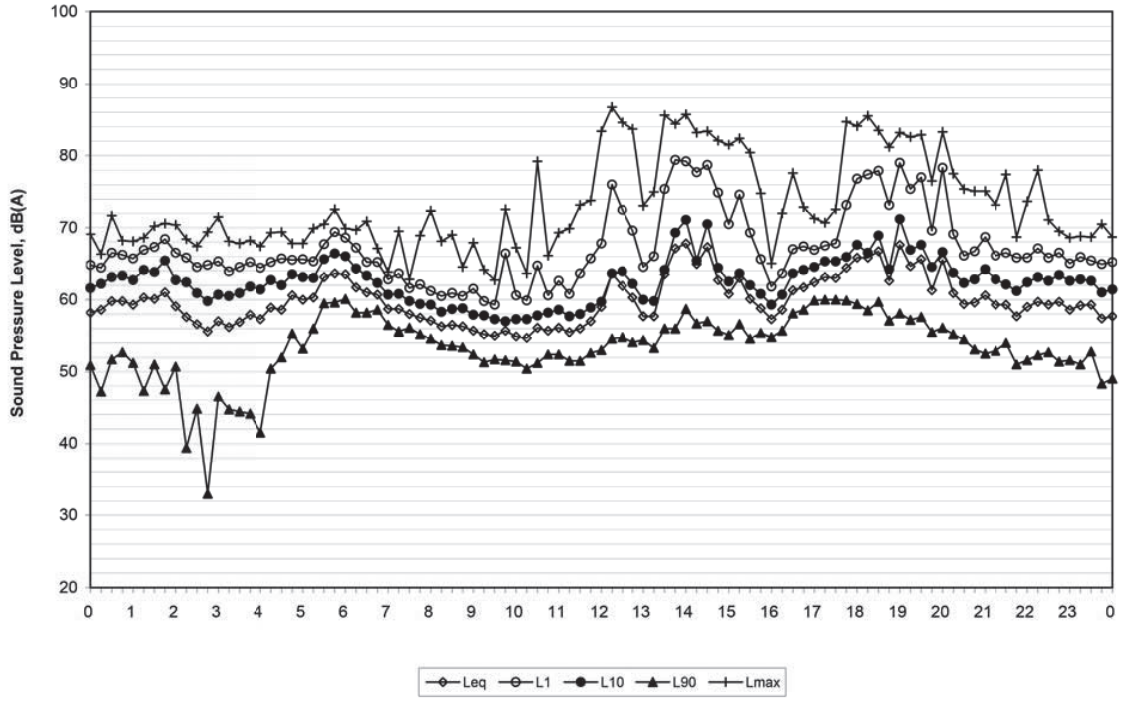


Reference Location M3
235 Bushells Ridge Road

5987R3.xls

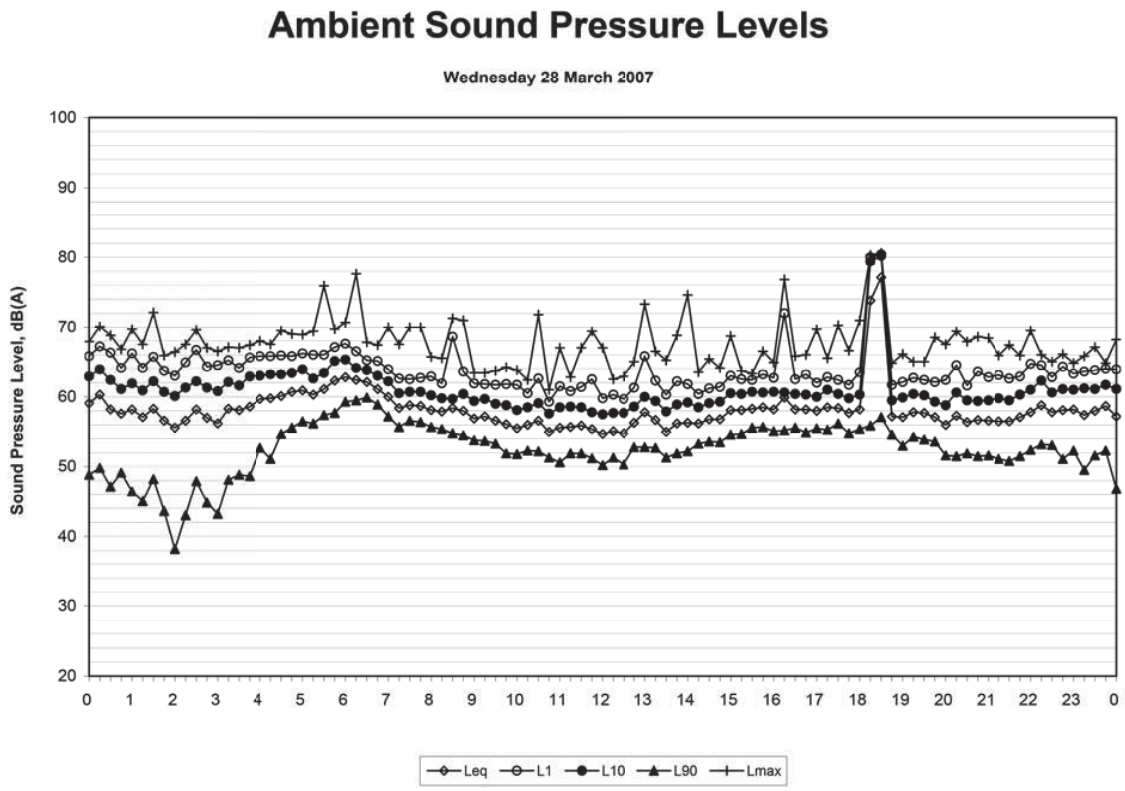
Ambient Sound Pressure Levels

Wednesday 15 November 2006



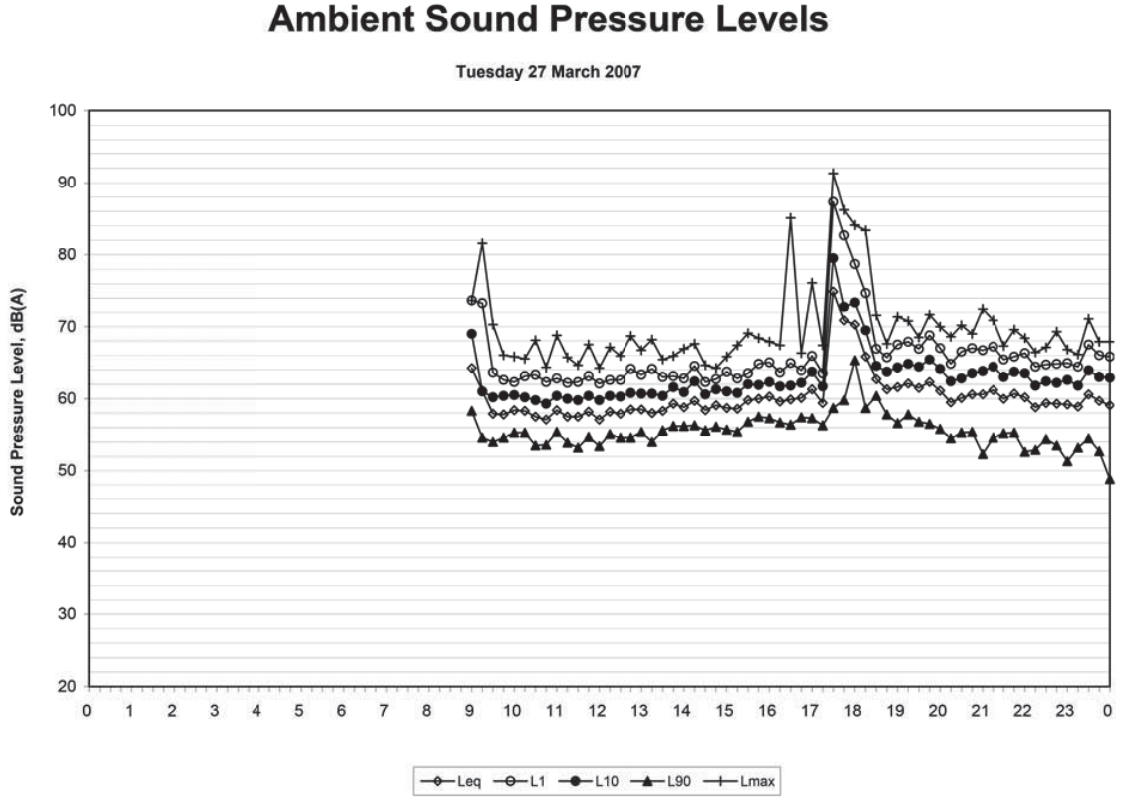
Reference Location M3
235 Bushells Ridge Road

5987R3.xls



Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

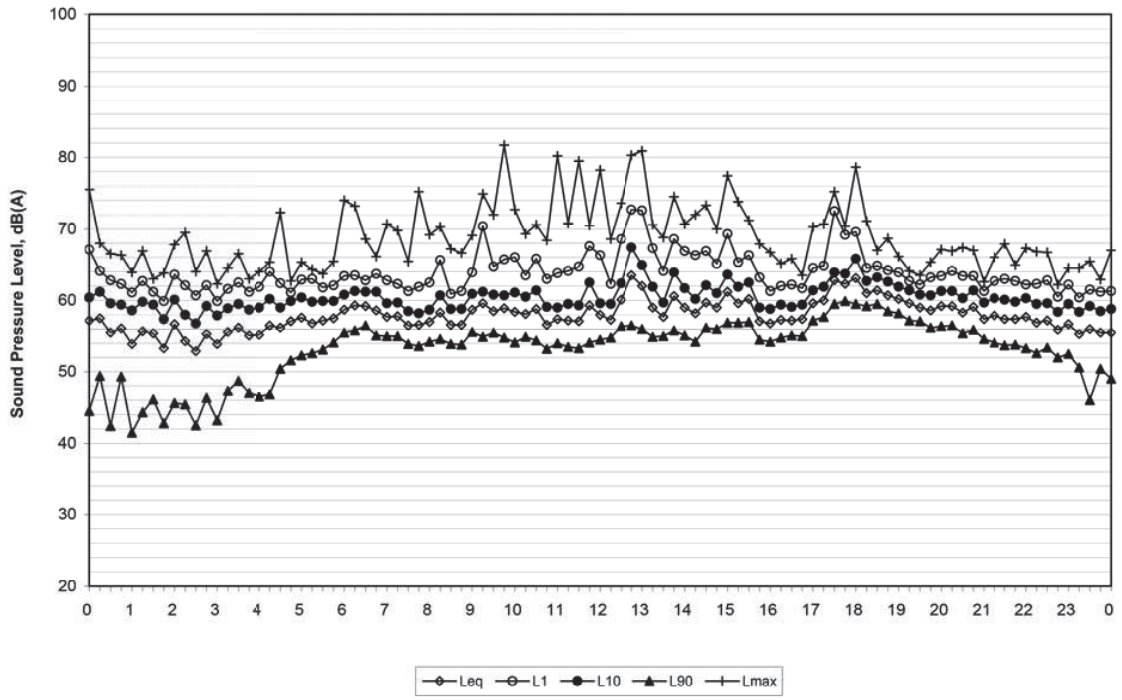


Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

Ambient Sound Pressure Levels

Friday 30 March 2007

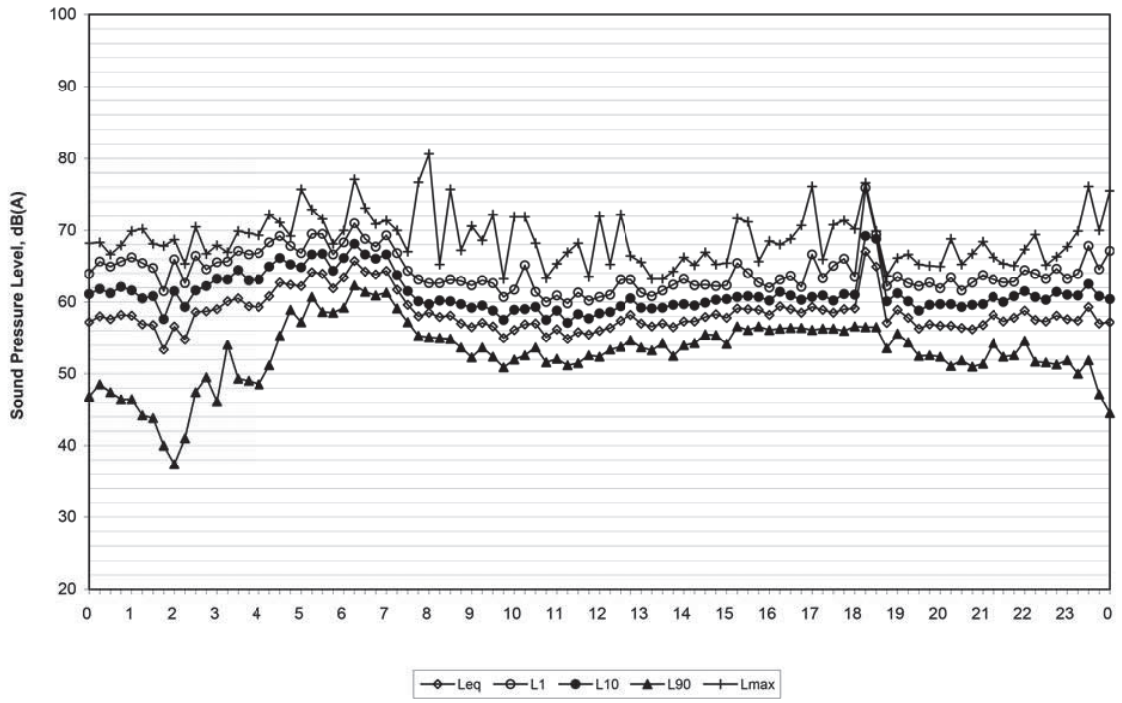


Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

Ambient Sound Pressure Levels

Thursday 29 March 2007

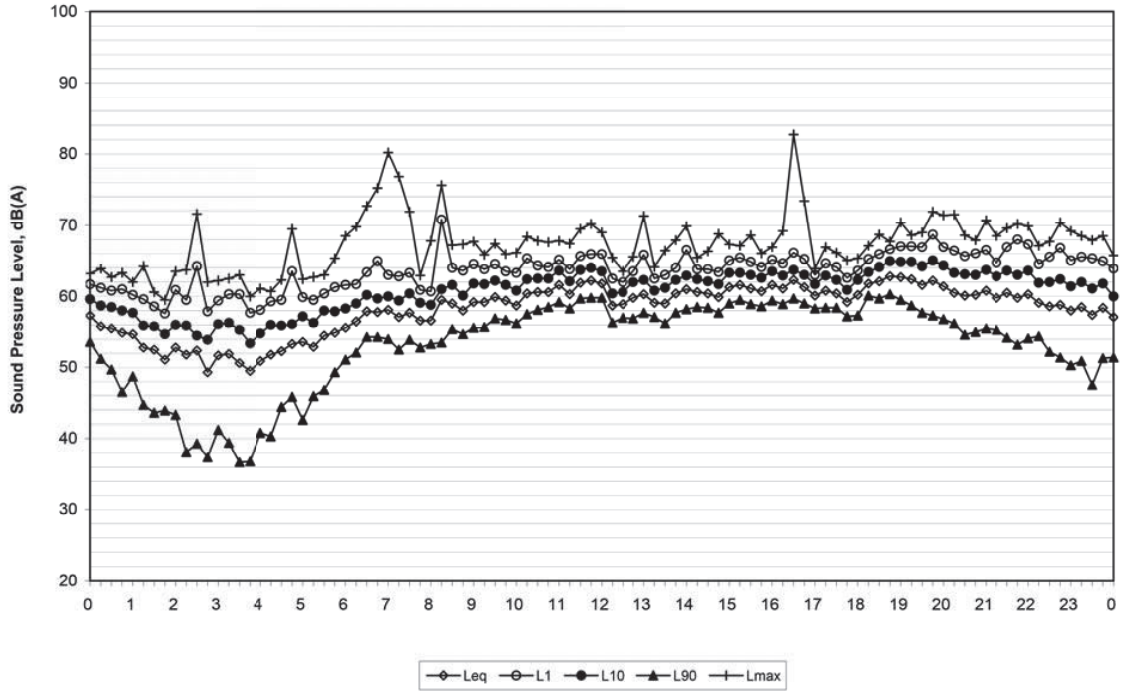


Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

Ambient Sound Pressure Levels

Sunday 01 April 2007

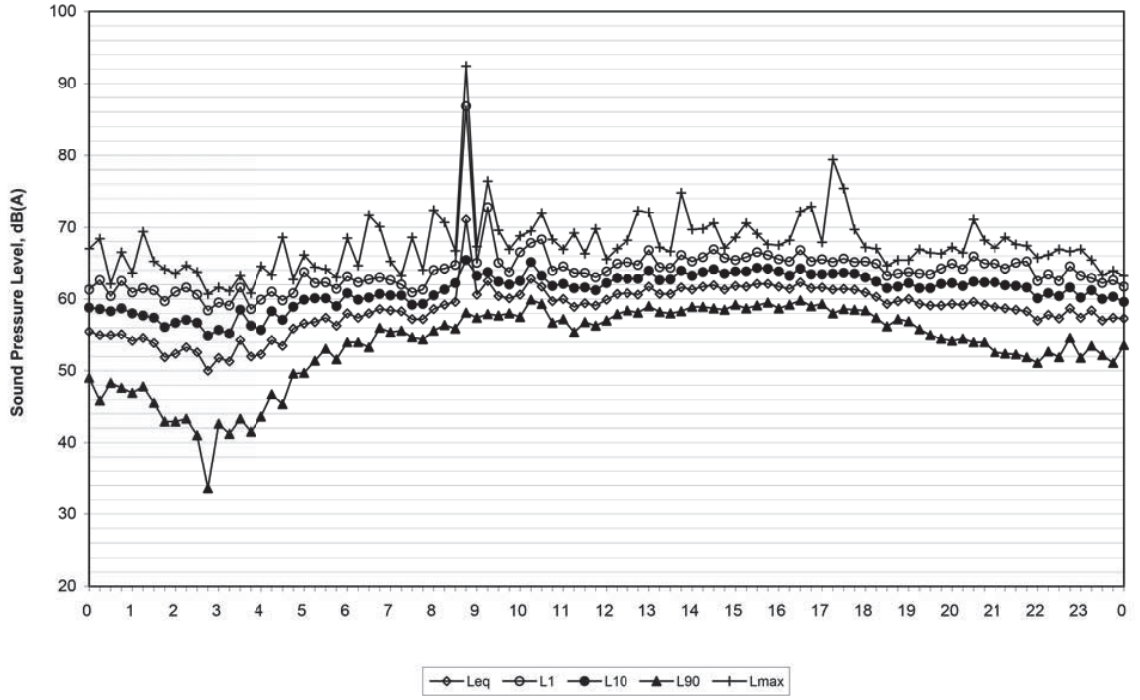


Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

Ambient Sound Pressure Levels

Saturday 31 March 2007

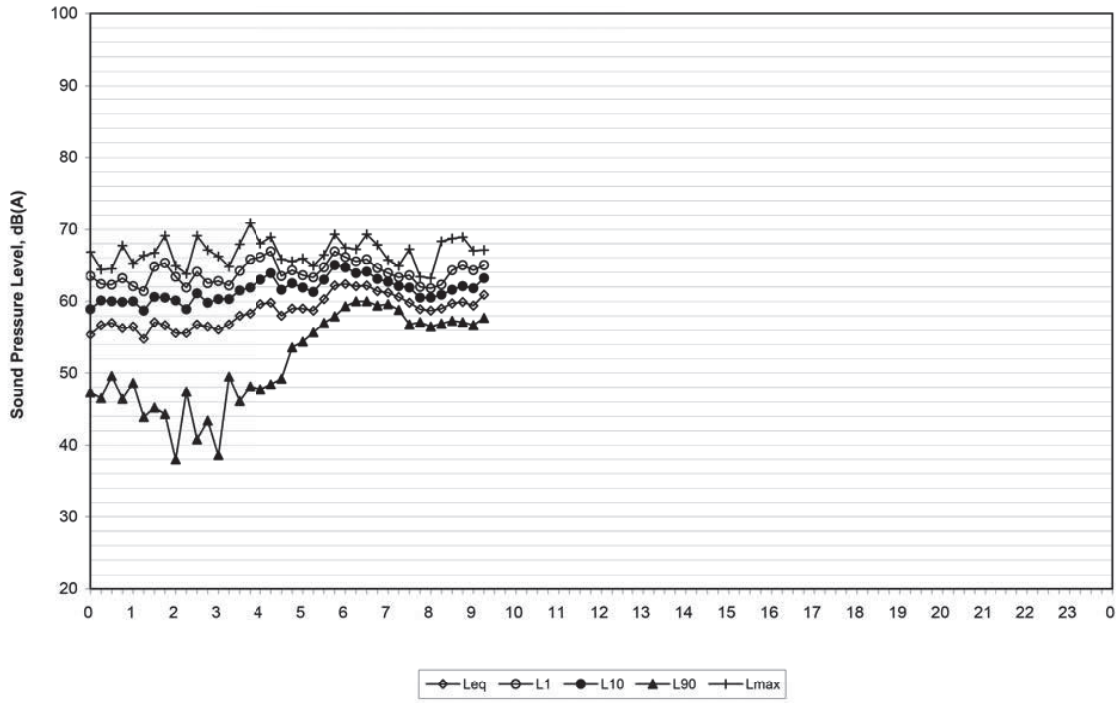


Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

Ambient Sound Pressure Levels

Tuesday 03 April 2007

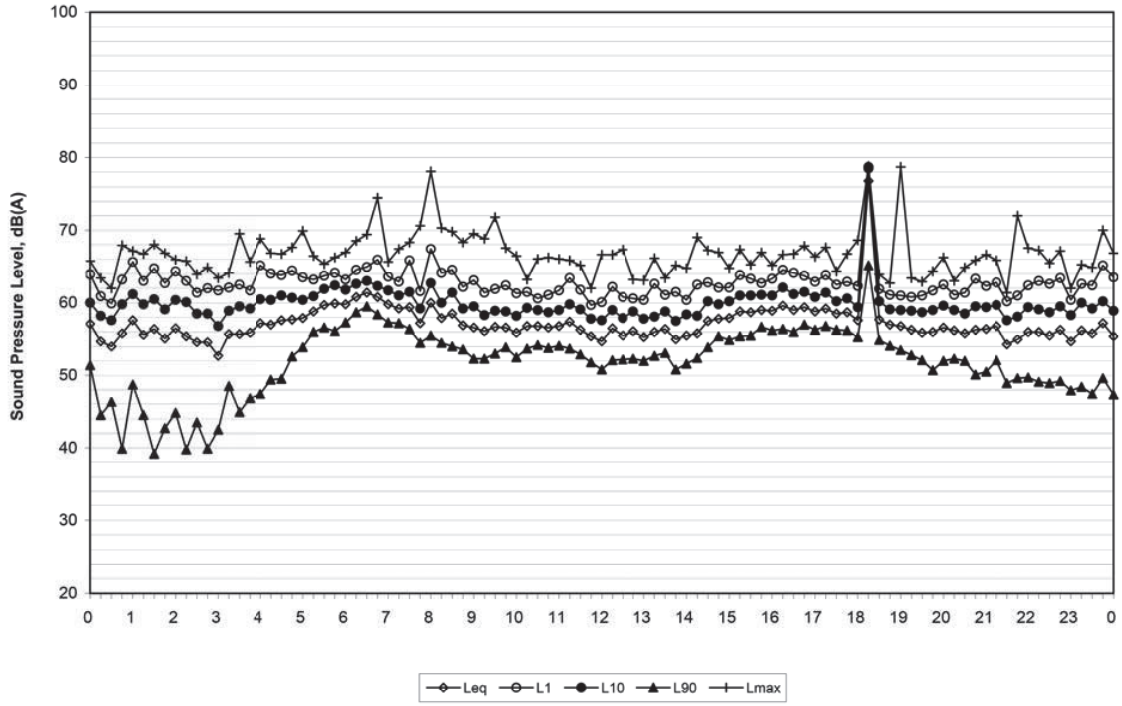


Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls

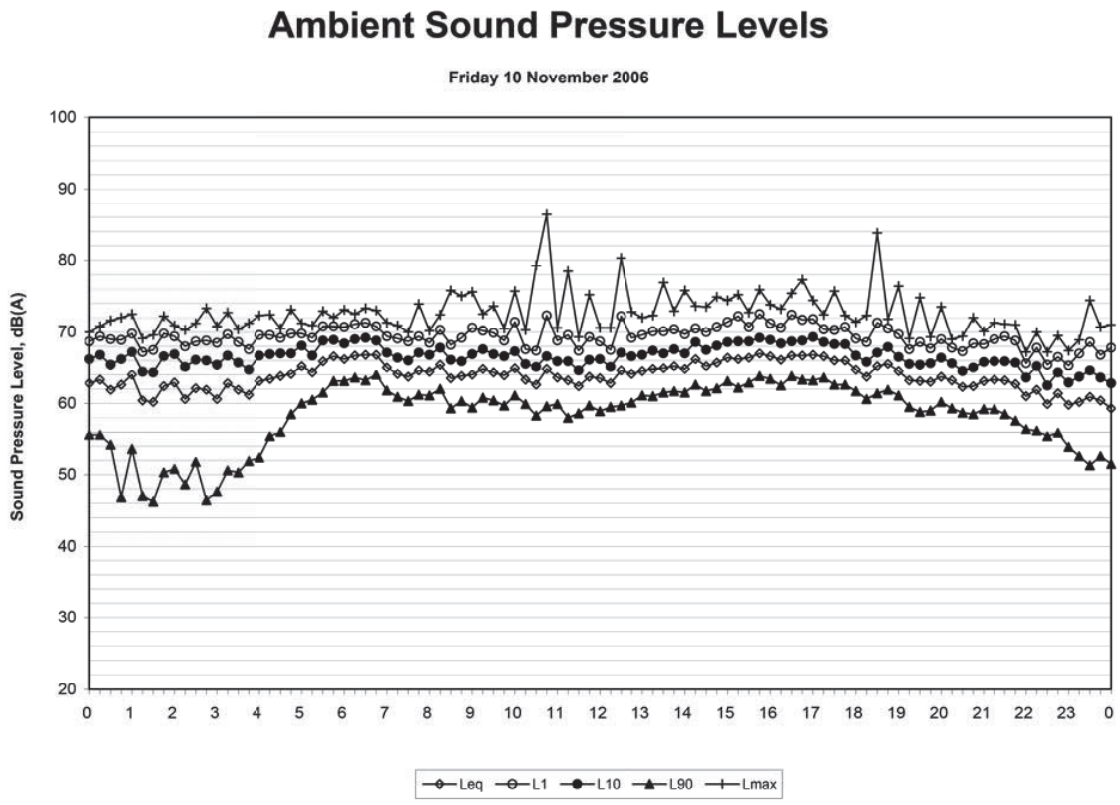
Ambient Sound Pressure Levels

Monday 02 April 2007



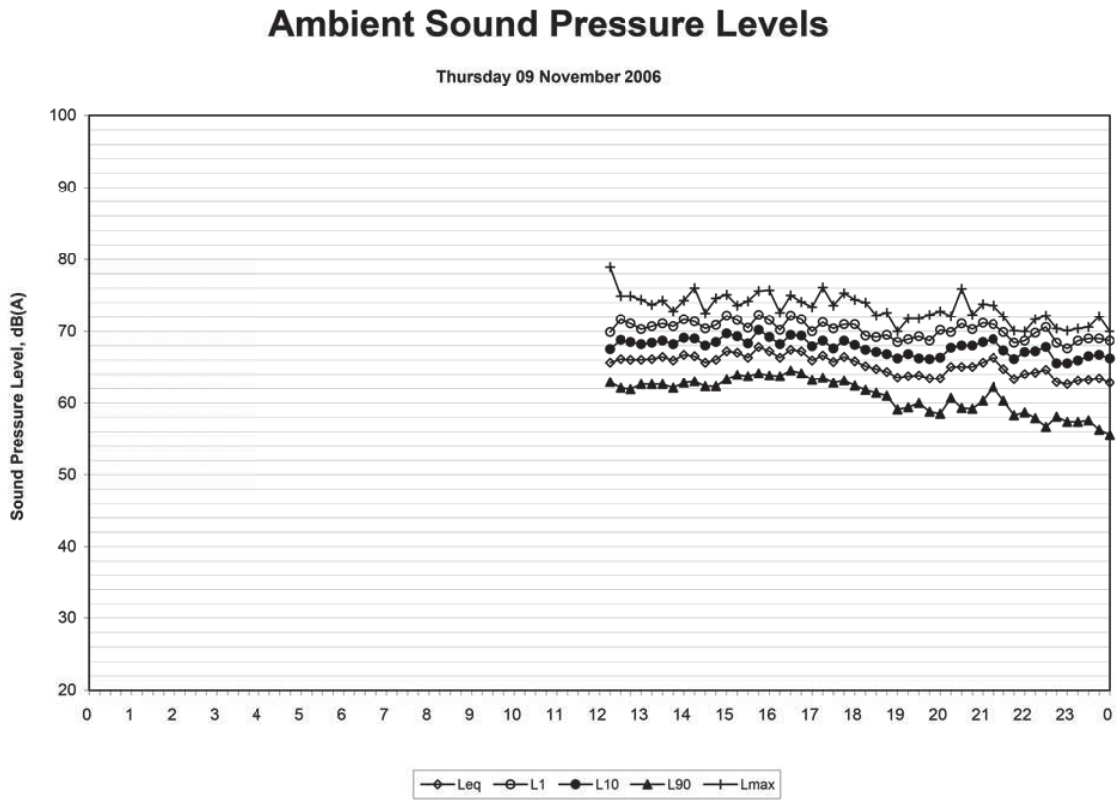
Reference Location M3
235 Bushells Ridge Road

5987R3_b.xls



Reference Location M4
209 Bushells Ridge Road

5987R4.xls

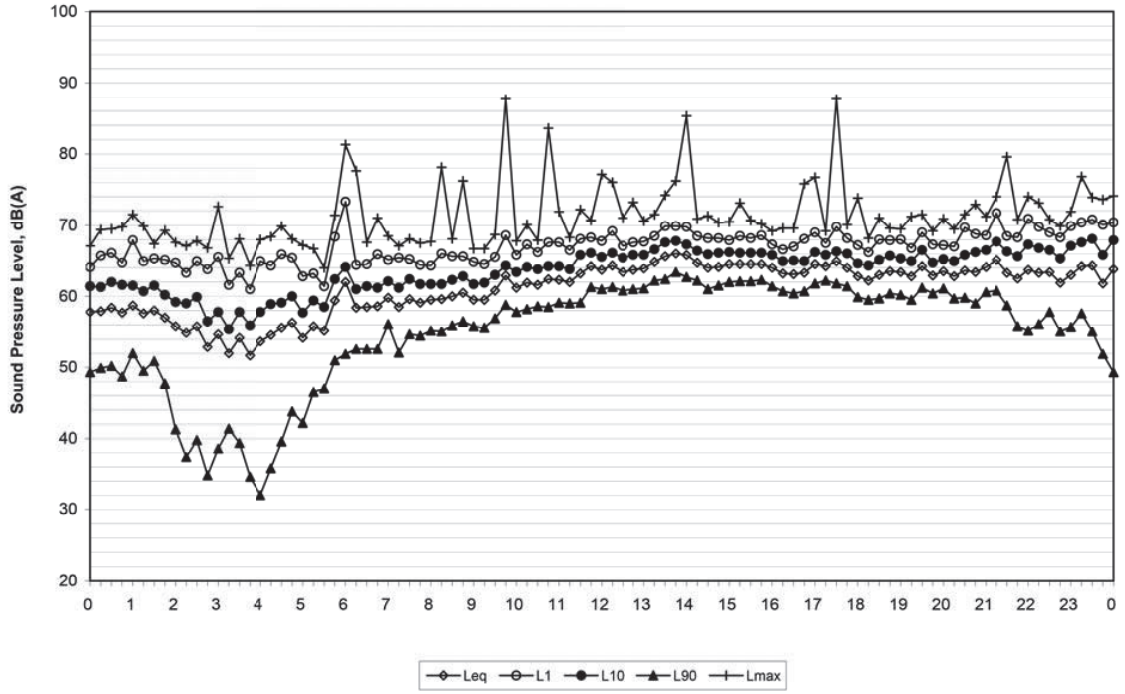


Reference Location M4
209 Bushells Ridge Road

5987R4.xls

Ambient Sound Pressure Levels

Sunday 12 November 2006

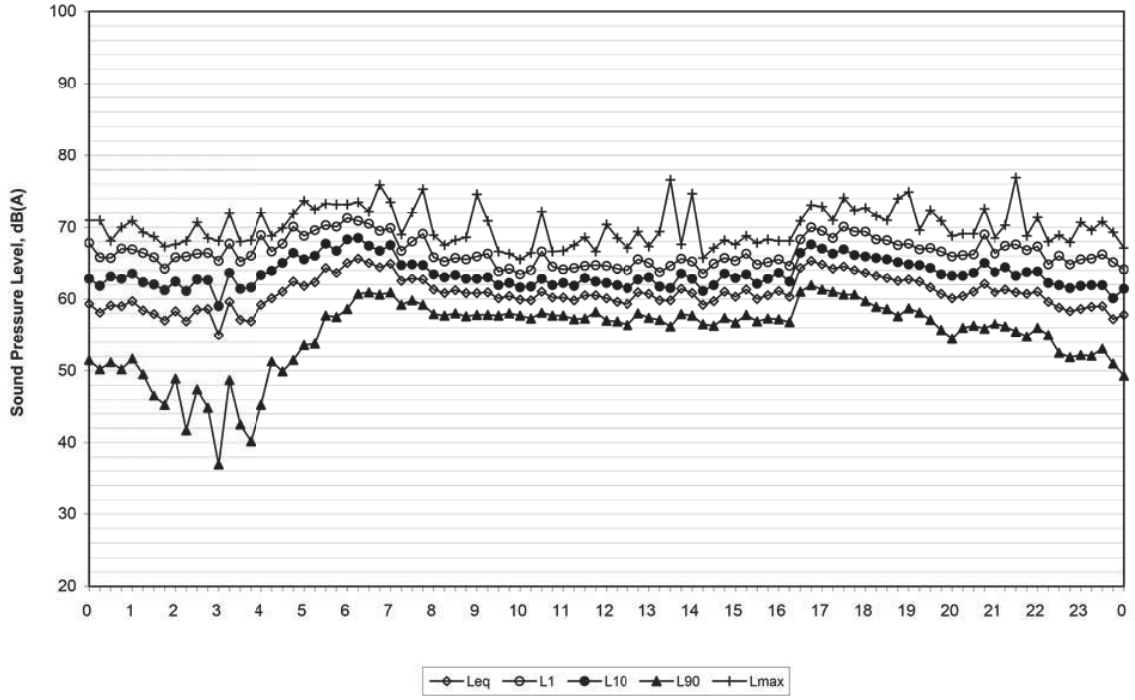


Reference Location M4
209 Bushells Ridge Road

5987R4.xls

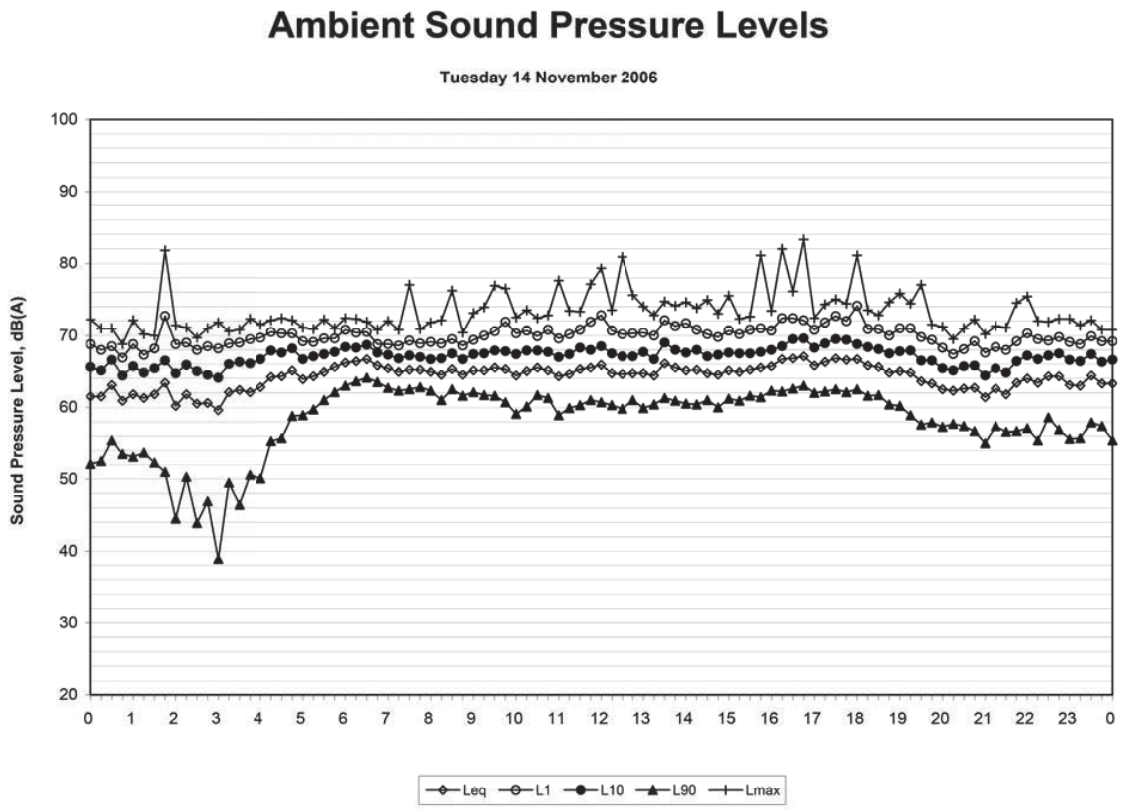
Ambient Sound Pressure Levels

Saturday 11 November 2006



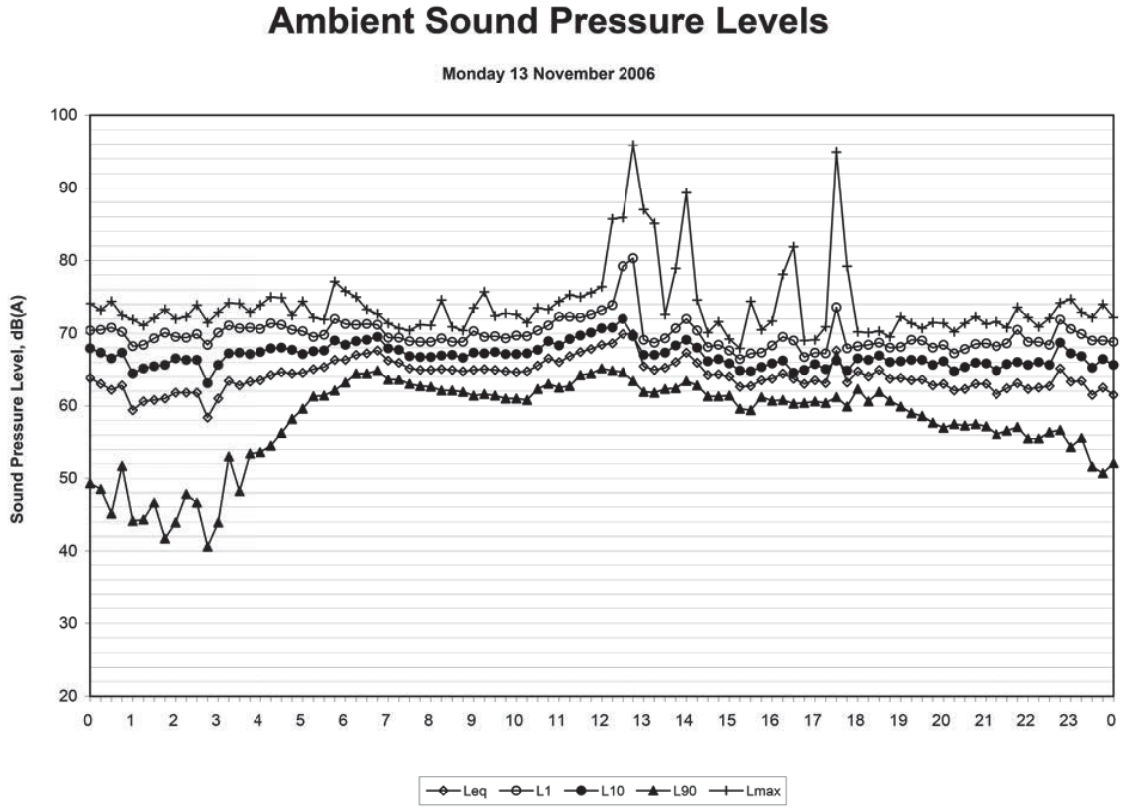
Reference Location M4
209 Bushells Ridge Road

5987R4.xls



Reference Location M4
209 Bushells Ridge Road

5987R4.xls

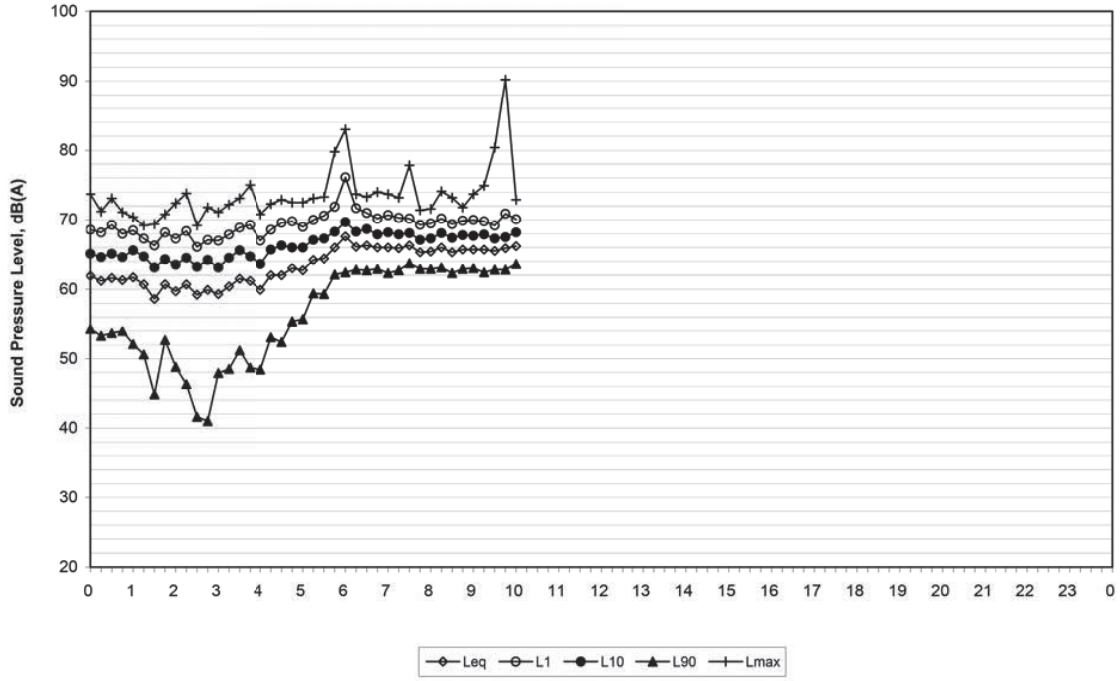


Reference Location M4
209 Bushells Ridge Road

5987R4.xls

Ambient Sound Pressure Levels

Thursday 16 November 2006

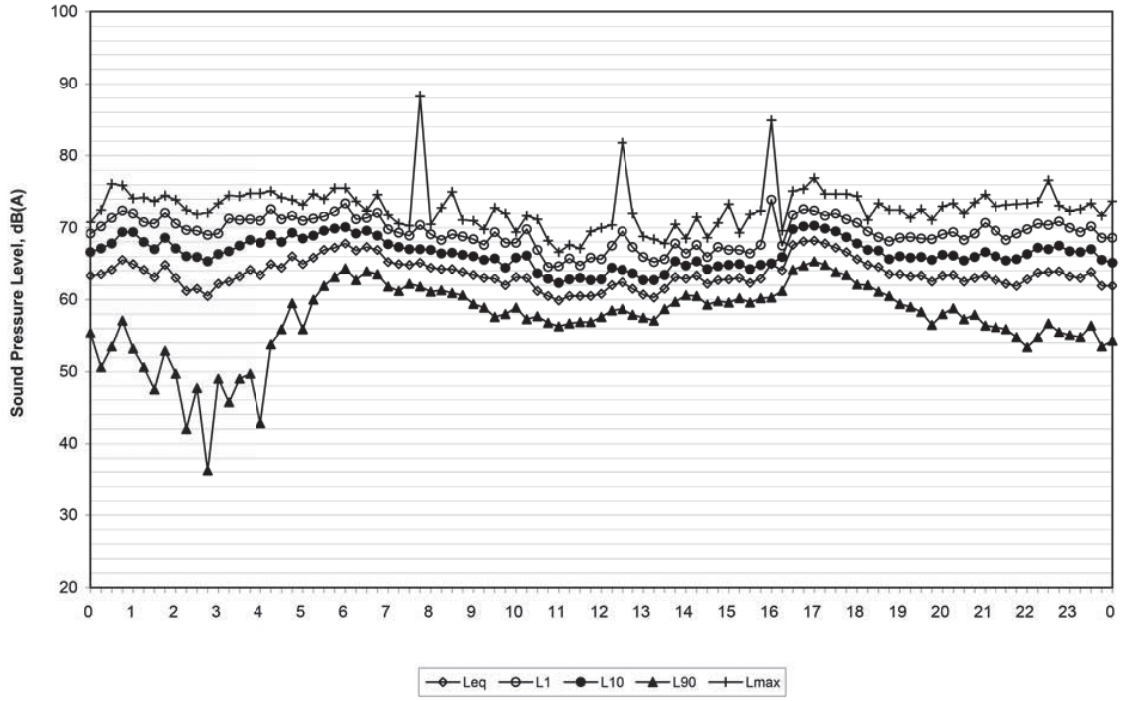


Reference Location M4
209 Bushells Ridge Road

5987R4.xls

Ambient Sound Pressure Levels

Wednesday 15 November 2006

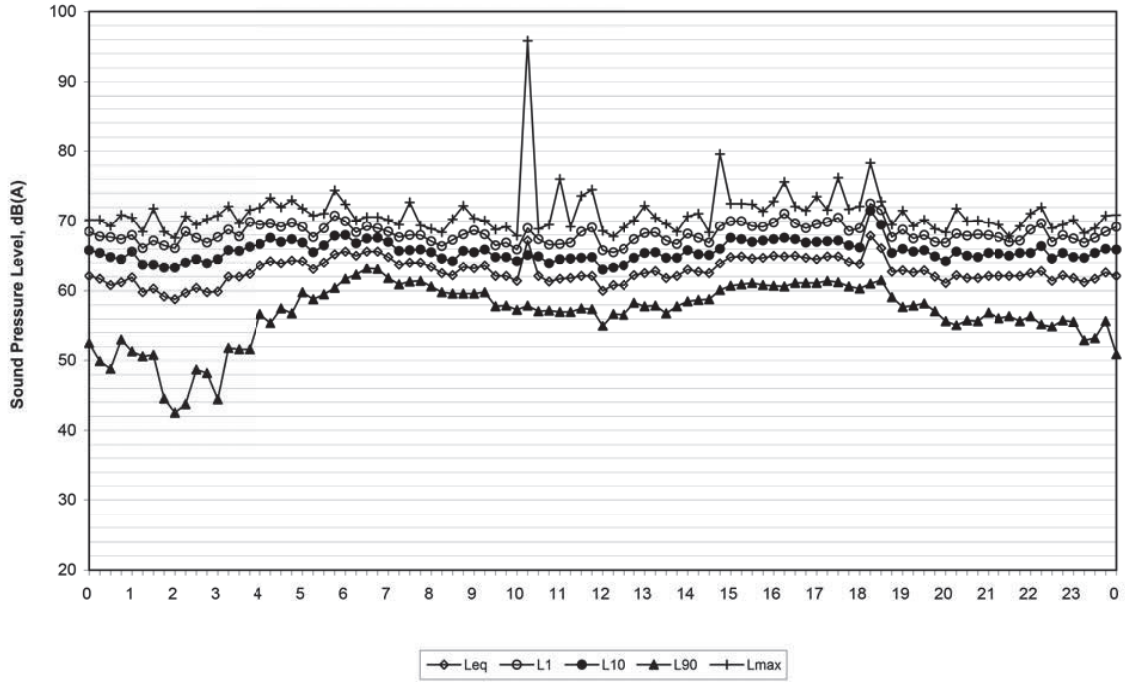


Reference Location M4
209 Bushells Ridge Road

5987R4.xls

Ambient Sound Pressure Levels

Wednesday 28 March 2007

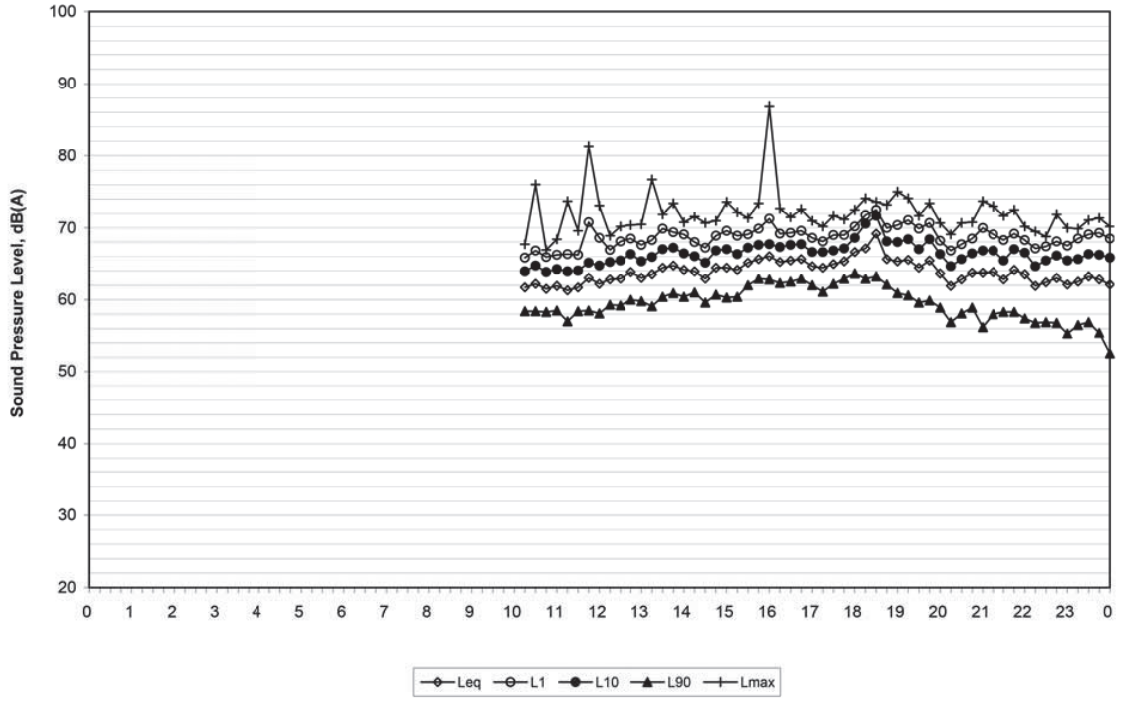


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

Ambient Sound Pressure Levels

Tuesday 27 March 2007

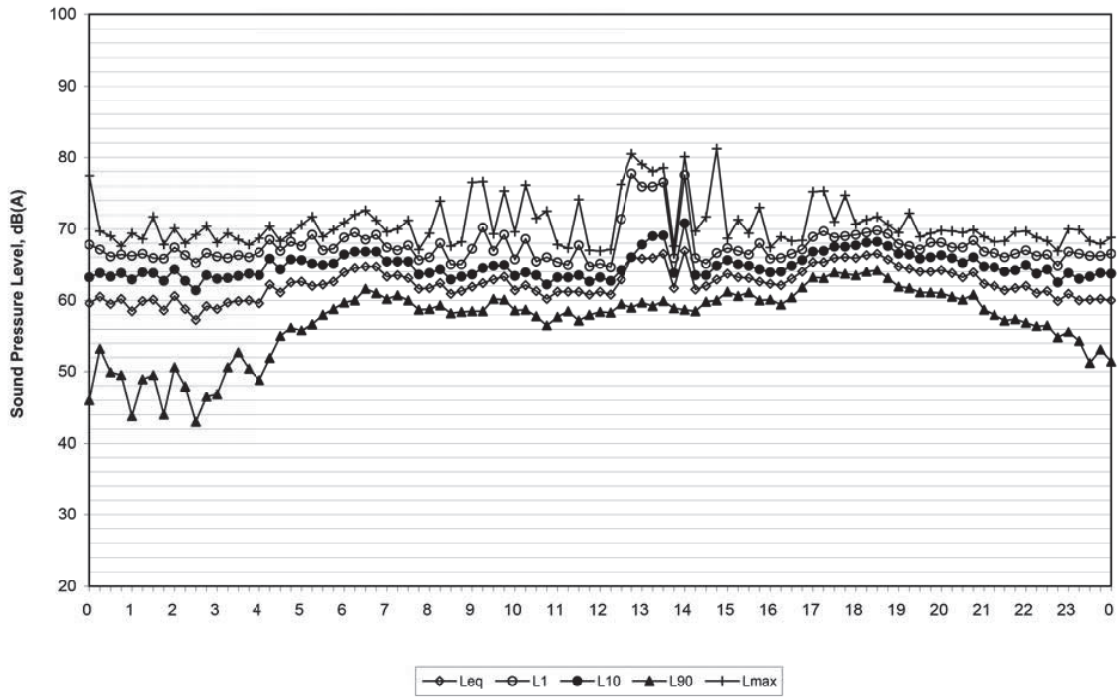


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

Ambient Sound Pressure Levels

Friday 30 March 2007

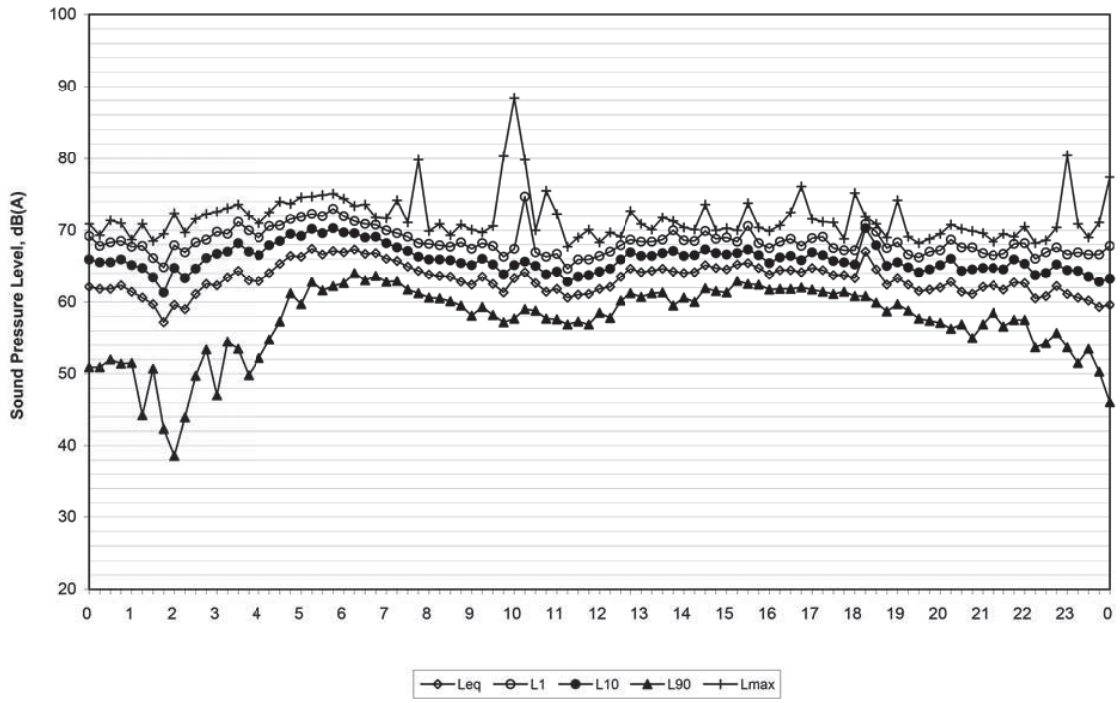


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

Ambient Sound Pressure Levels

Thursday 29 March 2007

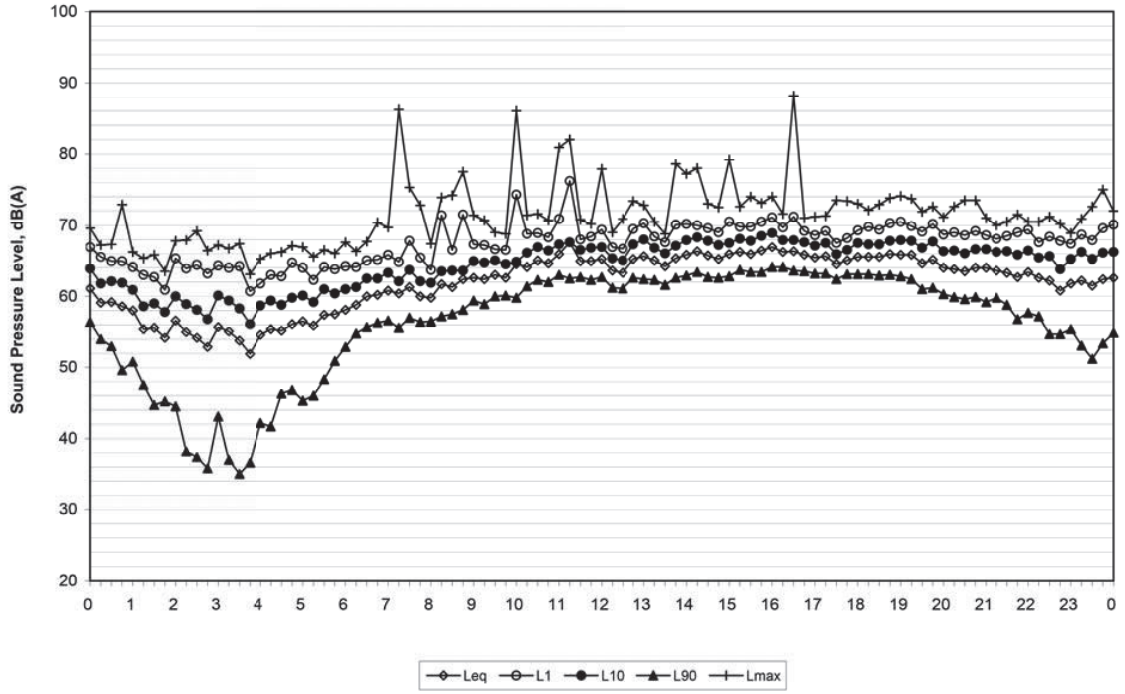


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

Ambient Sound Pressure Levels

Sunday 01 April 2007

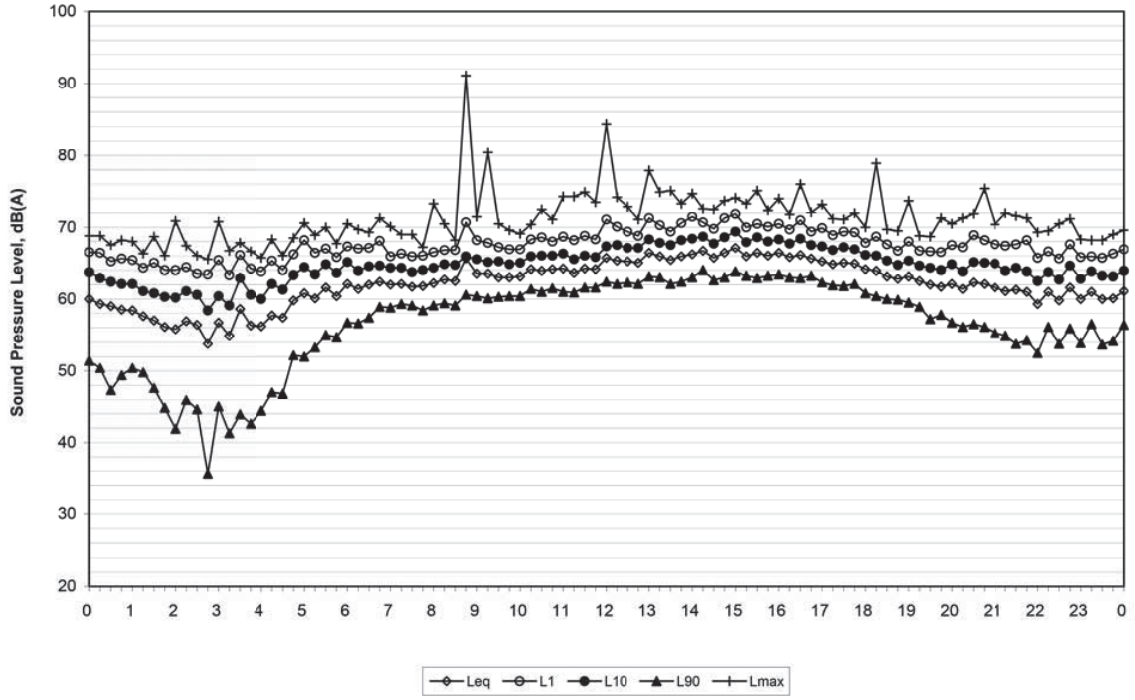


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

Ambient Sound Pressure Levels

Saturday 31 March 2007

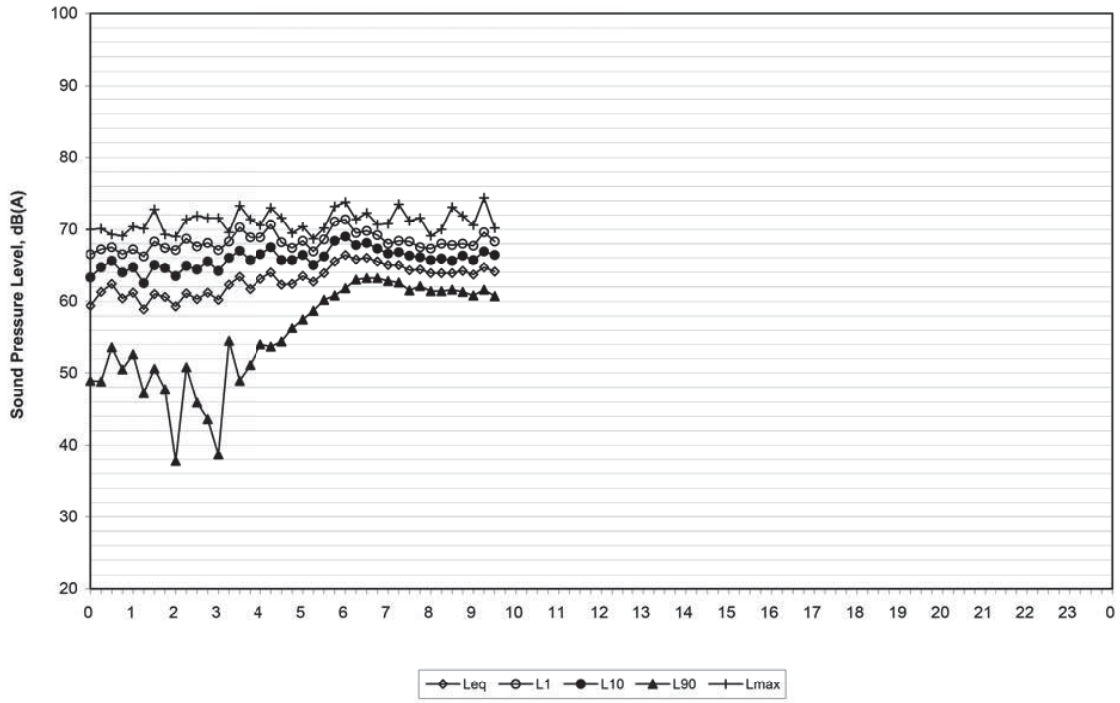


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

Ambient Sound Pressure Levels

Tuesday 03 April 2007

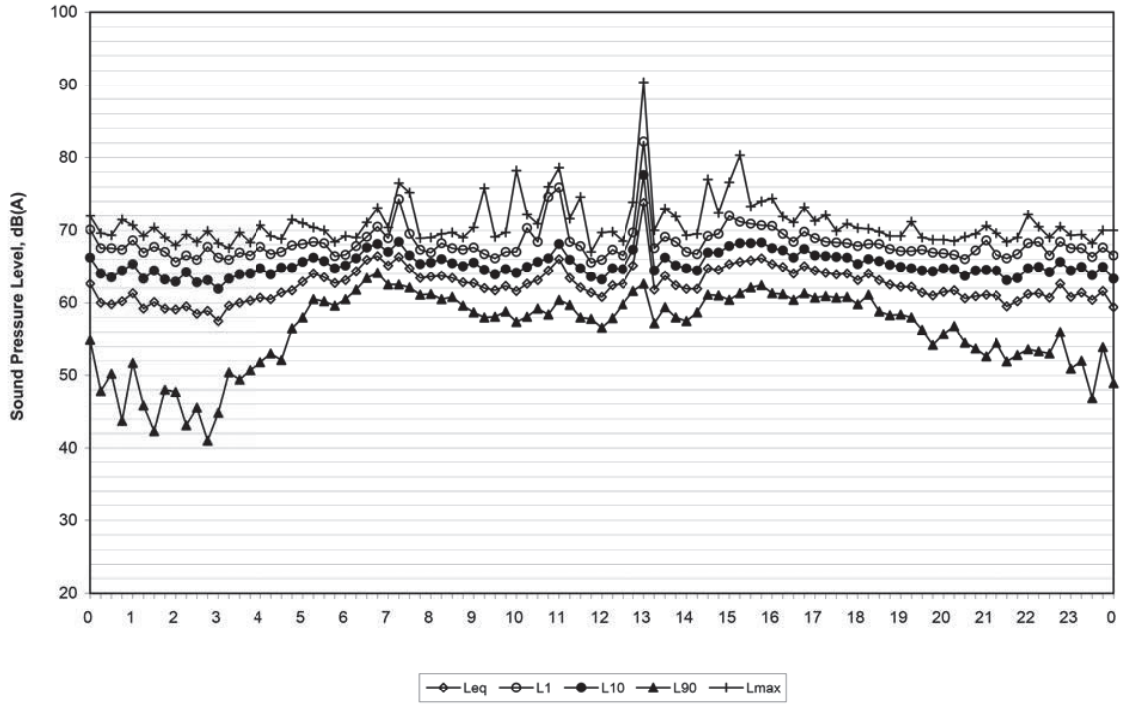


Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls

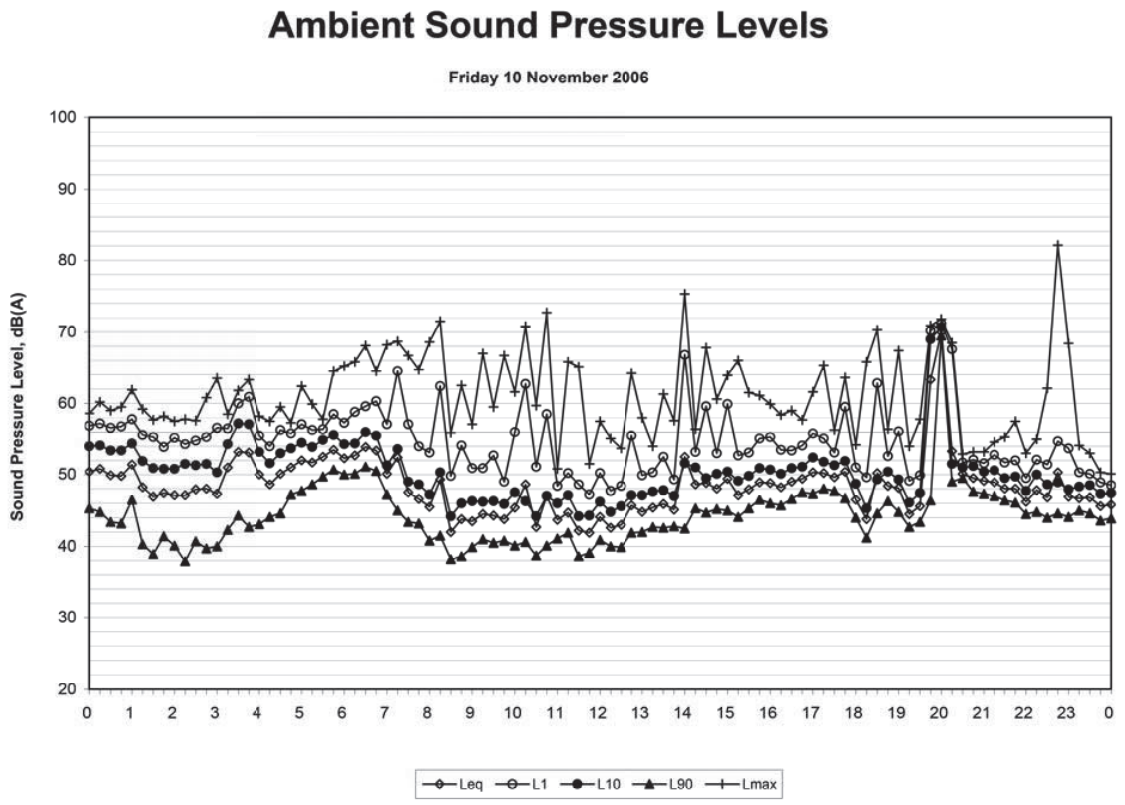
Ambient Sound Pressure Levels

Monday 02 April 2007



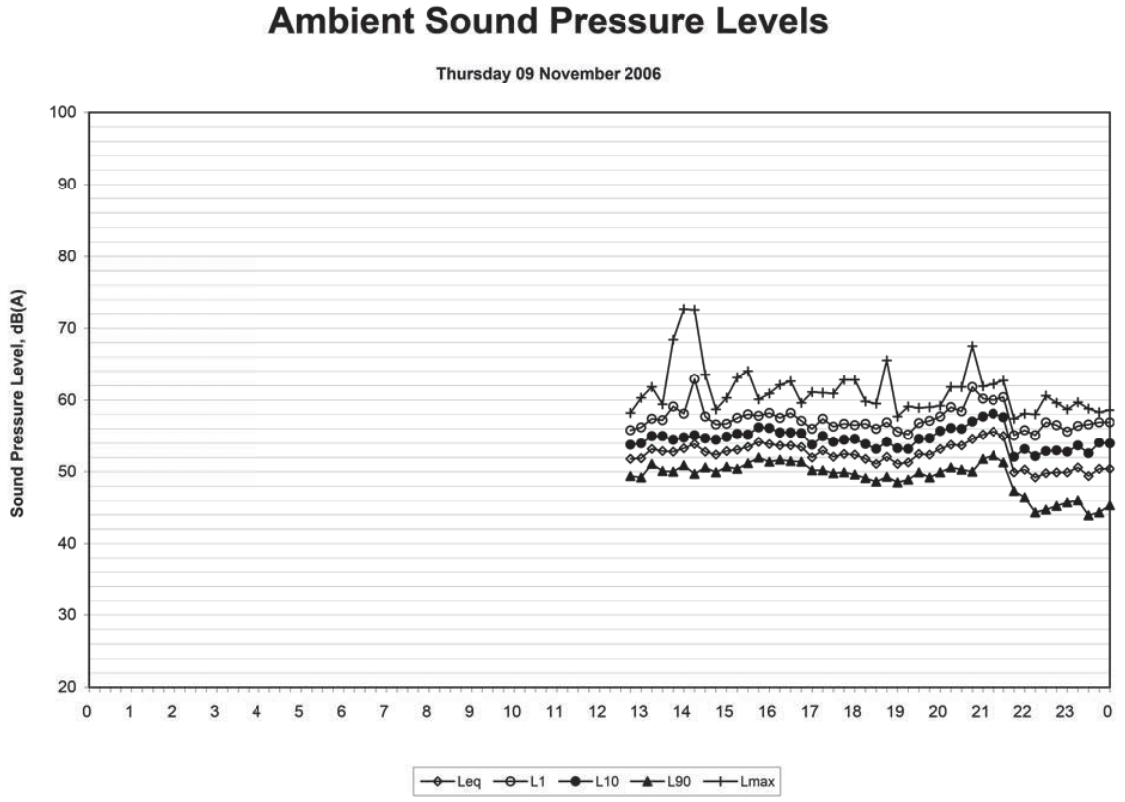
Reference Location M4
209 Bushells Ridge Road

5987R4_b.xls



Reference Location M5
97 Bushell Ridge Road

5987R5.xls

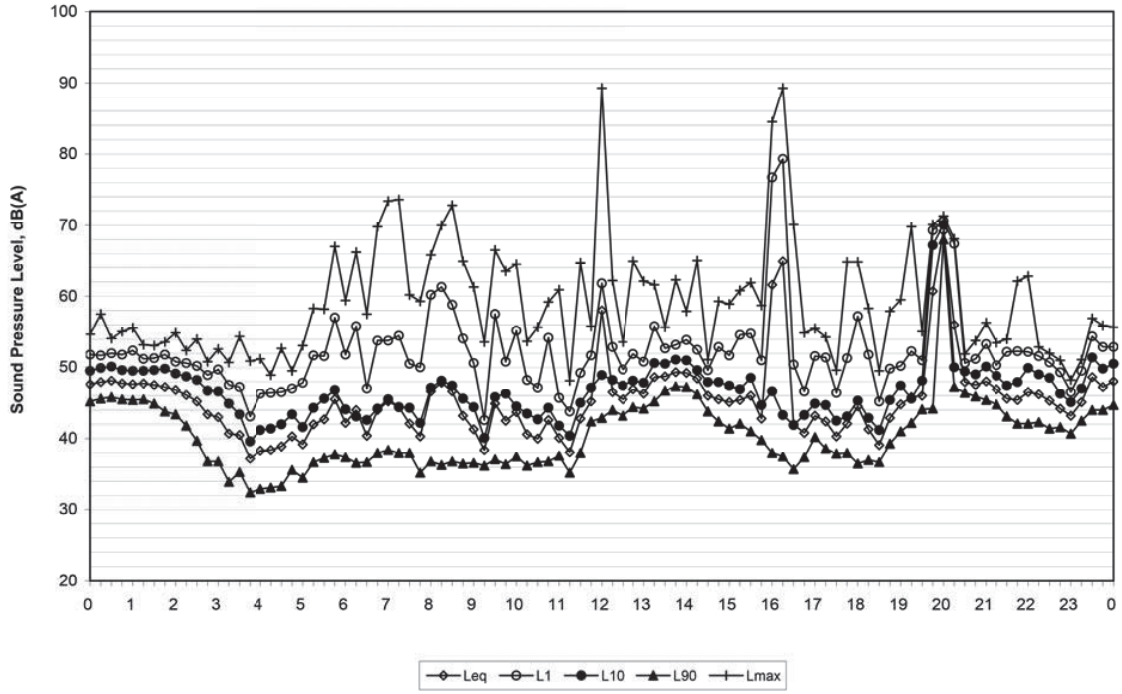


Reference Location M5
97 Bushell Ridge Road

5987R5.xls

Ambient Sound Pressure Levels

Sunday 12 November 2006

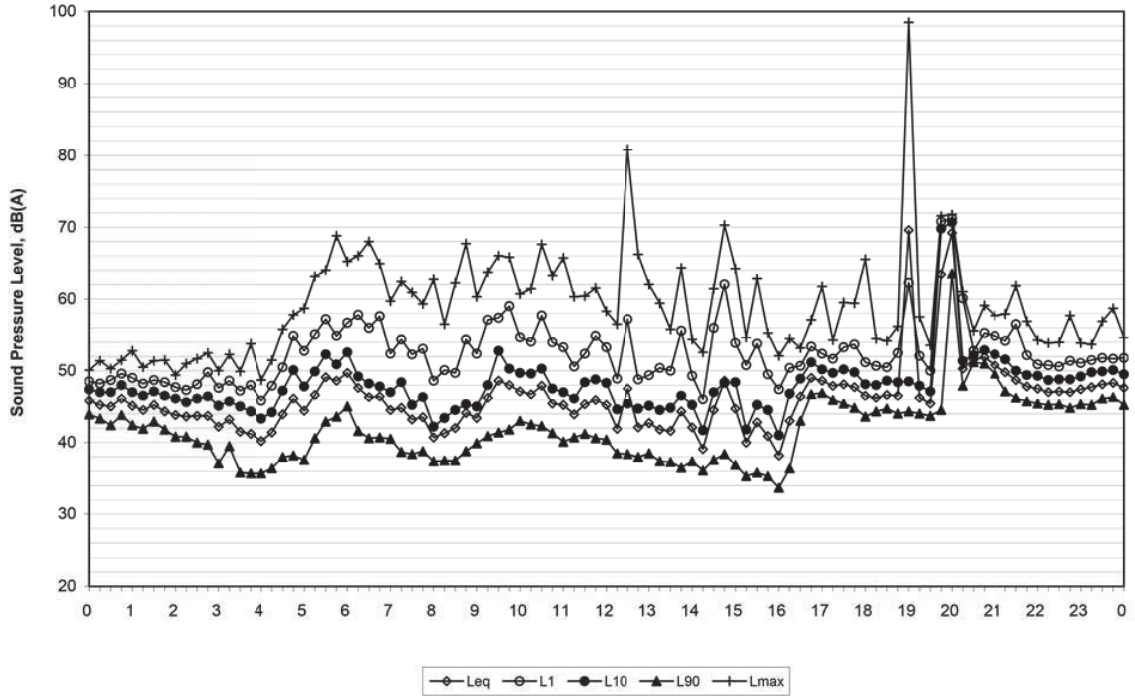


Reference Location M5
97 Bushell Ridge Road

5987R5.xls

Ambient Sound Pressure Levels

Saturday 11 November 2006

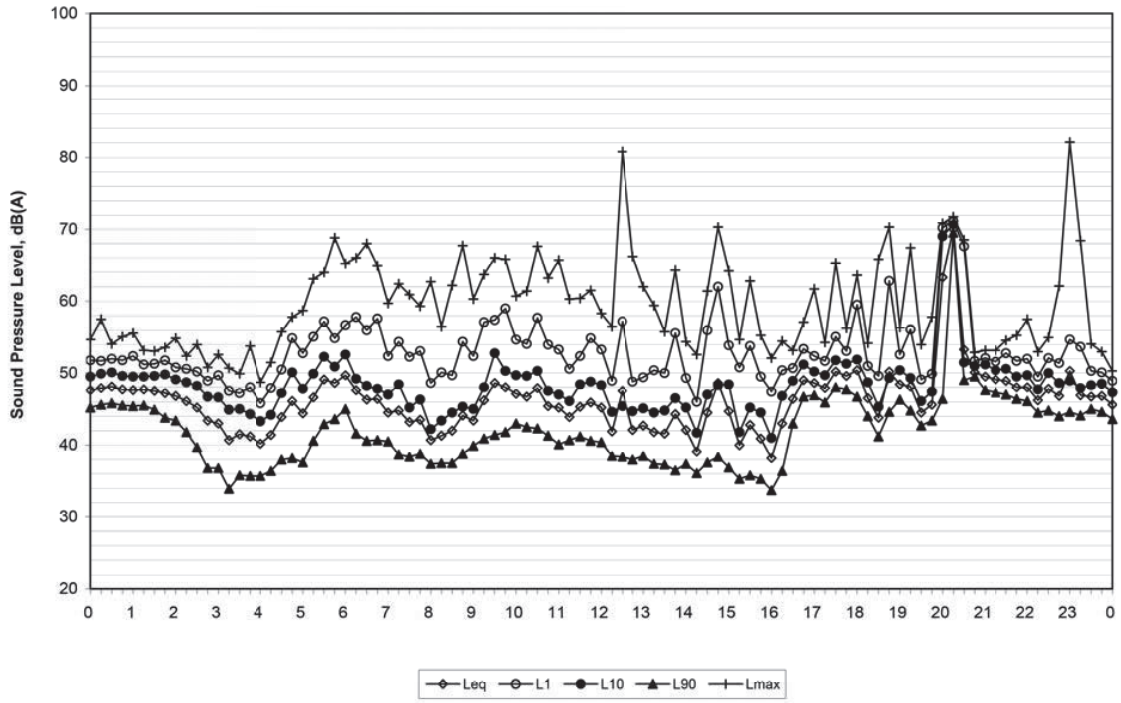


Reference Location M5
97 Bushell Ridge Road

5987R5.xls

Ambient Sound Pressure Levels

Tuesday 14 November 2006

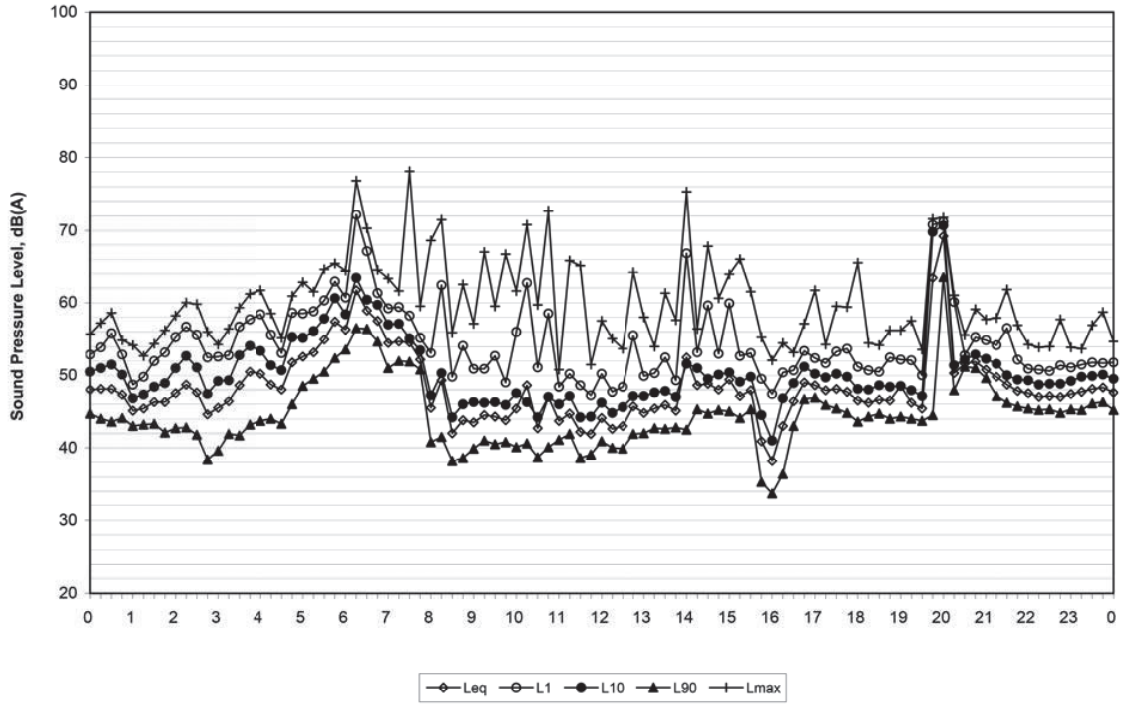


Reference Location M5
97 Bushell Ridge Road

5987R5.xls

Ambient Sound Pressure Levels

Monday 13 November 2006

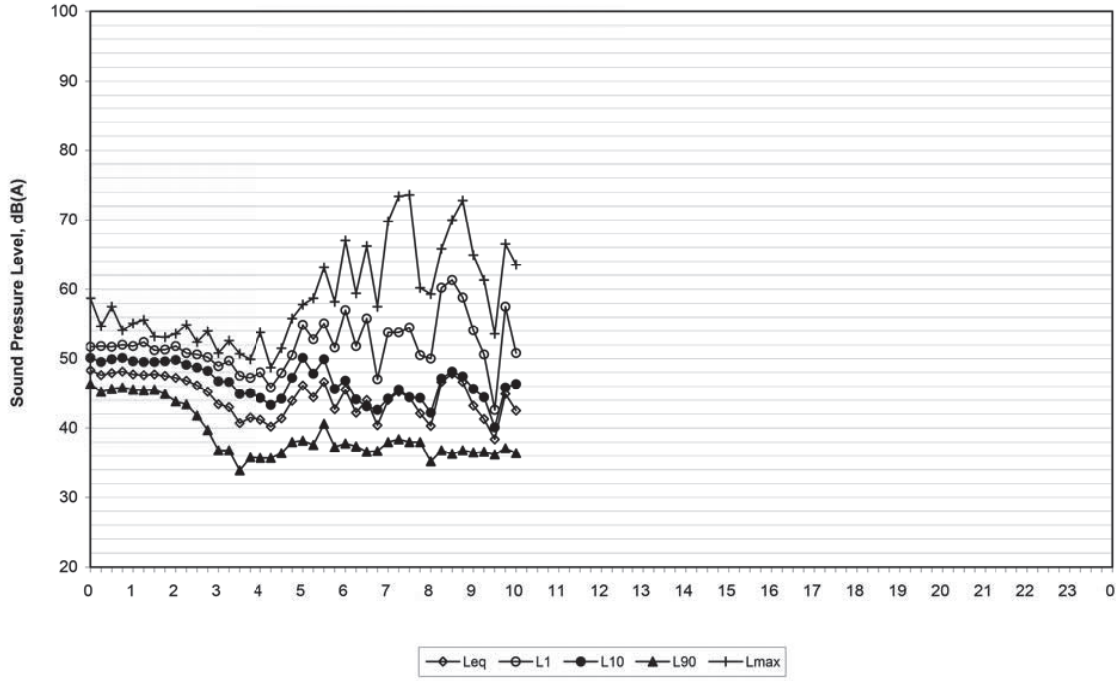


Reference Location M5
97 Bushell Ridge Road

5987R5.xls

Ambient Sound Pressure Levels

Thursday 16 November 2006

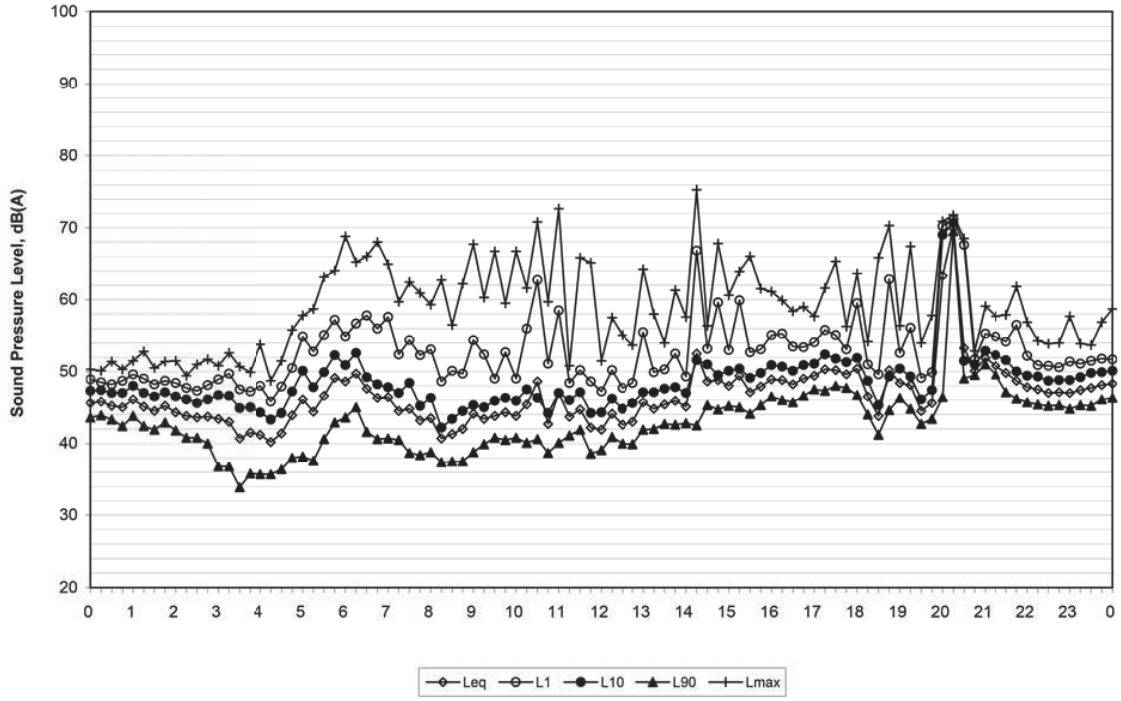


Reference Location M5
97 Bushell Ridge Road

5987R5.xls

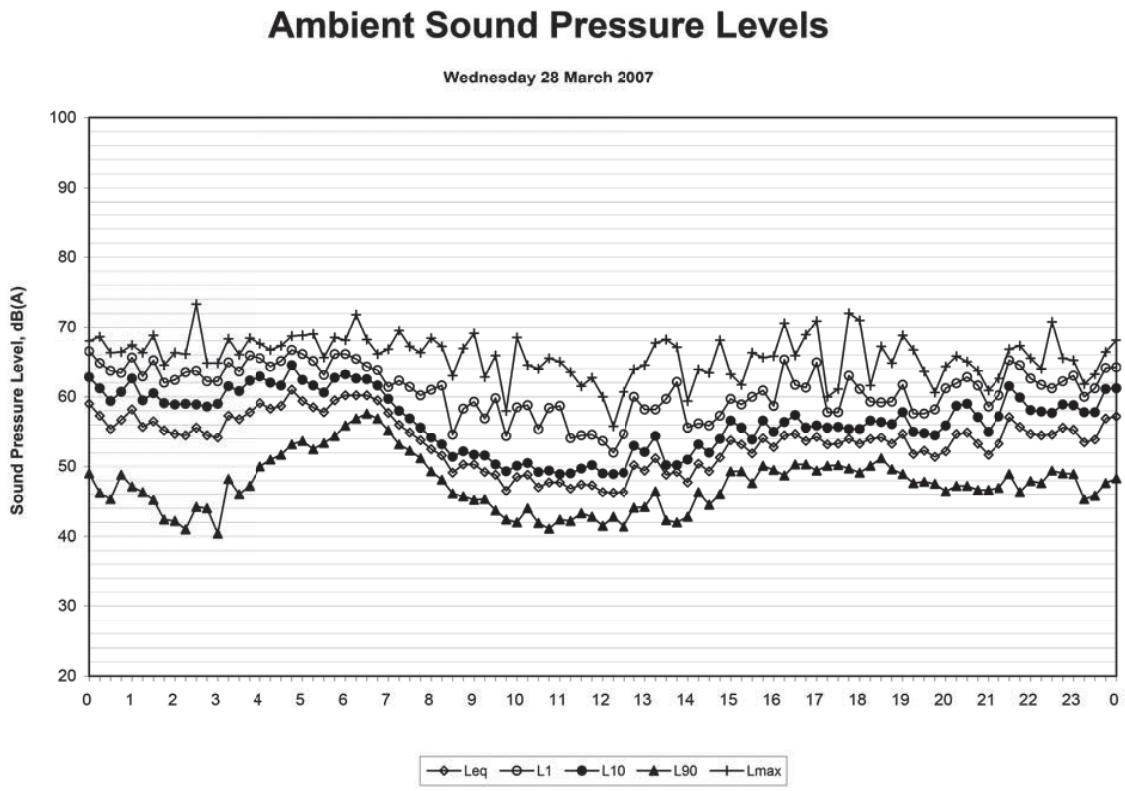
Ambient Sound Pressure Levels

Wednesday 15 November 2006



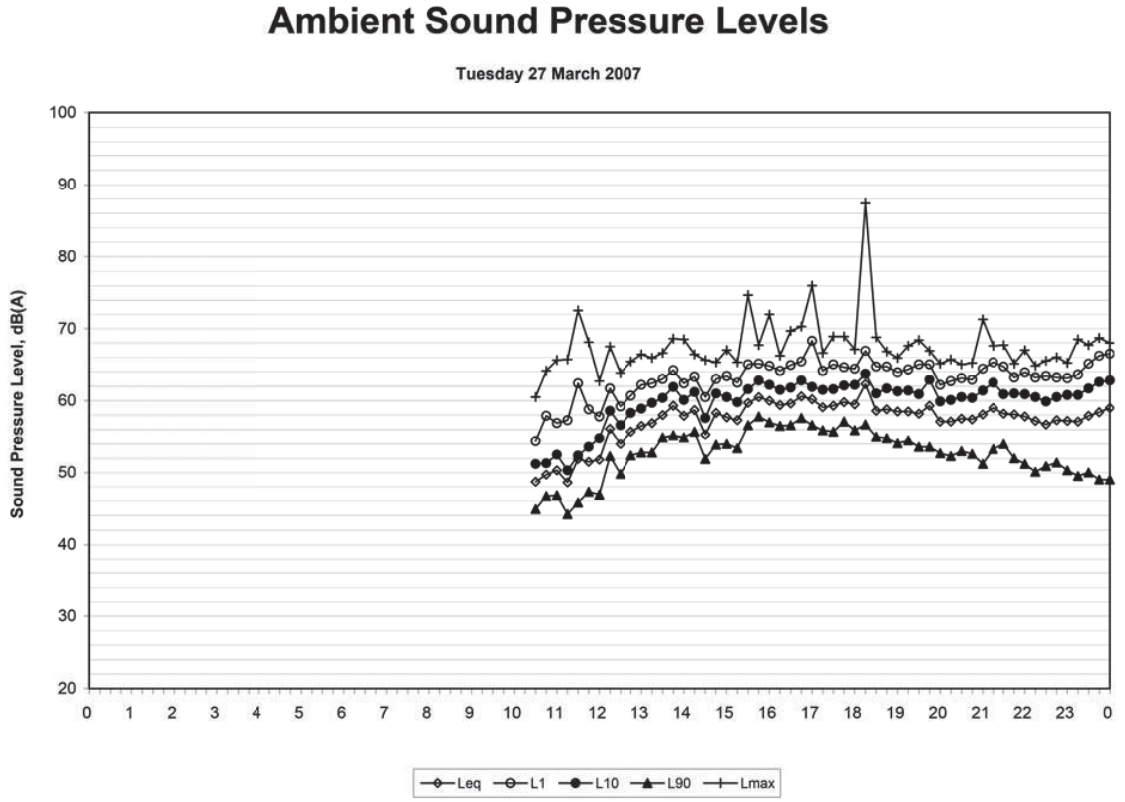
Reference Location M5
97 Bushell Ridge Road

5987R5.xls



Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls

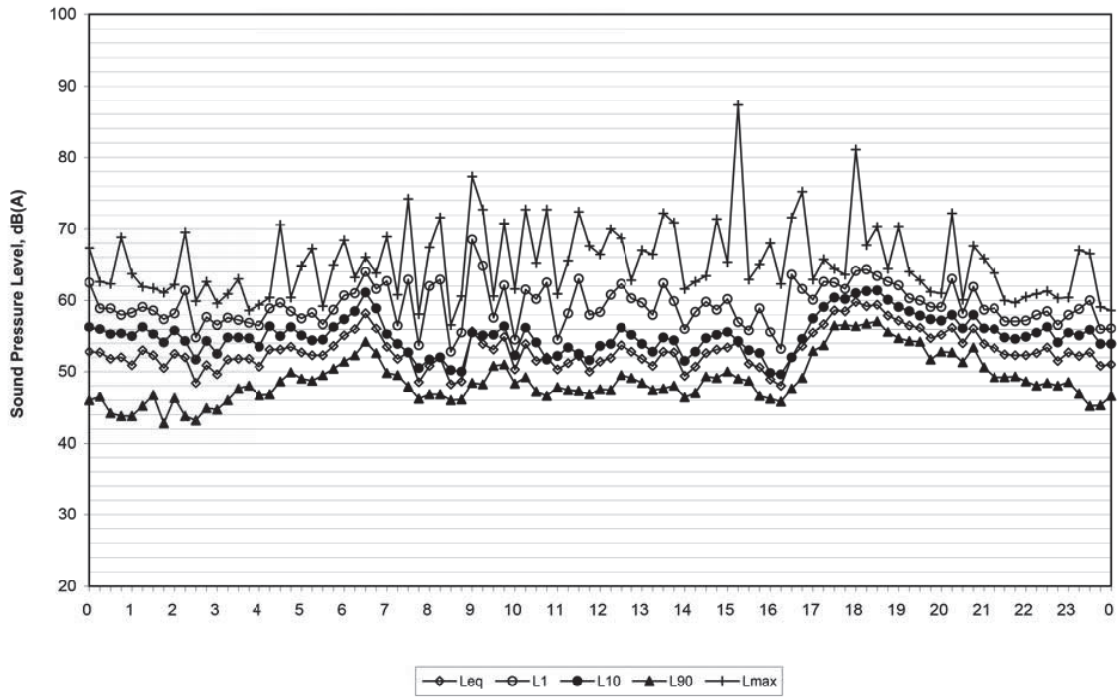


Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls

Ambient Sound Pressure Levels

Friday 30 March 2007

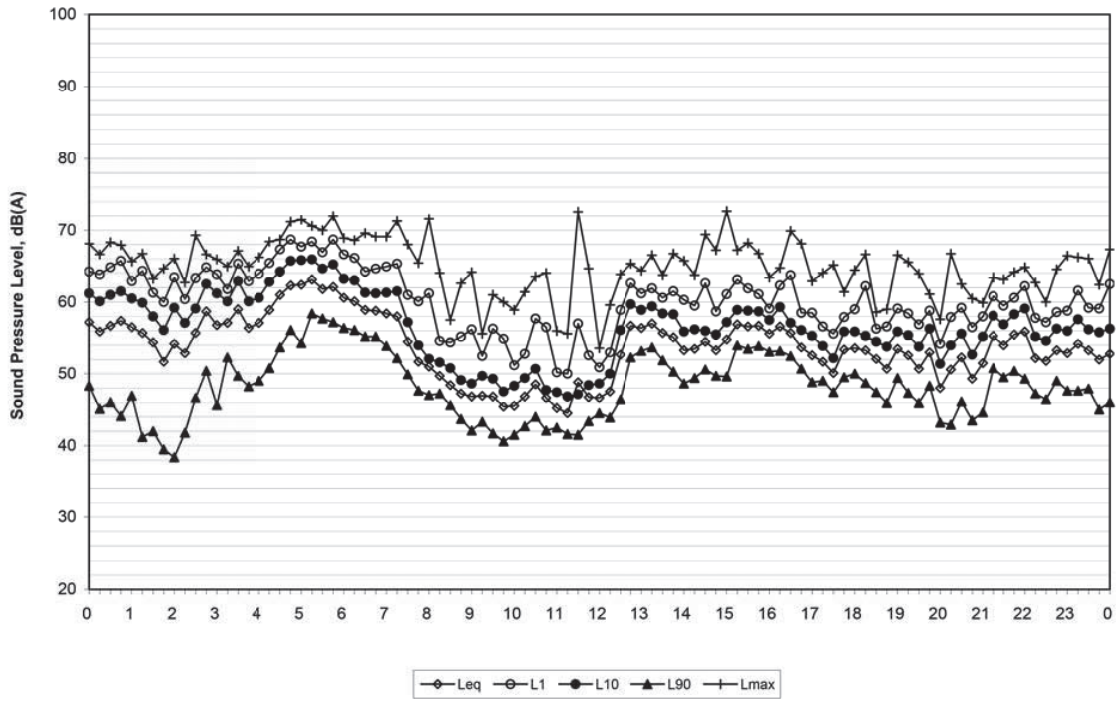


Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls

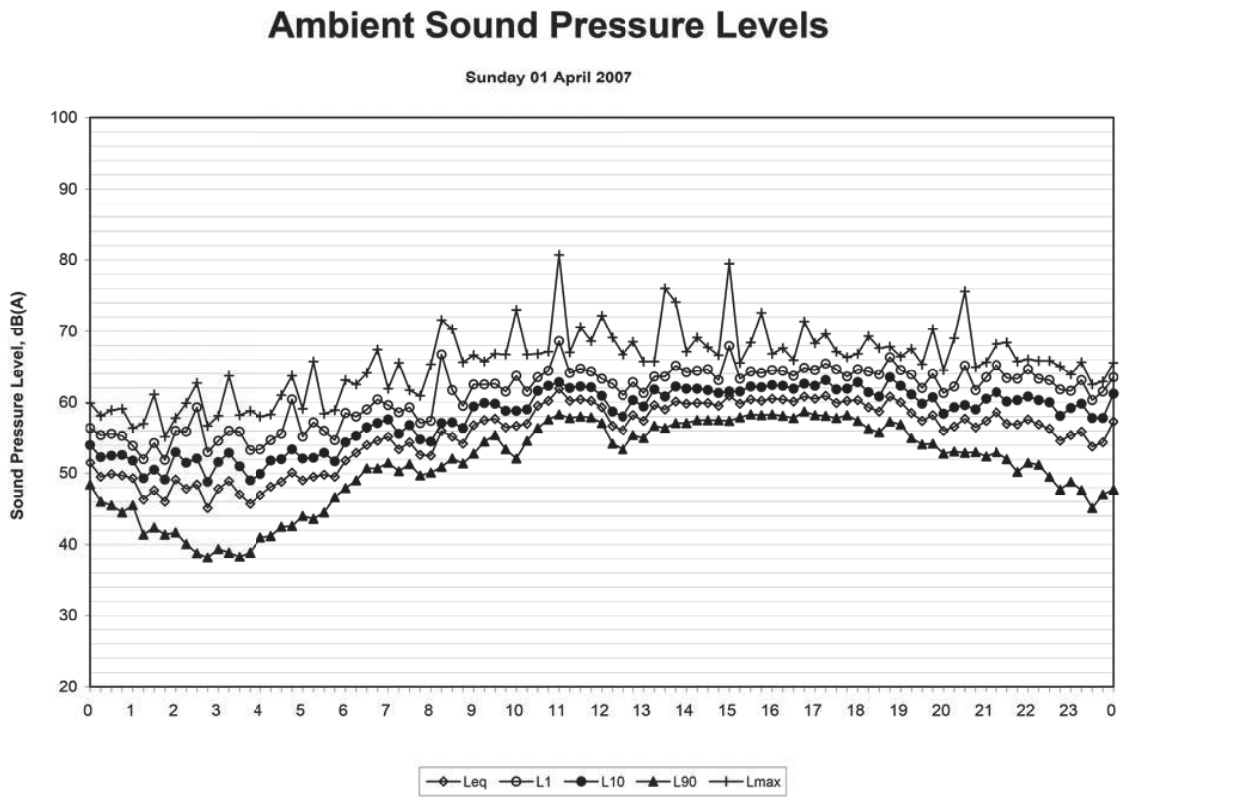
Ambient Sound Pressure Levels

Thursday 29 March 2007



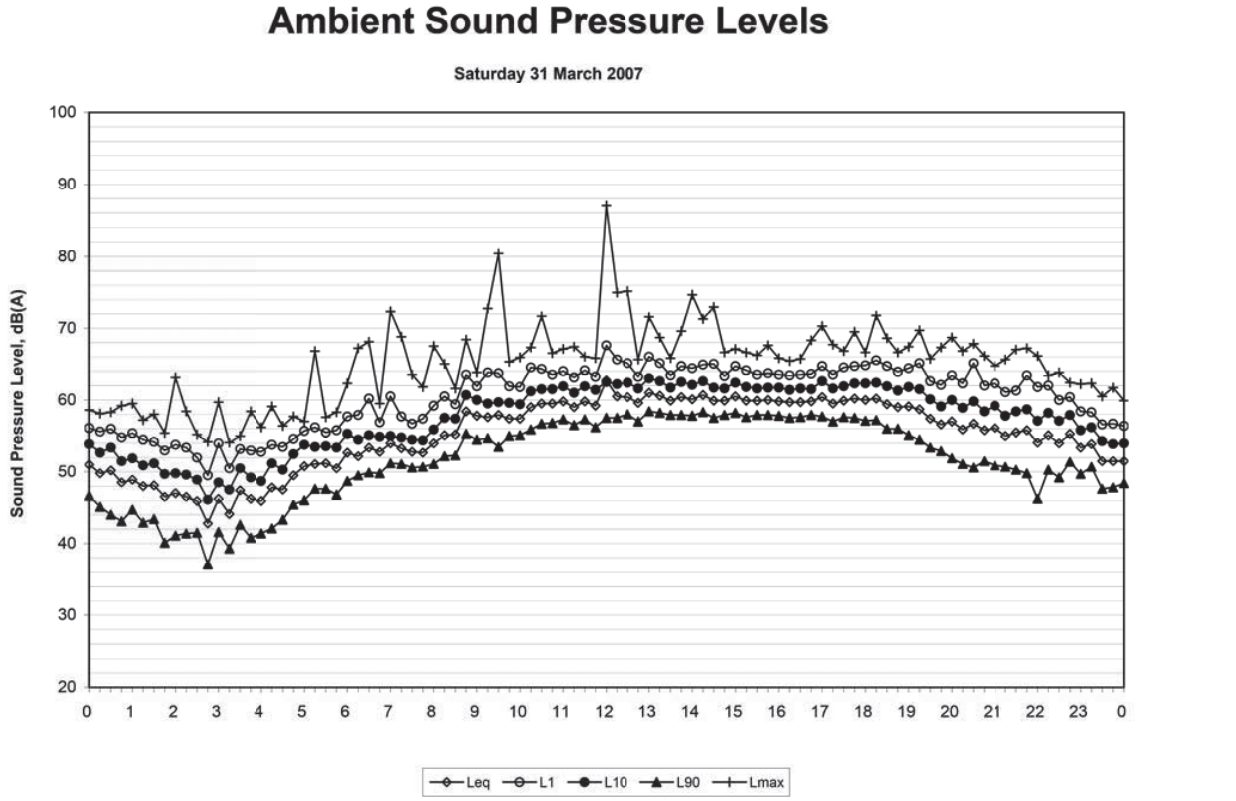
Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls



Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls

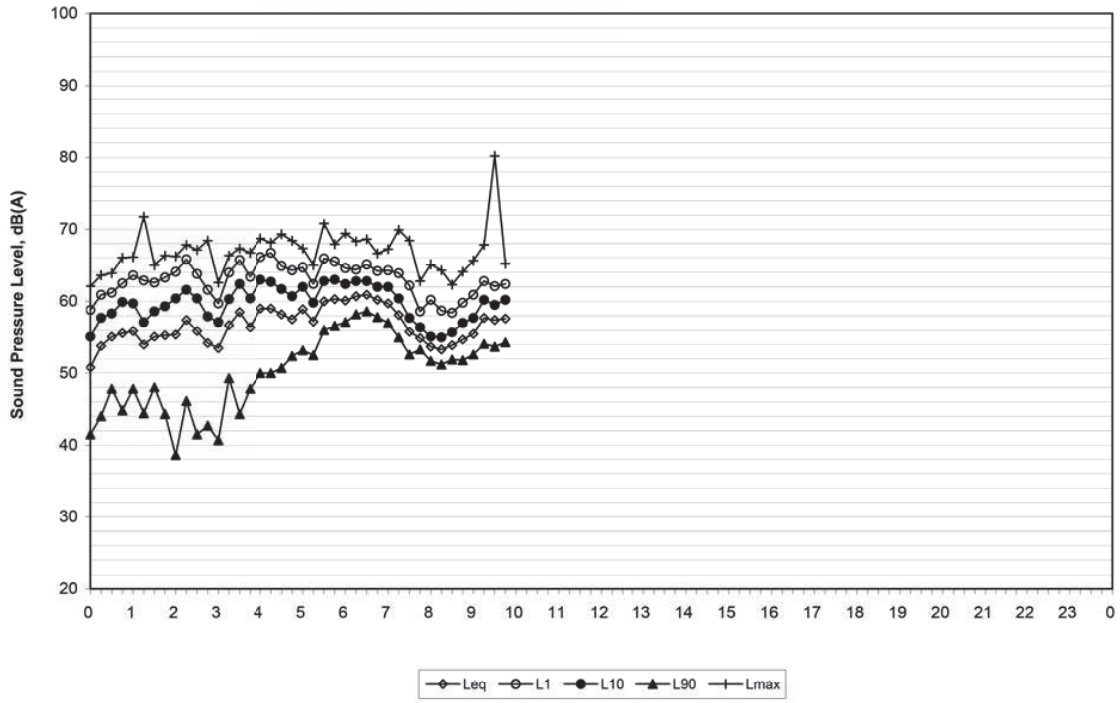


Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls

Ambient Sound Pressure Levels

Tuesday 03 April 2007

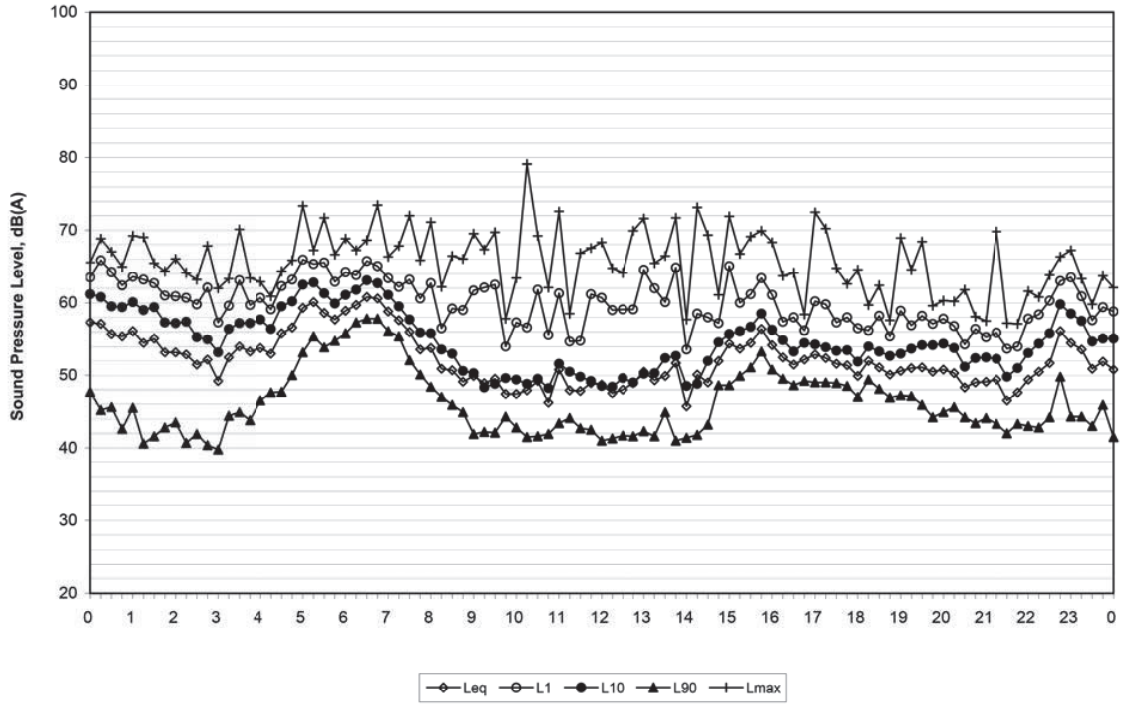


Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls

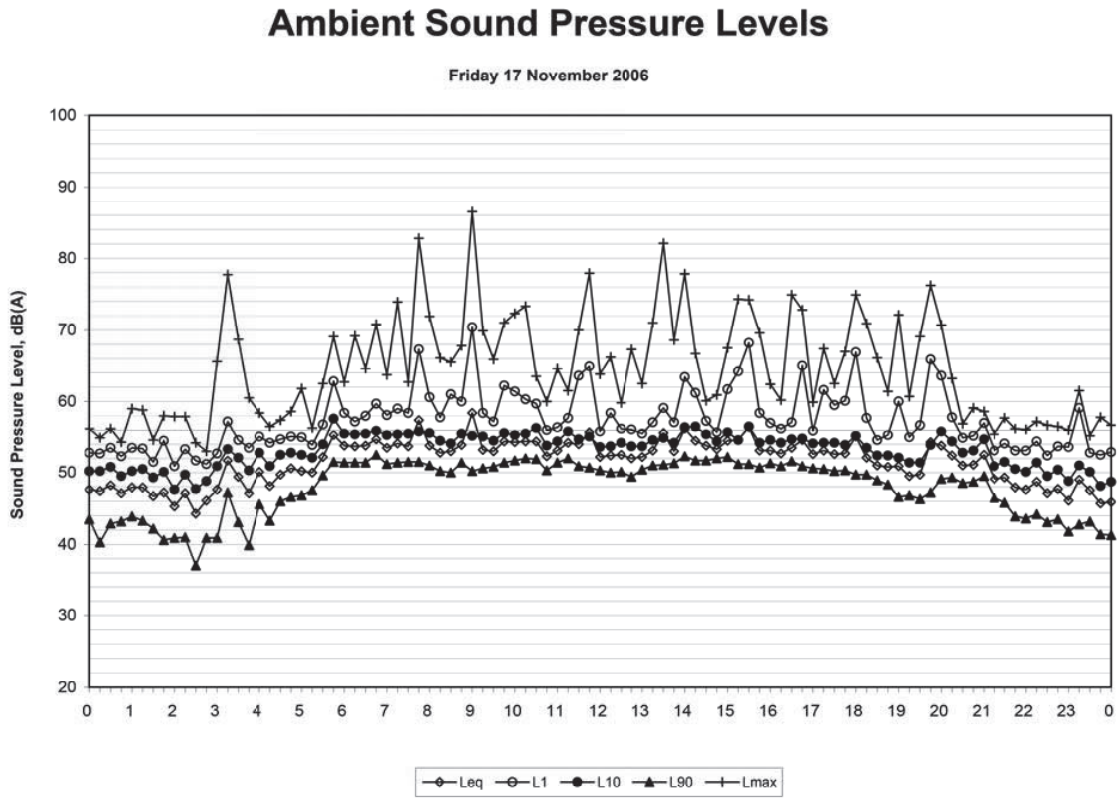
Ambient Sound Pressure Levels

Monday 02 April 2007



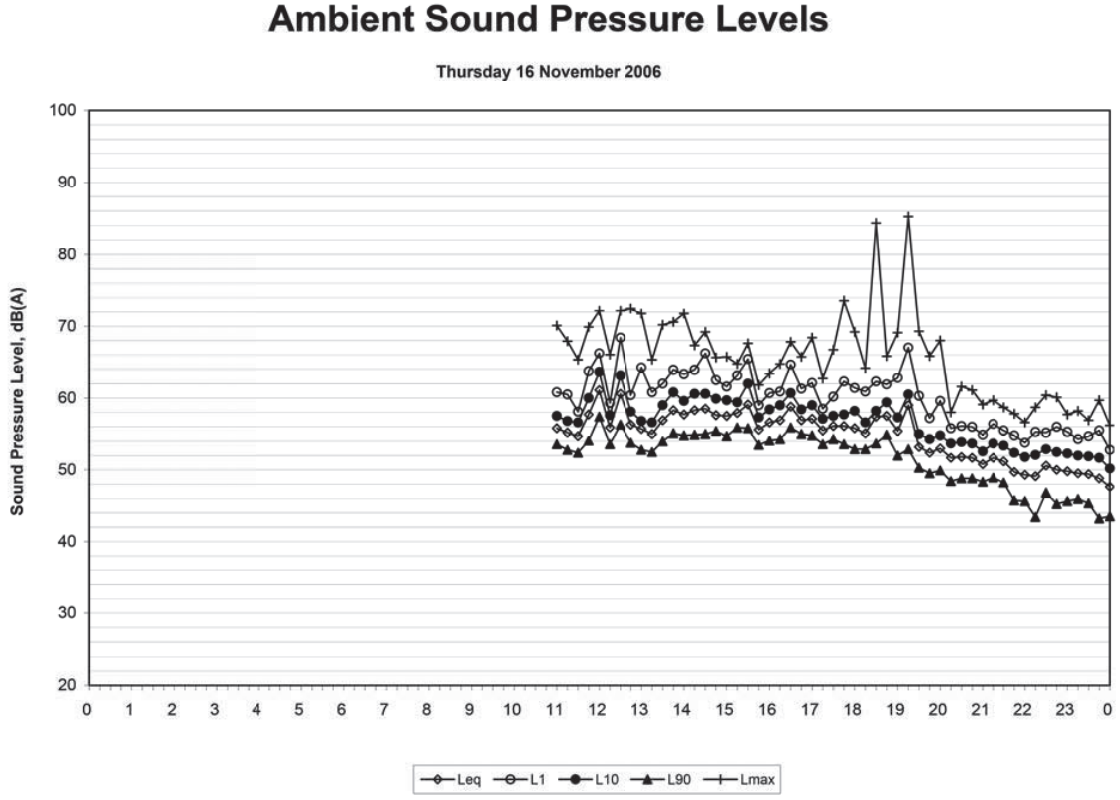
Reference Location M5
97 Bushells Ridge Road

5987R5_b.xls



Reference Location M6
4 Kira Ridge Road

5987R6.xls

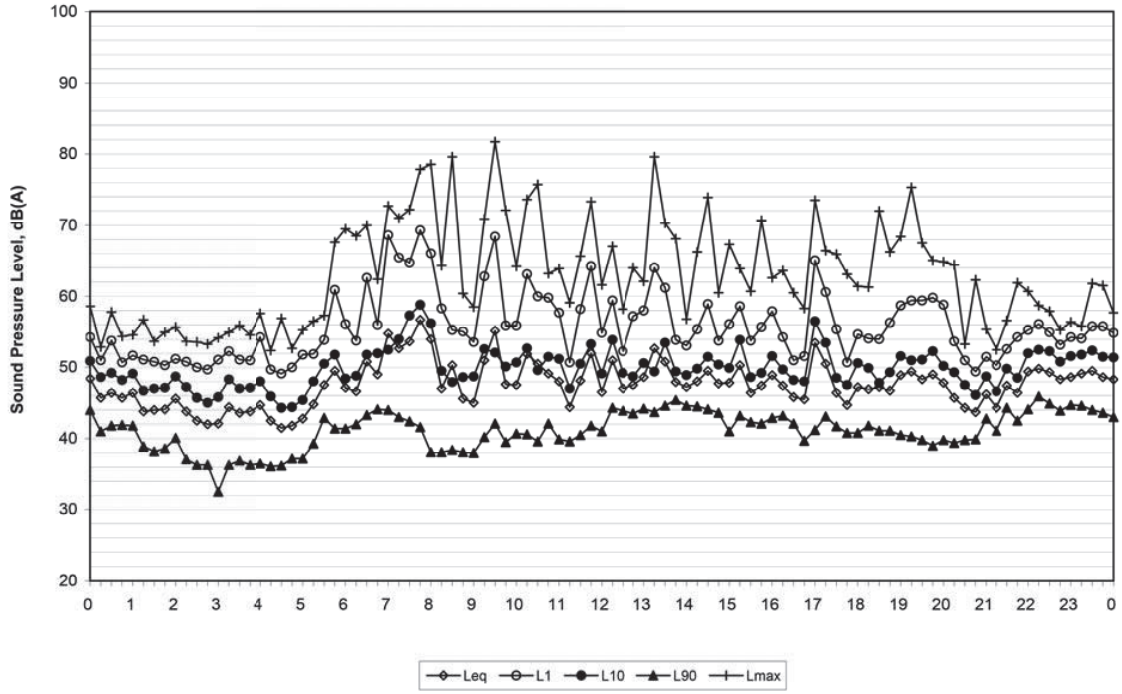


Reference Location M6
4 Kira Ridge Road

5987R6.xls

Ambient Sound Pressure Levels

Sunday 19 November 2006

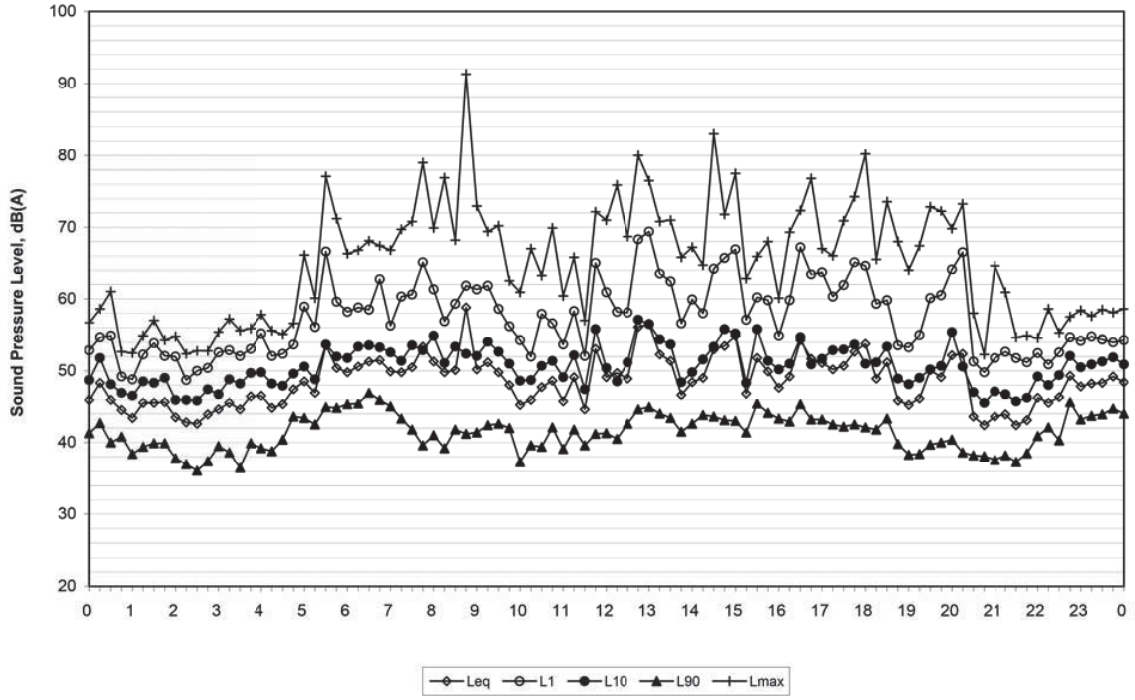


Reference Location M6
4 Kira Ridge Road

5987R6.xls

Ambient Sound Pressure Levels

Saturday 18 November 2006

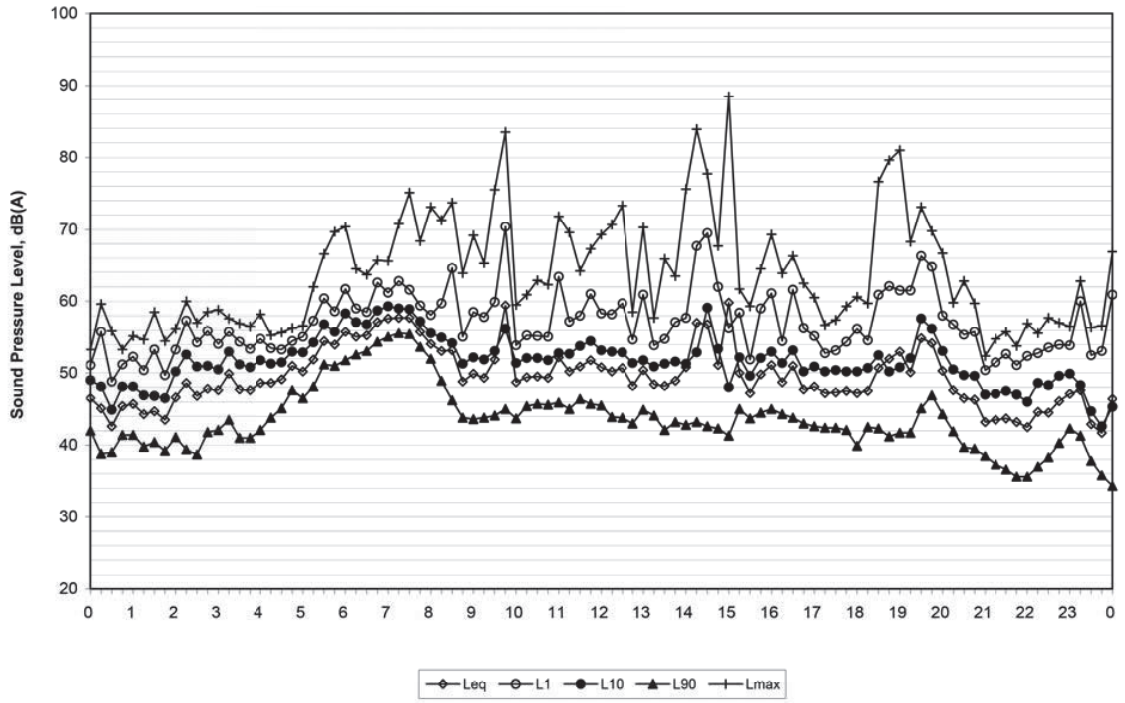


Reference Location M6
4 Kira Ridge Road

5987R6.xls

Ambient Sound Pressure Levels

Tuesday 21 November 2006

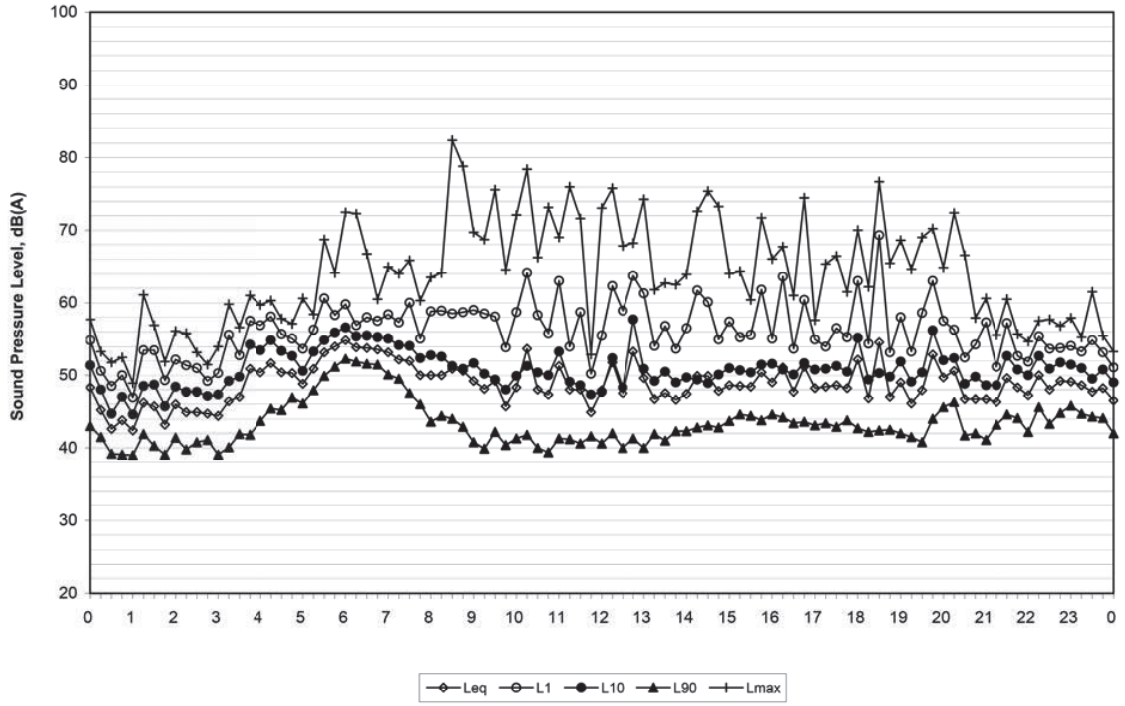


Reference Location M6
4 Kira Ridge Road

5987R6.xls

Ambient Sound Pressure Levels

Monday 20 November 2006

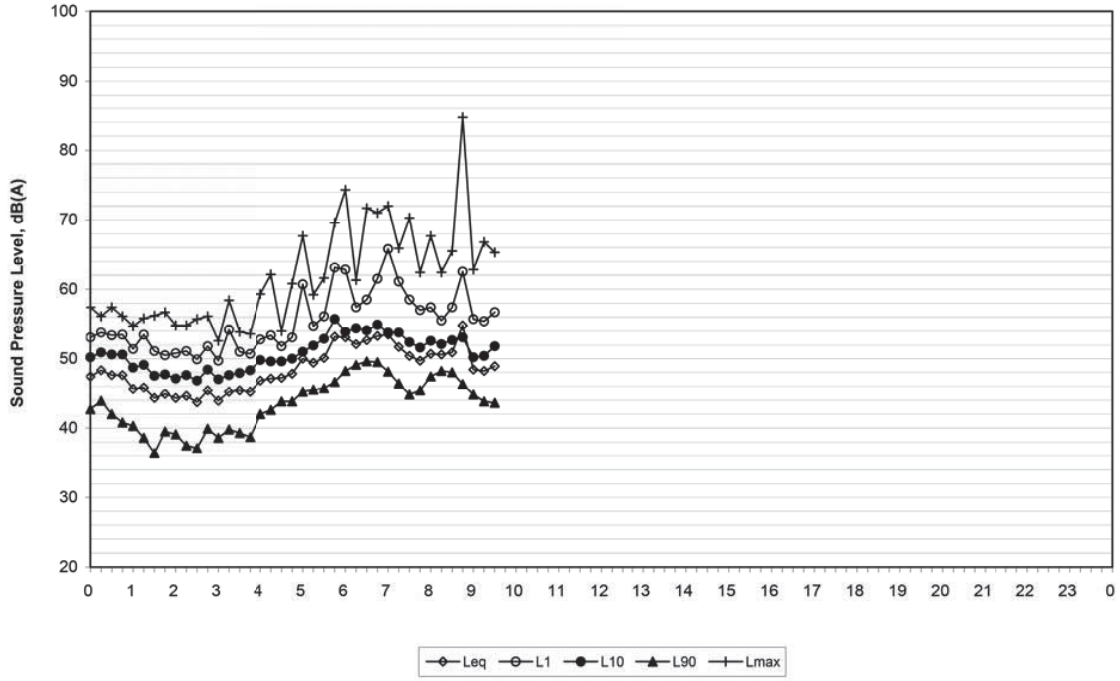


Reference Location M6
4 Kira Ridge Road

5987R6.xls

Ambient Sound Pressure Levels

Thursday 23 November 2006

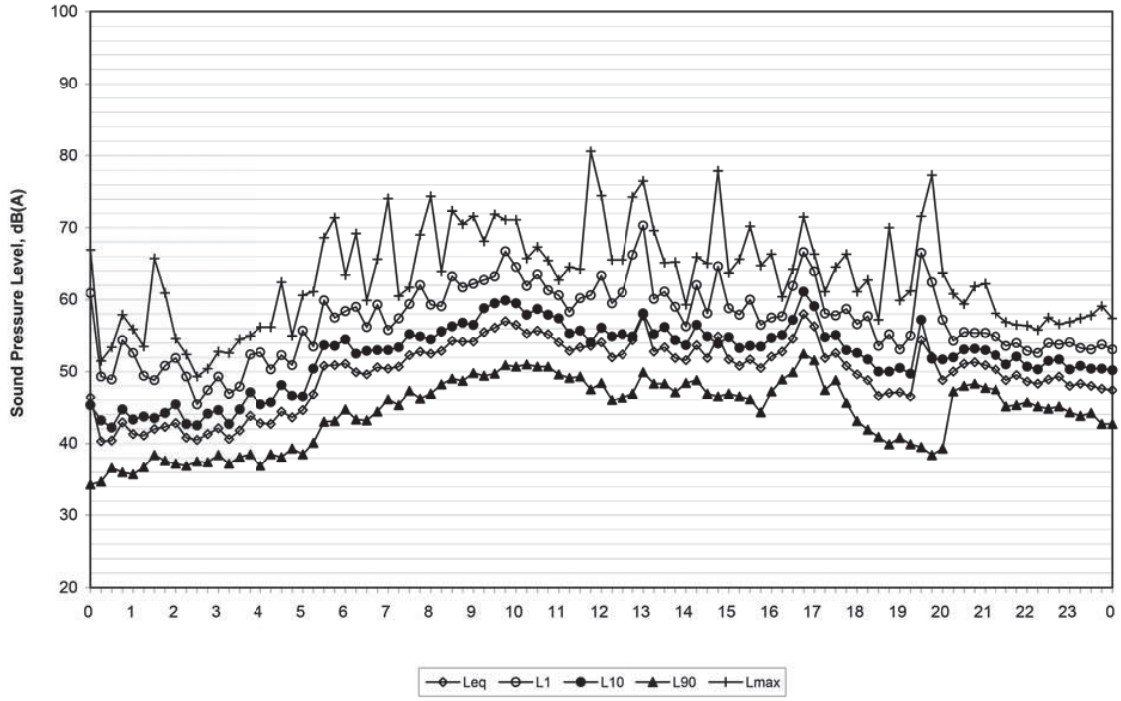


Reference Location M6
4 Kira Ridge Road

5987R6.xls

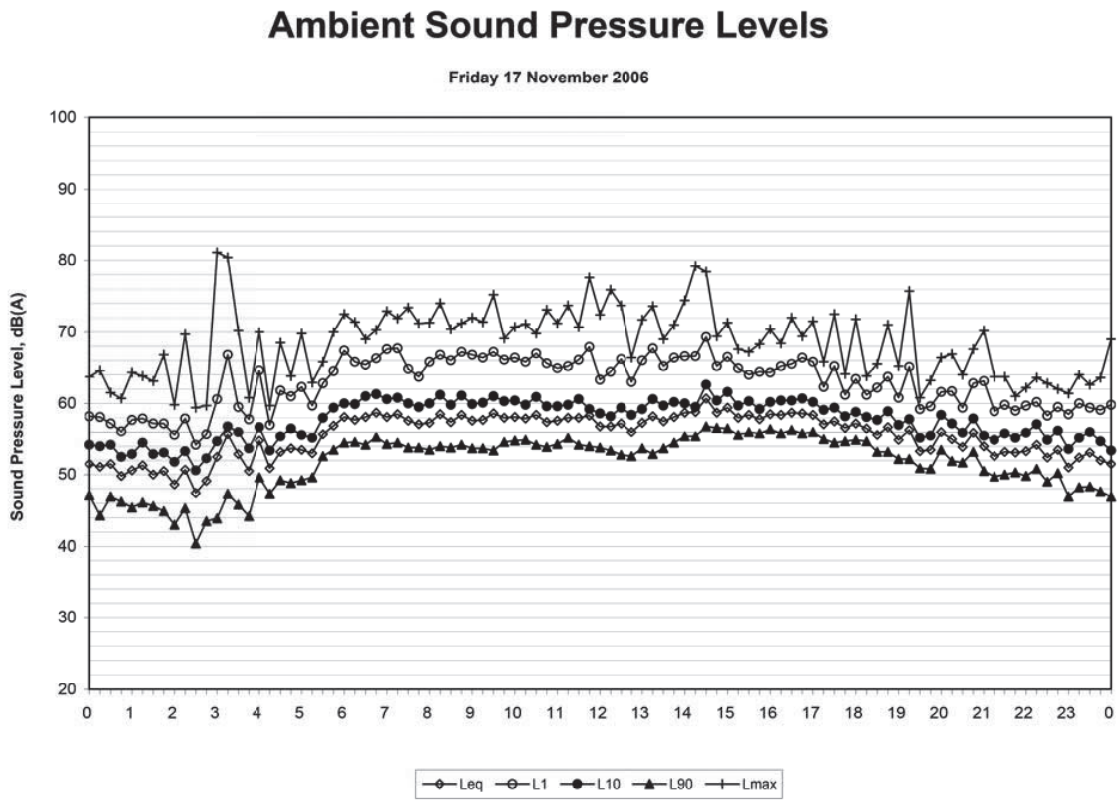
Ambient Sound Pressure Levels

Wednesday 22 November 2006



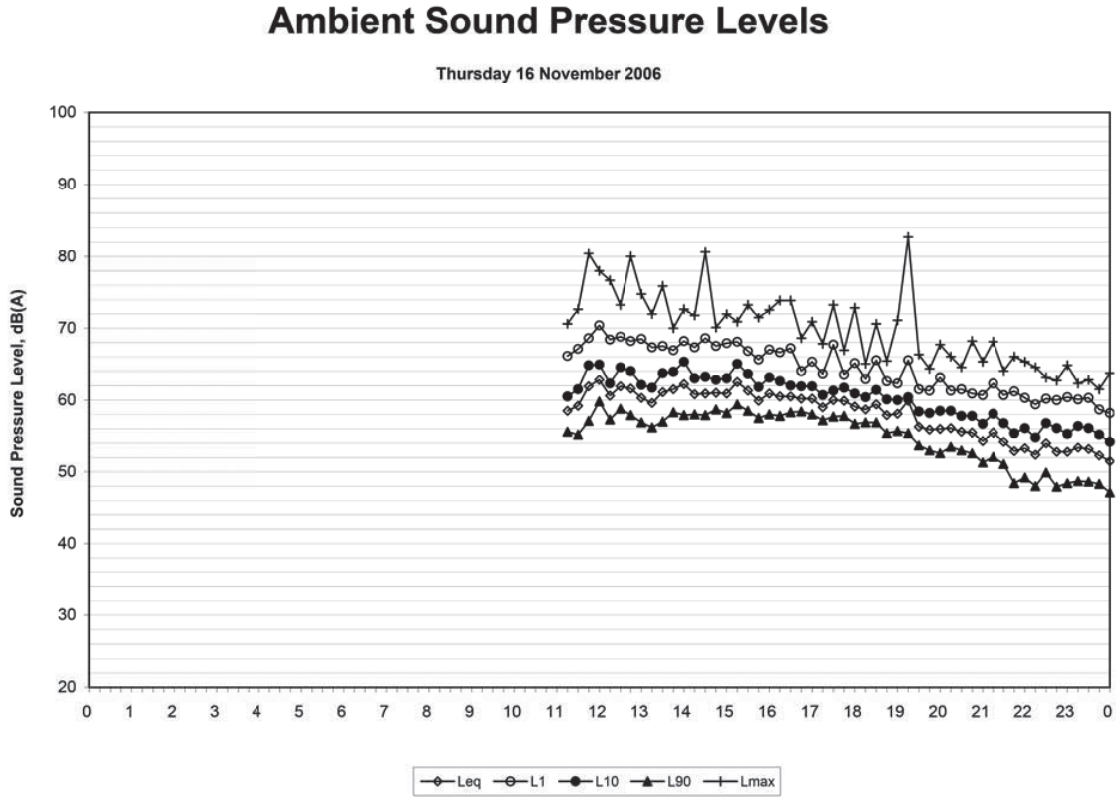
Reference Location M6
4 Kira Ridge Road

5987R6.xls



Reference Location M7
Hue Hue Road

5987R7.xls

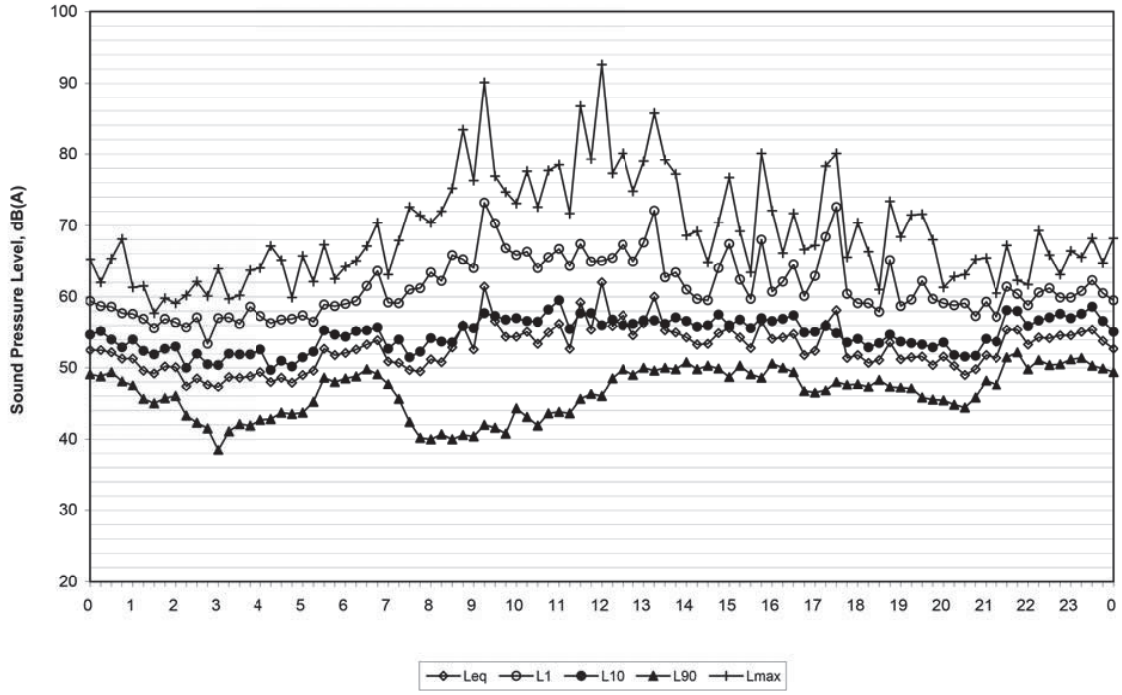


Reference Location M7
Hue Hue Road

5987R7.xls

Ambient Sound Pressure Levels

Sunday 19 November 2006

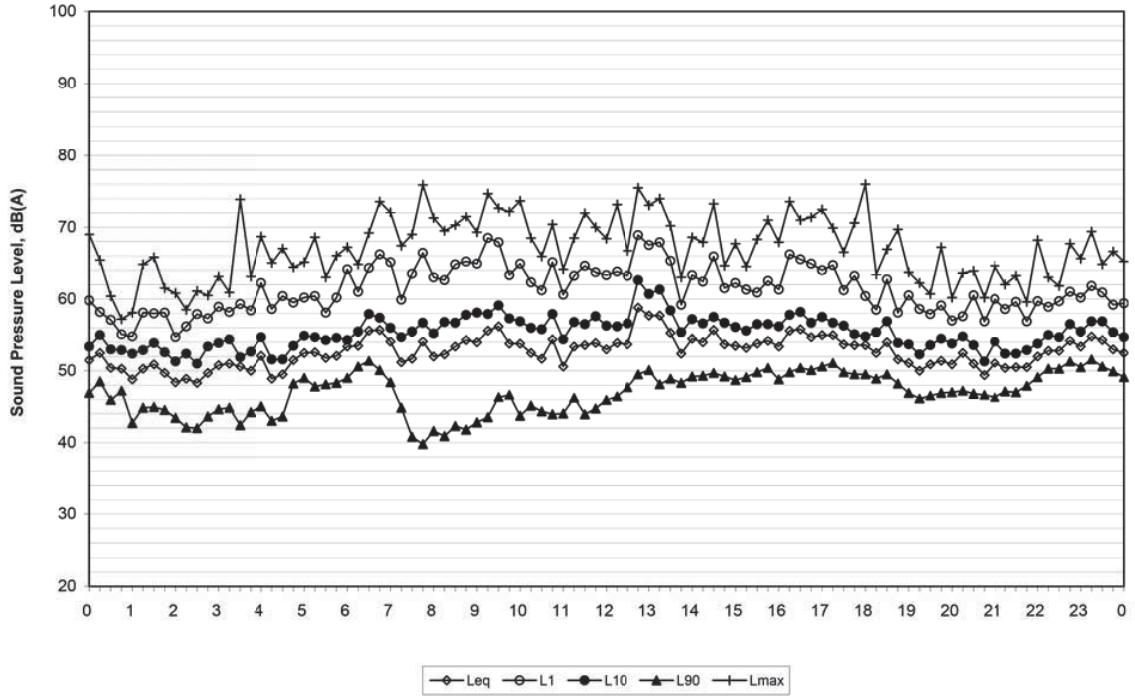


Reference Location M7
Hue Hue Road

5987R7.xls

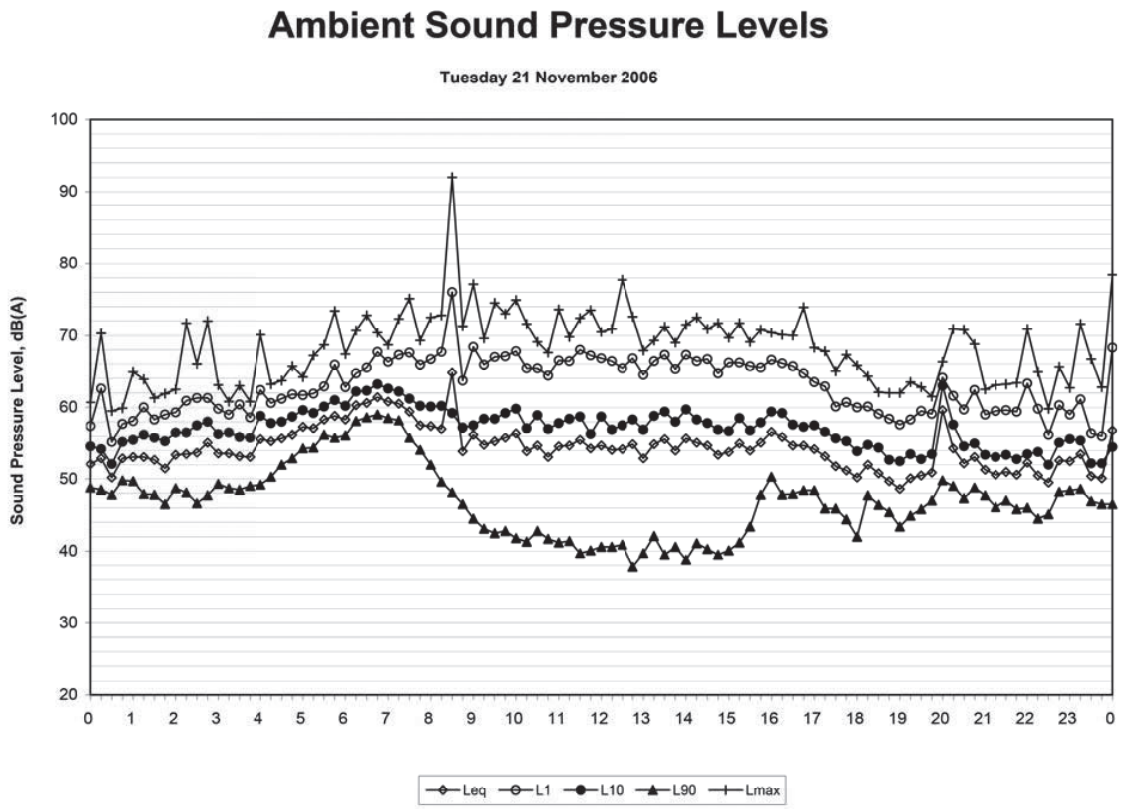
Ambient Sound Pressure Levels

Saturday 18 November 2006



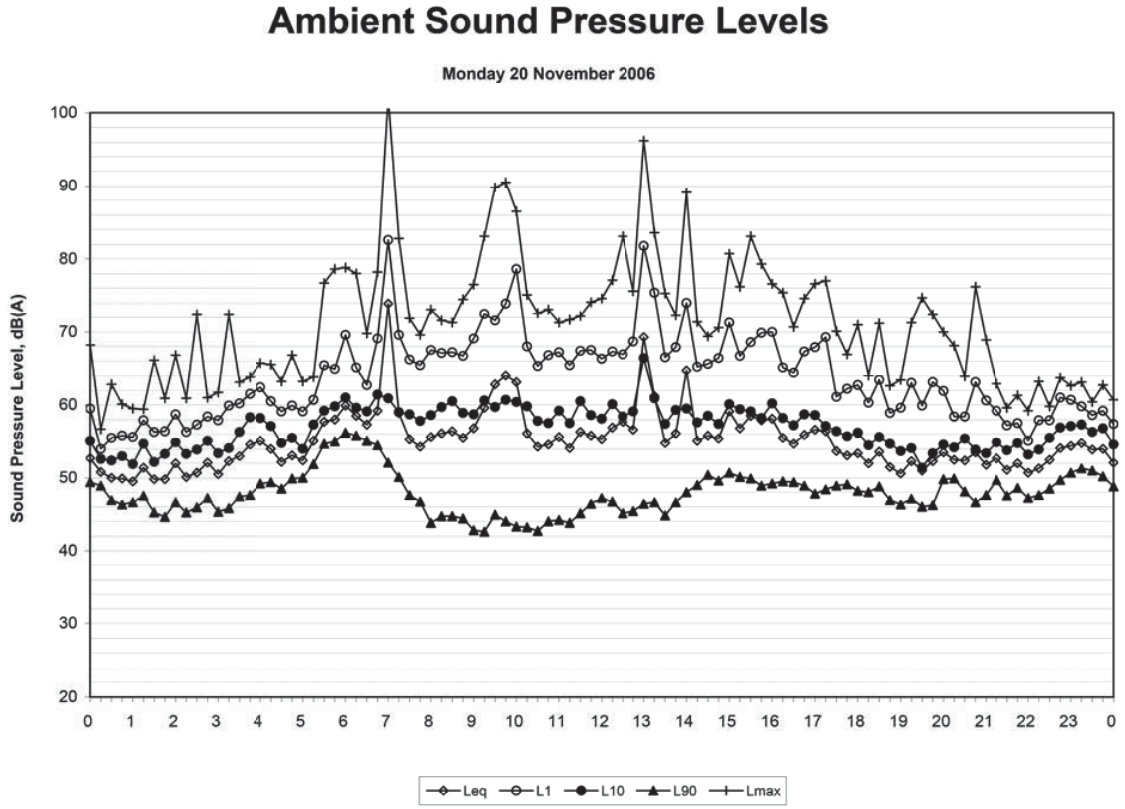
Reference Location M7
Hue Hue Road

5987R7.xls



Reference Location M7
Hue Hue Road

5987R7.xls

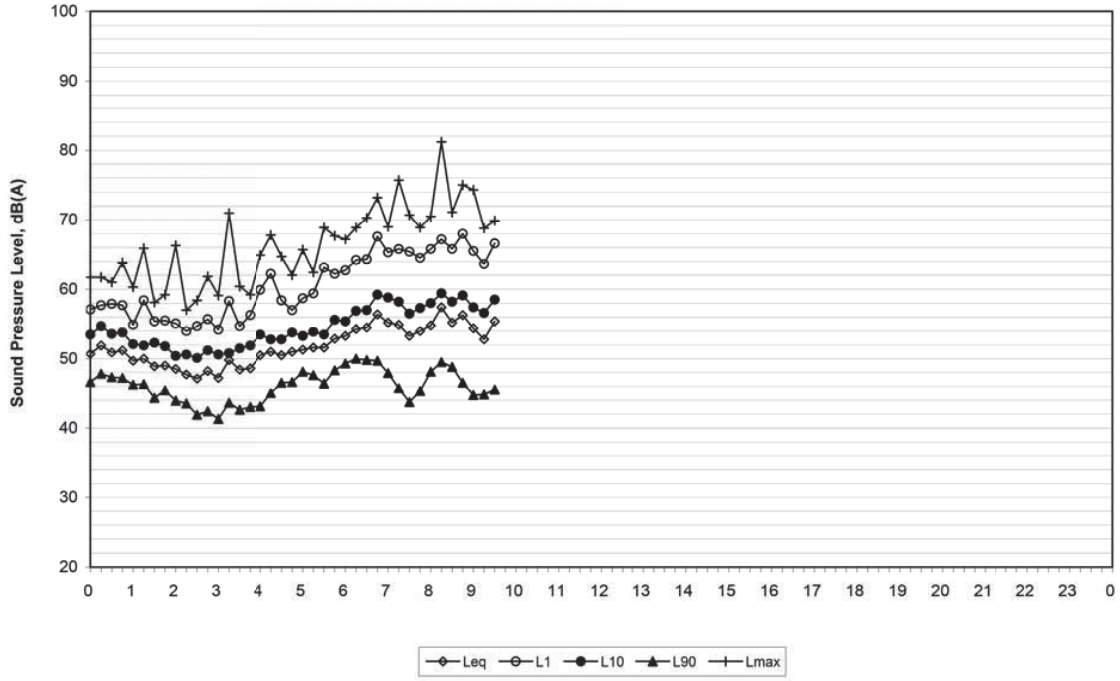


Reference Location M7
Hue Hue Road

5987R7.xls

Ambient Sound Pressure Levels

Thursday 23 November 2006

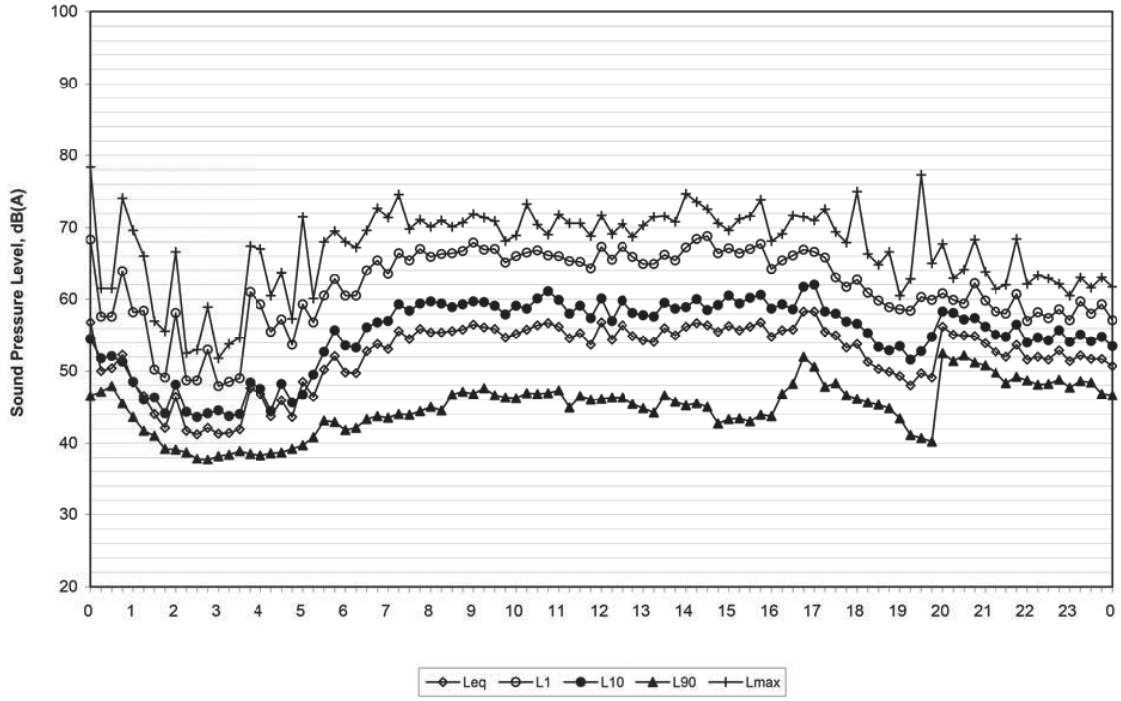


Reference Location M7
Hue Hue Road

5987R7.xls

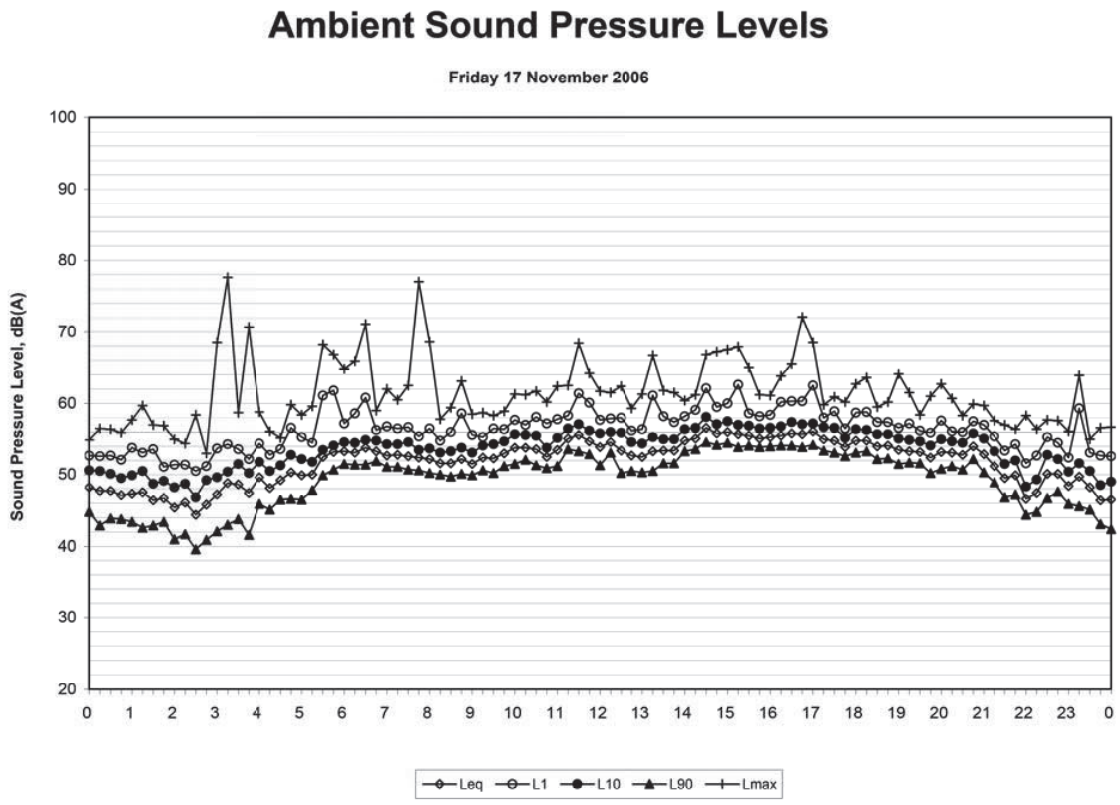
Ambient Sound Pressure Levels

Wednesday 22 November 2006



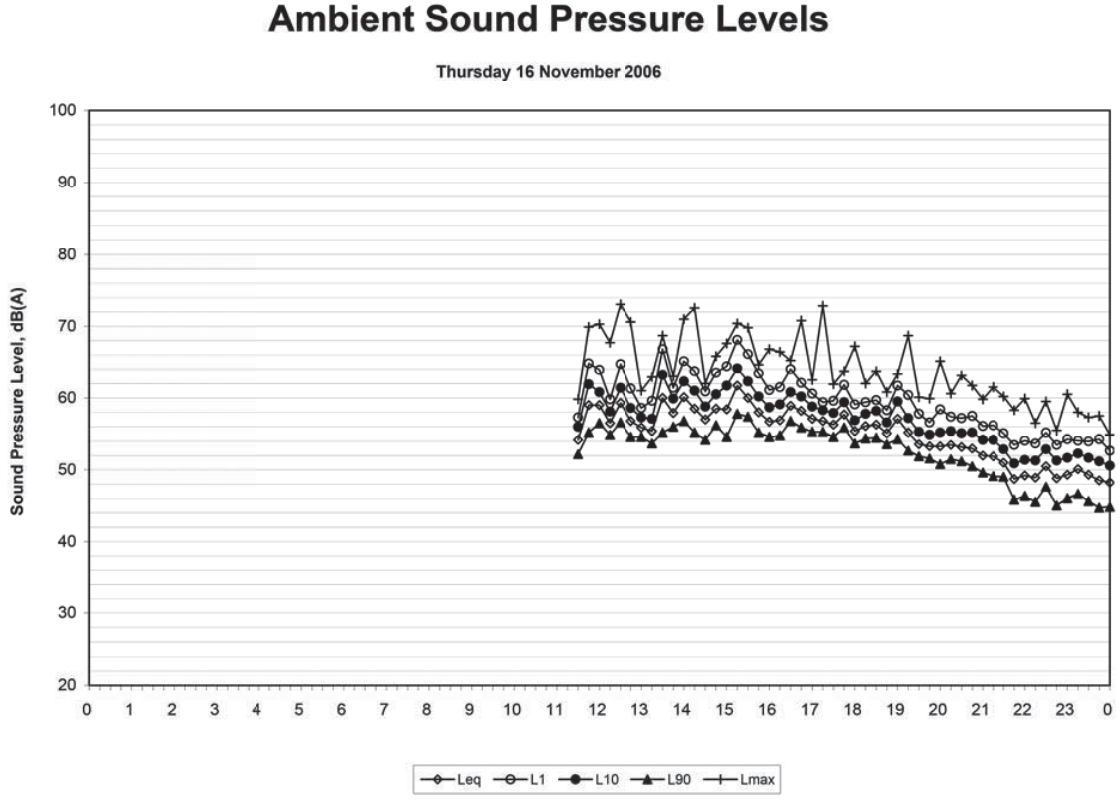
Reference Location M7
Hue Hue Road

5987R7.xls



Reference Location M8
Amberwood Road

5987R8.xls

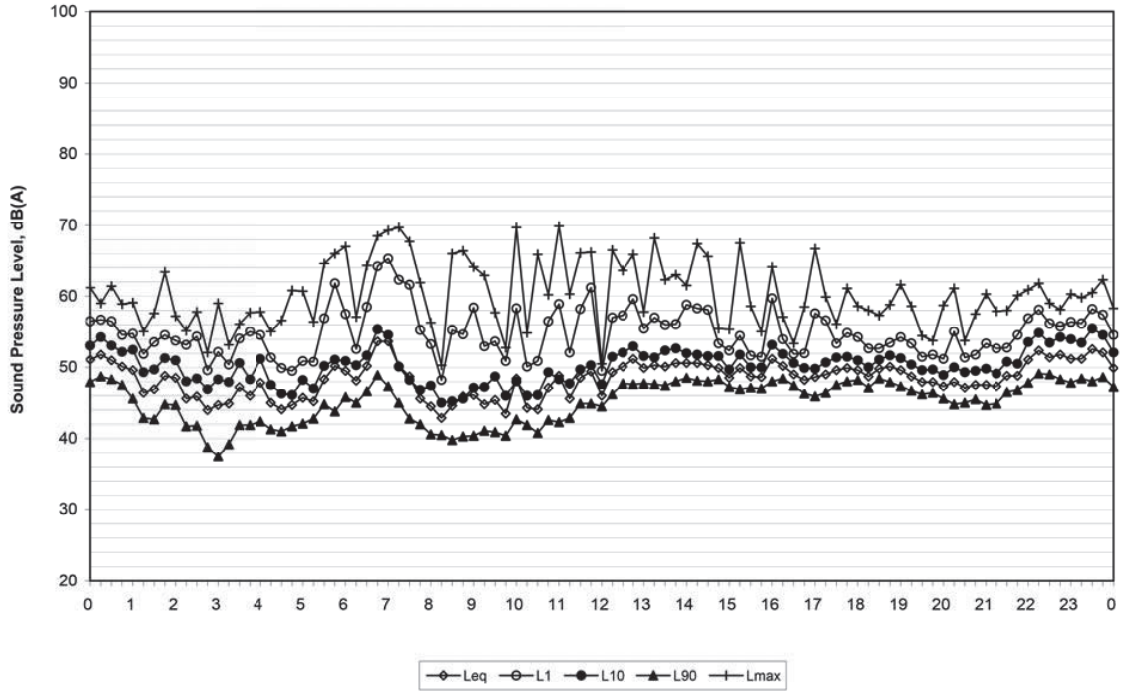


Reference Location M8
Amberwood Road

5987R8.xls

Ambient Sound Pressure Levels

Sunday 19 November 2006

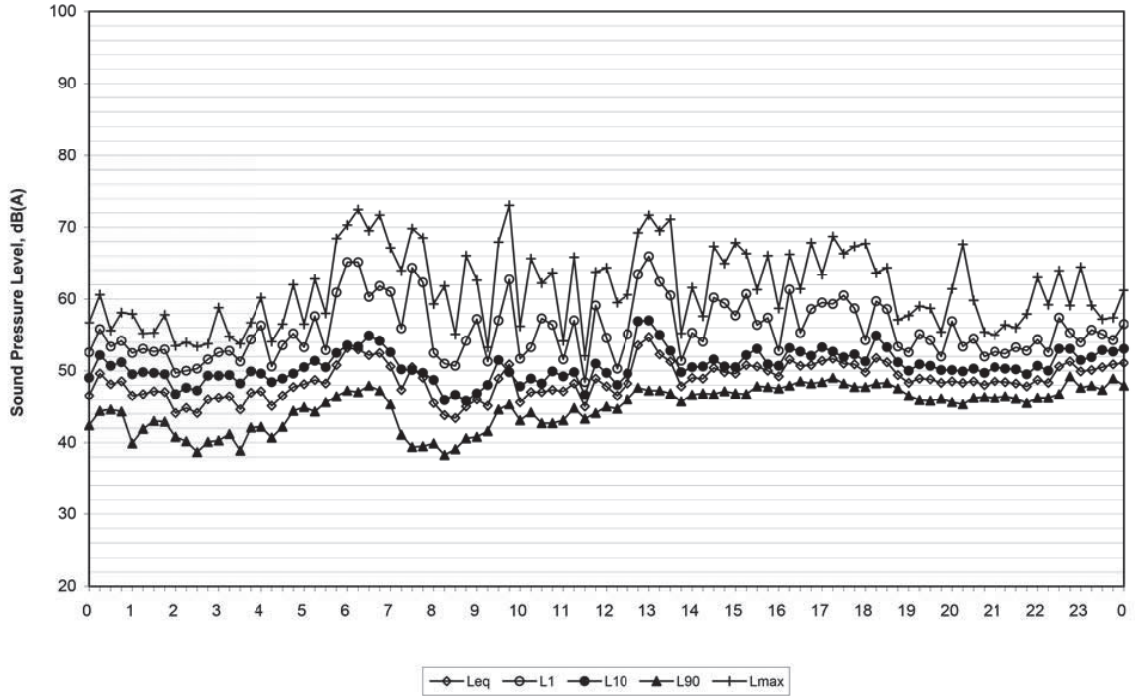


Reference Location M8
Amberwood Road

5987R8.xls

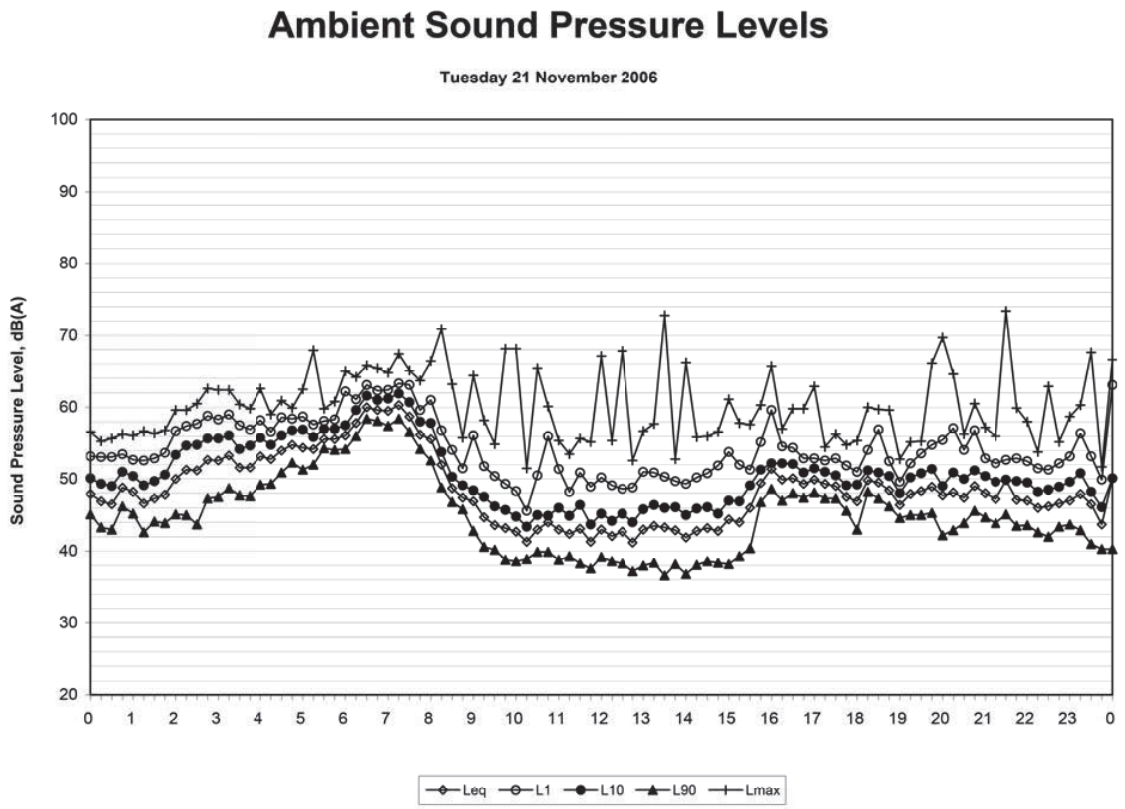
Ambient Sound Pressure Levels

Saturday 18 November 2006



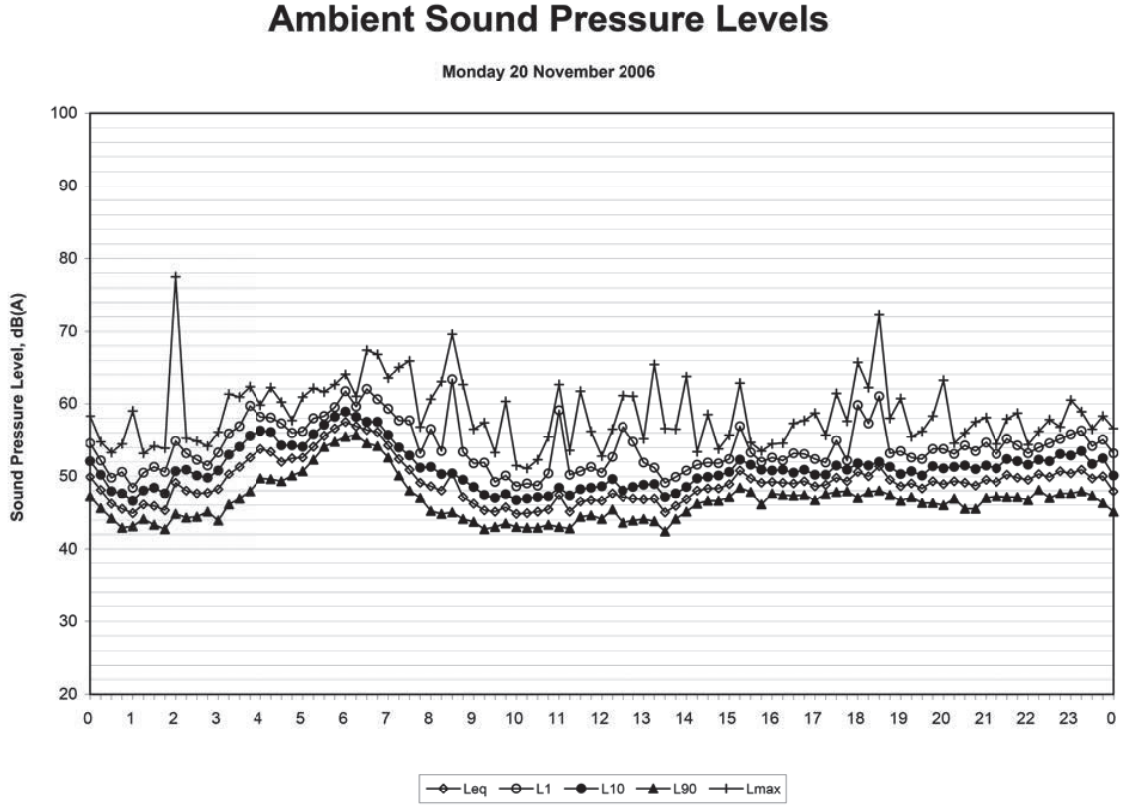
Reference Location M8
Amberwood Road

5987R8.xls



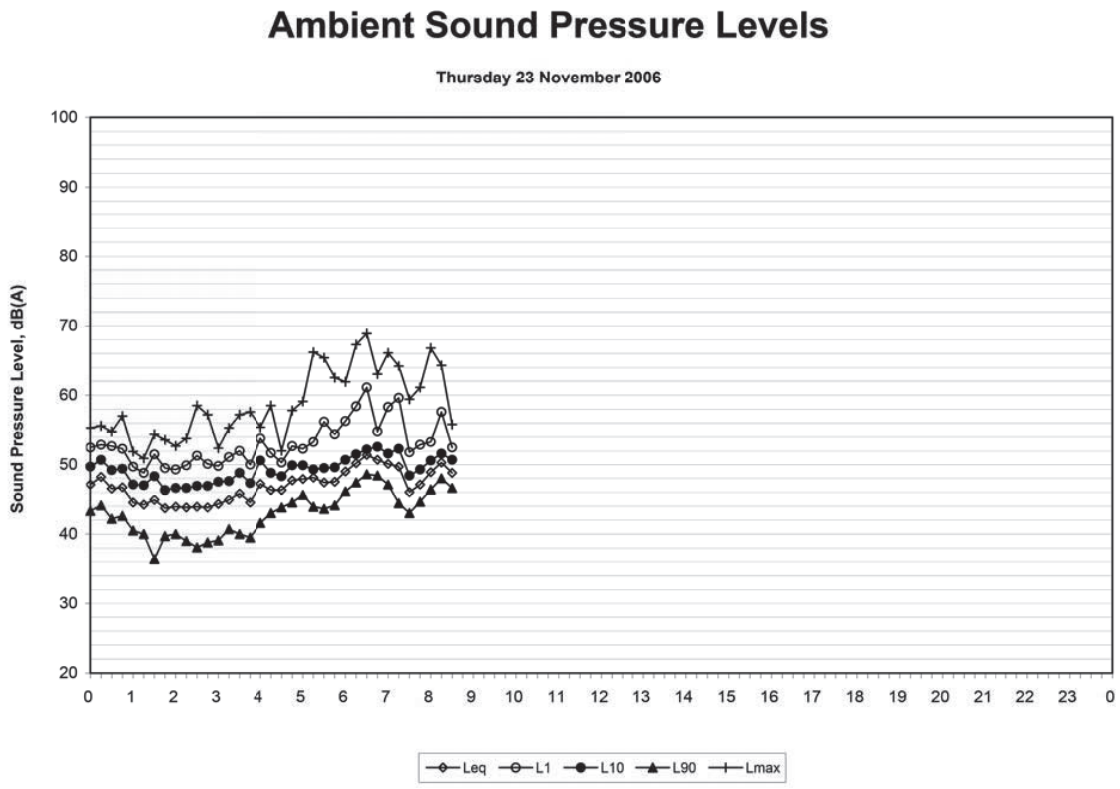
Reference Location M8
Amberwood Road

5987R8.xls



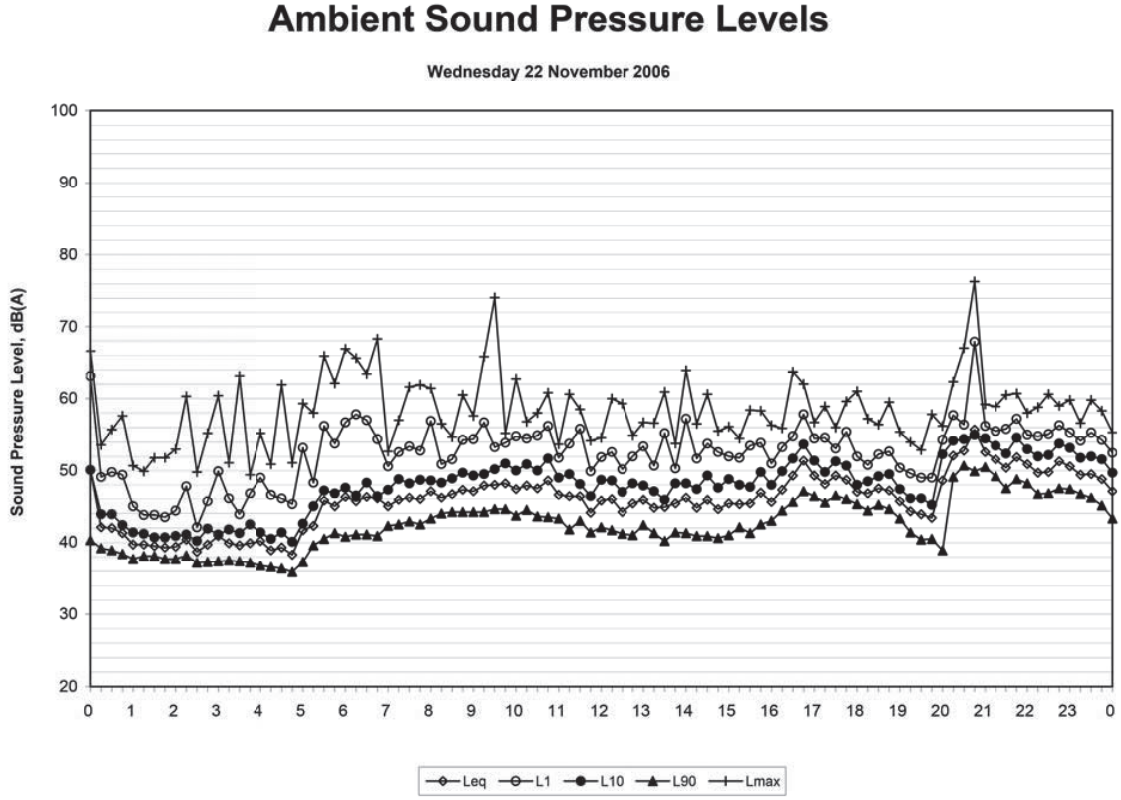
Reference Location M8
Amberwood Road

5987R8.xls



Reference Location M8
Amberwood Road

5987R8.xls

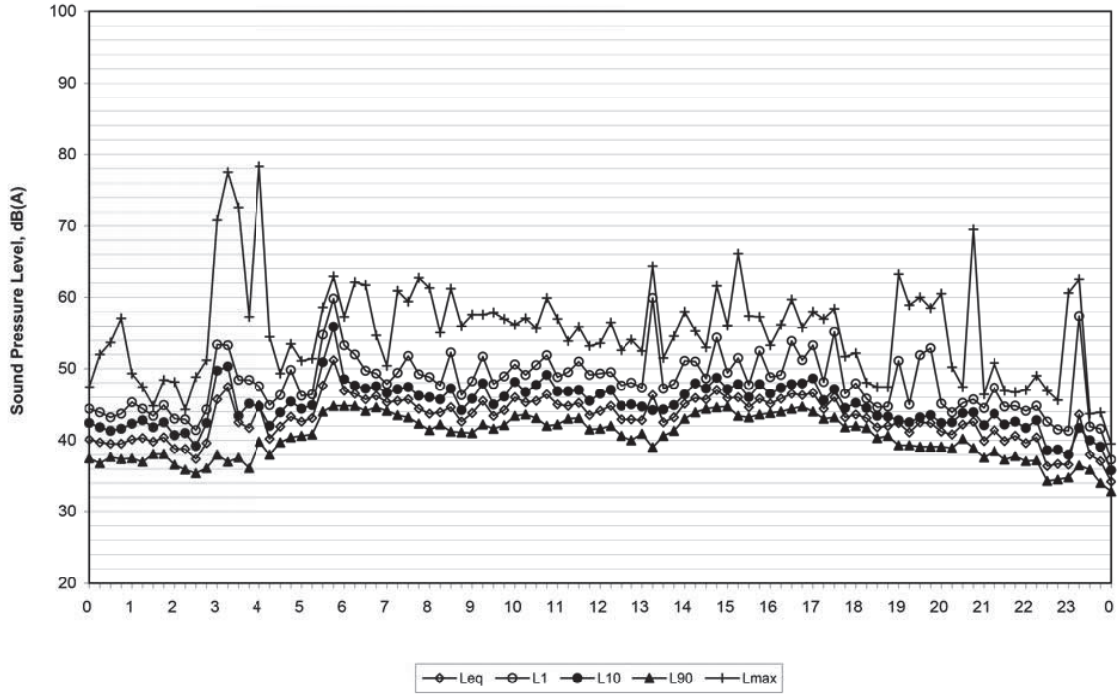


Reference Location M8
Amberwood Road

5987R8.xls

Ambient Sound Pressure Levels

Friday 17 November 2006

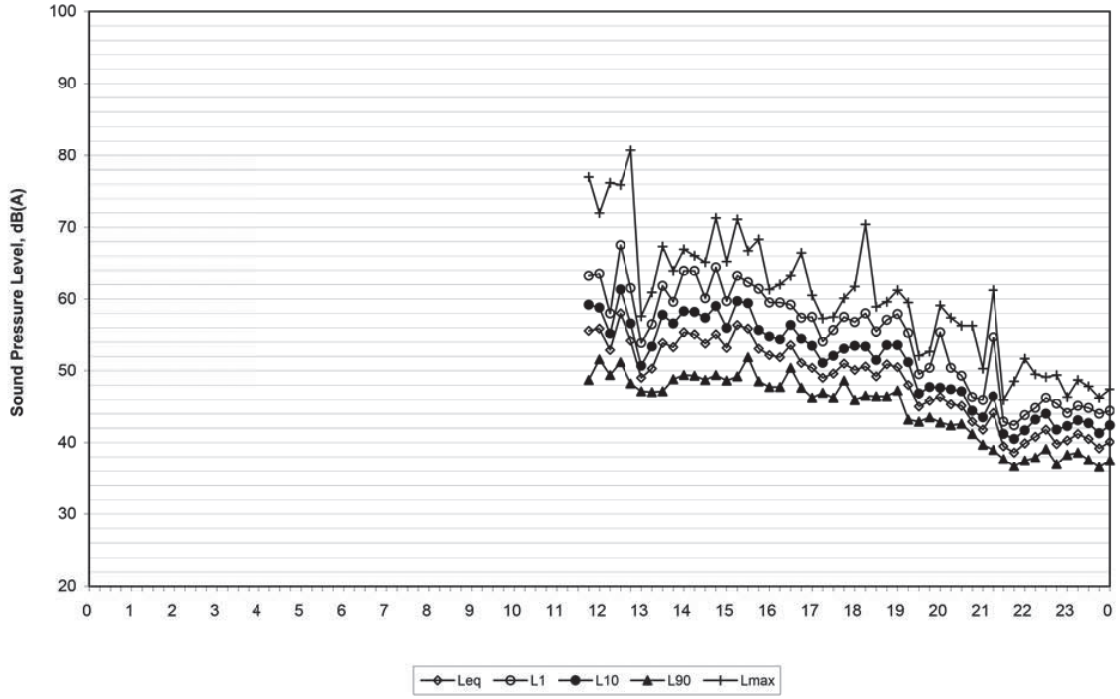


Reference Location M9
Sandra Road

5987R9.xls

Ambient Sound Pressure Levels

Thursday 16 November 2006

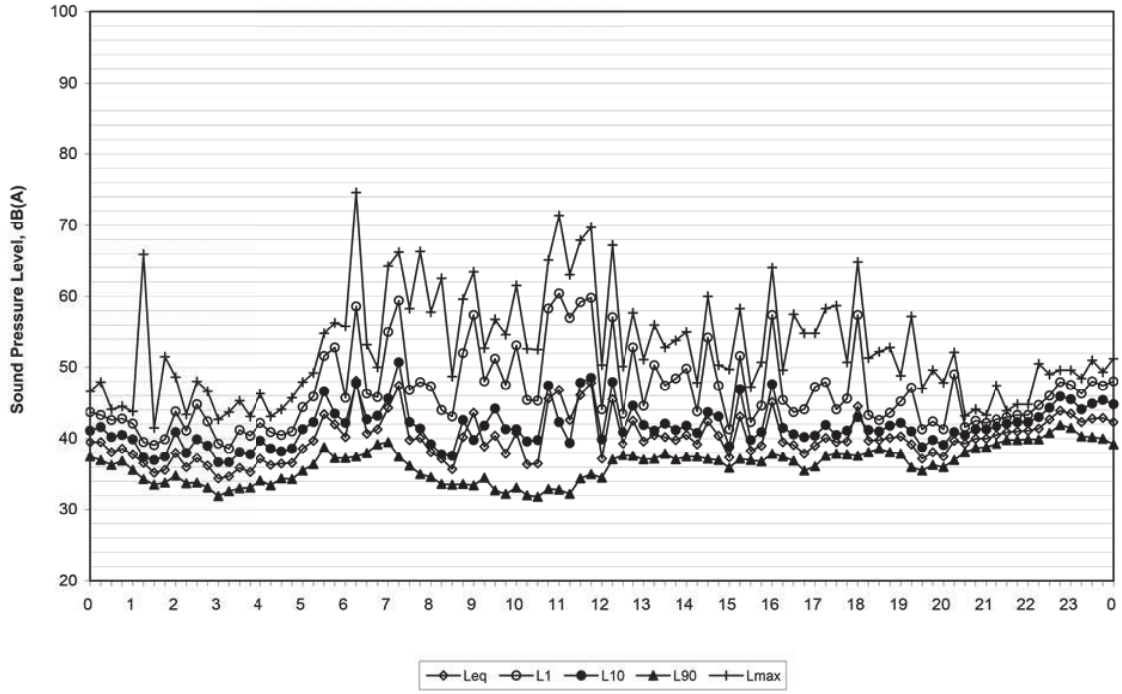


Reference Location M9
Sandra Road

5987R9.xls

Ambient Sound Pressure Levels

Sunday 19 November 2006

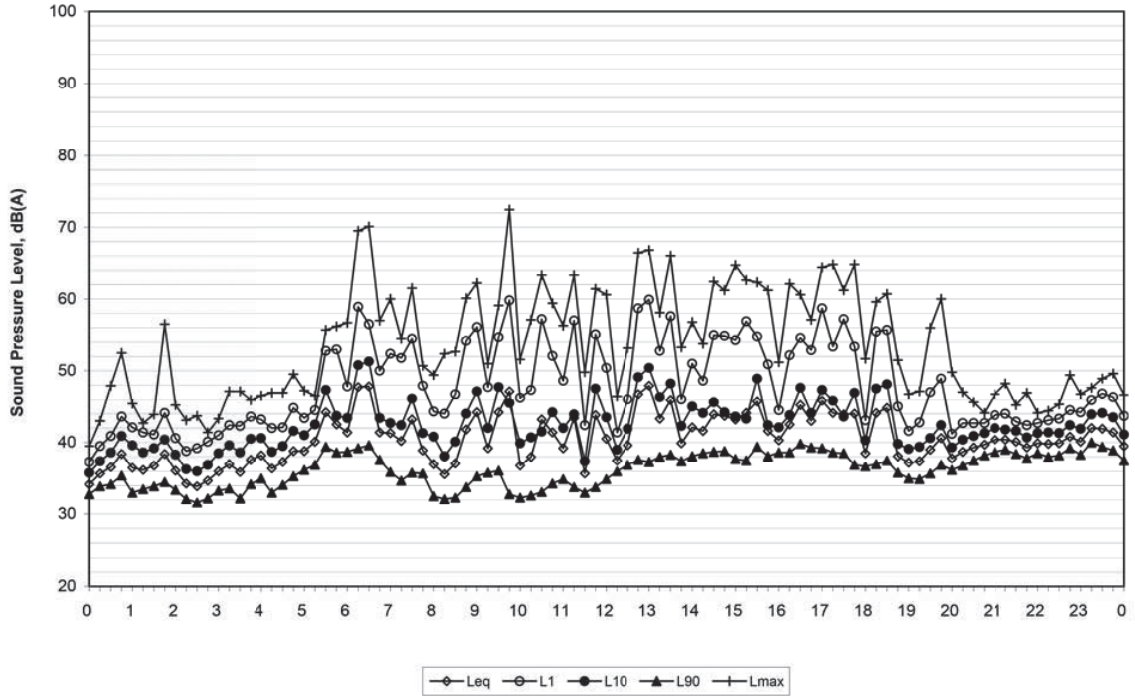


Reference Location M9
Sandra Road

5987R9.xls

Ambient Sound Pressure Levels

Saturday 18 November 2006

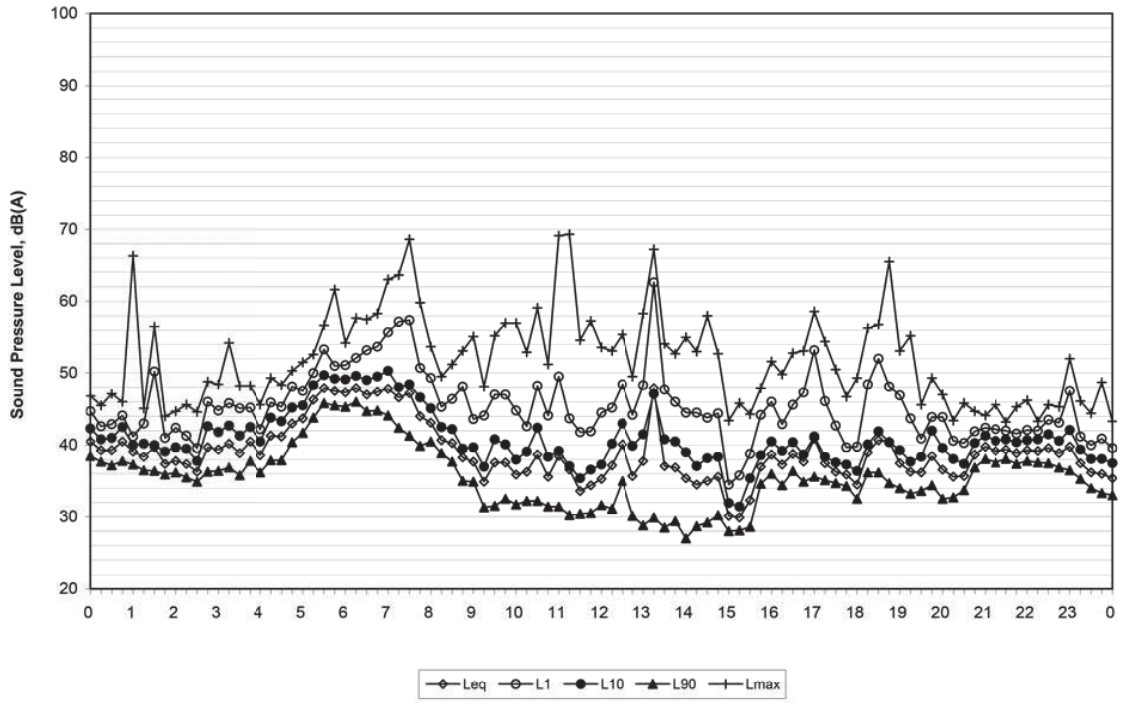


Reference Location M9
Sandra Road

5987R9.xls

Ambient Sound Pressure Levels

Tuesday 21 November 2006

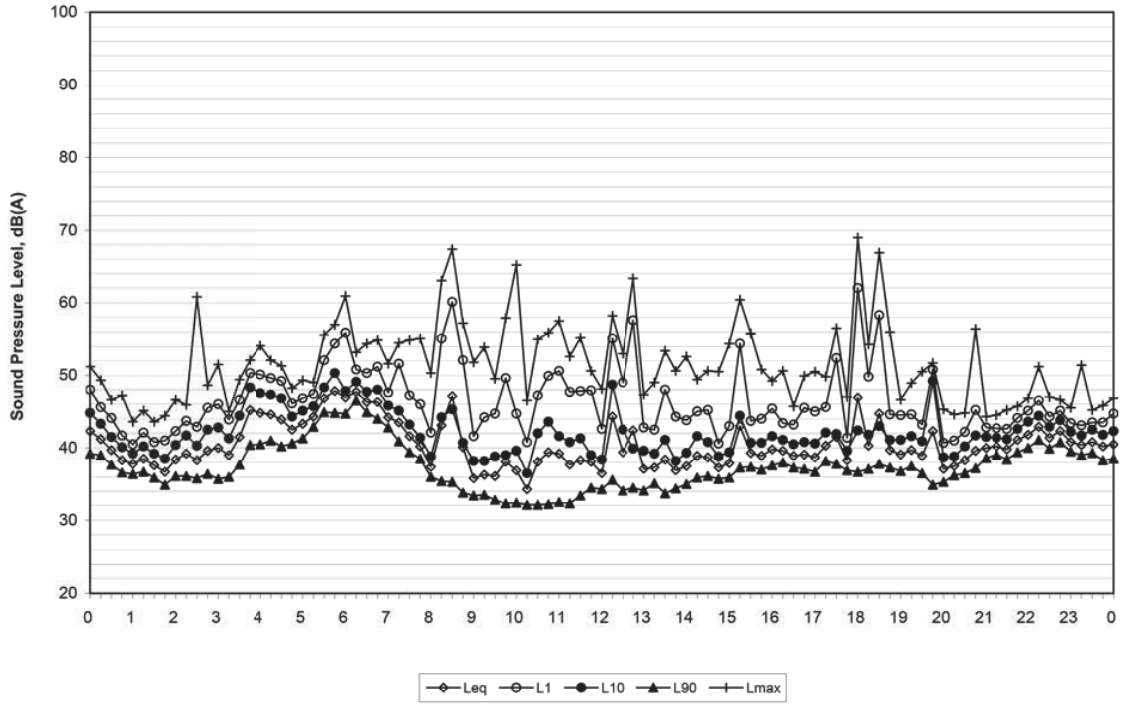


Reference Location M9
Sandra Road

5987R9.xls

Ambient Sound Pressure Levels

Monday 20 November 2006

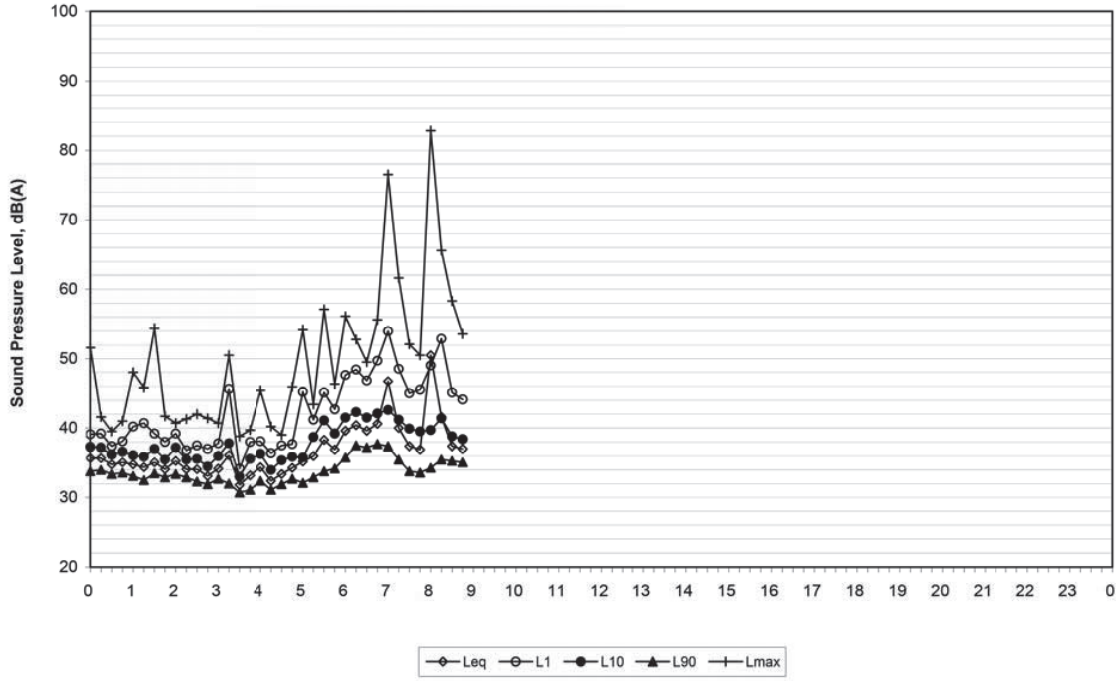


Reference Location M9
Sandra Road

5987R9.xls

Ambient Sound Pressure Levels

Thursday 23 November 2006

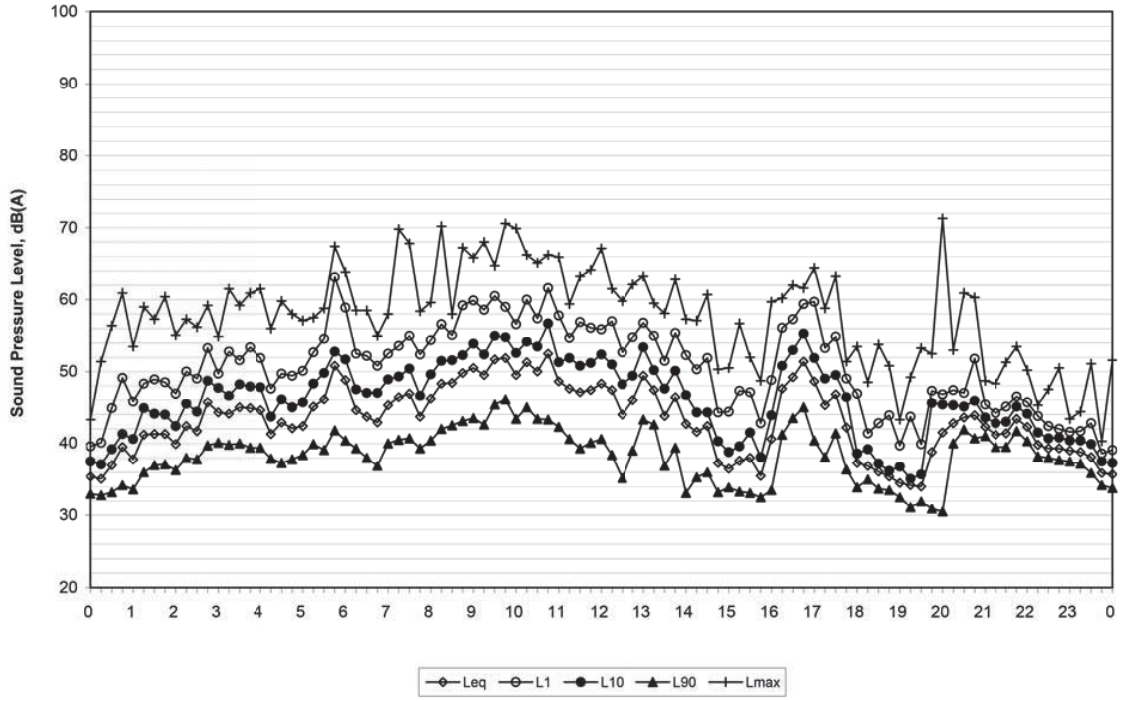


Reference Location M9
Sandra Road

5987R9.xls

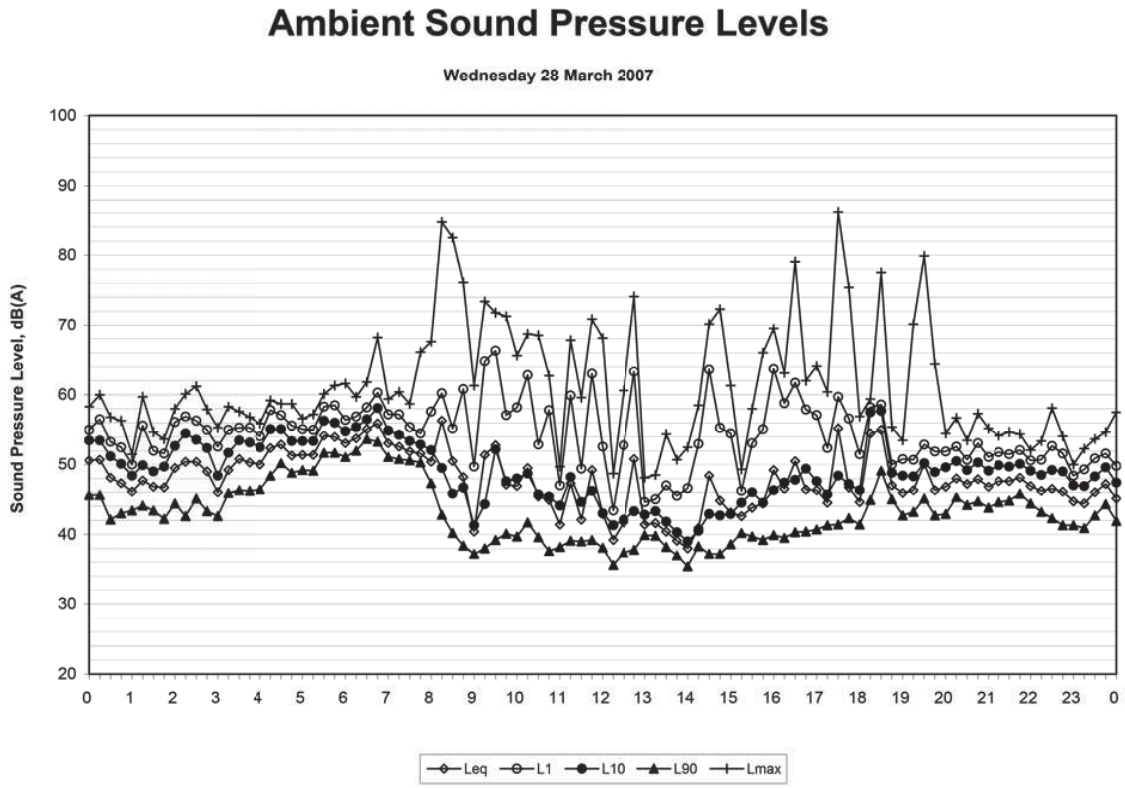
Ambient Sound Pressure Levels

Wednesday 22 November 2006



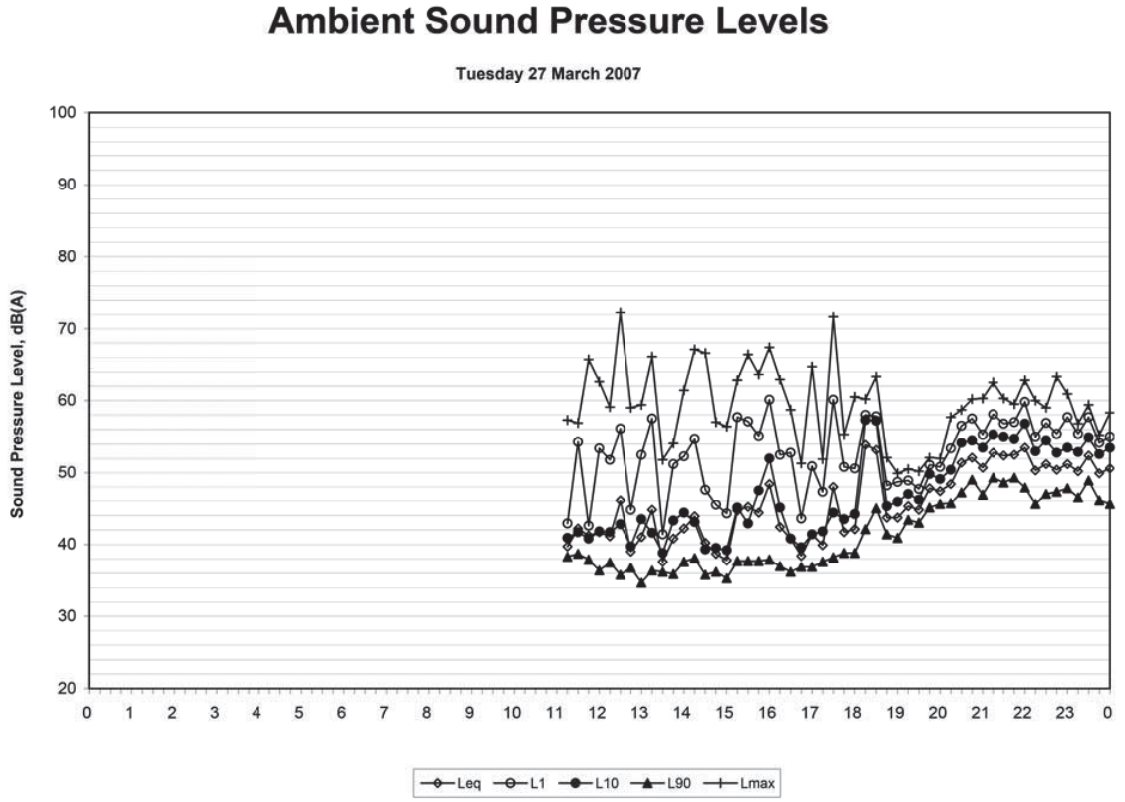
Reference Location M9
Sandra Road

5987R9.xls



Reference Location M10
113A Mountain Road

5987R10.xls

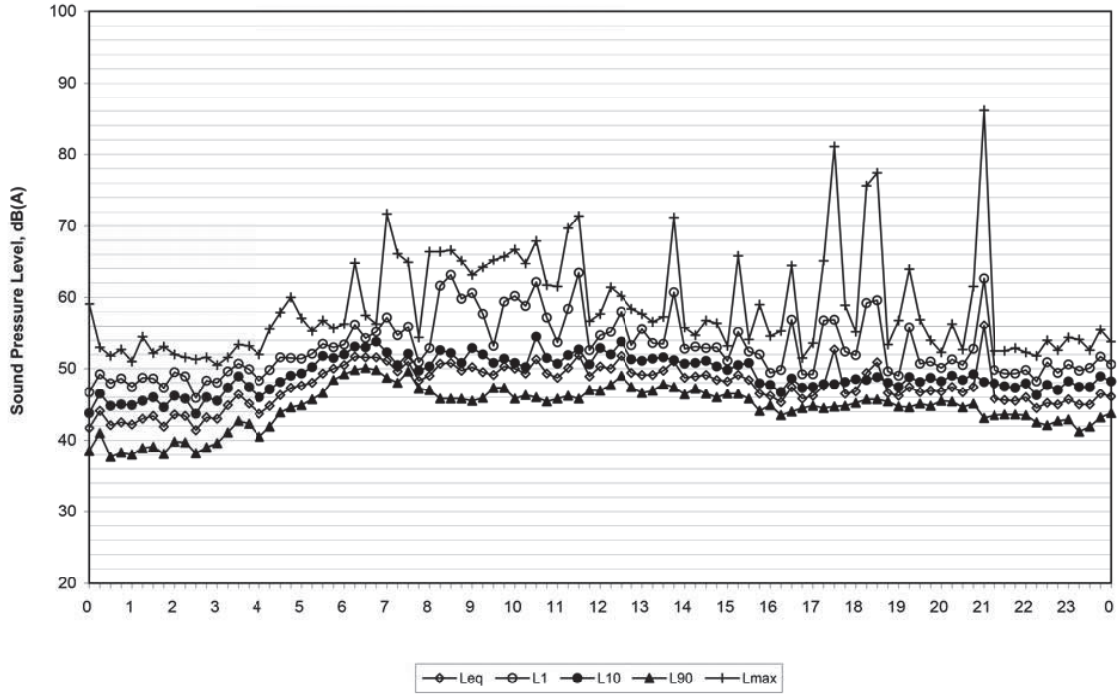


Reference Location M10
113A Mountain Road

5987R10.xls

Ambient Sound Pressure Levels

Friday 30 March 2007

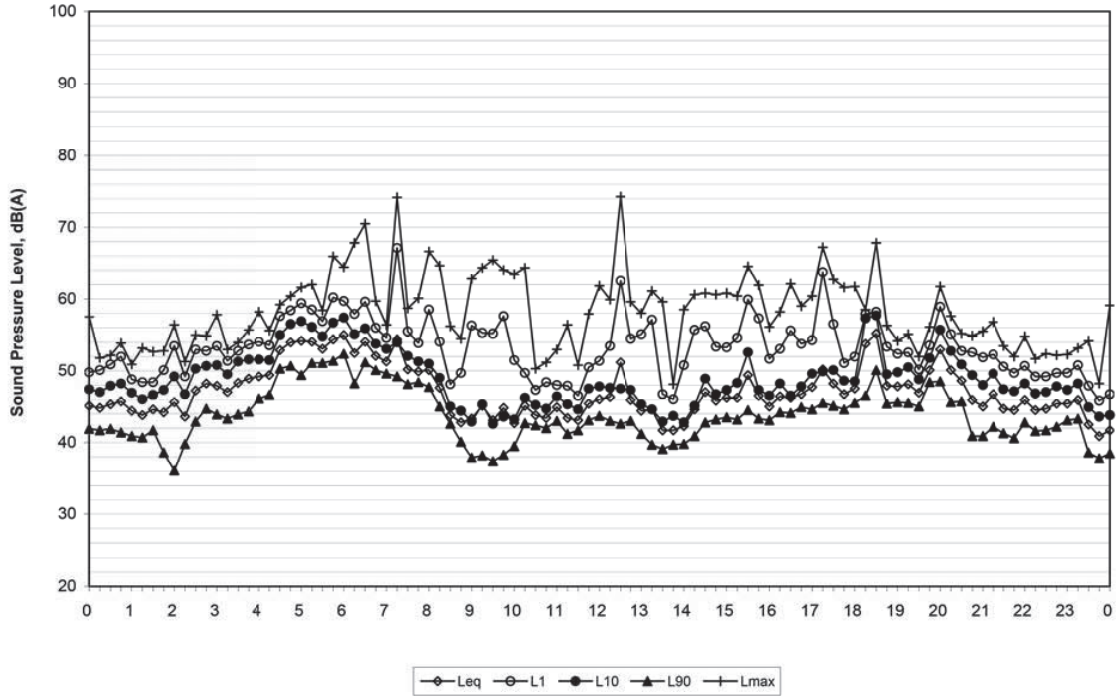


Reference Location M10
113A Mountain Road

5987R10.xls

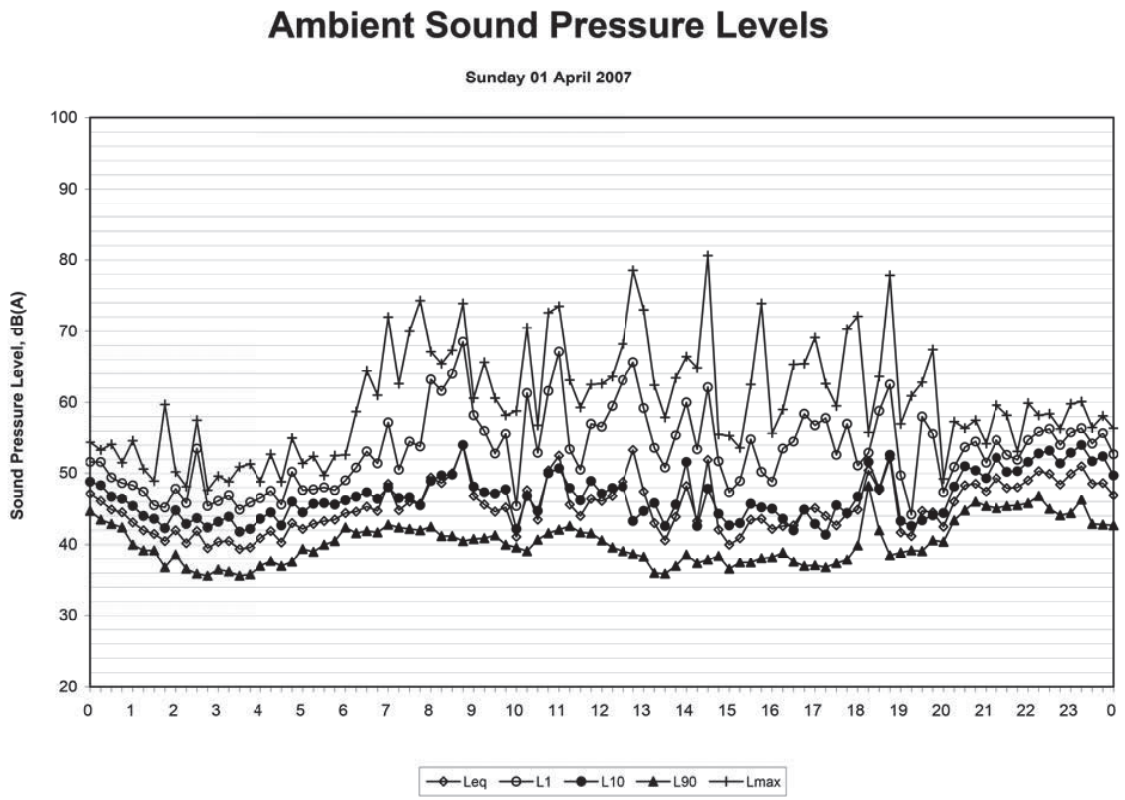
Ambient Sound Pressure Levels

Thursday 29 March 2007



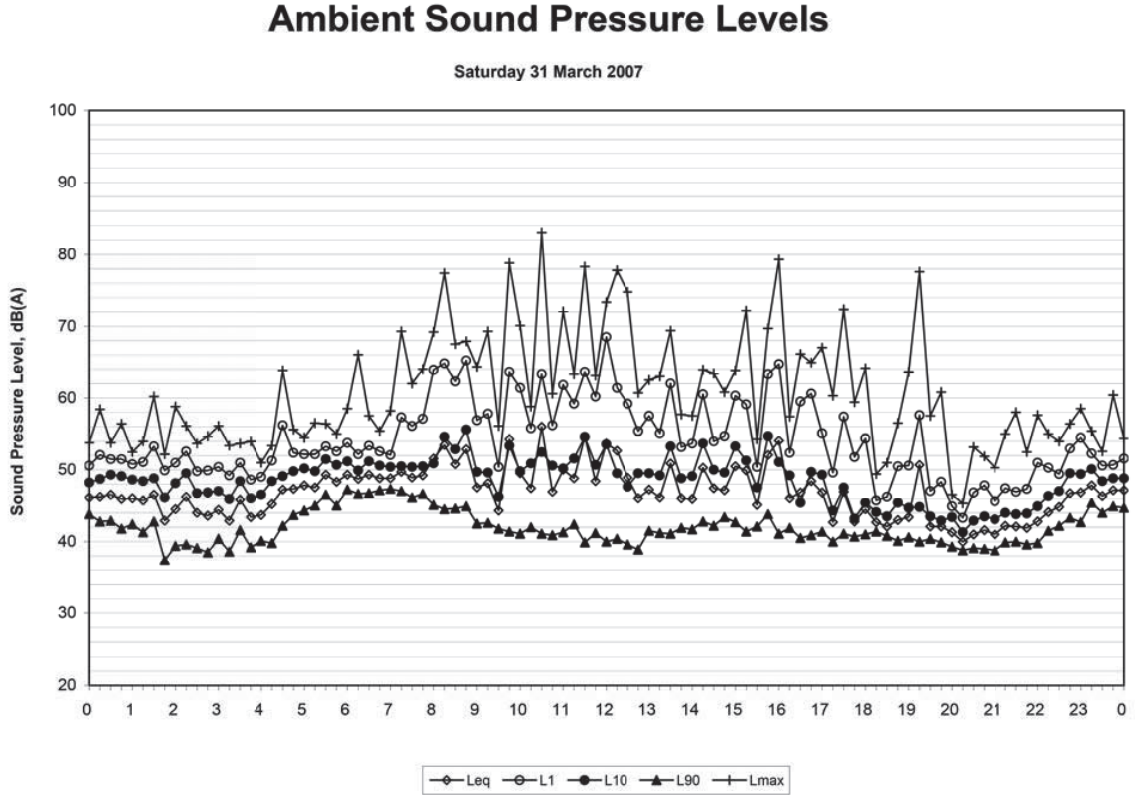
Reference Location M10
113A Mountain Road

5987R10.xls



Reference Location M10
113A Mountain Road

5987R10.xls

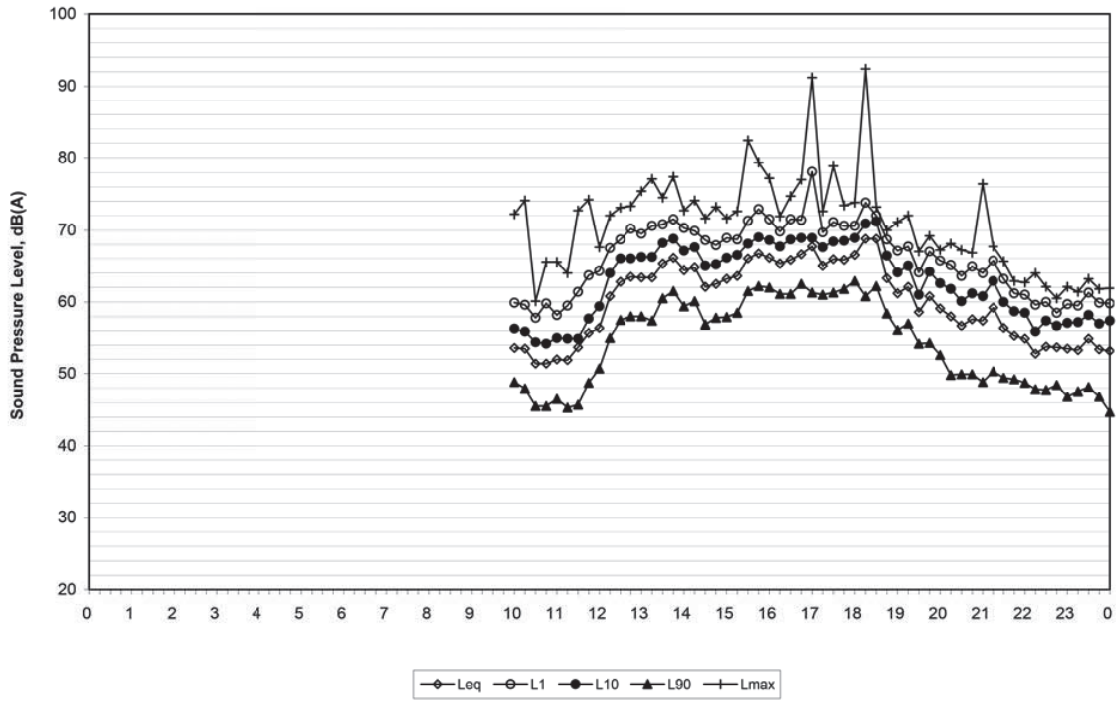


Reference Location M10
113A Mountain Road

5987R10.xls

Ambient Sound Pressure Levels

Tuesday 27 March 2007

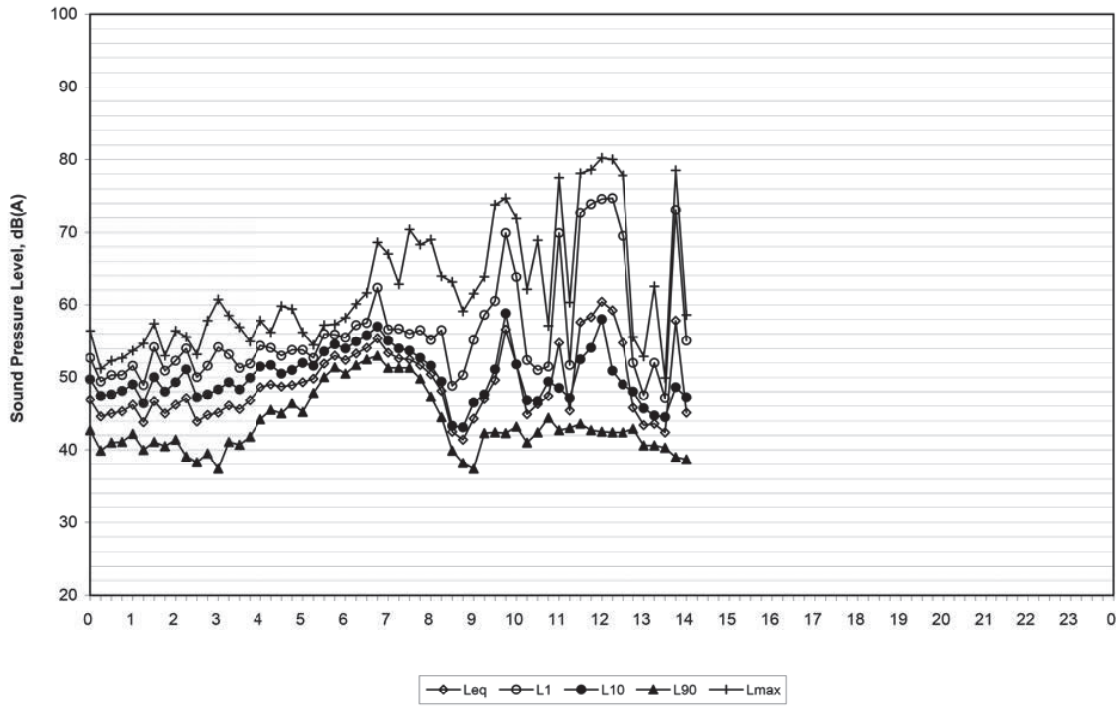


Reference Location M11
20 Bushells Ridge Road

5987R11.xls

Ambient Sound Pressure Levels

Monday 02 April 2007

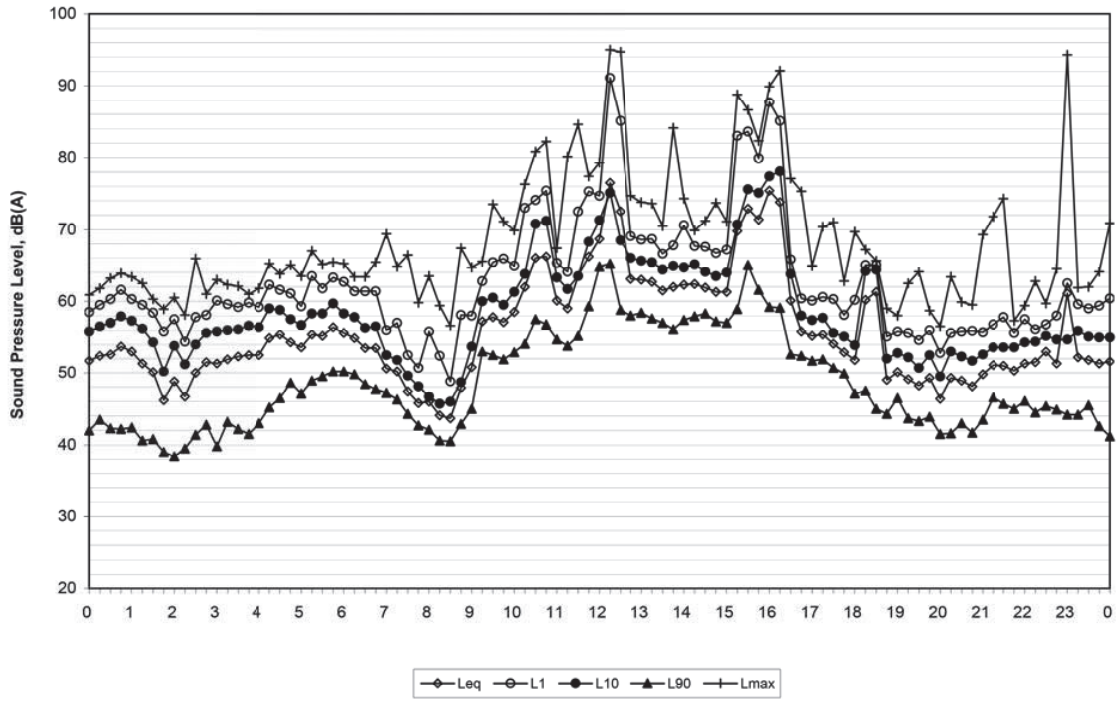


Reference Location M10
113A Mountain Road

5987R10.xls

Ambient Sound Pressure Levels

Thursday 29 March 2007

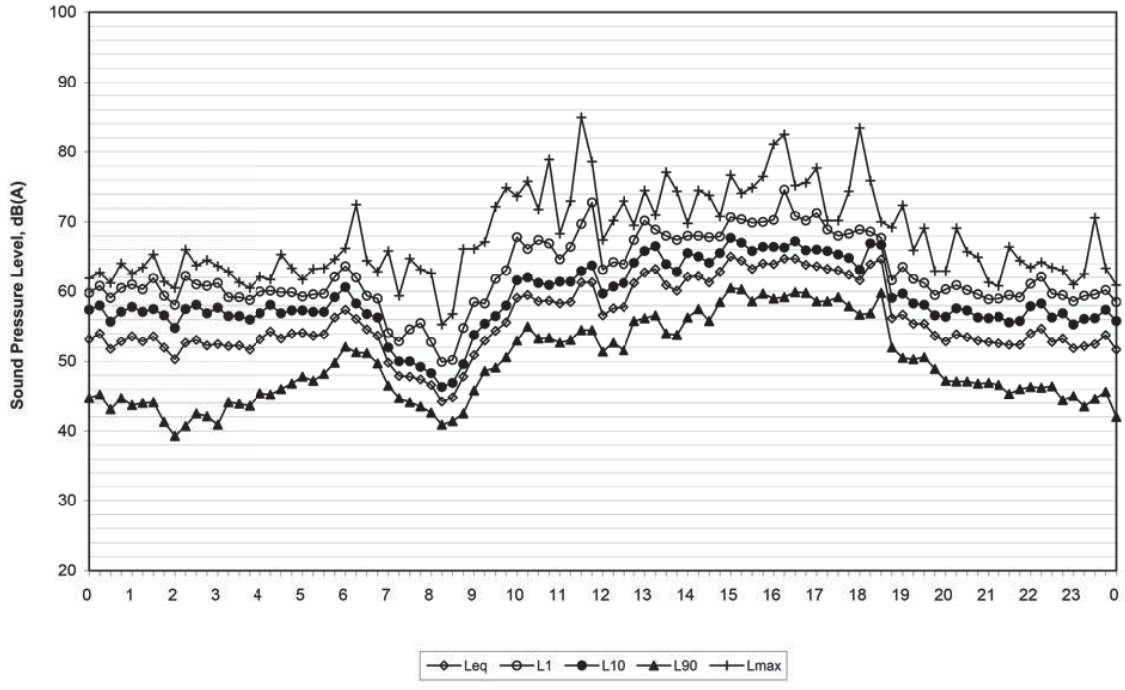


Reference Location M11
20 Bushells Ridge Road

5987R11.xls

Ambient Sound Pressure Levels

Wednesday 28 March 2007

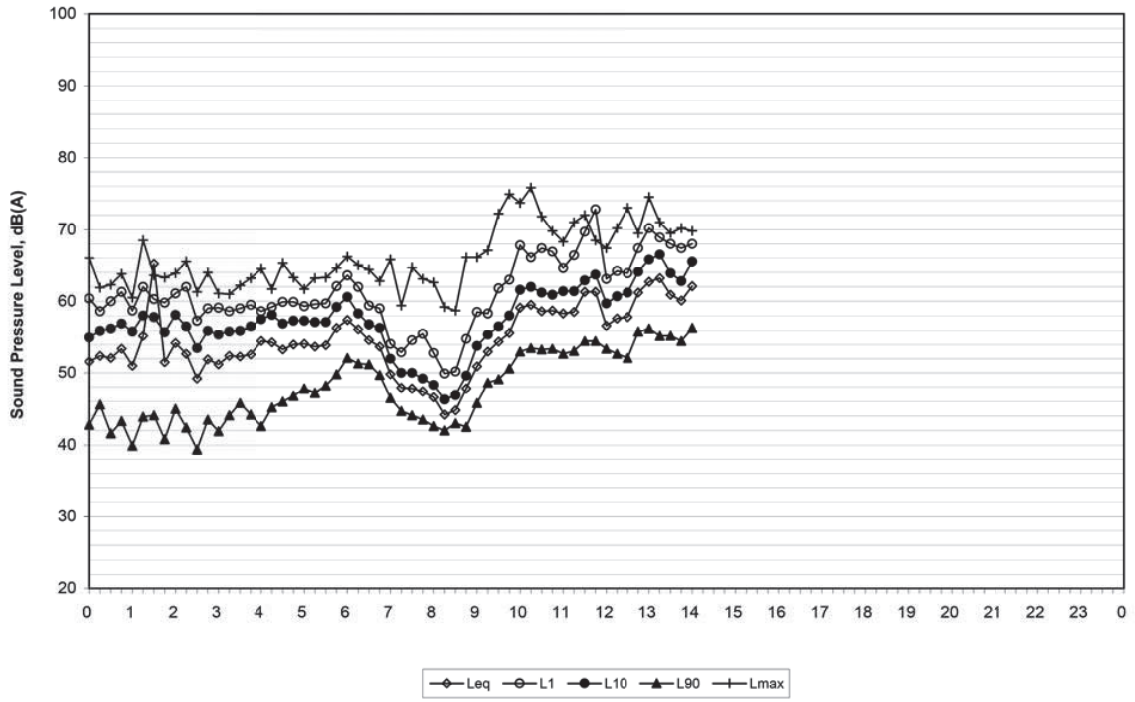


Reference Location M11
20 Bushells Ridge Road

5987R11.xls

Ambient Sound Pressure Levels

Saturday 31 March 2007

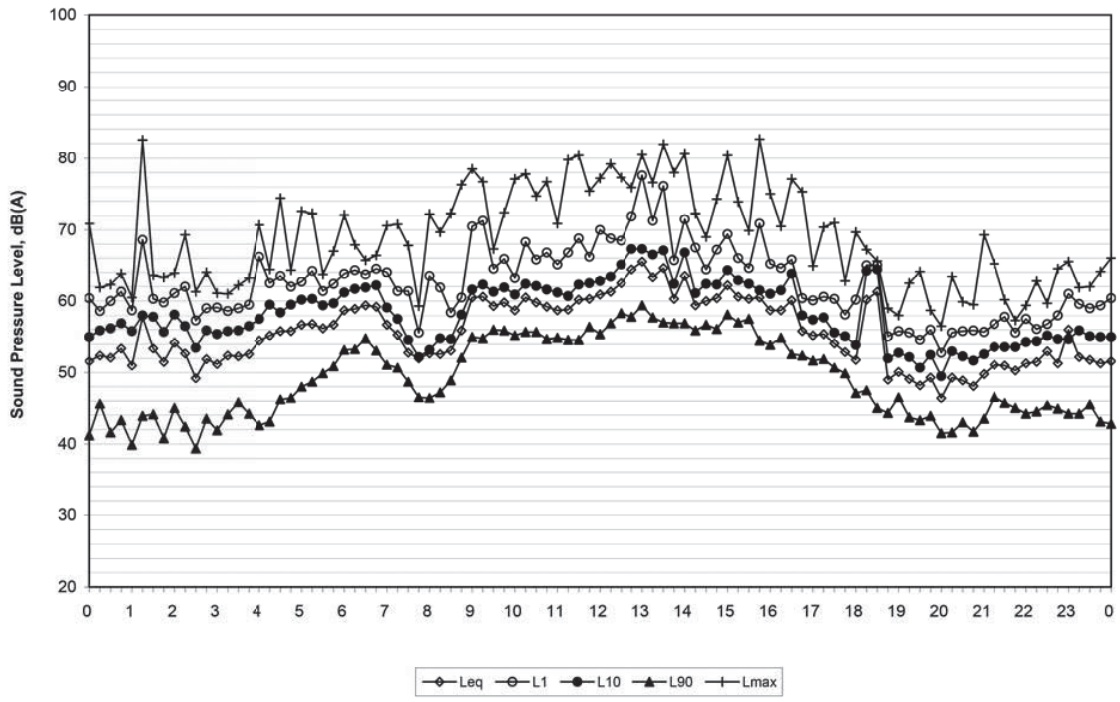


Reference Location M11
20 Bushells Ridge Road

5987R11.xls

Ambient Sound Pressure Levels

Friday 30 March 2007

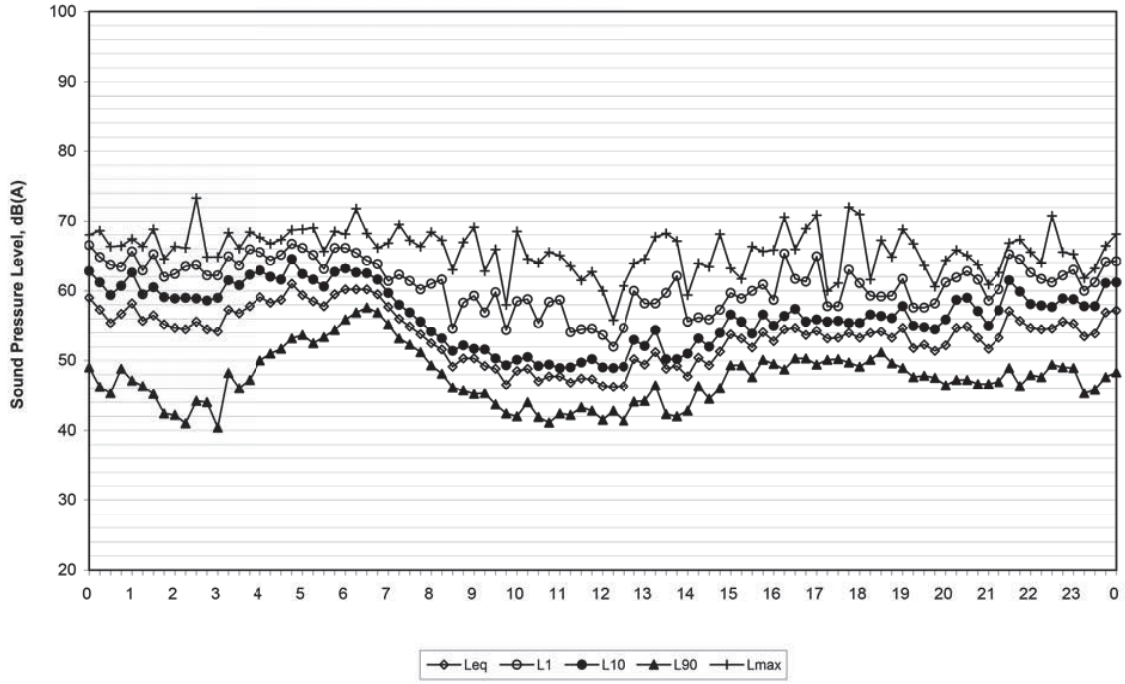


Reference Location M11
20 Bushells Ridge Road

5987R11.xls

Ambient Sound Pressure Levels

Wednesday 28 March 2007

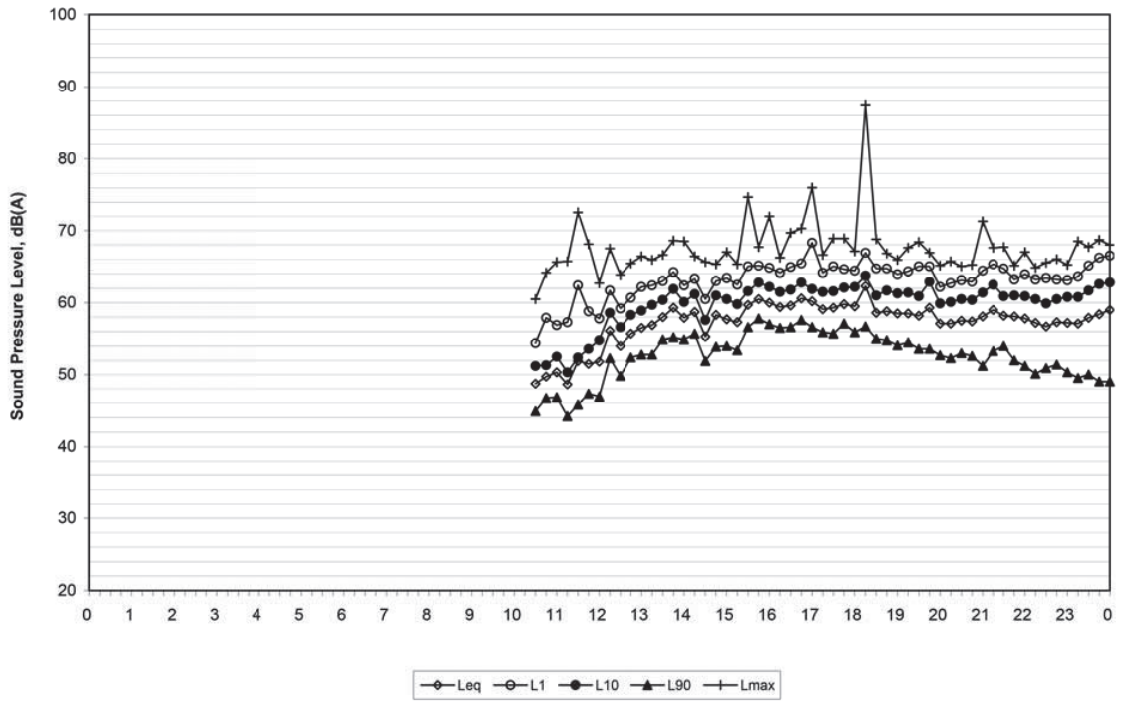


Reference Location M12
Bushells Ridge Road

5987R12.xls

Ambient Sound Pressure Levels

Tuesday 27 March 2007

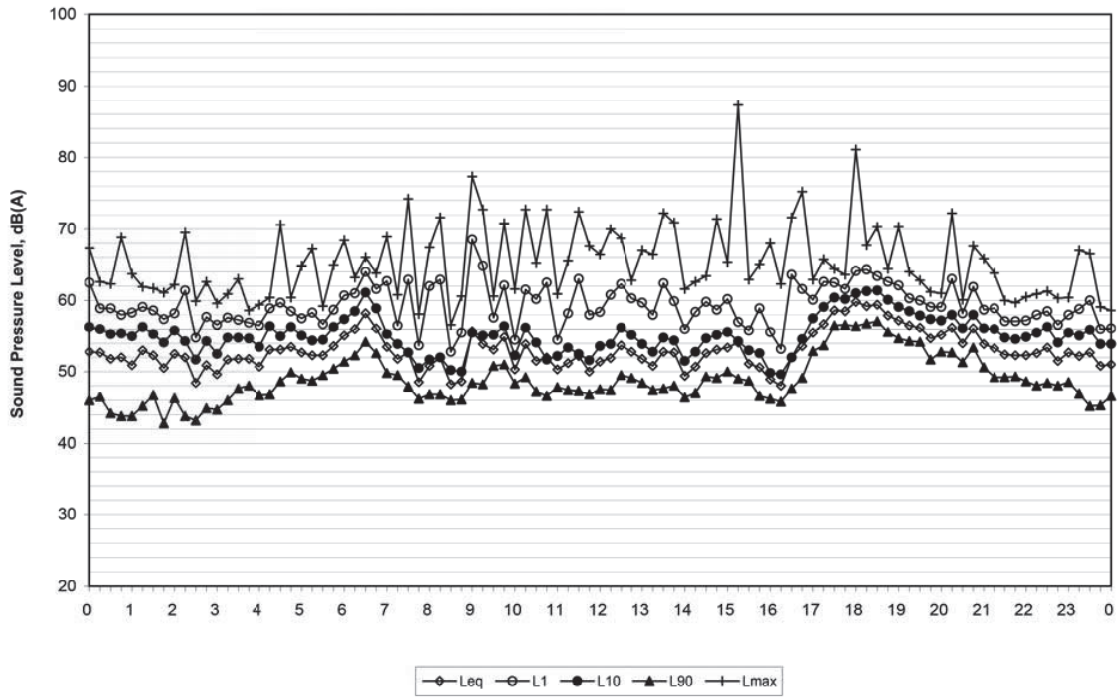


Reference Location M12
Bushells Ridge Road

5987R12.xls

Ambient Sound Pressure Levels

Friday 30 March 2007

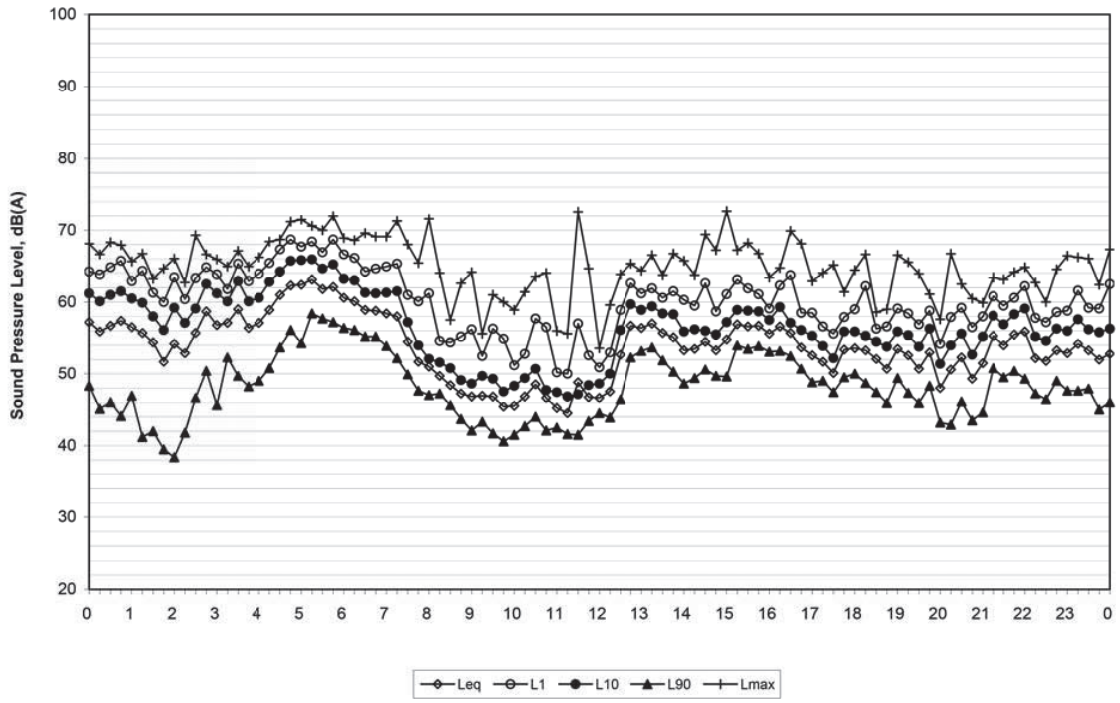


Reference Location M12
Bushells Ridge Road

5987R12.xls

Ambient Sound Pressure Levels

Thursday 29 March 2007

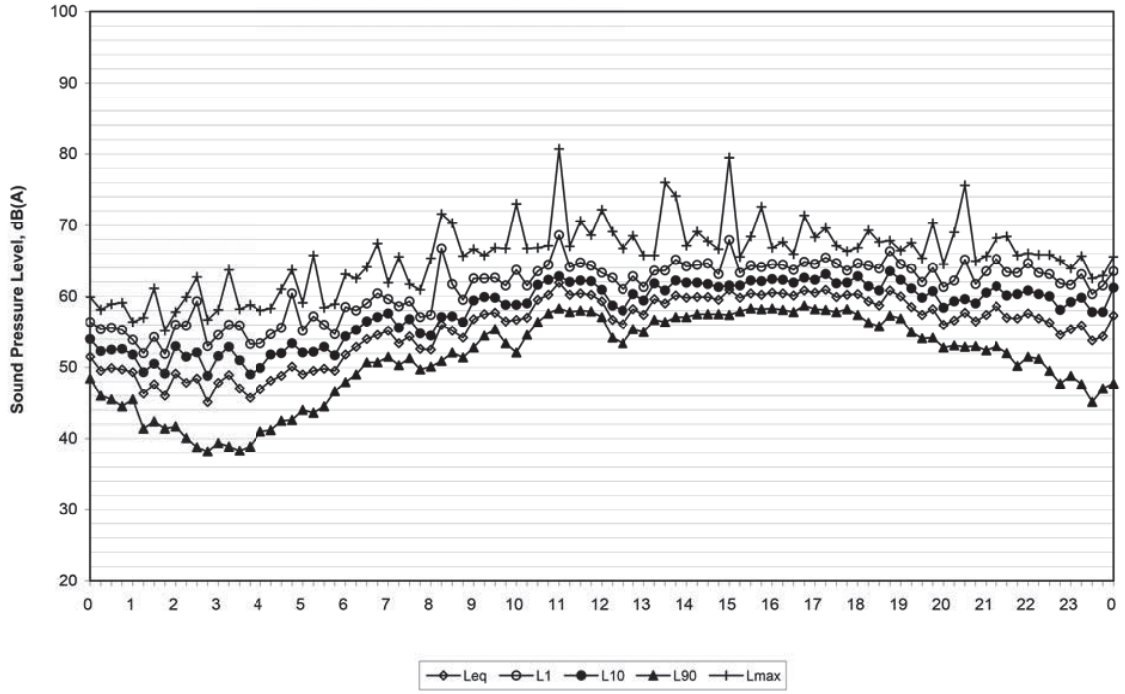


Reference Location M12
Bushells Ridge Road

5987R12.xls

Ambient Sound Pressure Levels

Sunday 01 April 2007

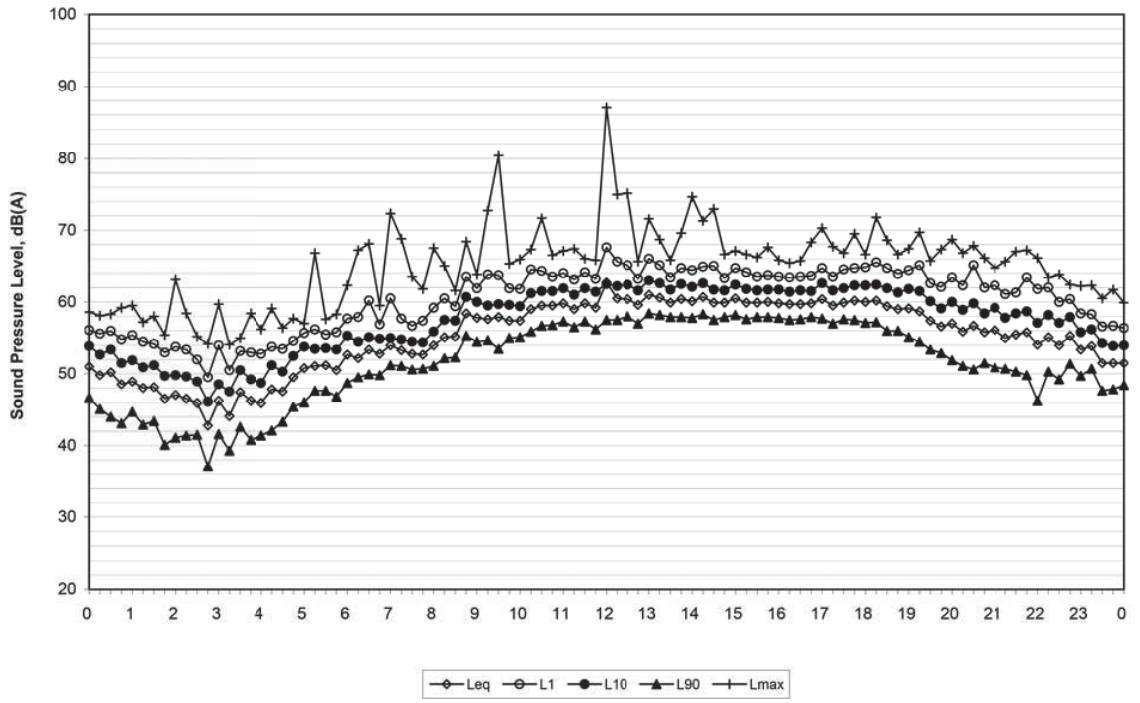


Reference Location M12
Bushells Ridge Road

5987R12.xls

Ambient Sound Pressure Levels

Saturday 31 March 2007

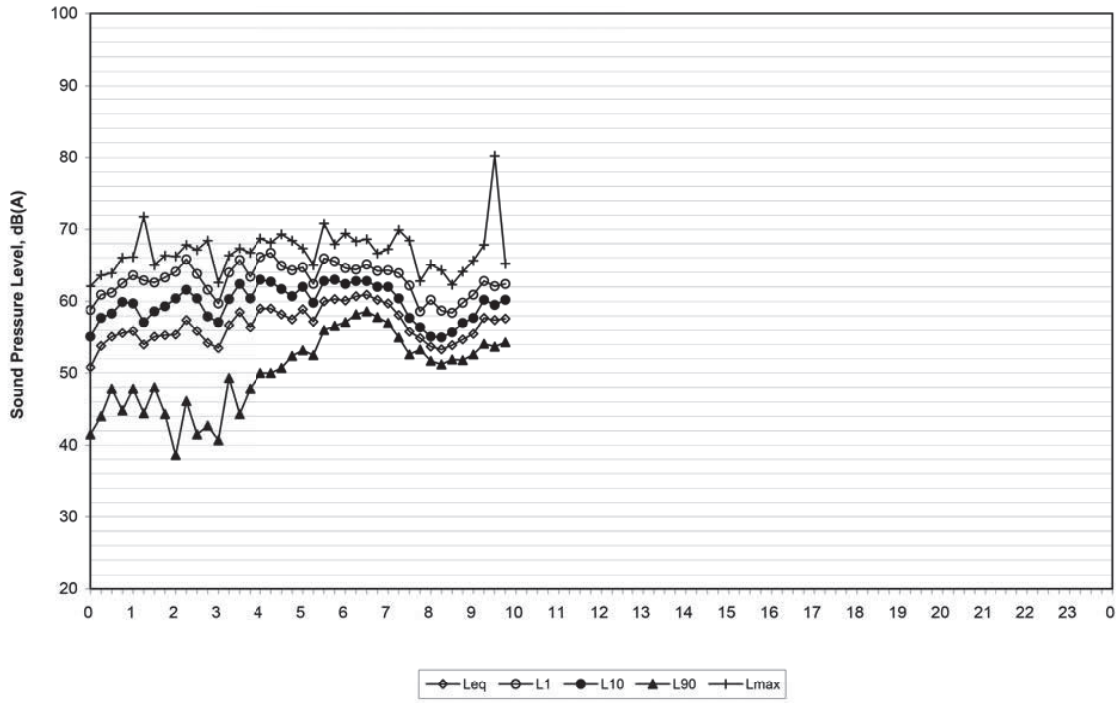


Reference Location M12
Bushells Ridge Road

5987R12.xls

Ambient Sound Pressure Levels

Tuesday 03 April 2007

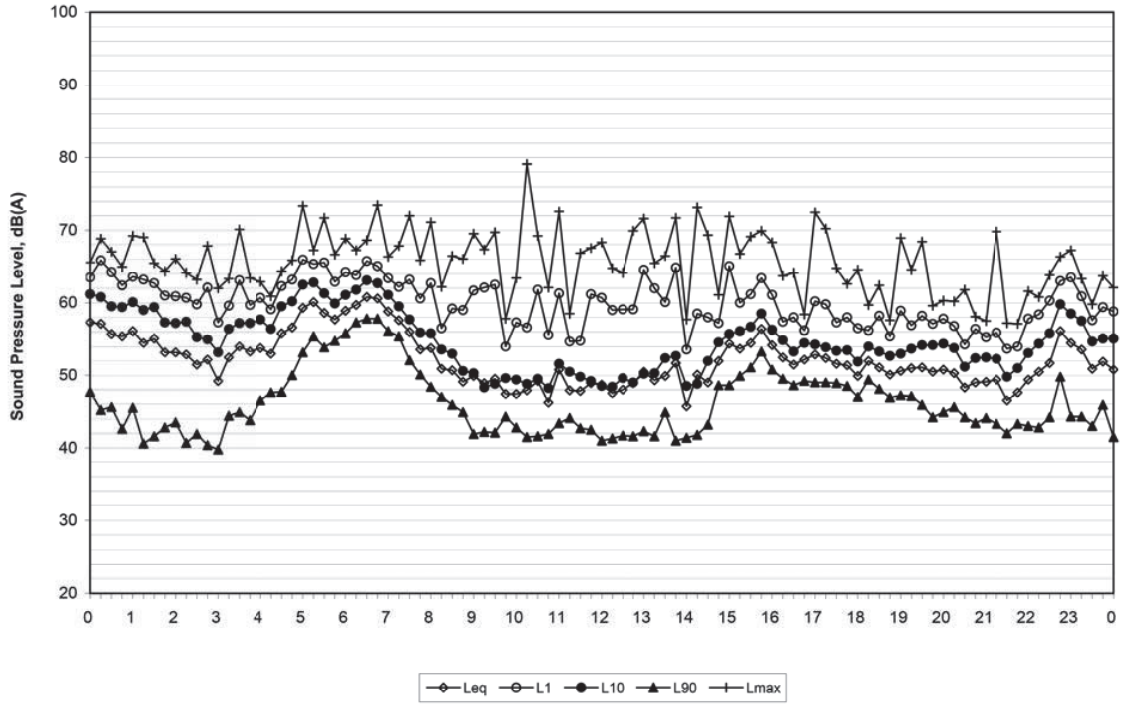


Reference Location M12
Bushells Ridge Road

5987R12.xls

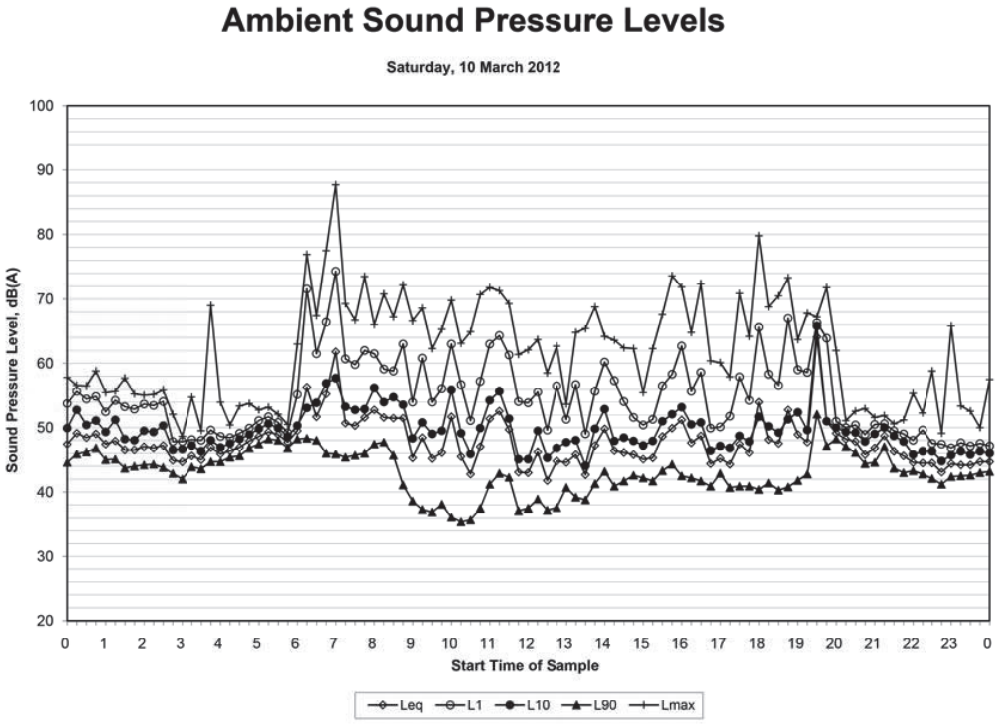
Ambient Sound Pressure Levels

Monday 02 April 2007



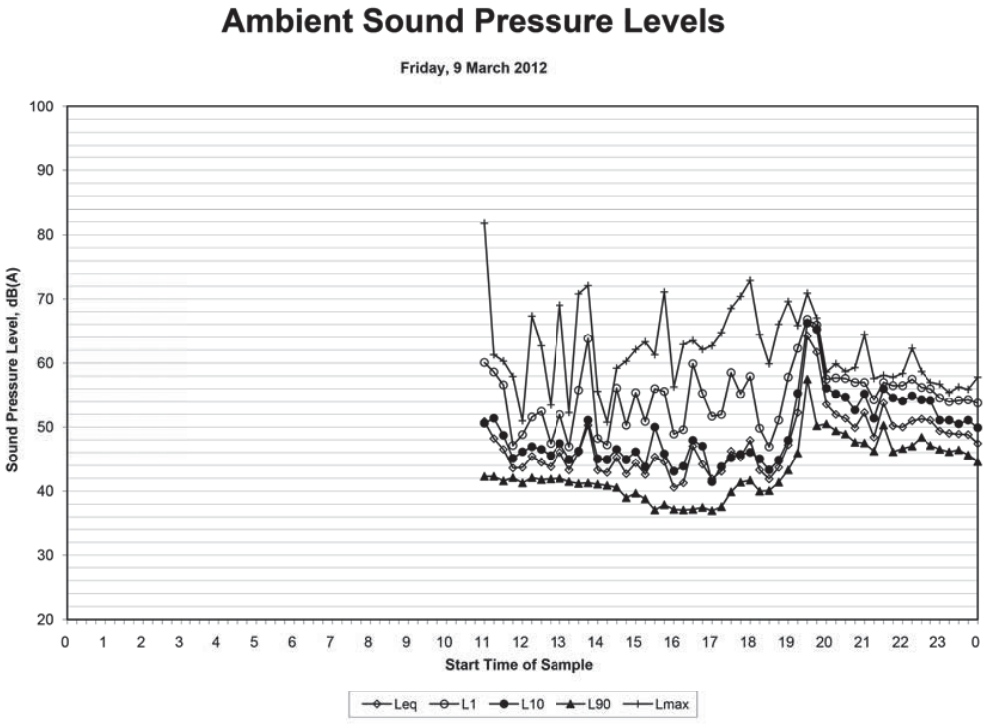
Reference Location M12
Bushells Ridge Road

5987R12.xls



Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

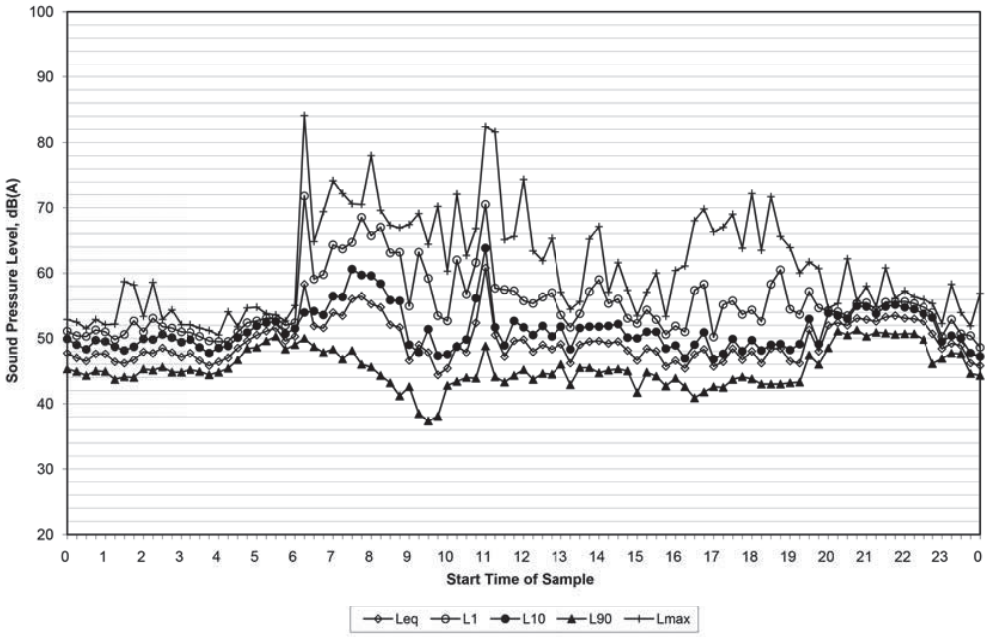


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

Ambient Sound Pressure Levels

Monday, 12 March 2012

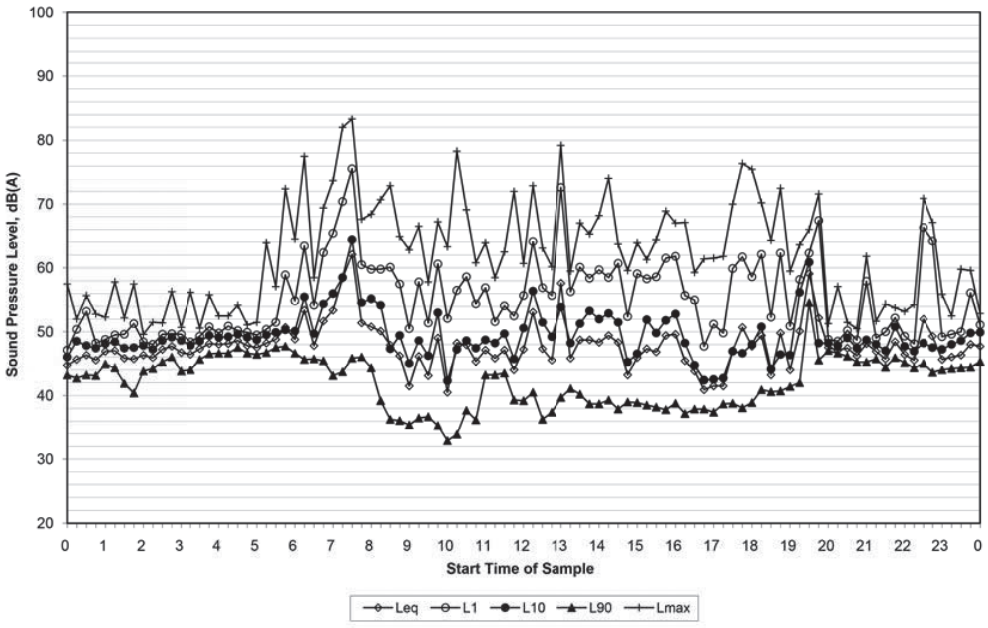


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

Ambient Sound Pressure Levels

Sunday, 11 March 2012

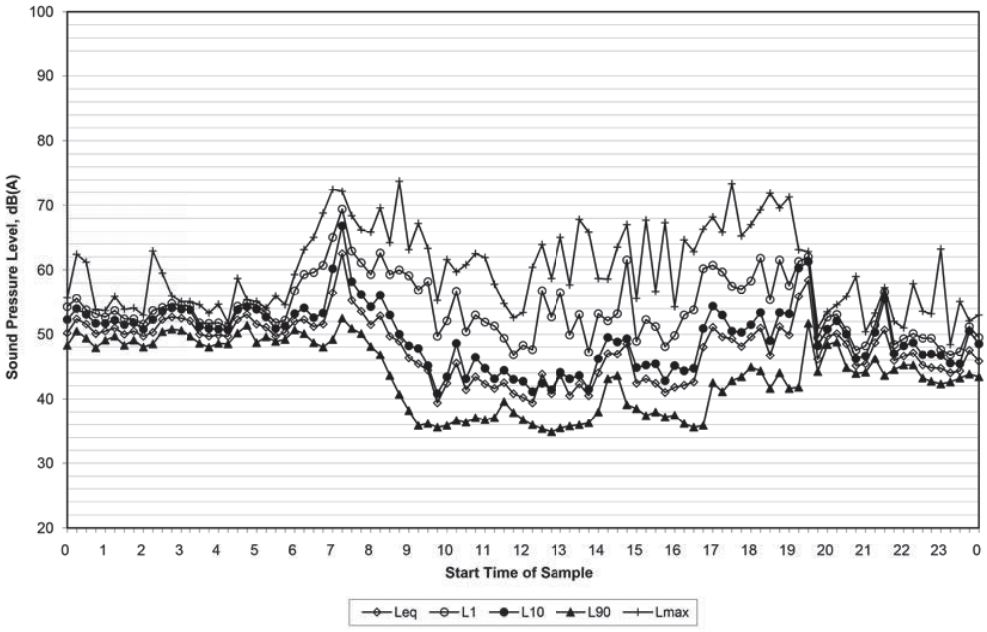


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

Ambient Sound Pressure Levels

Wednesday, 14 March 2012

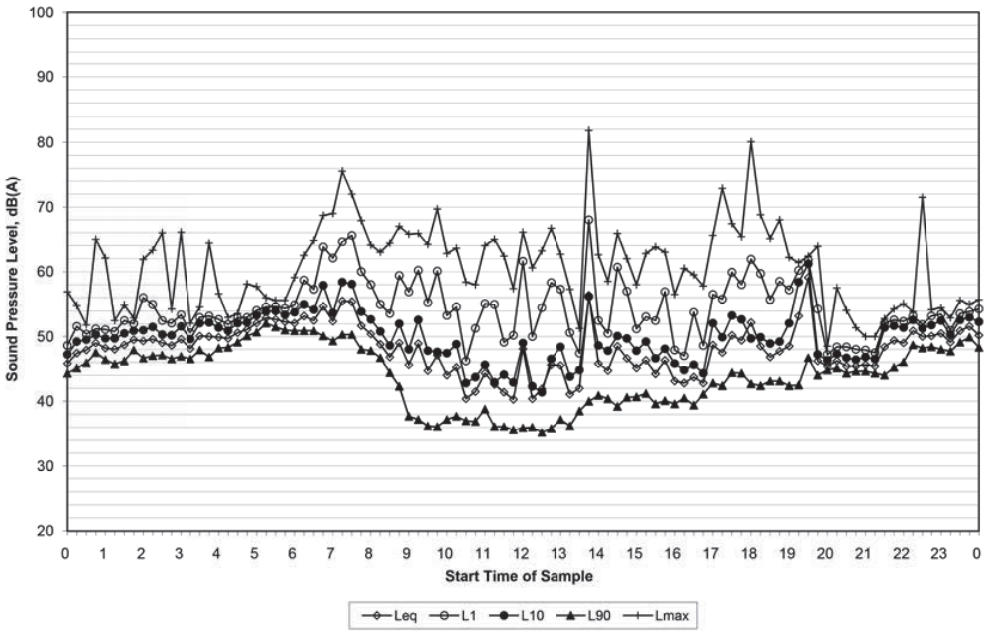


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

Ambient Sound Pressure Levels

Tuesday, 13 March 2012

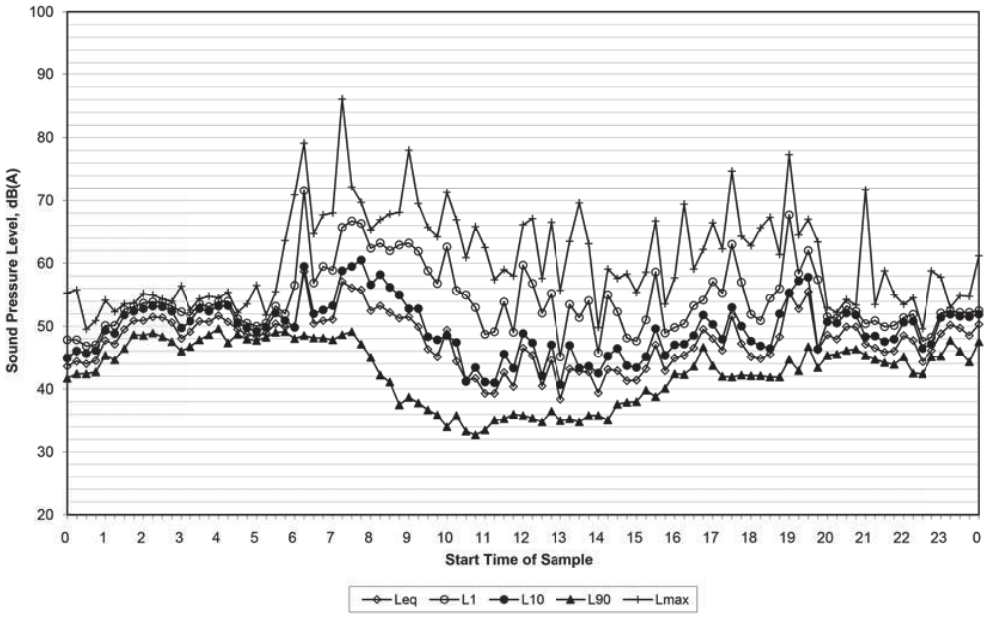


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

Ambient Sound Pressure Levels

Friday, 16 March 2012

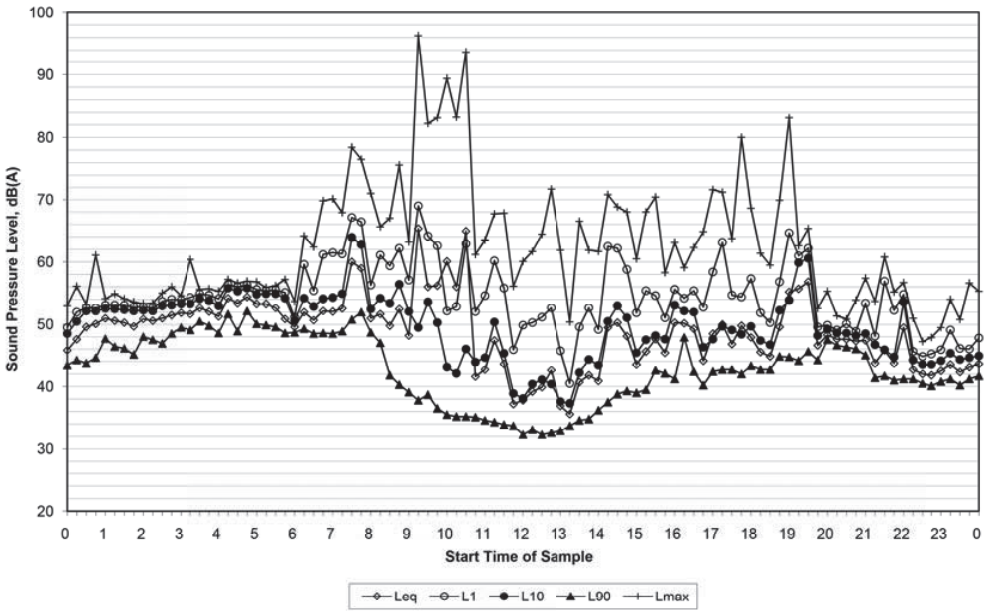


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

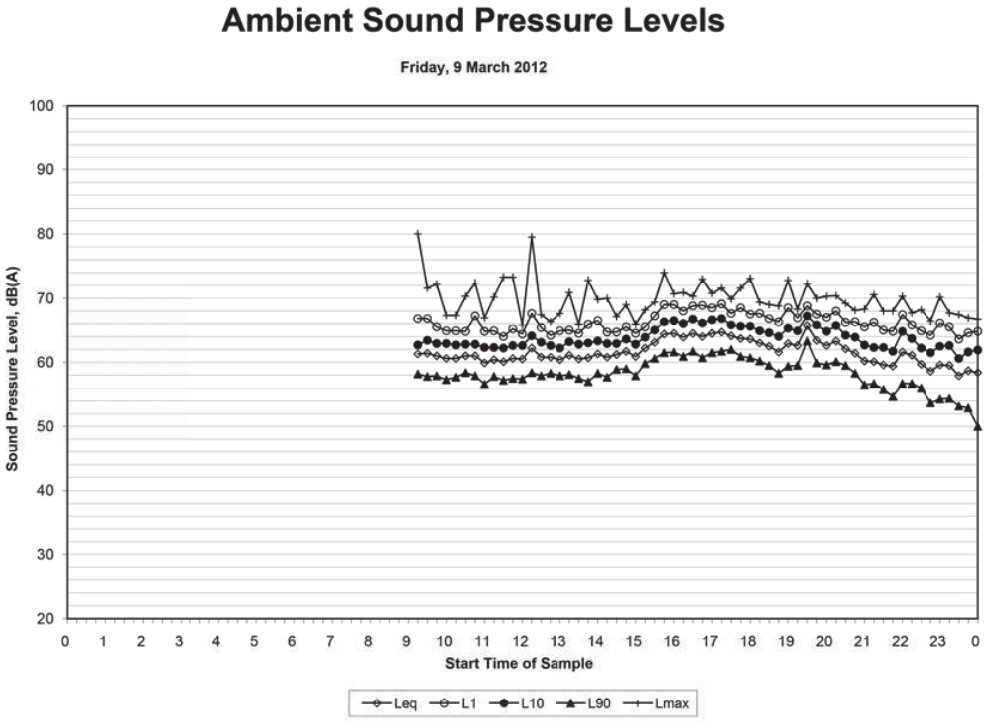
Ambient Sound Pressure Levels

Thursday, 15 March 2012



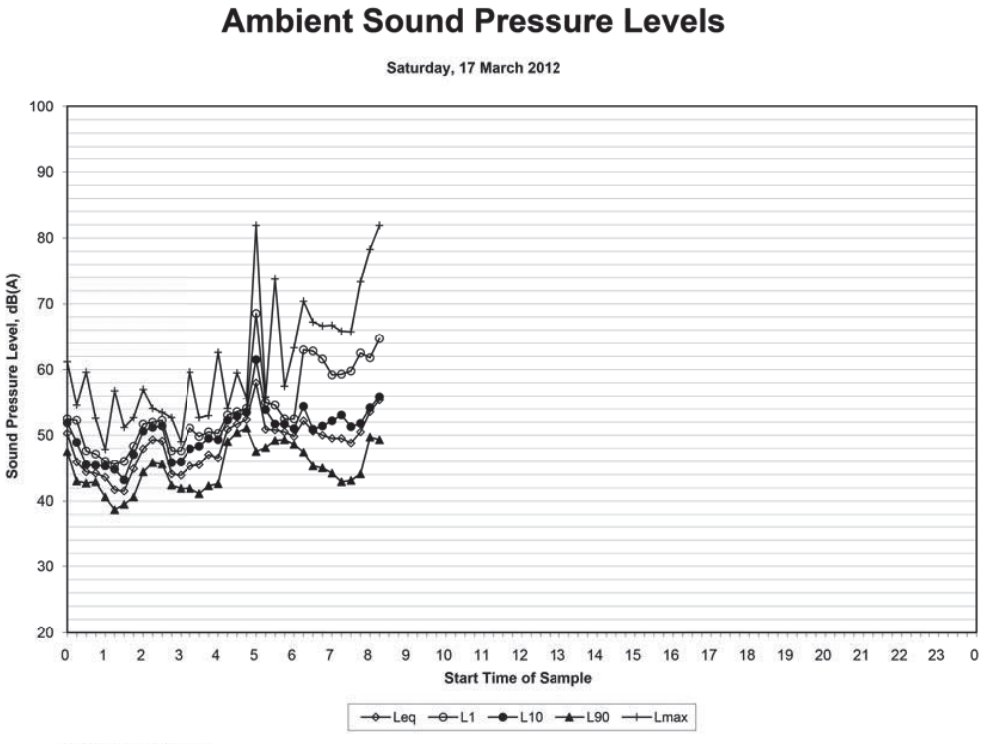
Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls



Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls

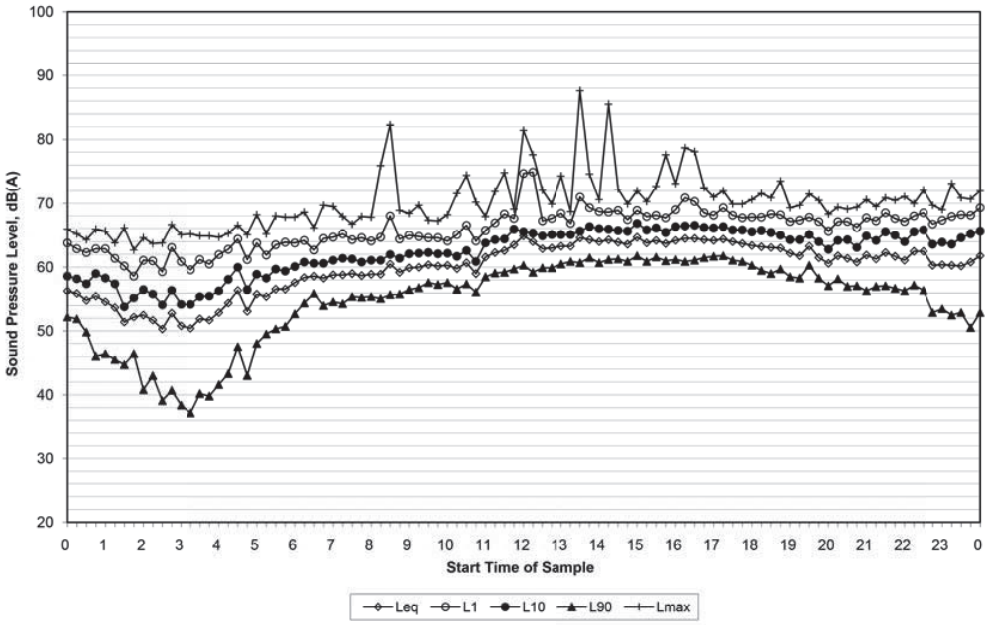


Reference Location M1
250/260 Bruce Crescent

42.6729.M1.xls

Ambient Sound Pressure Levels

Sunday, 11 March 2012

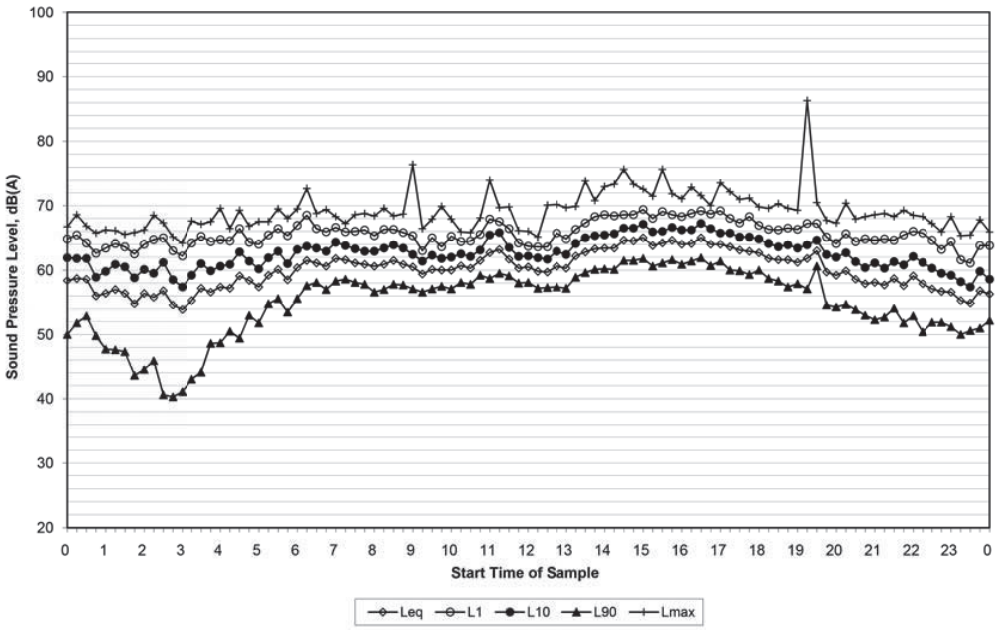


Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls

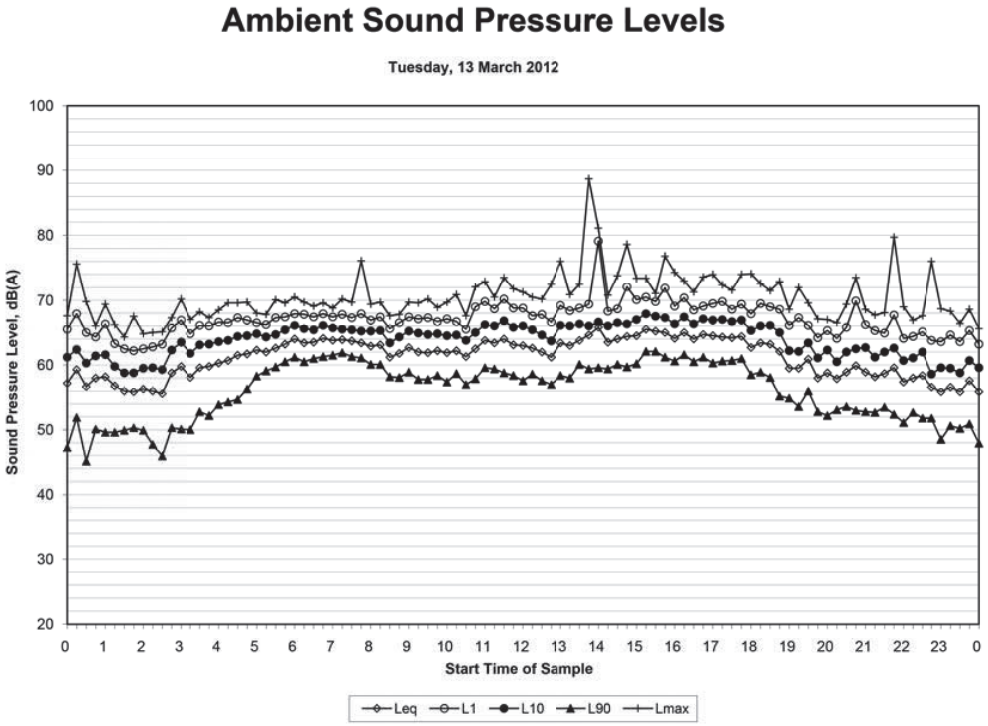
Ambient Sound Pressure Levels

Saturday, 10 March 2012



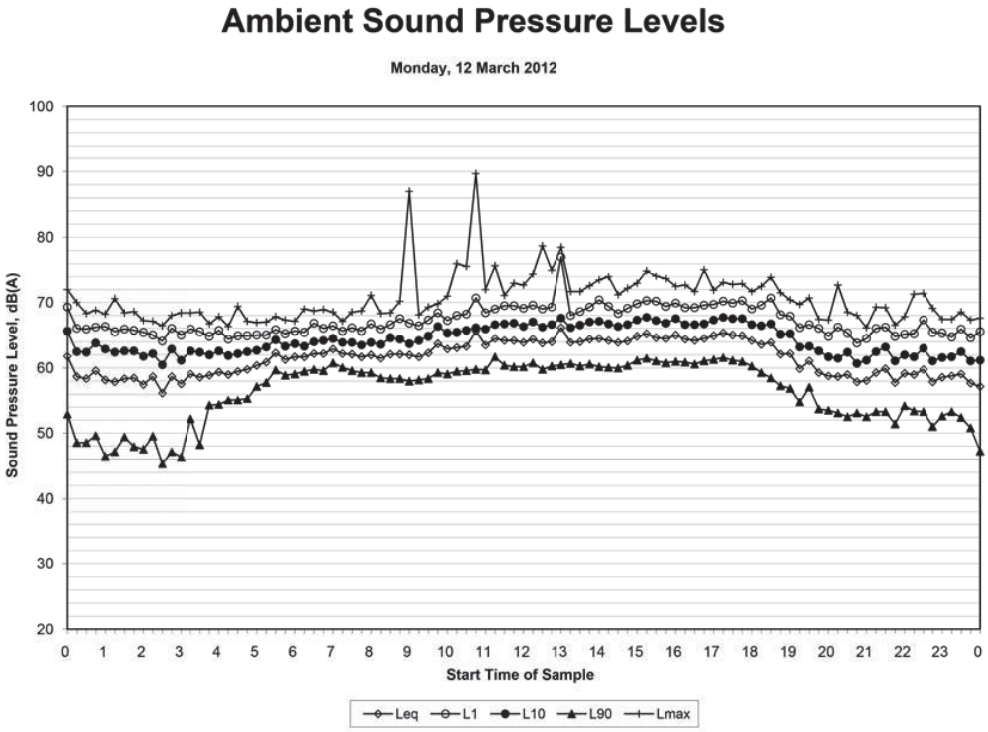
Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls



Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls

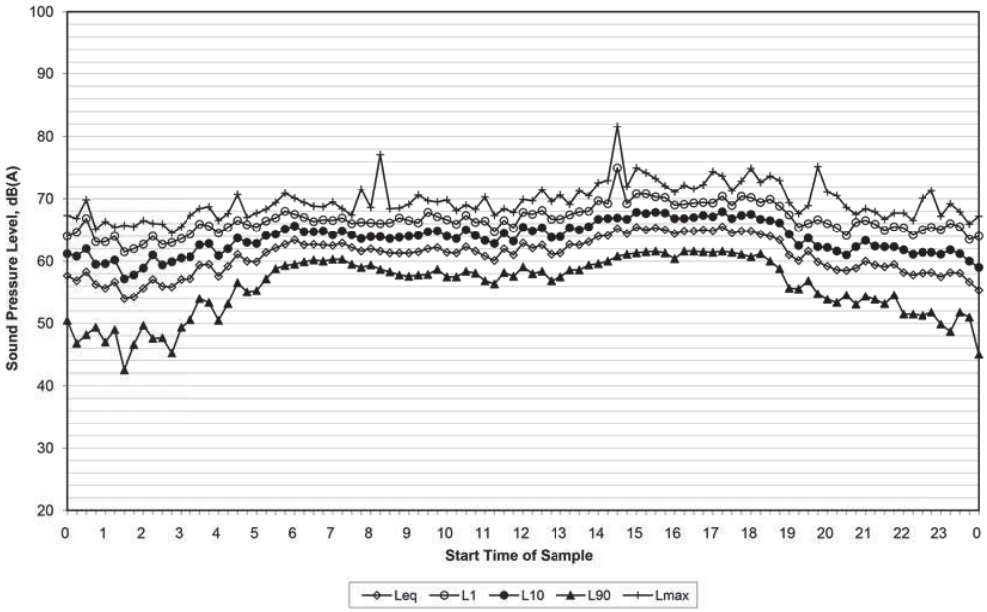


Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls

Ambient Sound Pressure Levels

Thursday, 15 March 2012

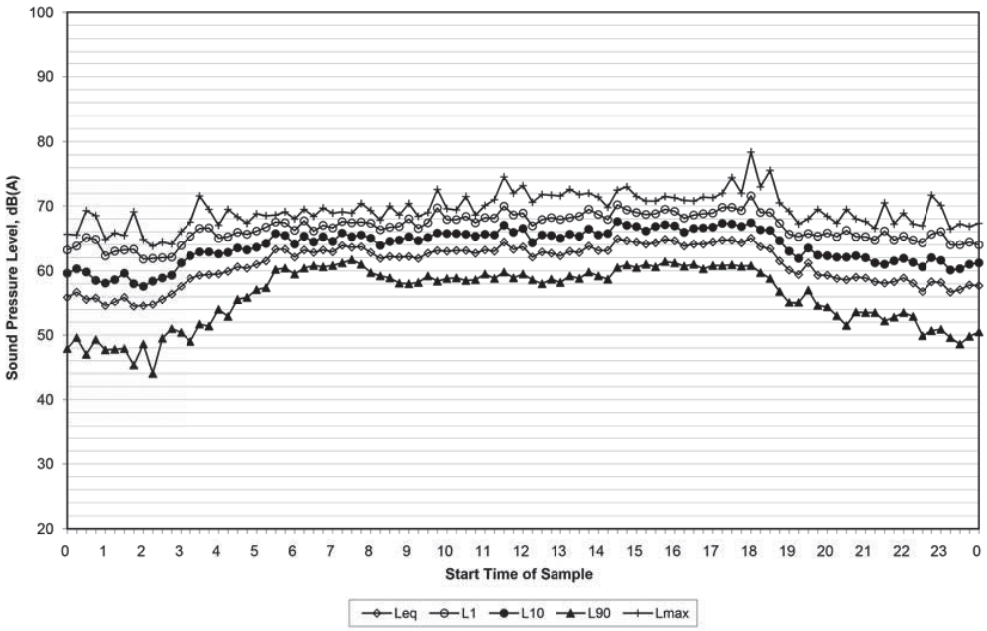


Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls

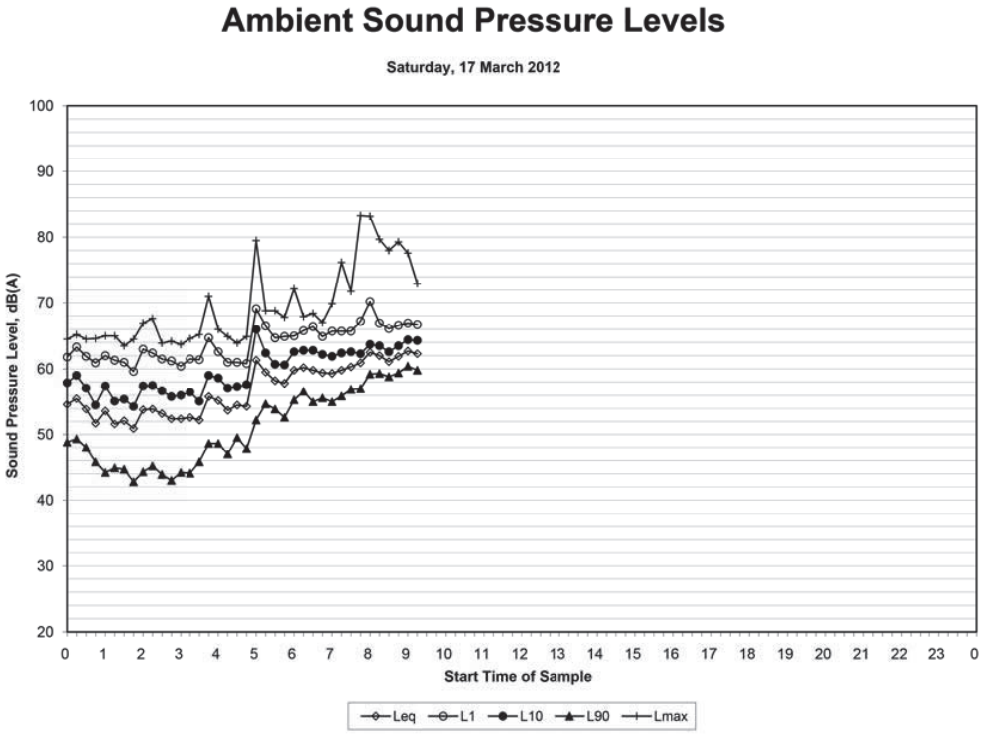
Ambient Sound Pressure Levels

Wednesday, 14 March 2012



Reference Location M2
118 Bushells Ridge Road Kiar

42.6729.M2.xls



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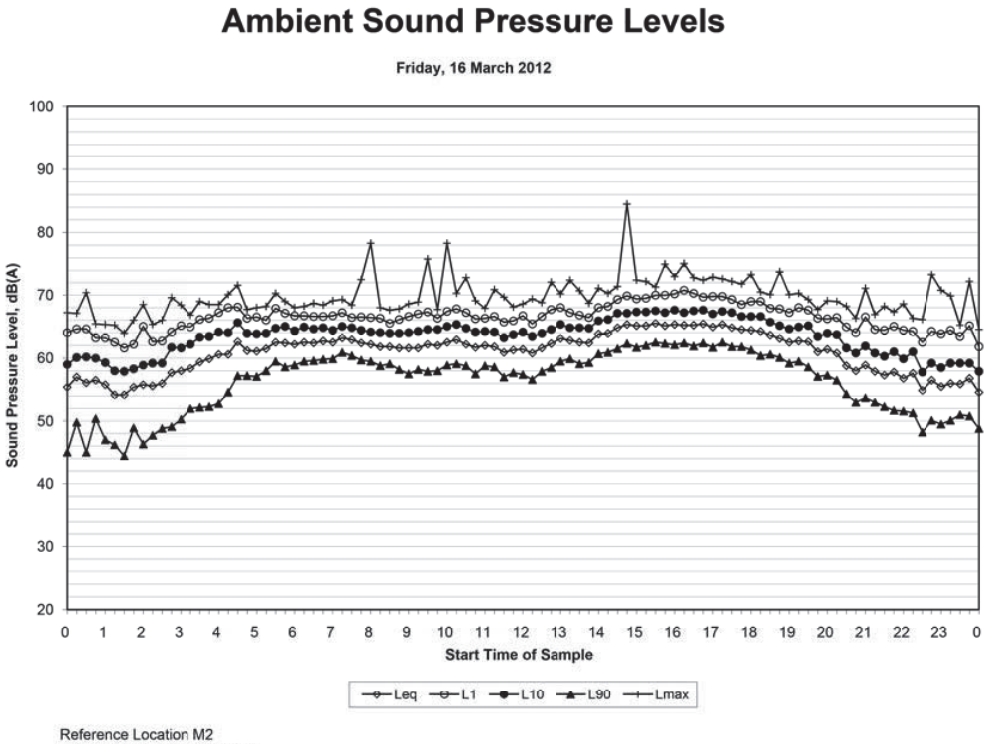
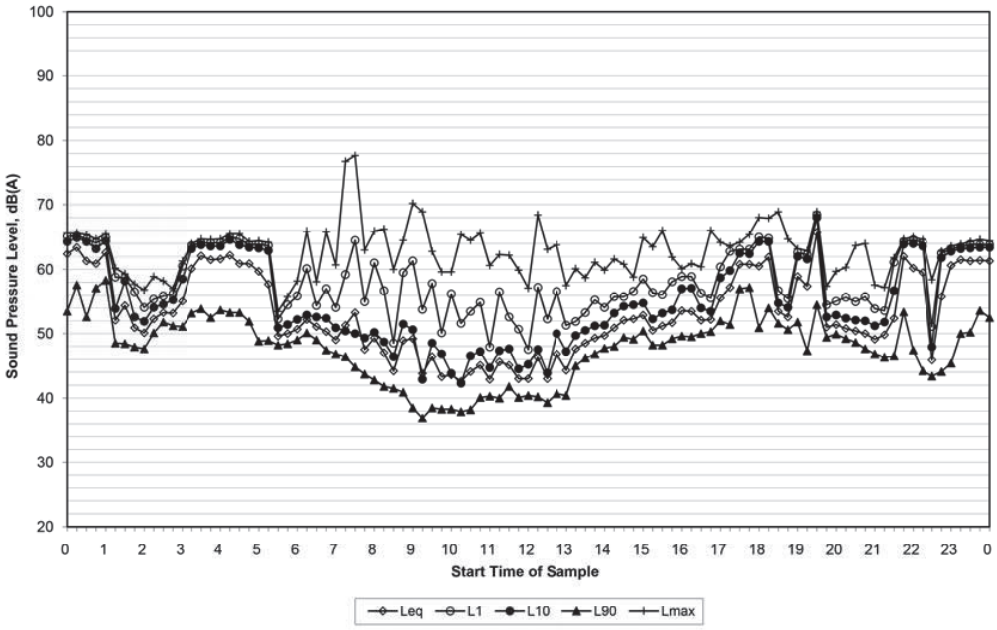


42.6729.M2.xls

Ambient Sound Pressure Levels

Saturday, 10 March 2012

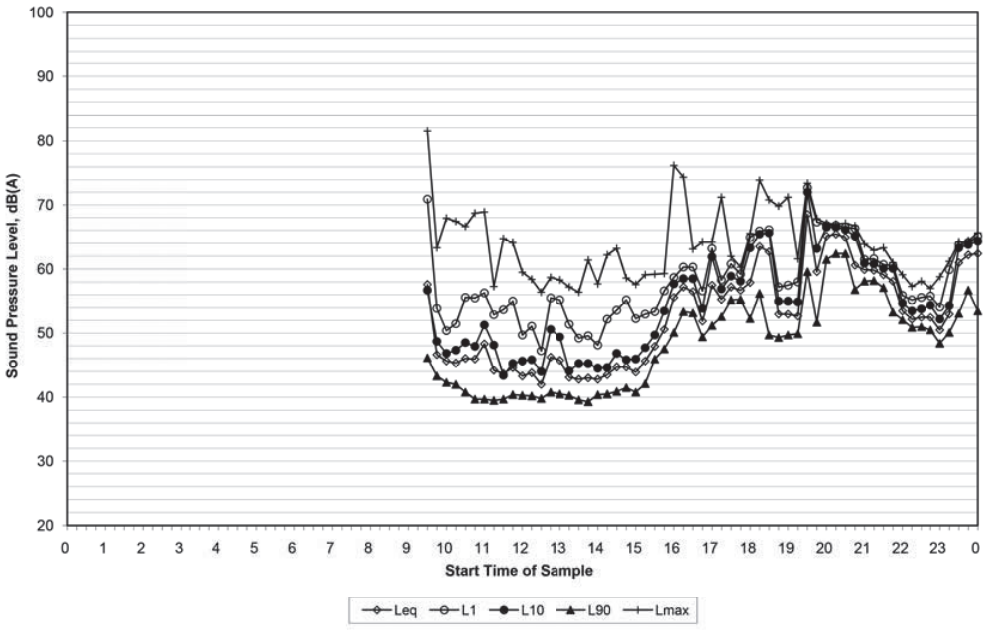


Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

Ambient Sound Pressure Levels

Friday, 9 March 2012

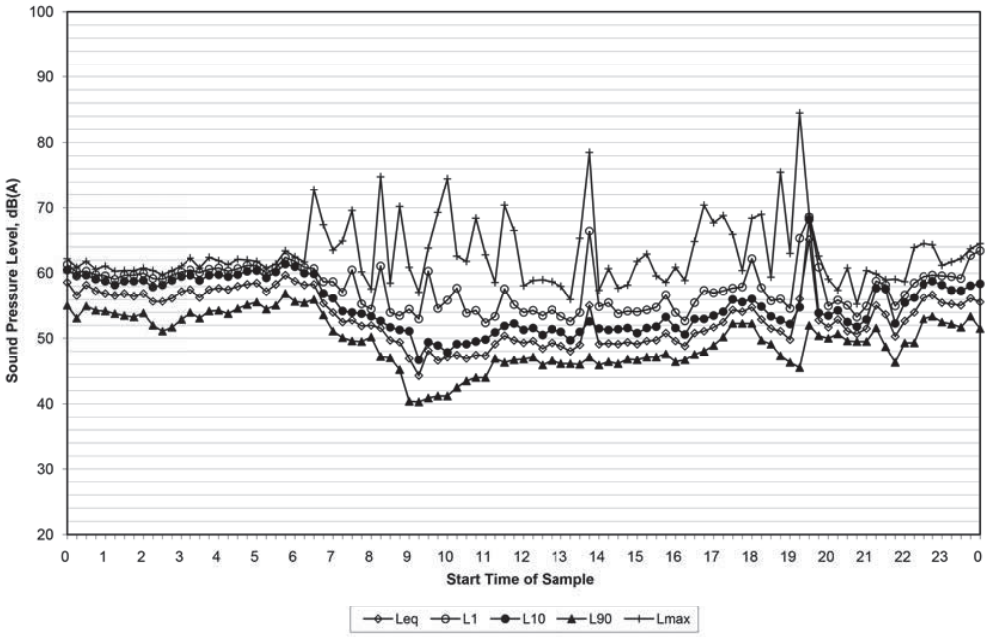


Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

Ambient Sound Pressure Levels

Monday, 12 March 2012

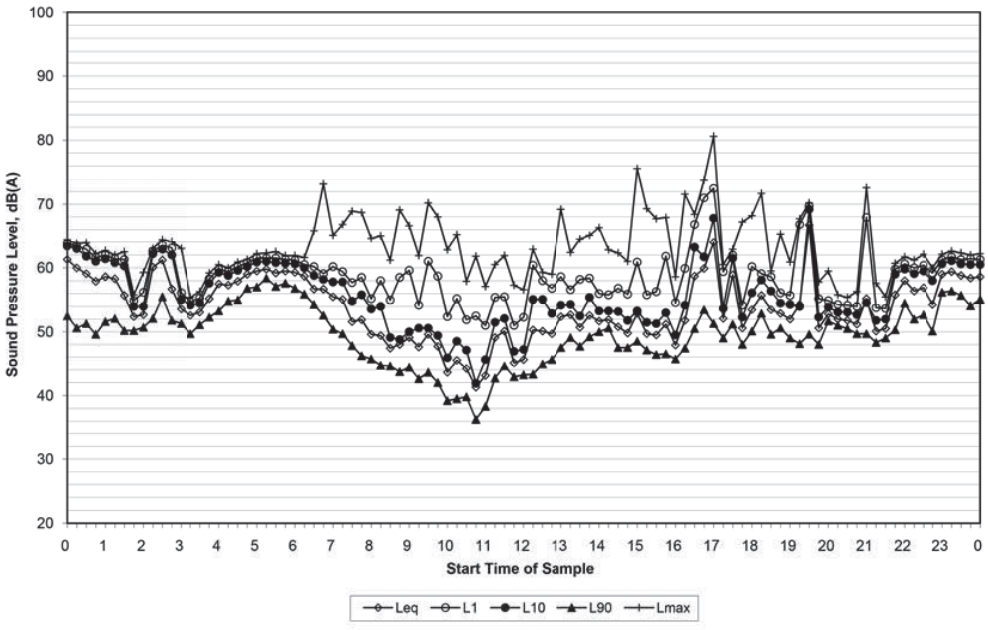


Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

Ambient Sound Pressure Levels

Sunday, 11 March 2012

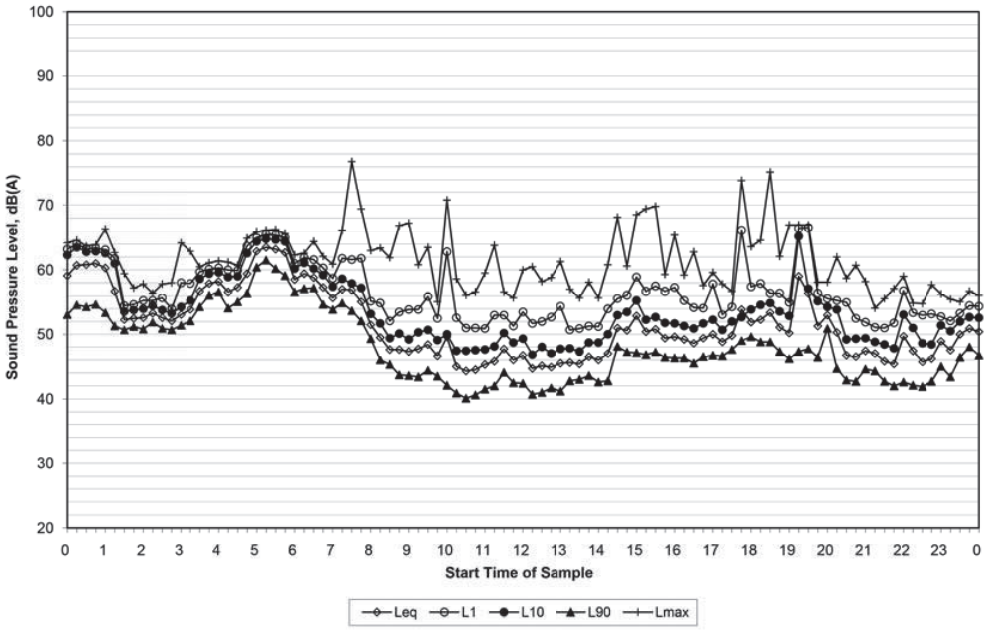


Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

Ambient Sound Pressure Levels

Wednesday, 14 March 2012

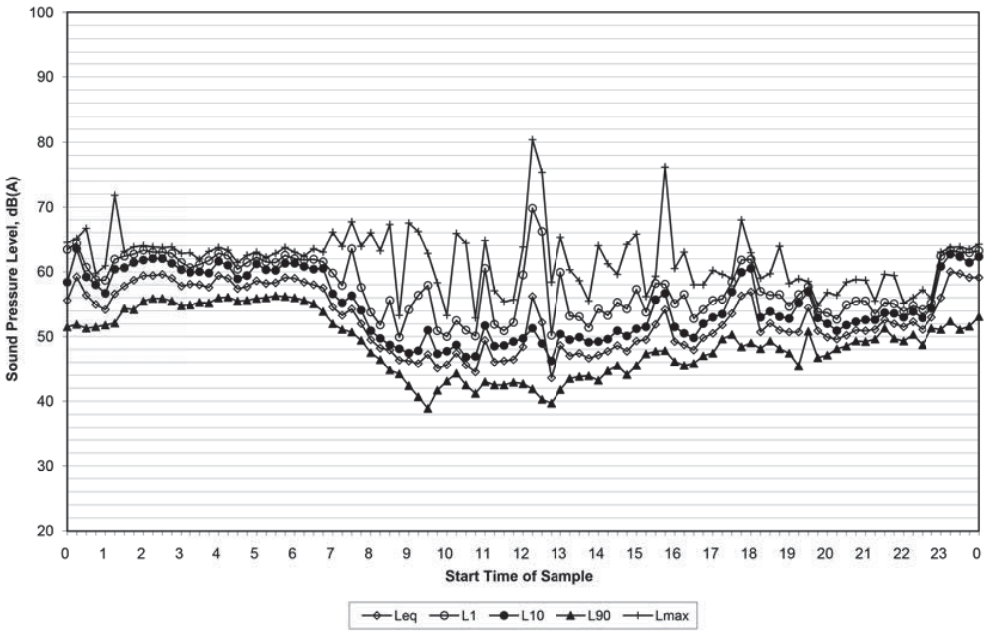


Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

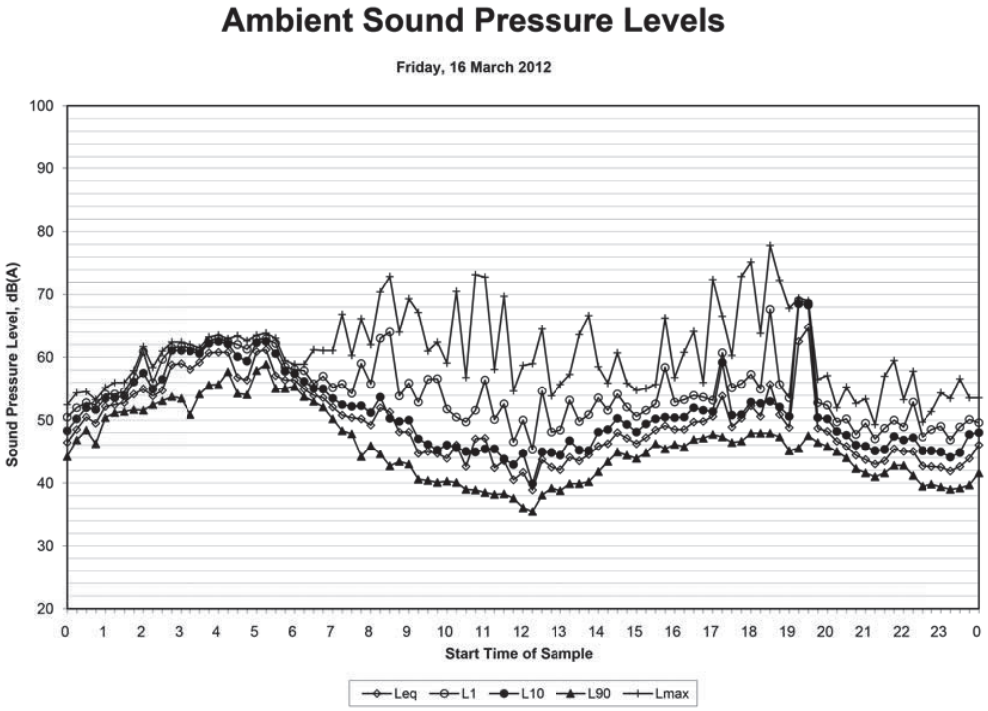
Ambient Sound Pressure Levels

Tuesday, 13 March 2012



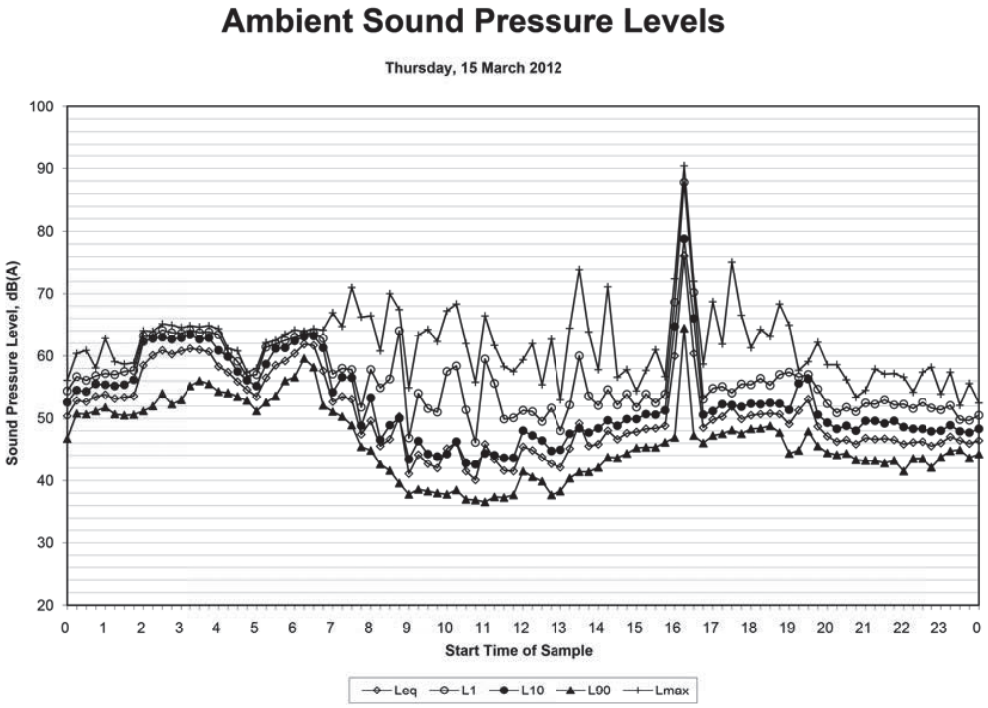
Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls



Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

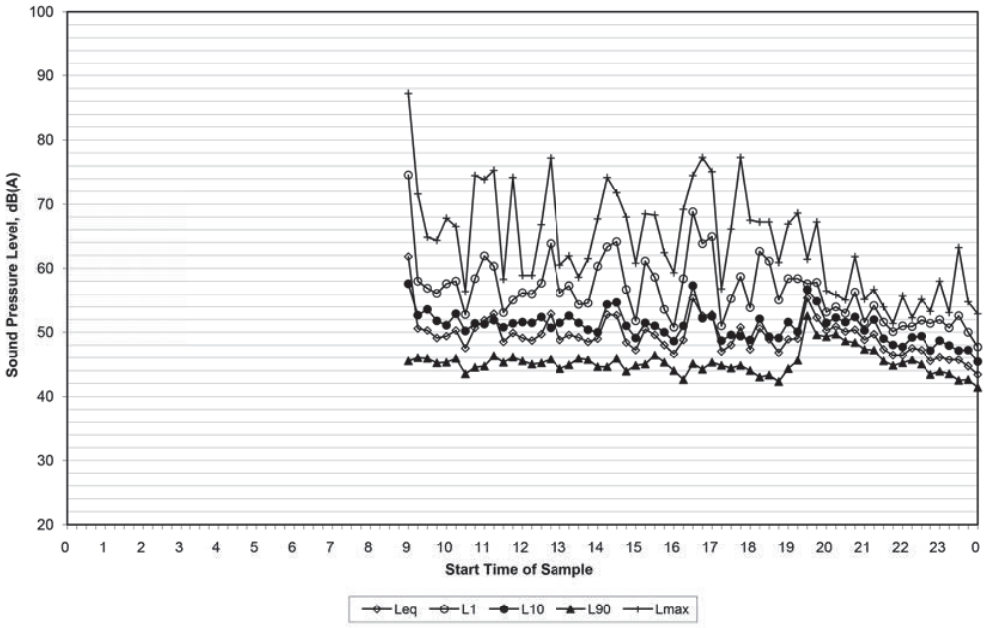


Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls

Ambient Sound Pressure Levels

Friday, 9 March 2012

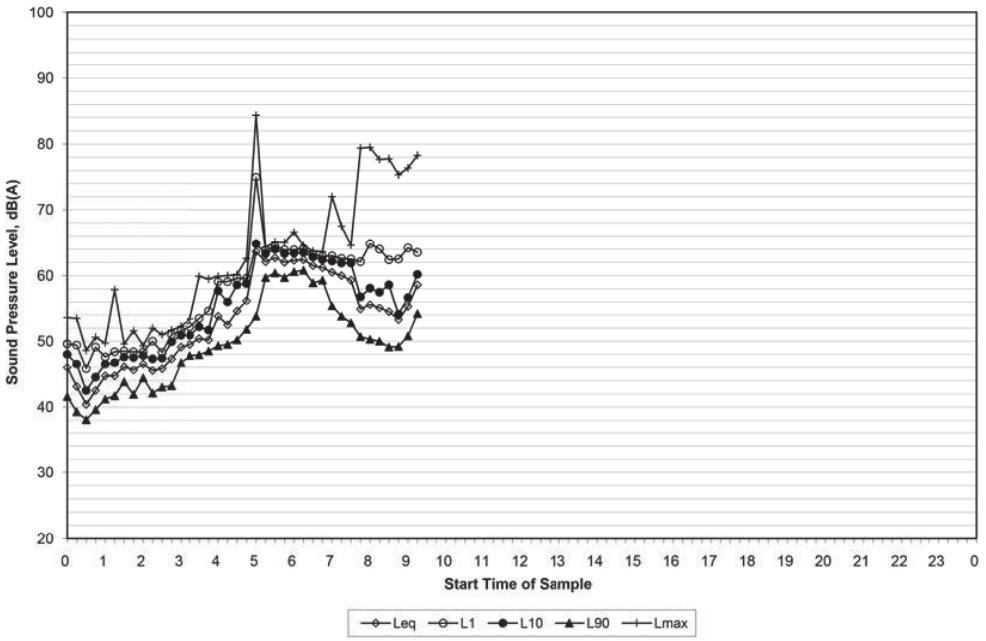


Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

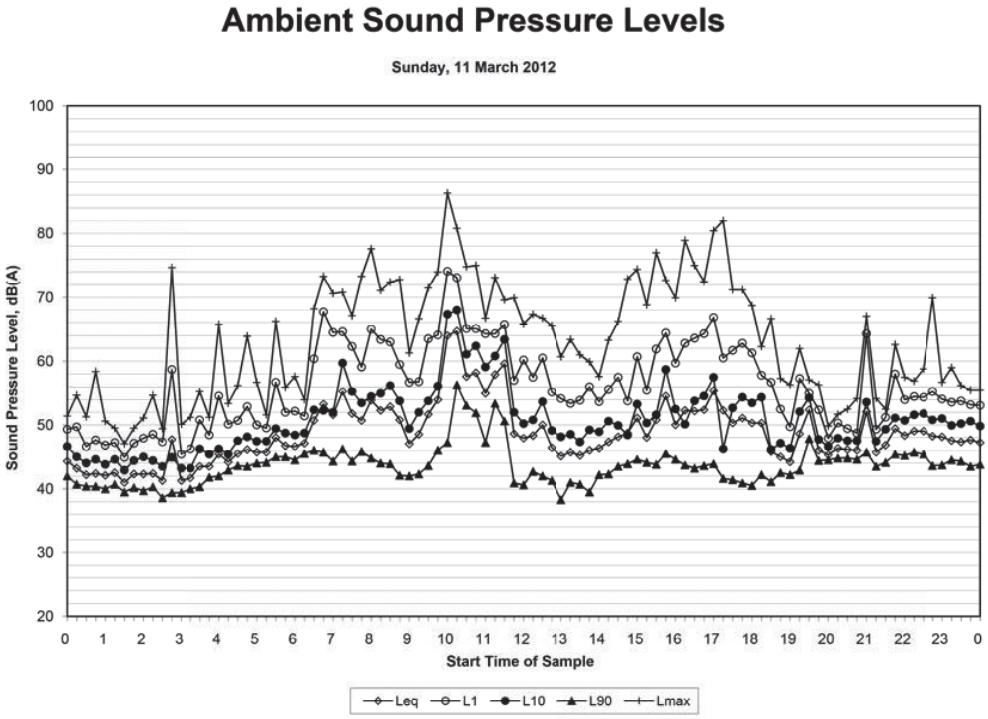
Ambient Sound Pressure Levels

Saturday, 17 March 2012



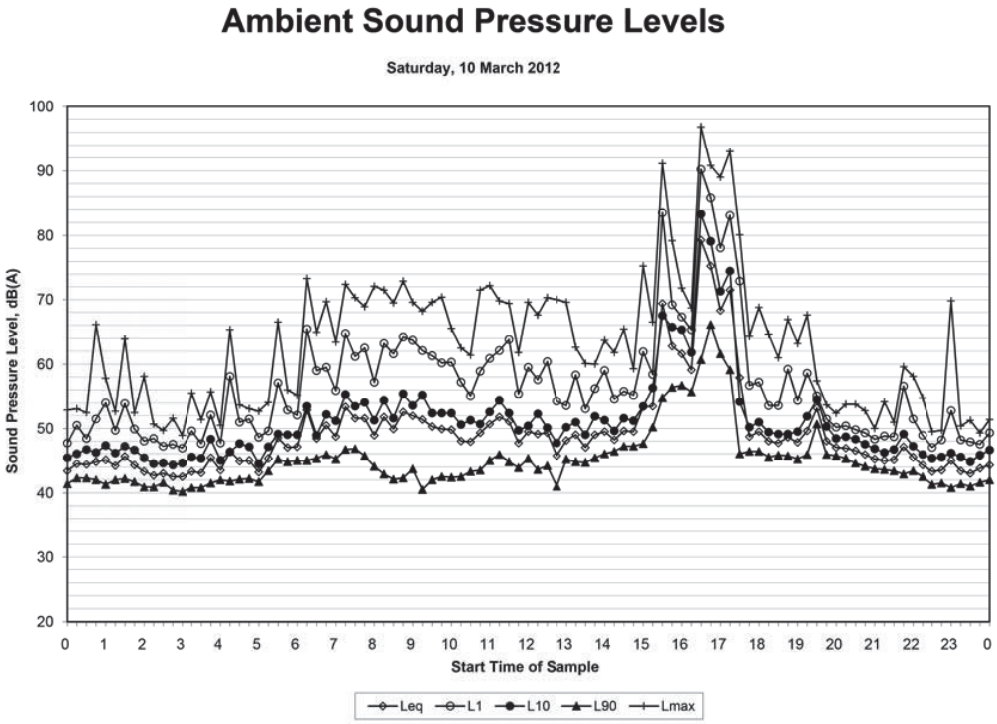
Reference Location M5
Lot 97 131 Bushells Ridge Road. Kiar

42.6729.M5.xls



Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

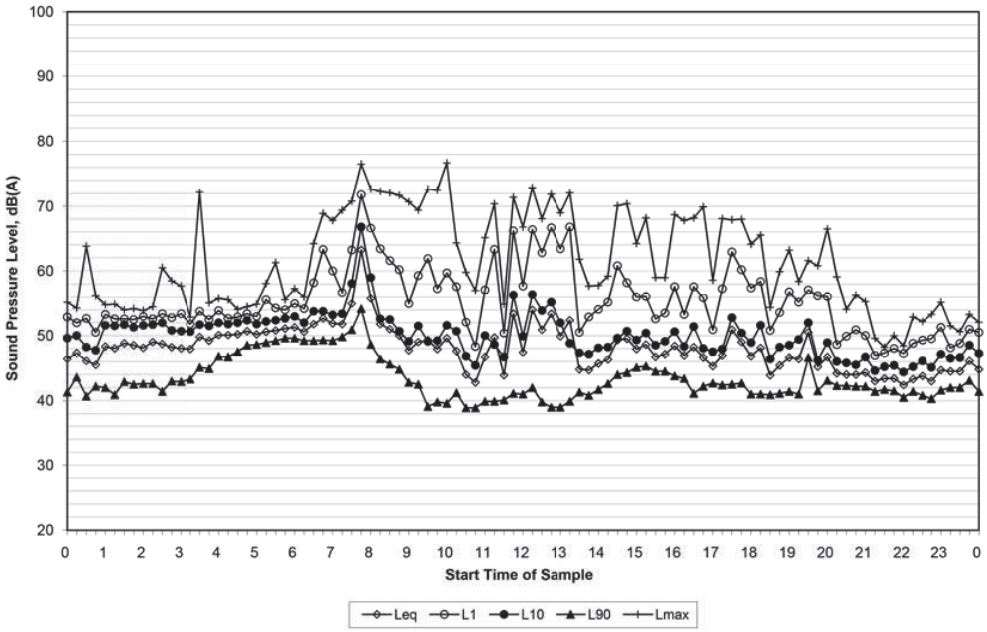


Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

Ambient Sound Pressure Levels

Tuesday, 13 March 2012

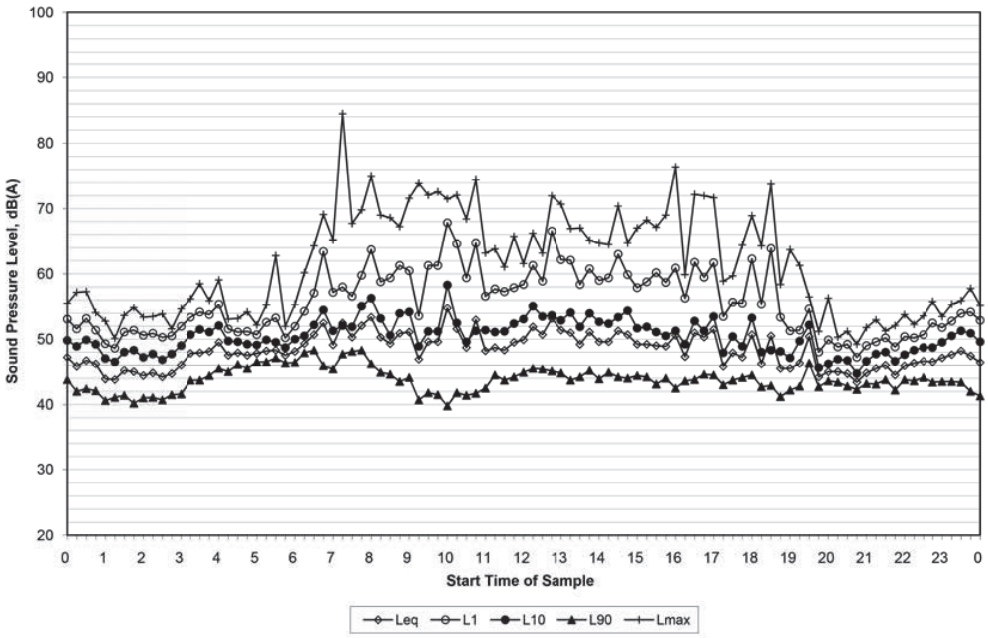


Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

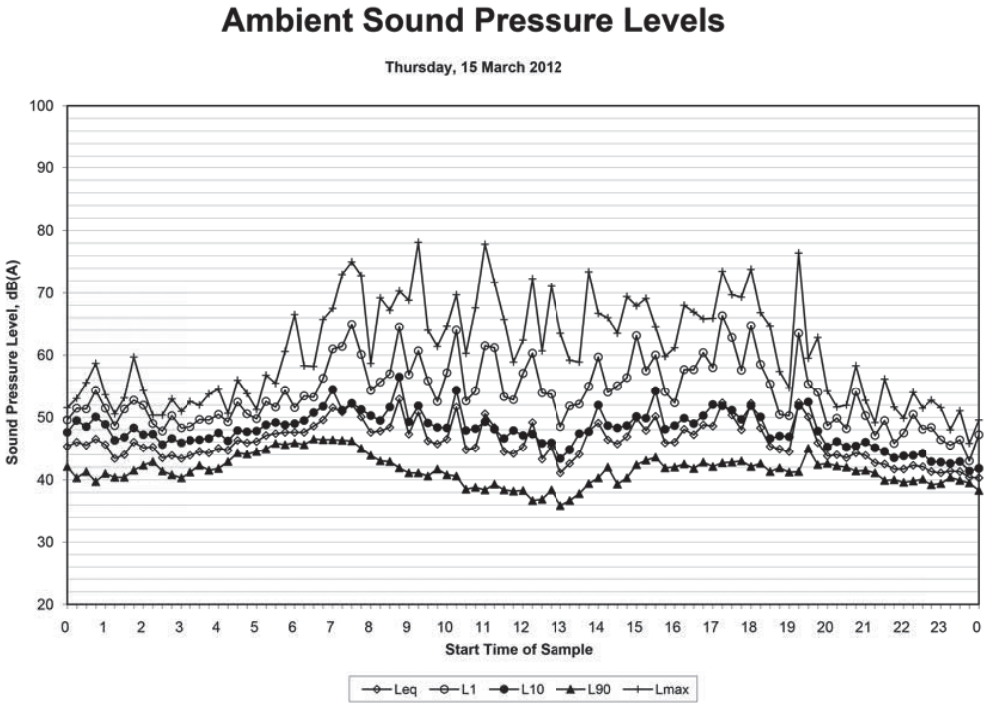
Ambient Sound Pressure Levels

Monday, 12 March 2012



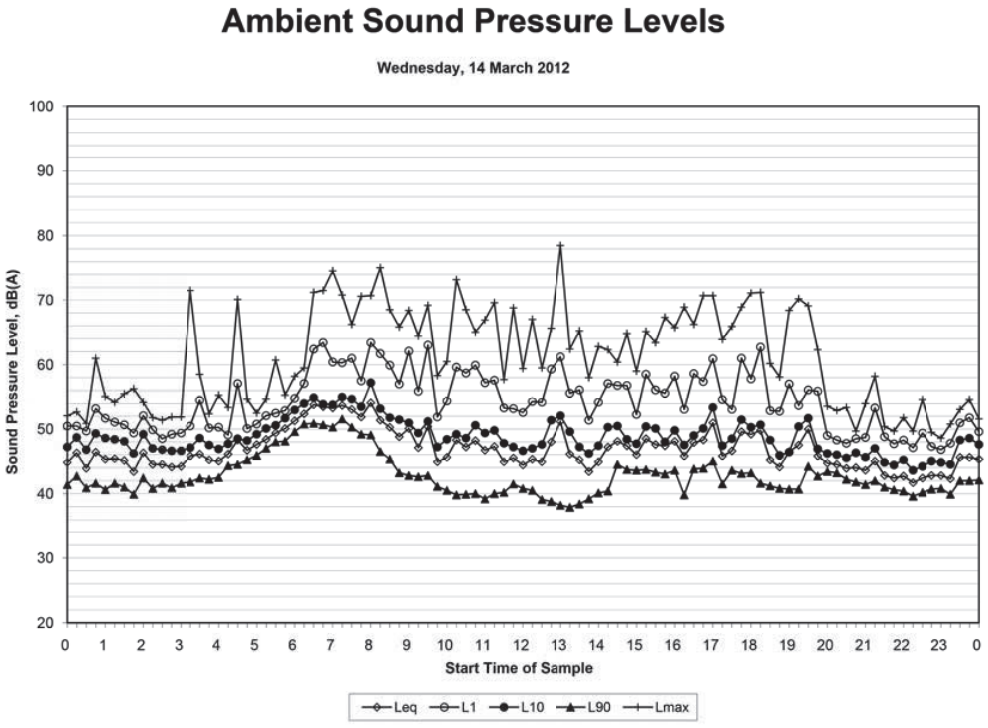
Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls



Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

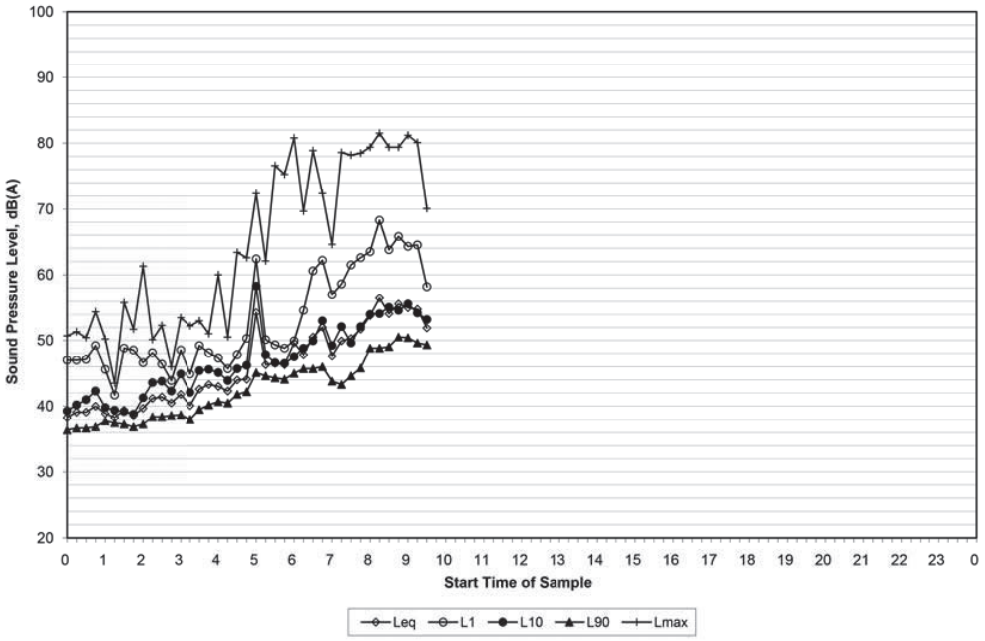


Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

Ambient Sound Pressure Levels

Saturday, 17 March 2012

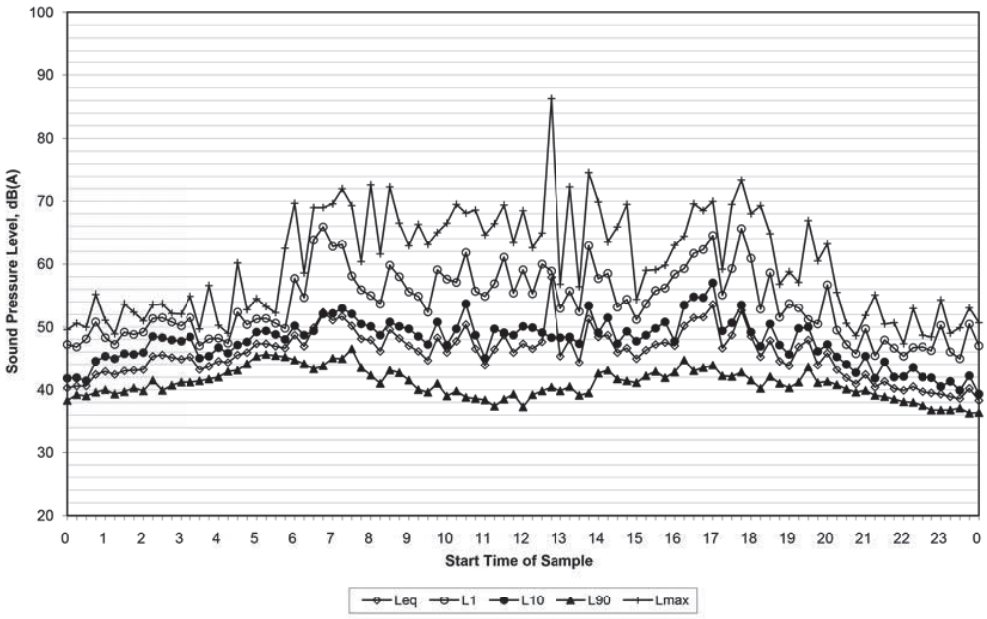


Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

Ambient Sound Pressure Levels

Friday, 16 March 2012

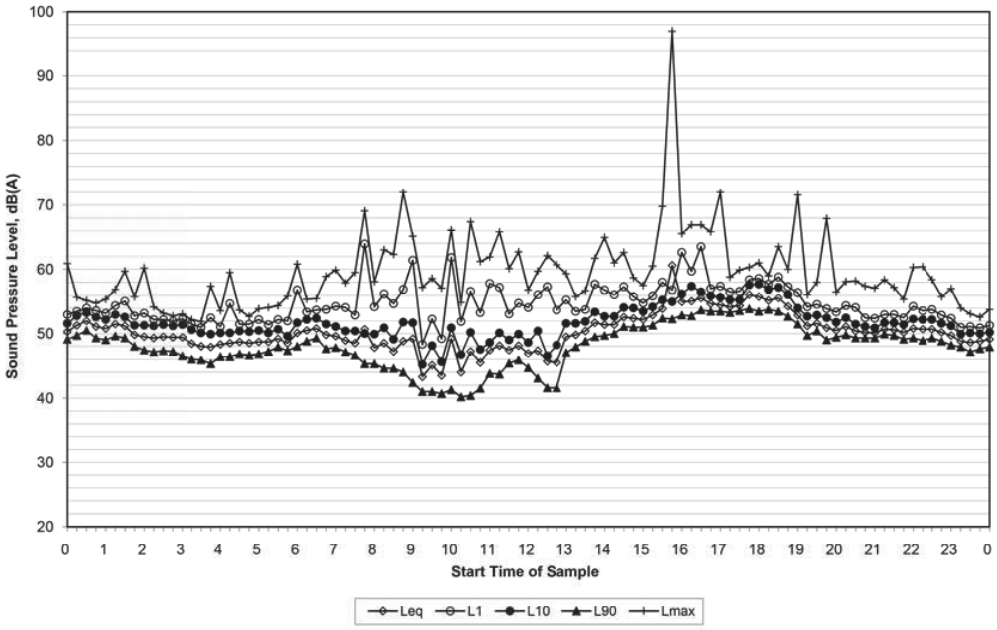


Reference Location M6
9 Kair Ridge Road Kiar

42.6729.M6.xls

Ambient Sound Pressure Levels

Saturday, 10 March 2012

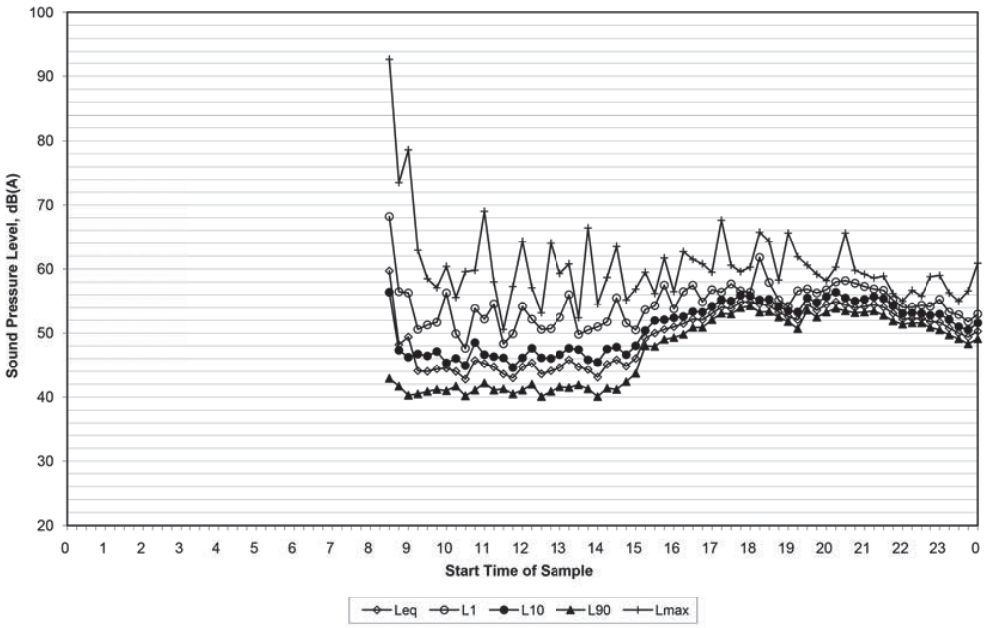


Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

Ambient Sound Pressure Levels

Friday, 9 March 2012

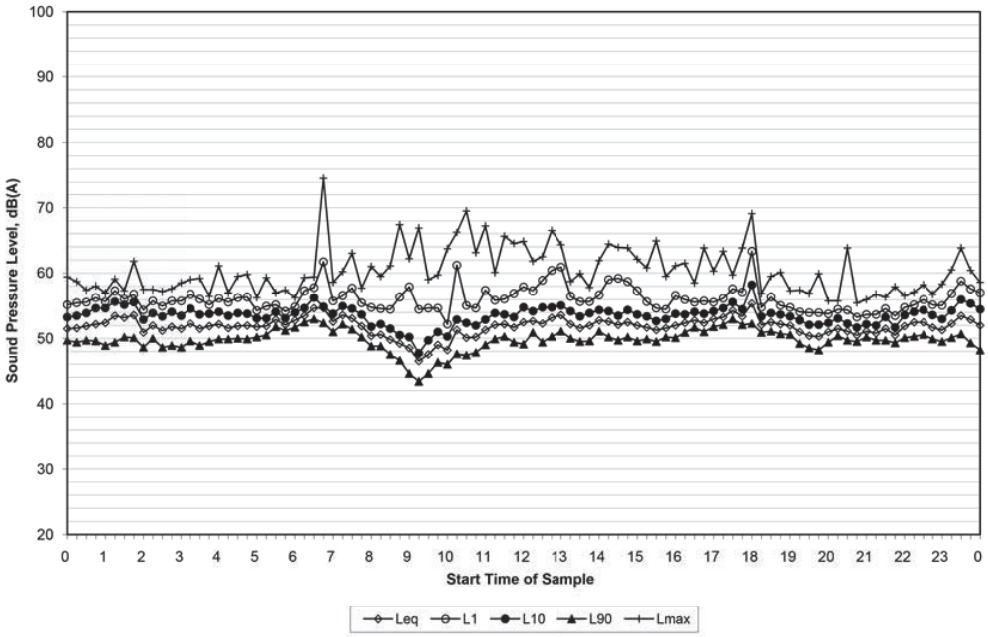


Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

Ambient Sound Pressure Levels

Monday, 12 March 2012

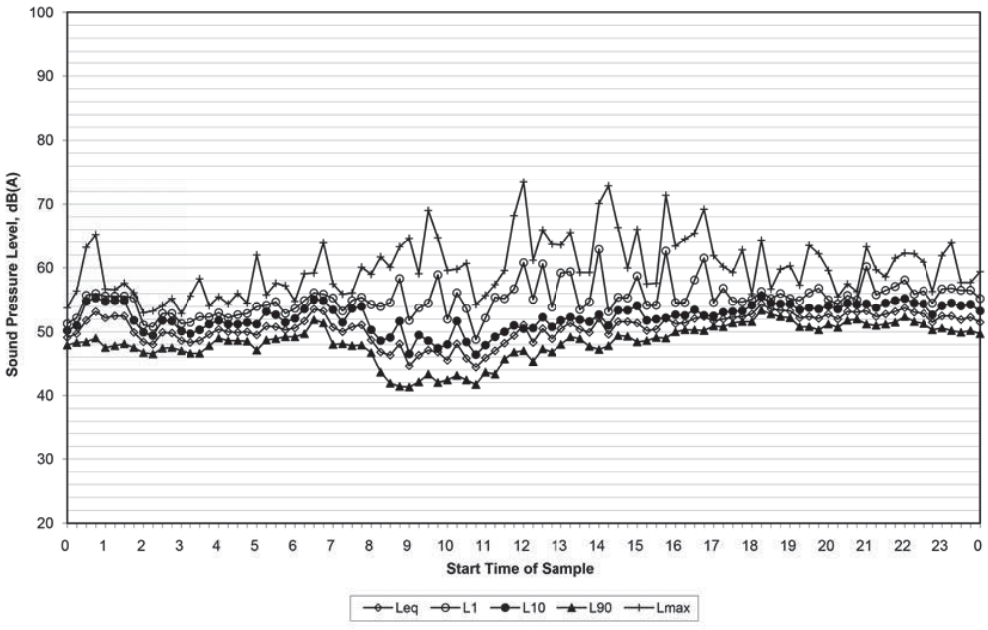


Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

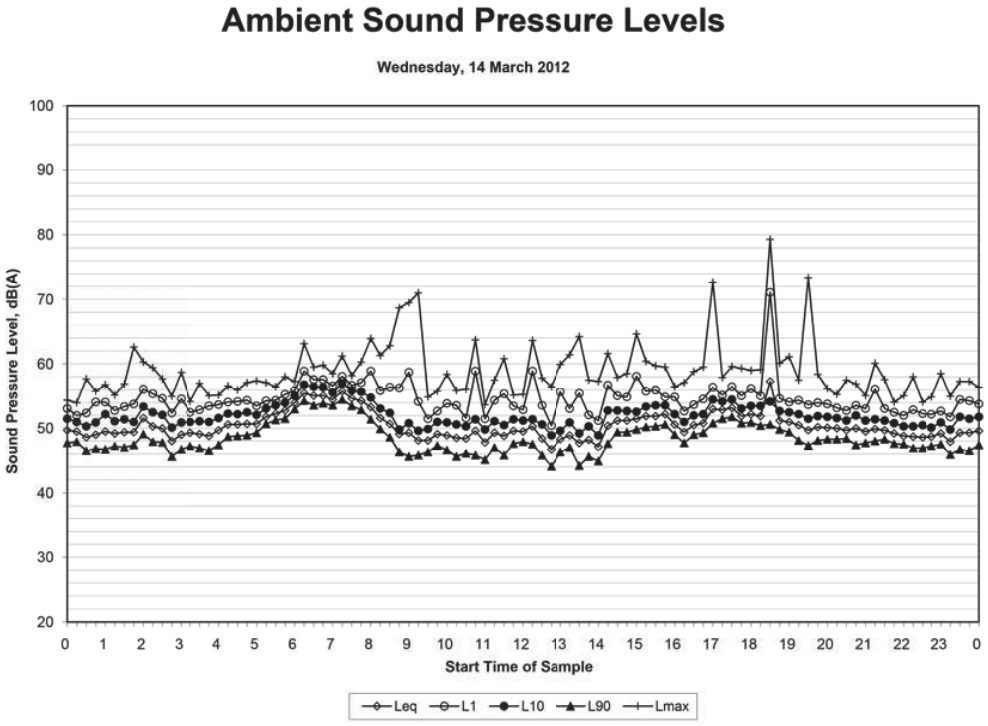
Ambient Sound Pressure Levels

Sunday, 11 March 2012



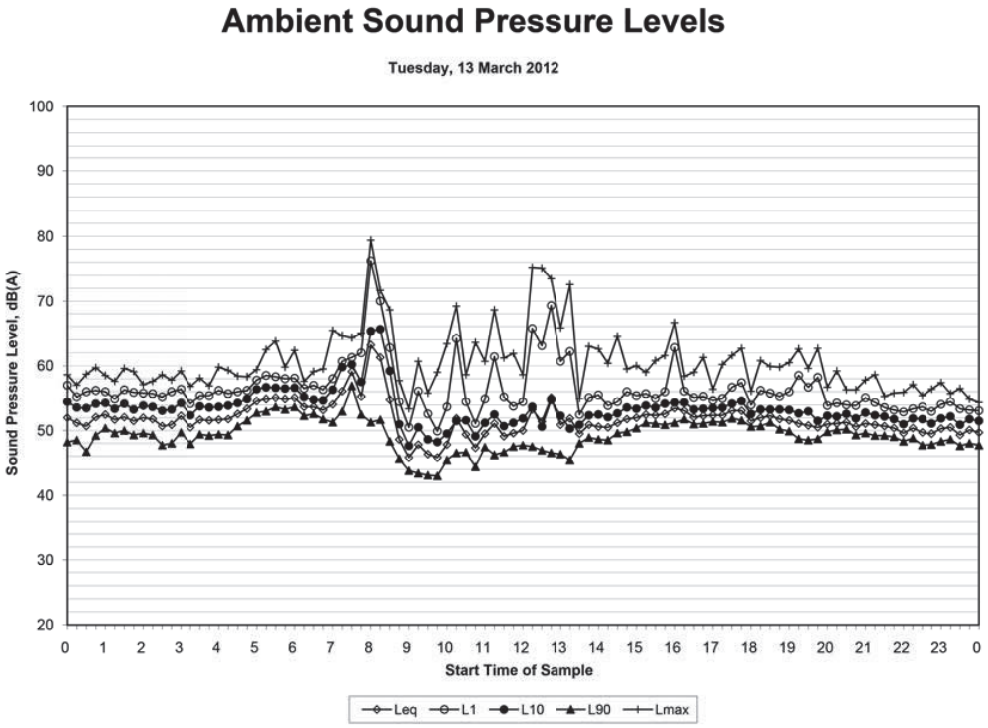
Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls



Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

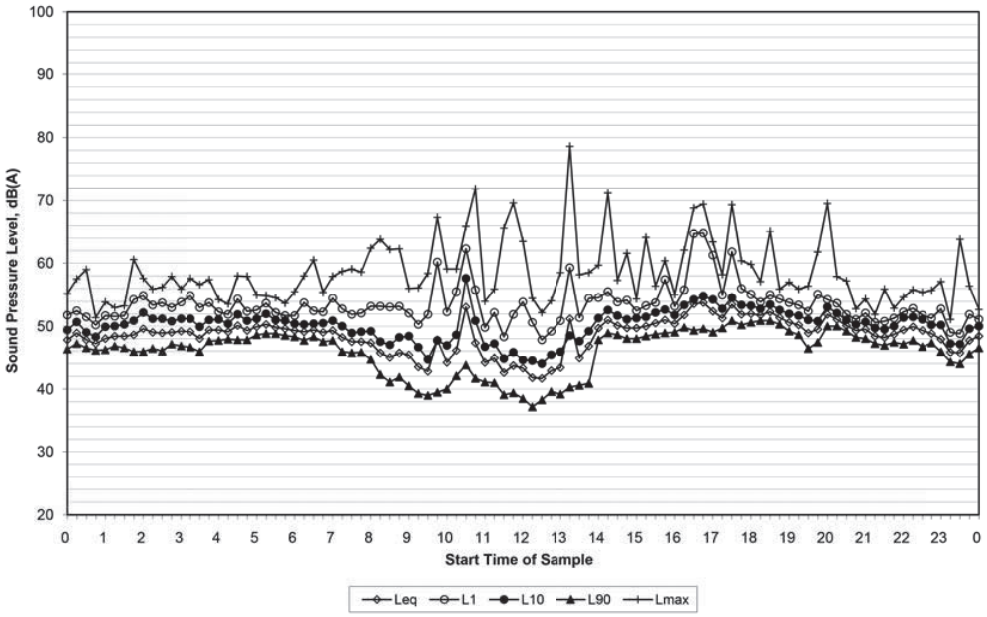


Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

Ambient Sound Pressure Levels

Friday, 16 March 2012

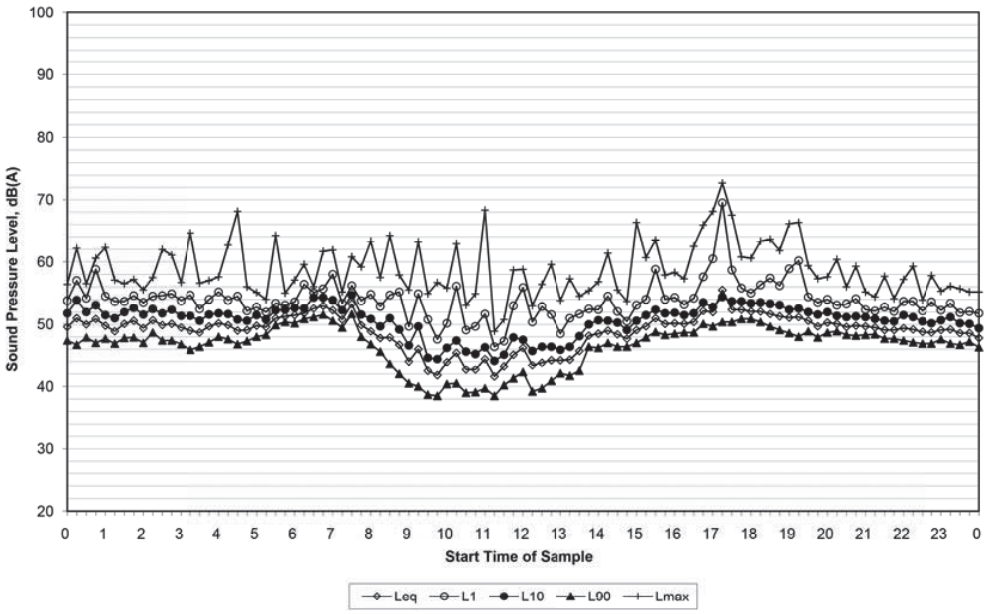


Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

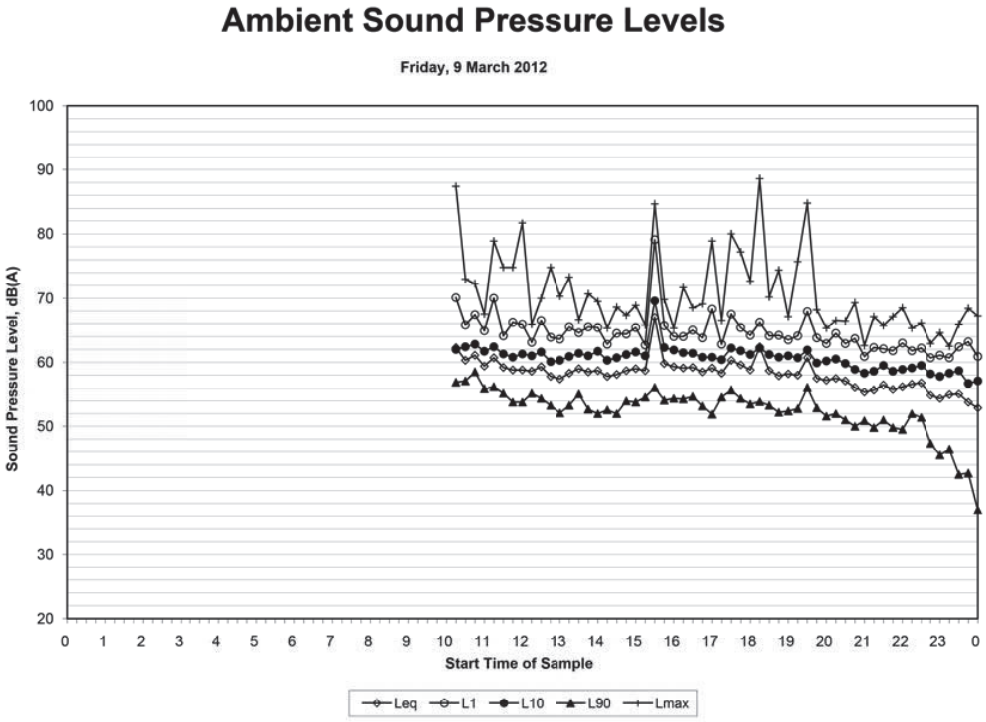
Ambient Sound Pressure Levels

Thursday, 15 March 2012



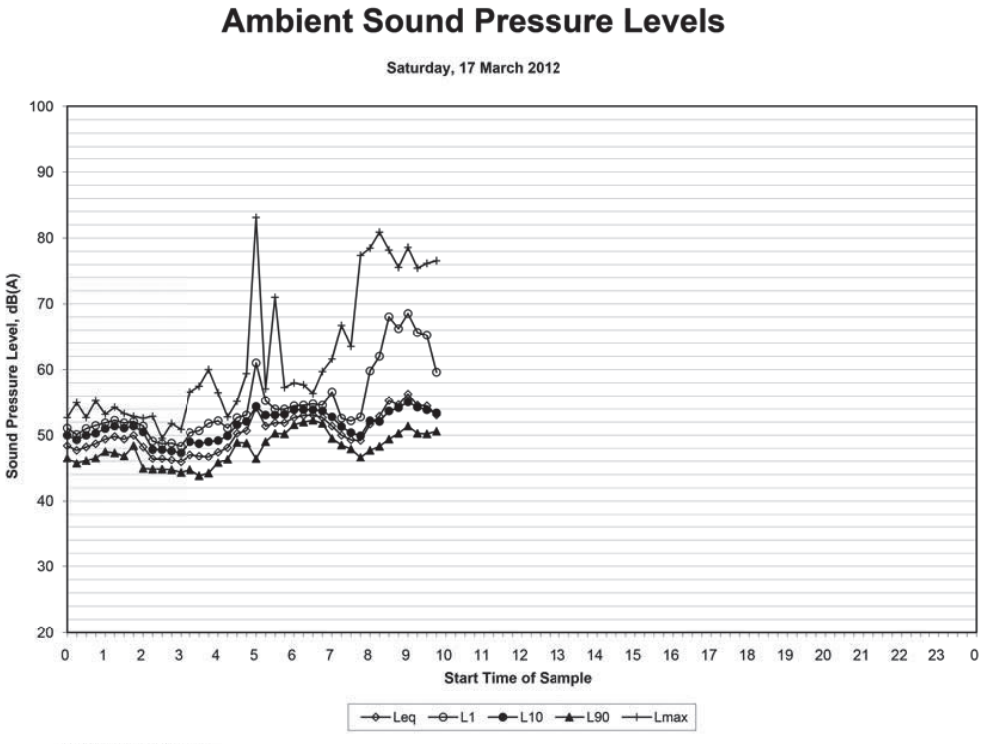
Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls



Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls

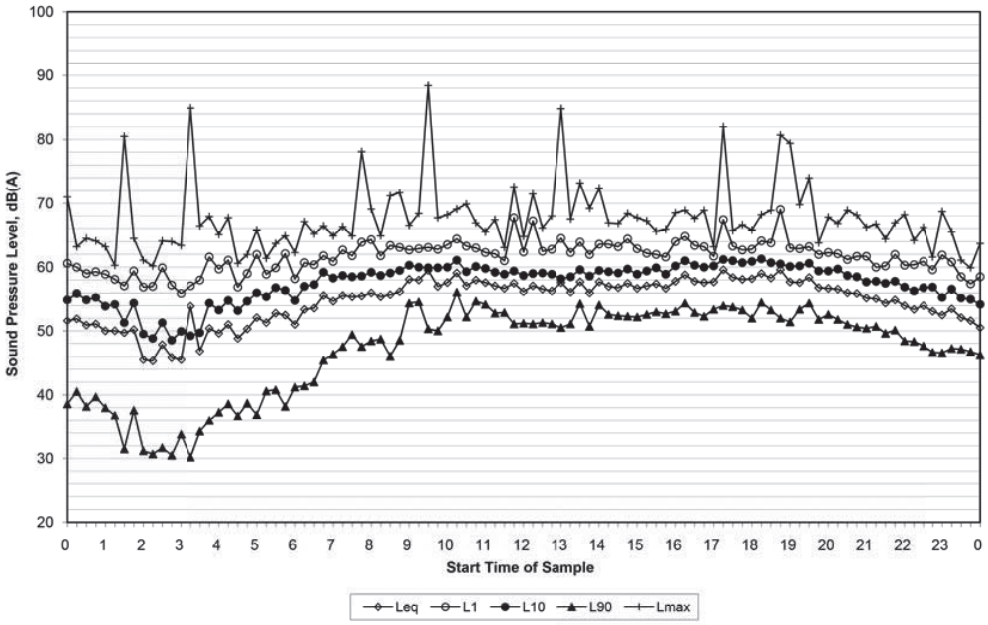


Reference Location M8
3 Amberwood Close Jilliby

42.6729.M8.xls

Ambient Sound Pressure Levels

Sunday, 11 March 2012

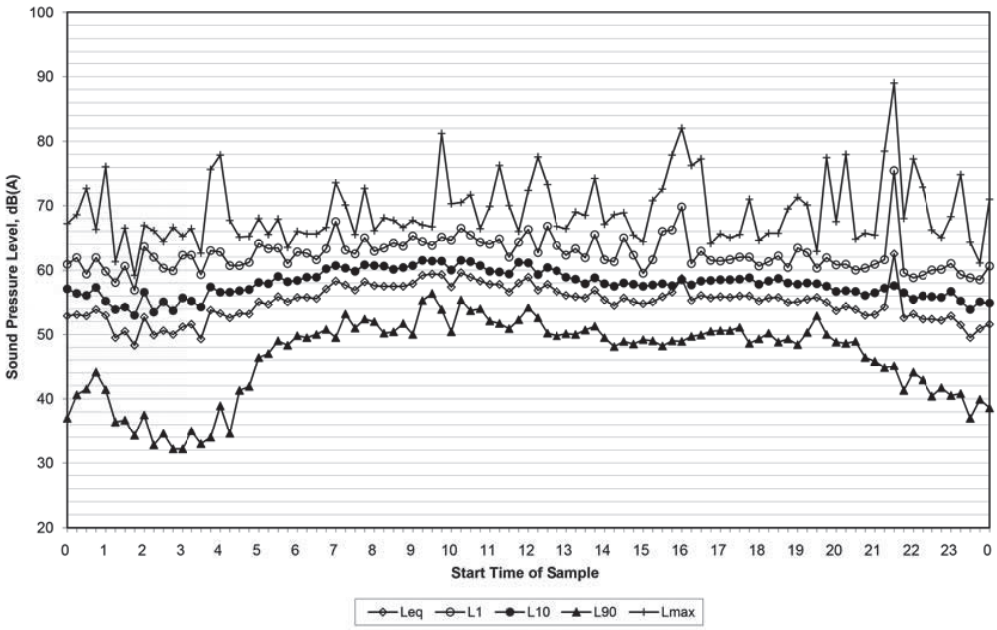


Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls

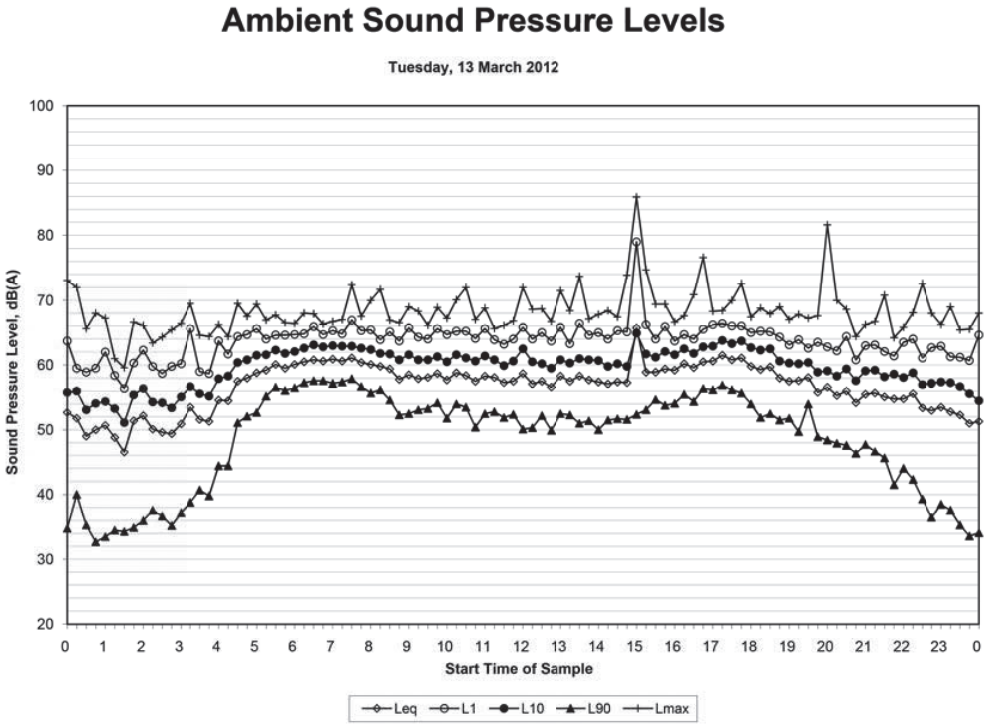
Ambient Sound Pressure Levels

Saturday, 10 March 2012



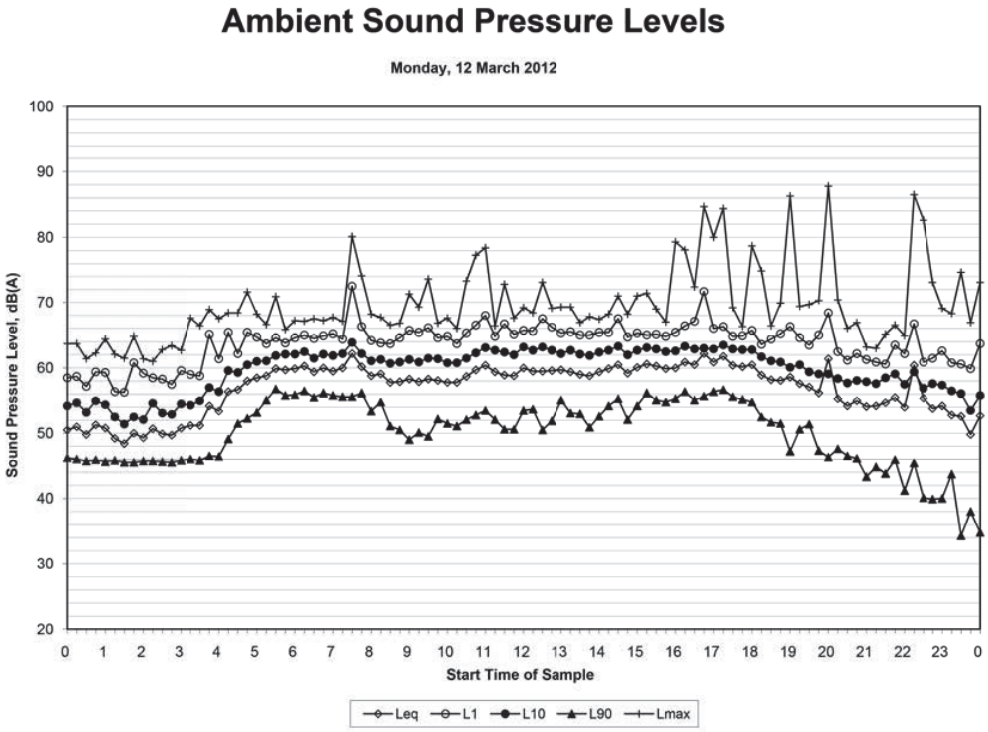
Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls



Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls

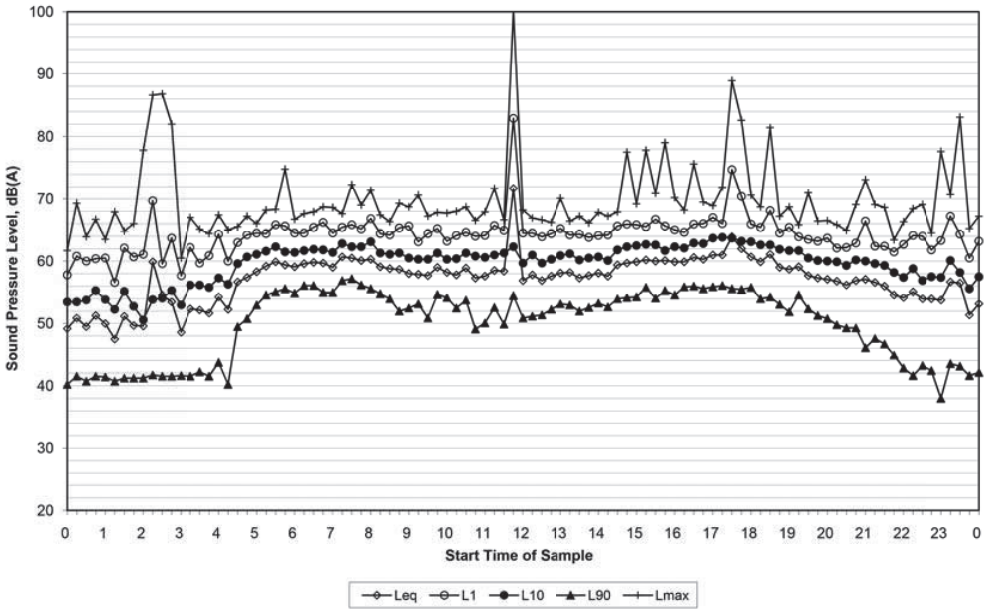


Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls

Ambient Sound Pressure Levels

Thursday, 15 March 2012

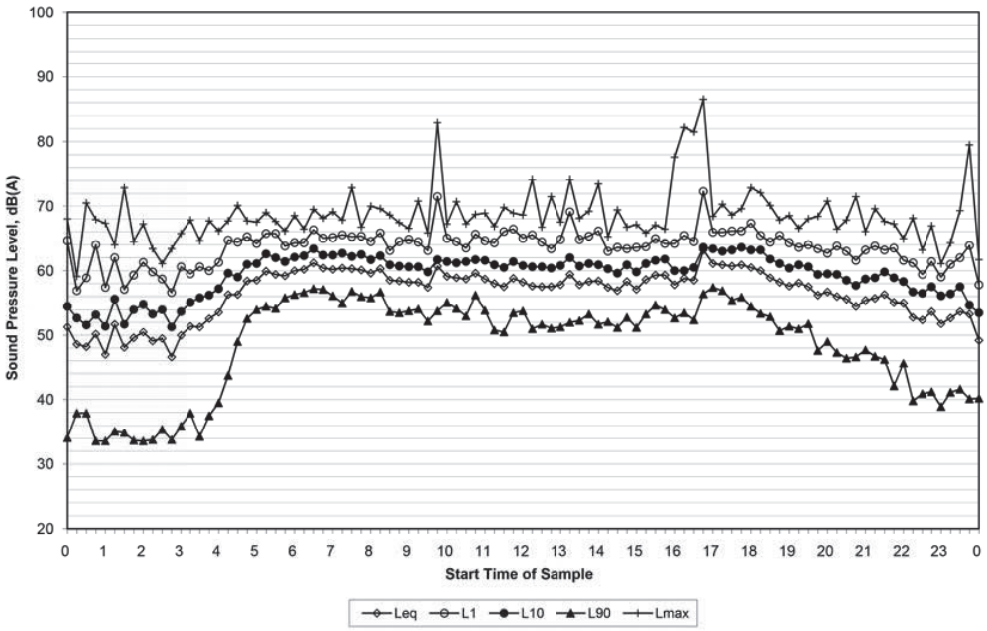


Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls

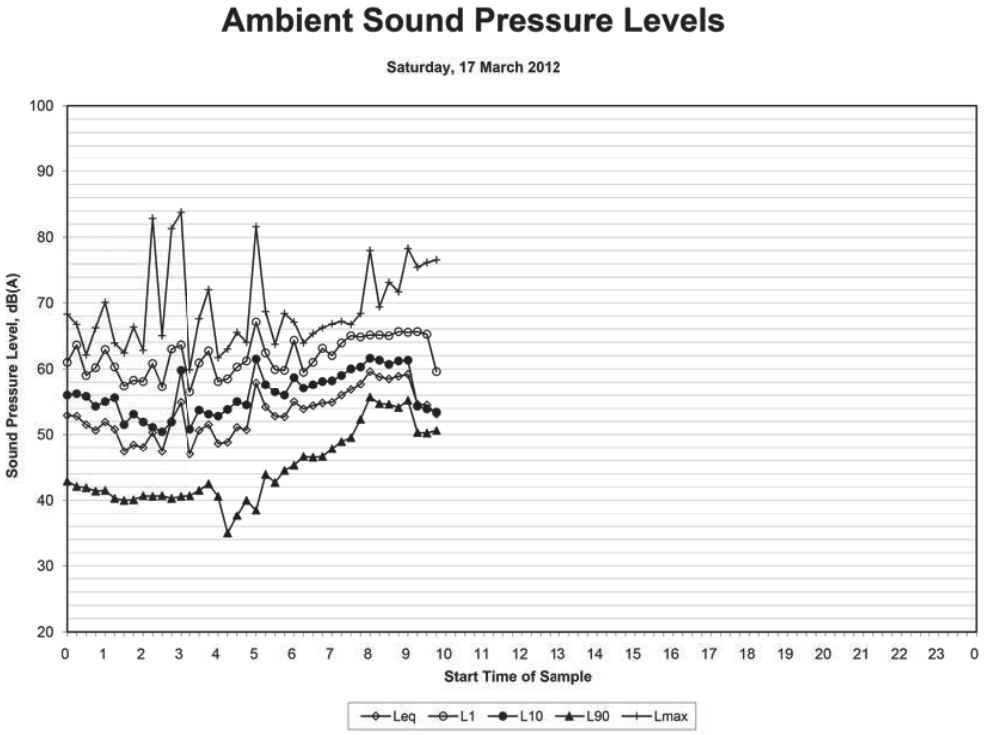
Ambient Sound Pressure Levels

Wednesday, 14 March 2012



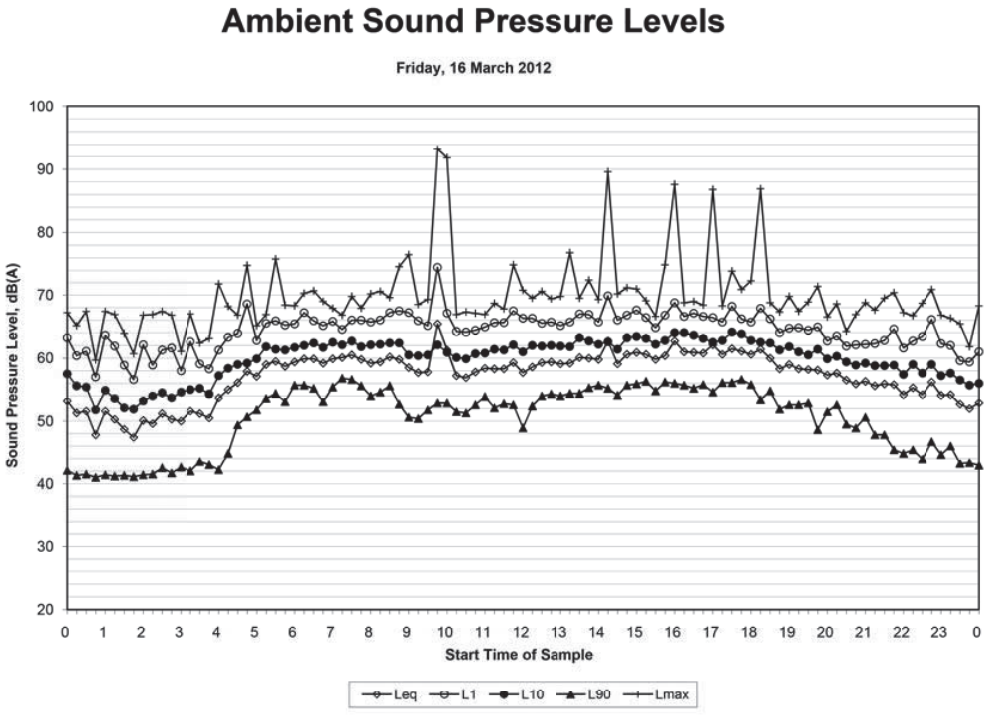
Reference Location M13
19 Popran Way Blue Haven

42.6729.M13.xls



Reference Location M13
19 Popran Way Blue Haven

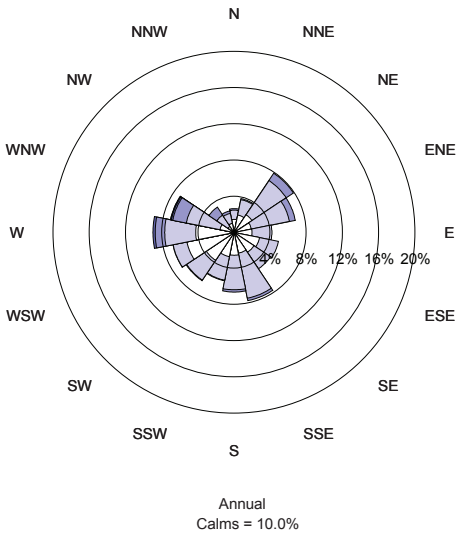
42.6729.M13.xls



Reference Location M13
19 Popran Way Blue Haven

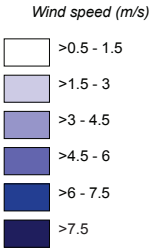
42.6729.M13.xls

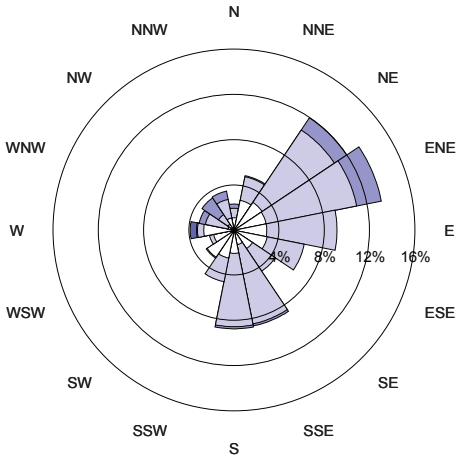
ATTACHMENT 3: LOCAL METEOROLOGY CONDITIONS



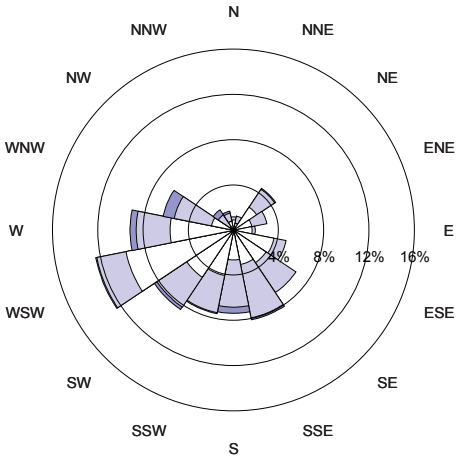
Annual
Calms = 10.0%

Annual and seasonal windroses for Wallarah (2010-2011) Day windroses

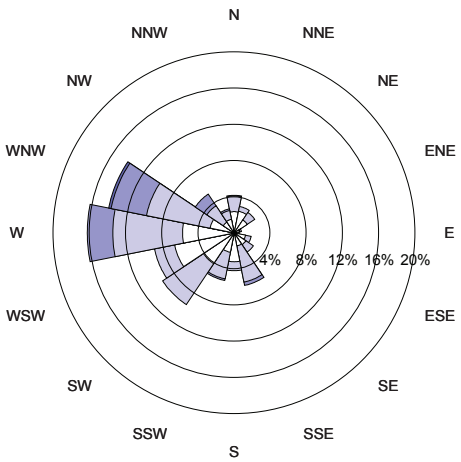




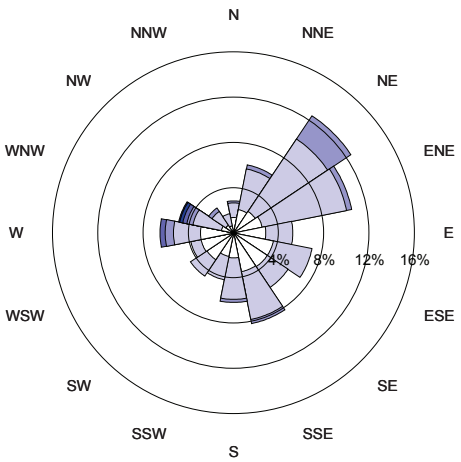
Summer
Calms = 6.8%



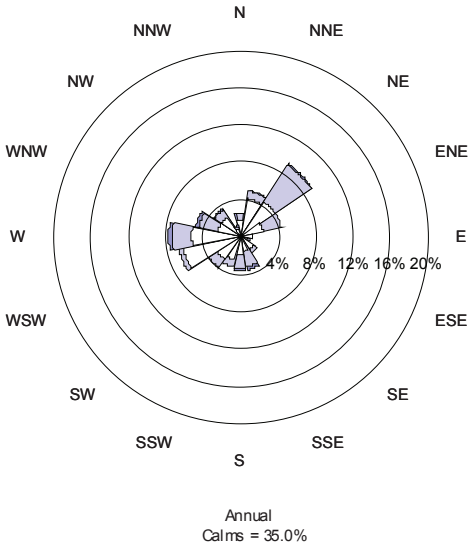
Autumn
Calms = 13.8%



Winter
Calms = 12.2%

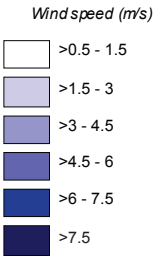


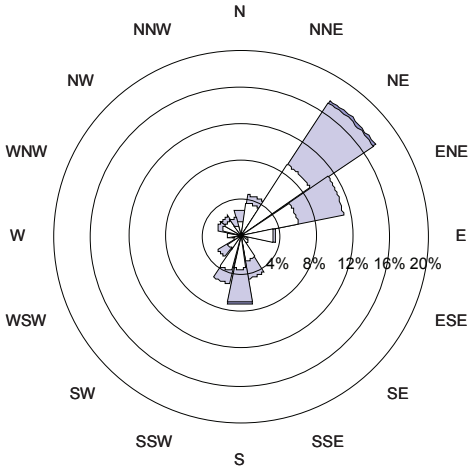
Spring
Calms = 7.1%



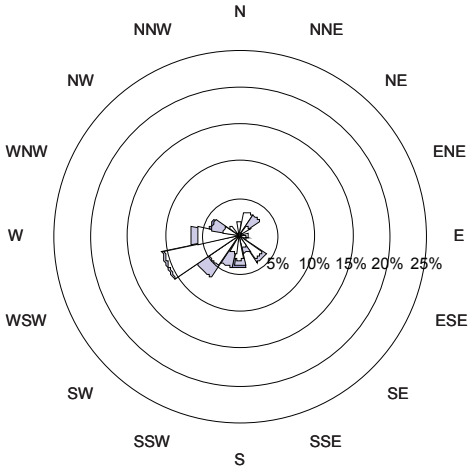
Annual
Calms = 35.0%

Annual and seasonal windroses for Wallarah (2010-2011) Evening windroses

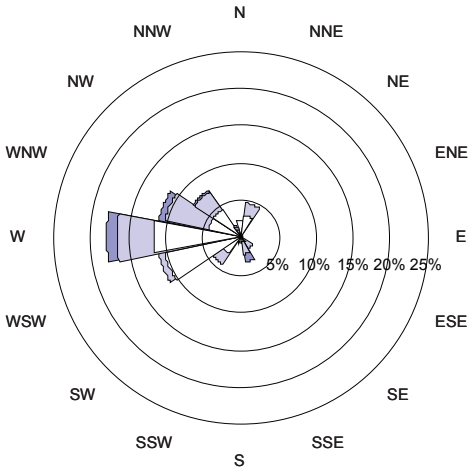




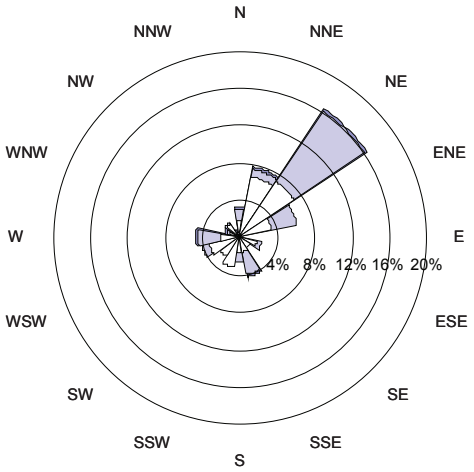
Summer
Calms = 28.6%



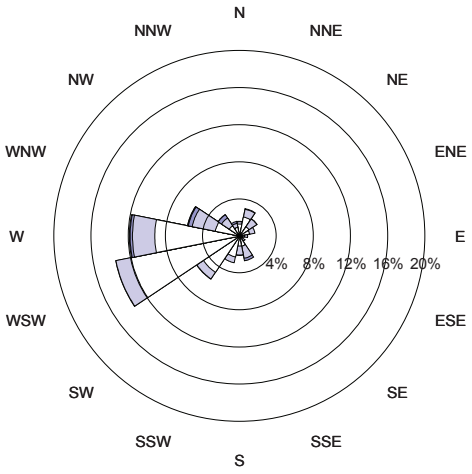
Autumn
Calms = 43.8%



Winter
Calms = 31.8%

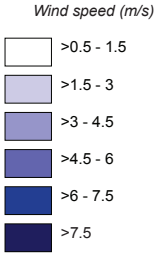


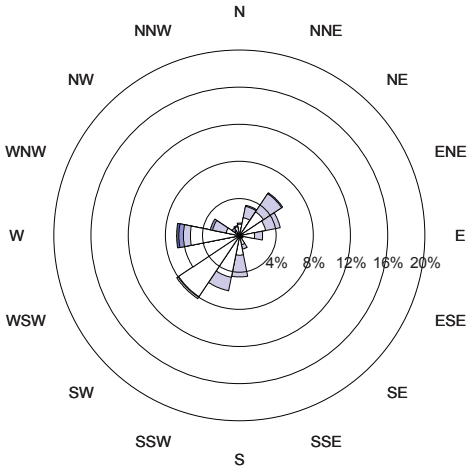
Spring
Calms = 35.7%



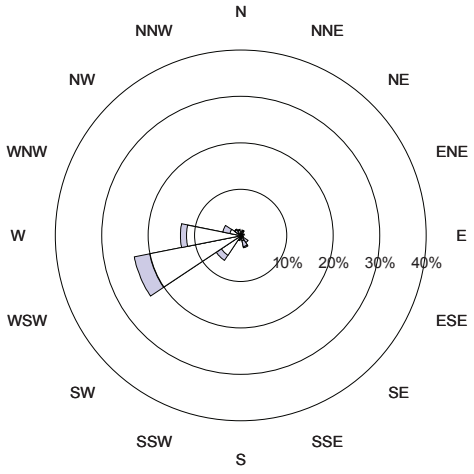
Annual
Calms = 40.7%

Annual and seasonal windroses for Wallarah (2010-2011) Night windroses

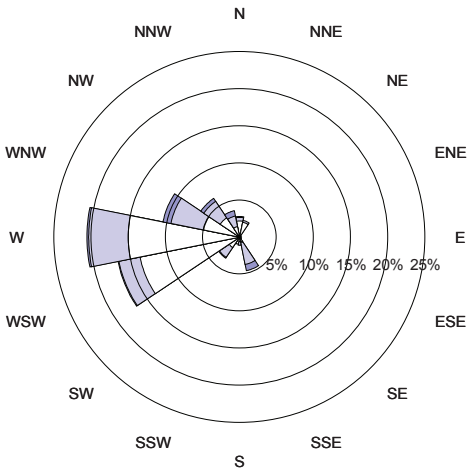




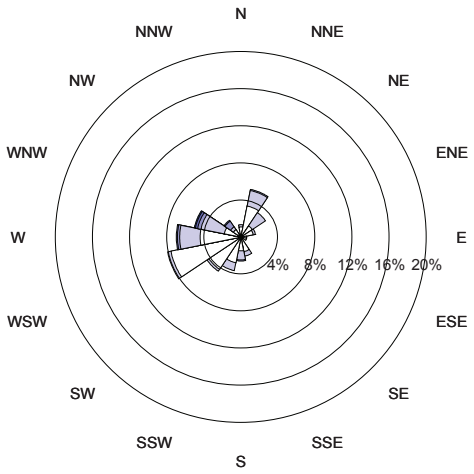
Summer
Calms = 43.8%



Autumn
Calms = 40.6%



Winter
Calms = 26.7%



Spring
Calms = 51.8%

ATTACHMENT 4: PASQUILL STABILITY DATA

PASQUILL STABILITY CLASS 'A'

	Wind Speed Class (m/s)							
WIND SECTOR	0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0.000343	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0
WNW	0.000685	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0
CALM								
TOTAL	0.001028	0	0	0	0	0	0	0

MEAN WIND SPEED (m/s) = 0.53
NUMBER OF OBSERVATIONS = 19

PASQUILL STABILITY CLASS 'B'

WIND SECTOR	Wind Speed Class (m/s) 0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0	0	0	0	0	0	0	0
NE	0.000343	0	0	0	0	0	0	0
ENE	0.000343	0	0	0	0	0	0	0
E	0.000343	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0	0
SSW	0.000343	0	0	0	0	0	0	0
SW	0.001028	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0
CALM								
TOTAL	0.002398	0	0	0	0	0	0	0

MEAN WIND SPEED (m/s) = 0.84

NUMBER OF OBSERVATIONS = 11

PASQUILL STABILITY CLASS 'C'

	Wind Speed Class (m/s)							
WIND SECTOR	0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0.000343	0	0	0	0	0	0	0
NE	0.000343	0.000343	0	0	0	0	0	0
ENE	0.000685	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0
SSE	0.000343	0	0	0	0	0	0	0
S	0	0	0.000343	0	0	0	0	0
SSW	0.000685	0	0	0	0	0	0	0
SW	0.00137	0	0	0	0	0	0	0
WSW	0.001713	0	0	0	0	0	0	0
W	0.001028	0	0.000685	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0
CALM								
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TOTAL	0.006509	0.000343	0.001028	0	0	0	0	0

MEAN WIND SPEED (m/s) = 1.17

NUMBER OF OBSERVATIONS = 31

PASQUILL STABILITY CLASS 'D'

	Wind Speed Class (m/s)							
WIND SECTOR	0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0.013703	0.006509	0	0	0	0	0	0
NE	0.003426	0.003768	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0
SSE	0	0.002398	0.003083	0	0	0	0	0
S	0	0.000343	0	0	0	0	0	0
SSW	0.001028	0.000343	0	0	0	0	0	0
SW	0.007194	0.001028	0.000343	0	0	0	0	0
WSW	0.04248	0.003083	0.000343	0	0	0	0	0
W	0.06235	0.011305	0.002055	0	0	0	0	0
WNW	0.012333	0.016444	0.003768	0.000685	0	0	0	0
NW	0.003426	0.005139	0.002398	0.000343	0	0	0	0
NNW	0.002055	0.00137	0.002055	0	0	0	0	0
N	0.004454	0.00137	0.000343	0	0	0	0	0
CALM								
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TOTAL	0.152449	0.0531	0.014388	0.001028	0	0	0	0

MEAN WIND SPEED (m/s) = 1.29

NUMBER OF OBSERVATIONS = 832

PASQUILL STABILITY CLASS 'E'

	Wind Speed Class (m/s)							
WIND SECTOR	0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0.003426	0.000343	0	0	0	0	0	0
NE	0.004796	0.003426	0	0	0	0	0	0
ENE	0.002741	0.003426	0	0	0	0	0	0
E	0.000343	0.000343	0	0	0	0	0	0
ESE	0.000343	0	0	0	0	0	0	0
SE	0	0.000343	0	0	0	0	0	0
SSE	0.002398	0.005824	0	0	0	0	0	0
S	0.004796	0.006509	0	0	0	0	0	0
SSW	0.013703	0.005824	0	0	0	0	0	0
SW	0.027749	0.002741	0	0	0	0	0	0
WSW	0.06235	0.010277	0	0	0	0	0	0
W	0.019185	0.008222	0	0	0	0	0	0
WNW	0.008565	0.005139	0	0	0	0	0	0
NW	0.004796	0.004454	0	0	0	0	0	0
NNW	0.003083	0.002741	0	0	0	0	0	0
N	0.003768	0.000685	0	0	0	0	0	0
CALM								
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TOTAL	0.162042	0.060295	0	0	0	0	0	0

MEAN WIND SPEED (m/s) = 0.98

NUMBER OF OBSERVATIONS = 1010

PASQUILL STABILITY CLASS 'F'

	Wind Speed Class (m/s)							
WIND SECTOR	0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0.002398	0	0	0	0	0	0	0
NE	0.000343	0	0	0	0	0	0	0
ENE	0.006166	0.00137	0	0	0	0	0	0
E	0.005139	0.00137	0	0	0	0	0	0
ESE	0.00137	0.000343	0	0	0	0	0	0
SE	0.002741	0.002741	0	0	0	0	0	0
SSE	0.008565	0.003768	0	0	0	0	0	0
S	0.004796	0.00137	0	0	0	0	0	0
SSW	0.005481	0	0	0	0	0	0	0
SW	0.007879	0.001713	0	0	0	0	0	0
WSW	0.014046	0.002055	0	0	0	0	0	0
W	0.009592	0.001028	0	0	0	0	0	0
WNW	0.007194	0.000685	0	0	0	0	0	0
NW	0.006509	0.000685	0	0	0	0	0	0
NNW	0.003083	0	0	0	0	0	0	0
N	0.002055	0	0	0	0	0	0	0
CALM								
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TOTAL	0.087359	0.017129	0	0	0	0	0	0

MEAN WIND SPEED (m/s) = 0.53

NUMBER OF OBSERVATIONS = 19

ALL PASQUILL STABILITY CLASSES

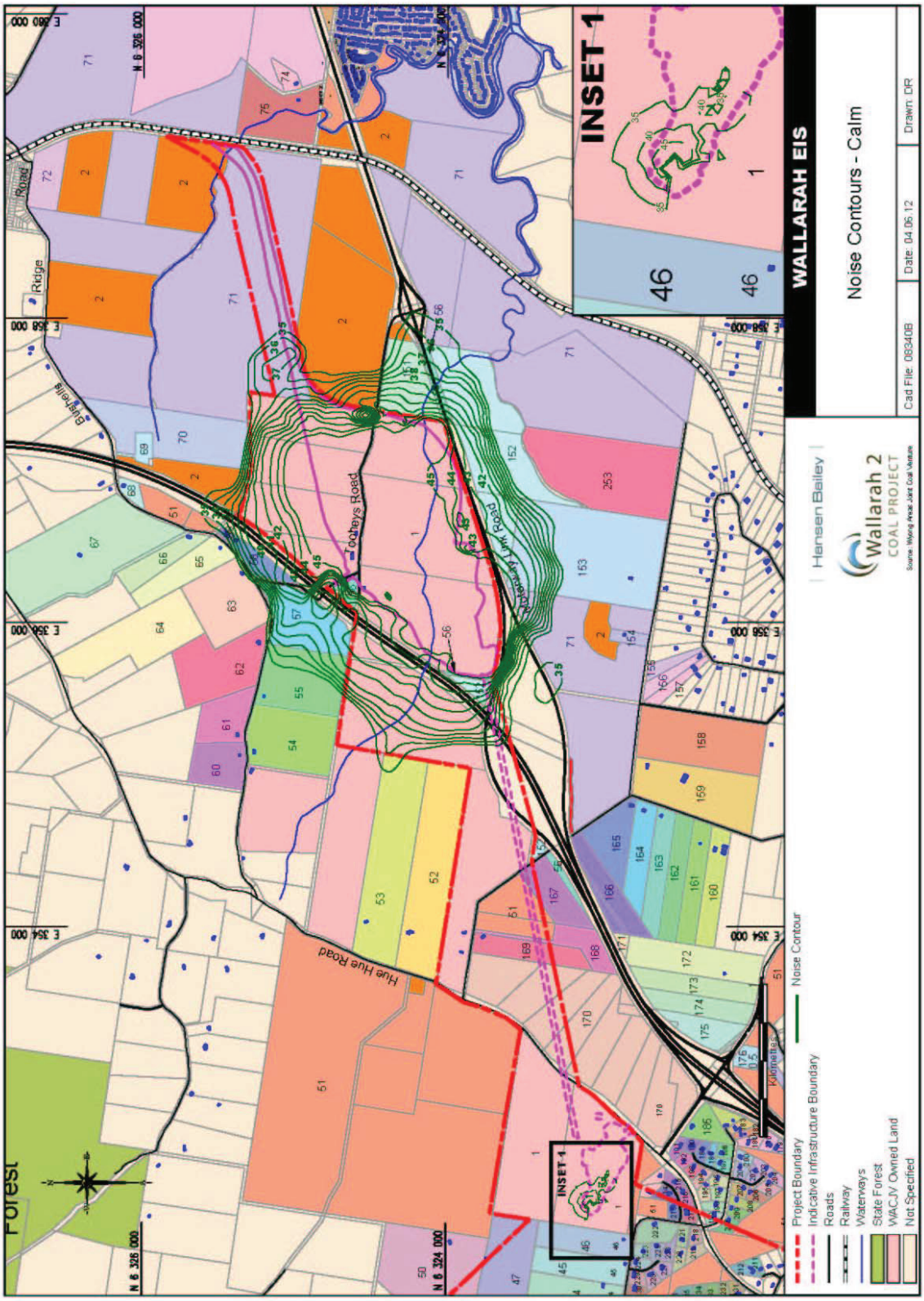
	Wind Speed Class (m/s)							
WIND SECTOR	0.5 TO 1.5	1.5 TO 3	3 TO 4.5	4.5 TO 6	6 TO 7.5	7.5 TO 9	9 TO 10.5	GREATER THAN 10.5
NNE	0.020212	0.006852	0	0	0	0	0	0
NE	0.00925	0.007537	0	0	0	0	0	0
ENE	0.009935	0.004796	0	0	0	0	0	0
E	0.005824	0.001713	0	0	0	0	0	0
ESE	0.001713	0.000343	0	0	0	0	0	0
SE	0.002741	0.003083	0	0	0	0	0	0
SSE	0.011305	0.01199	0.003083	0	0	0	0	0
S	0.009592	0.008222	0.000343	0	0	0	0	0
SSW	0.02124	0.006166	0	0	0	0	0	0
SW	0.045221	0.005481	0.000343	0	0	0	0	0
WSW	0.120589	0.015416	0.000343	0	0	0	0	0
W	0.092155	0.020555	0.002741	0	0	0	0	0
WNW	0.028777	0.022268	0.003768	0.000685	0	0	0	0
NW	0.014731	0.010277	0.002398	0.000343	0	0	0	0
NNW	0.008222	0.004111	0.002055	0	0	0	0	0
N	0.010277	0.002055	0.000343	0	0	0	0	0
CALM								
---	---	---	---	---	---	---	---	---
TOTAL	0.411785	0.130867	0.015416	0.001028	0	0	0	0

MEAN WIND SPEED (m/s) = 0.53
NUMBER OF OBSERVATIONS = 19

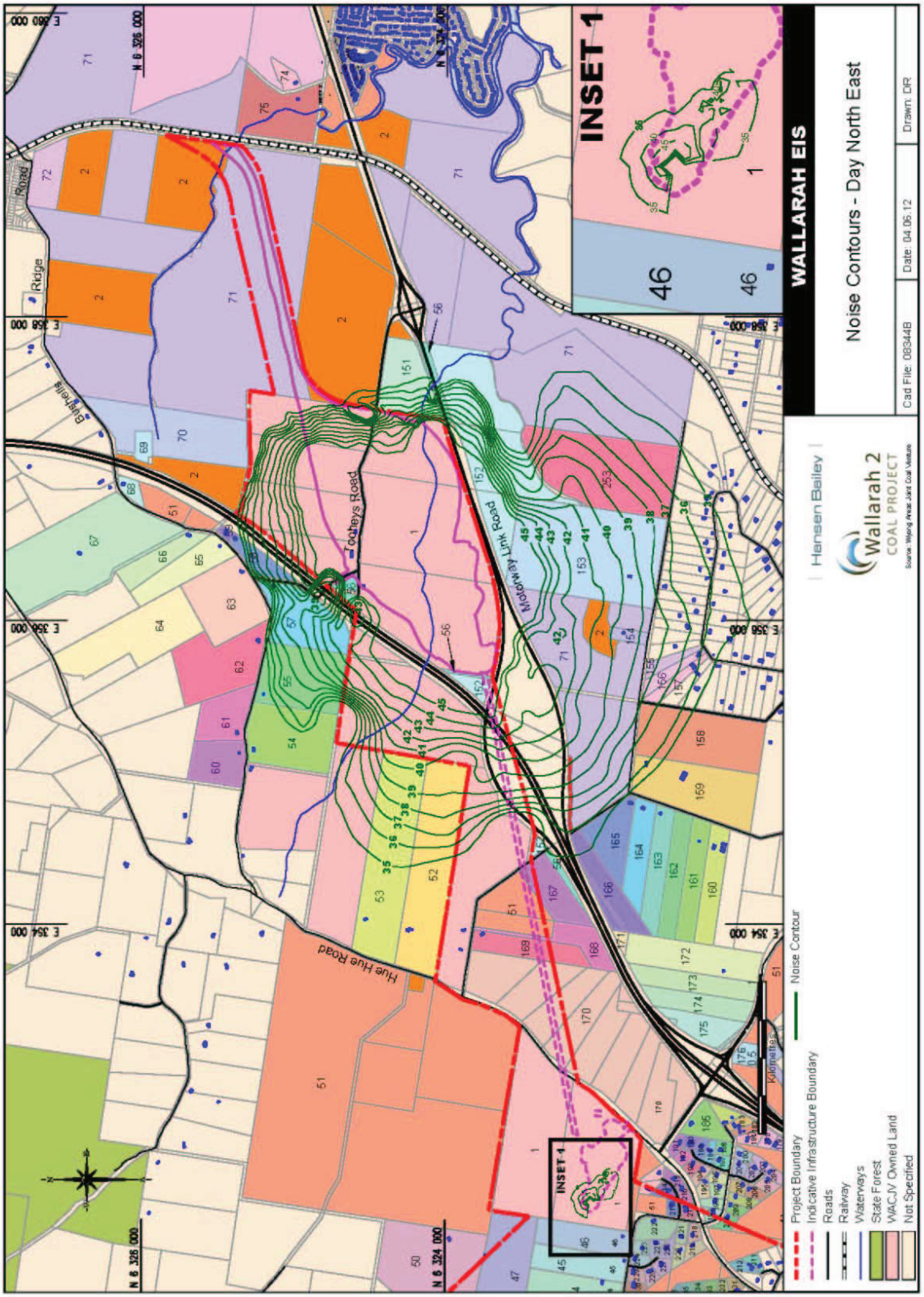
FREQUENCY OF OCCURRENCE OF STABILITY CLASSES

A :	0.70%
B :	0.40%
C :	1.10%
D :	28.50%
E :	34.60%
F :	34.80%

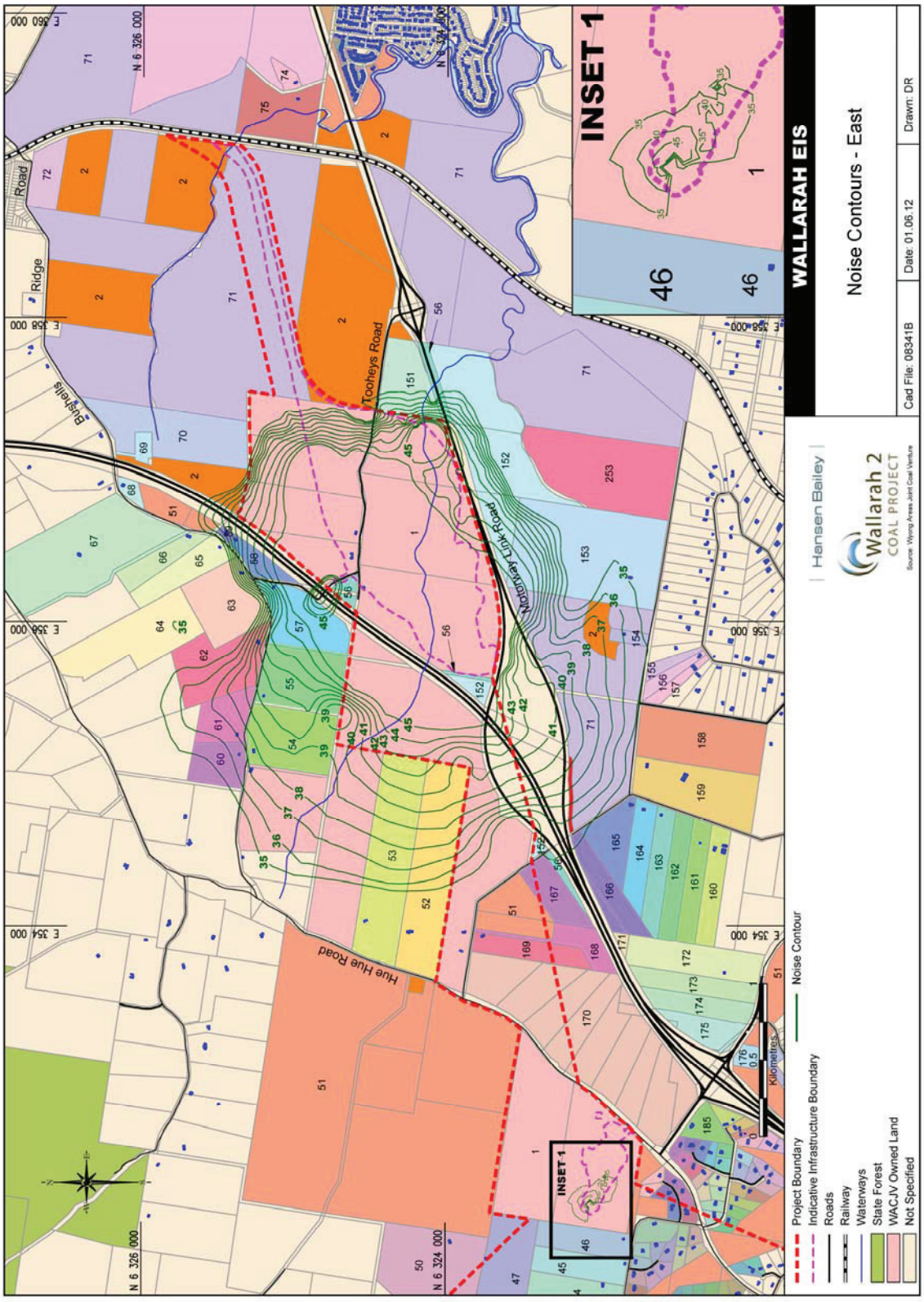
ATTACHMENT 5: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL
(Calm Wind)



ATTACHMENT 6: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL
(North-East Wind)

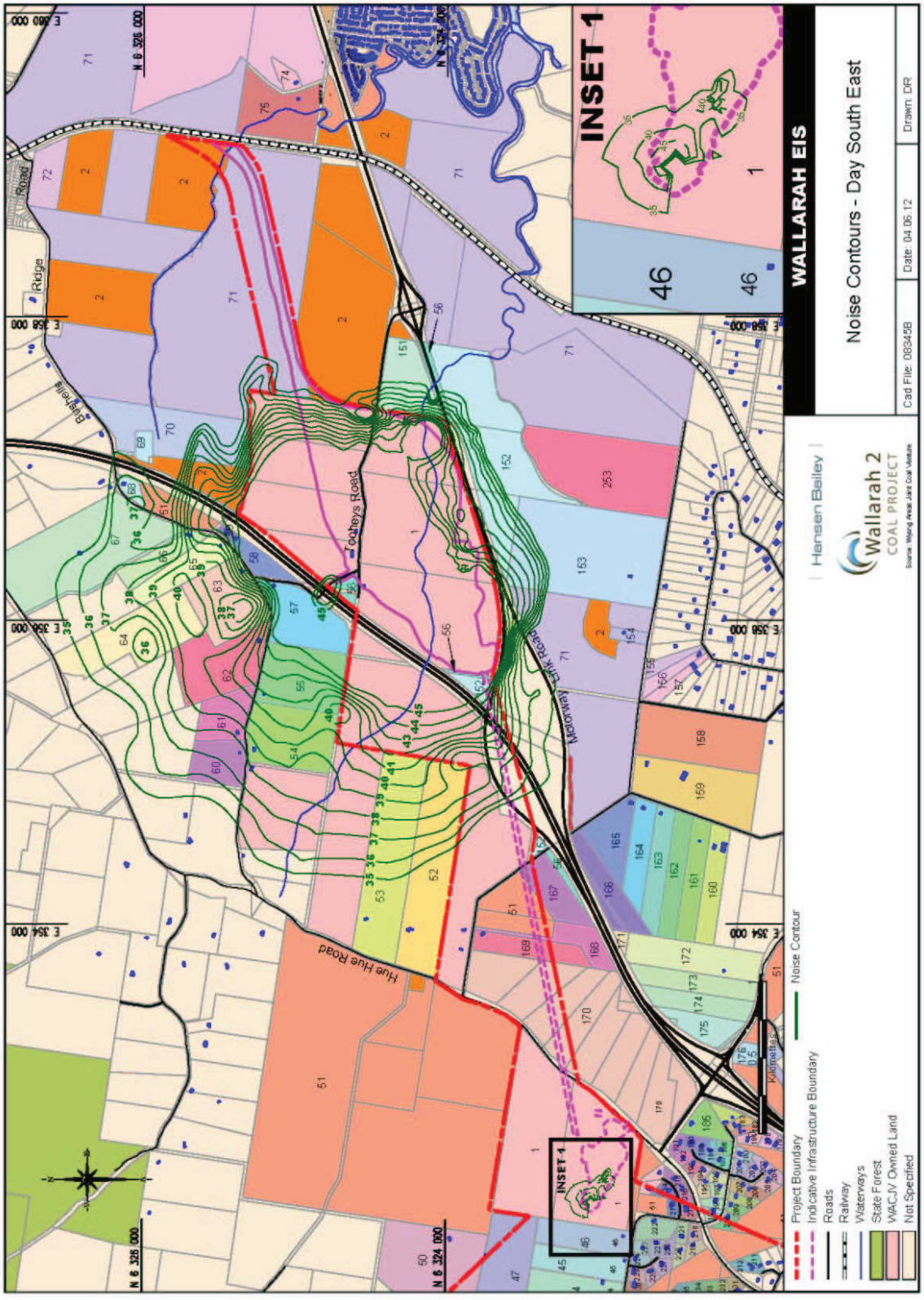


ATTACHMENT 7: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL
(East Wind)

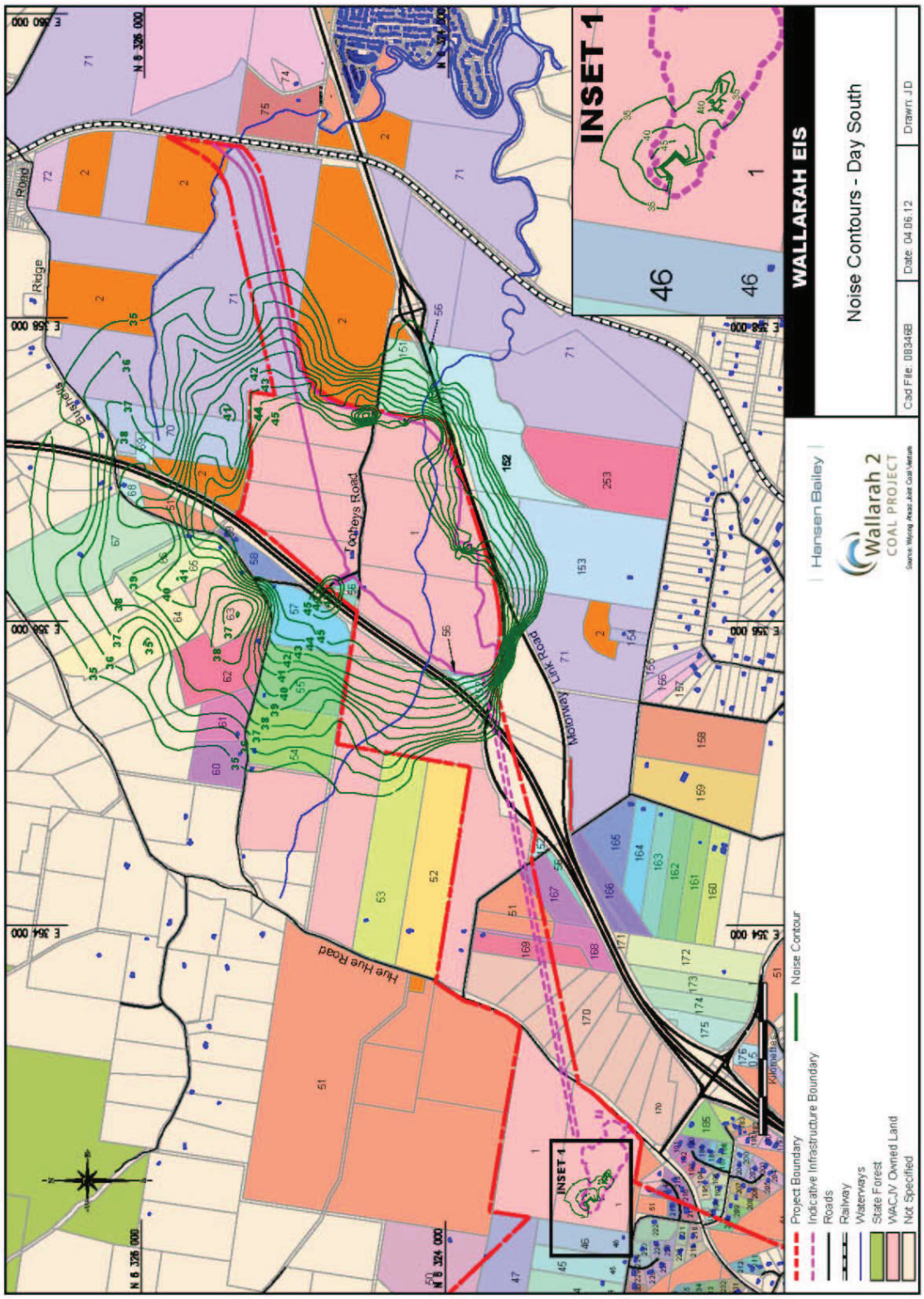


ATTACHMENT 8: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL

(South-East Wind)

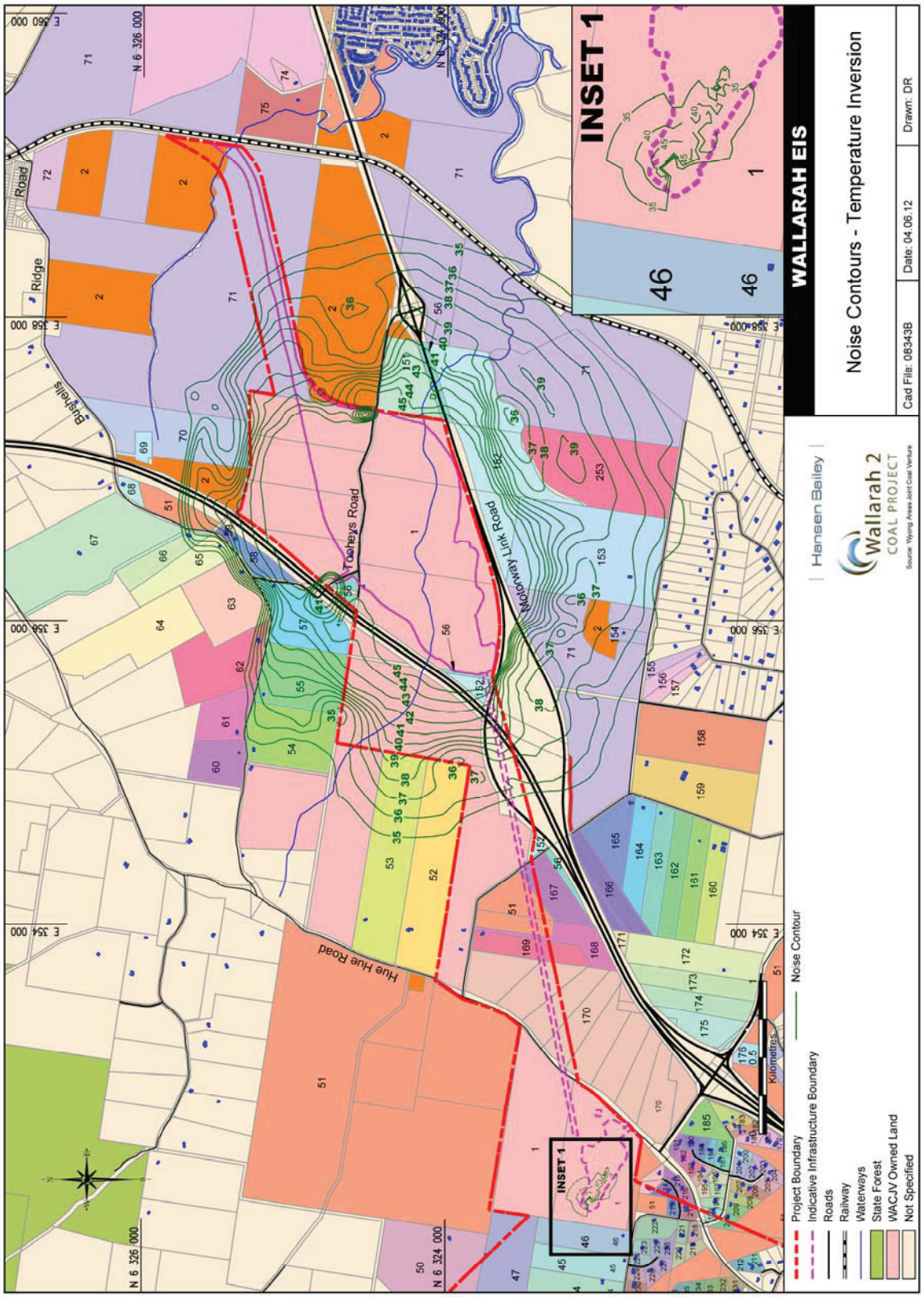


ATTACHMENT 9: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL
(South Wind)

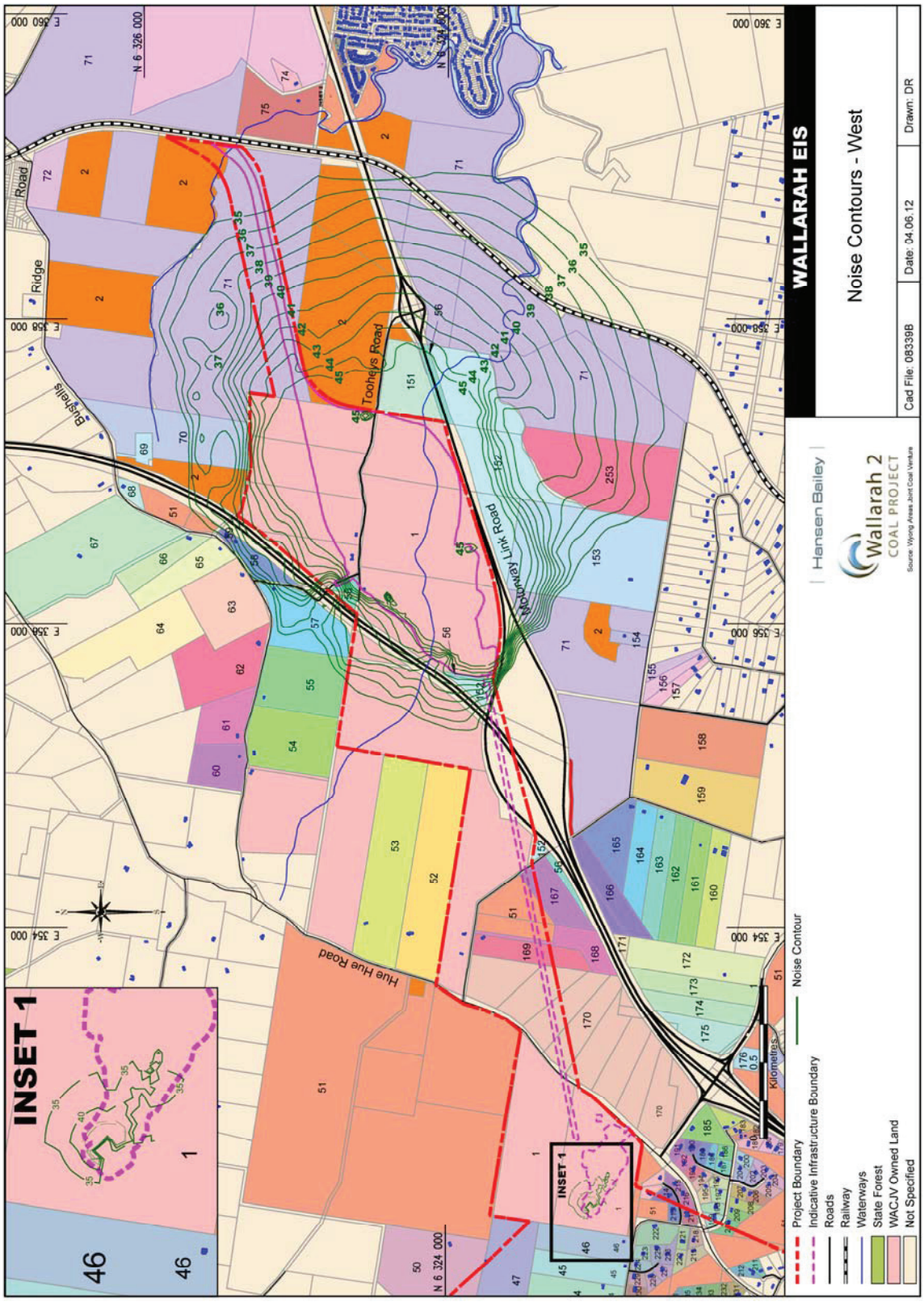


ATTACHMENT 10: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL

(Temperature Inversion)

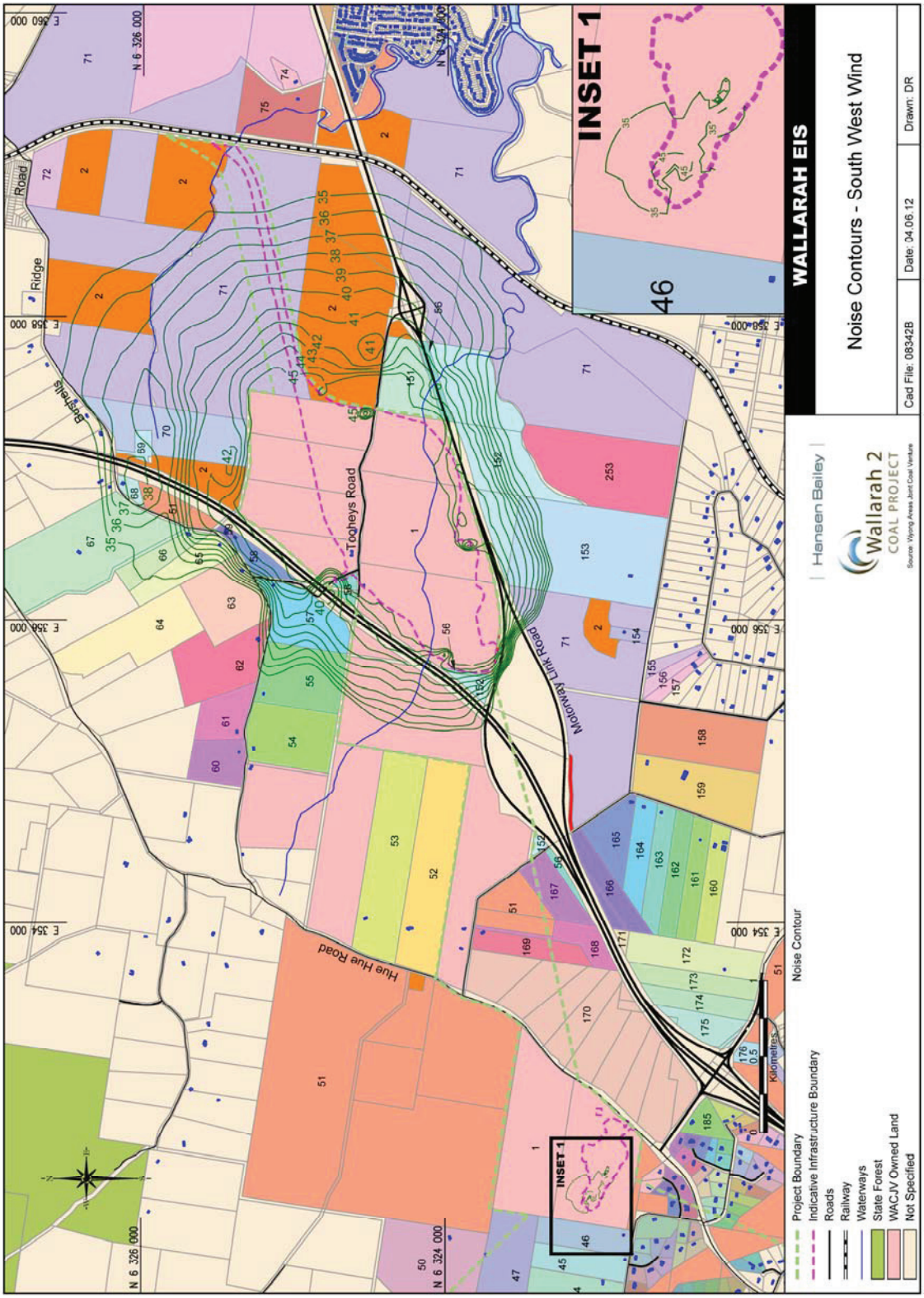


ATTACHMENT 11: TOOHEYS ROAD/BUTTONDERRY OPERATIONAL
(West Wind)

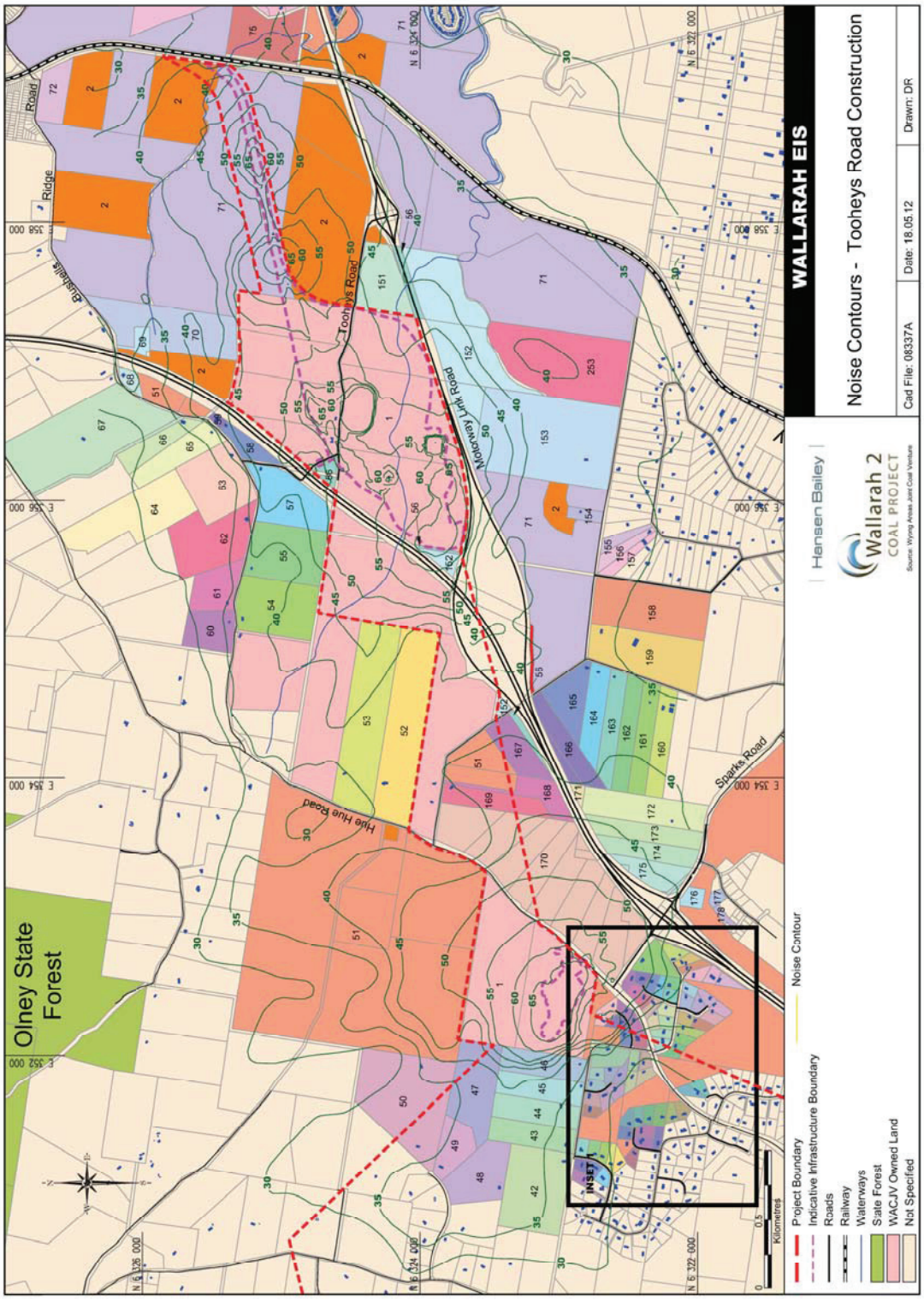


ATTACHMENT 12 TOOHEYS ROAD/BUTTONDERRY OPERATIONAL

(South-West Wind)



ATTACHMENT 13: TOOHEYS ROAD/BUTTONDERRY CONSTRUCTION



ATTACHMENT 14. OPERATIONAL PROJECT SPECIFIC NOISE CRITERIA

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
3	703391	1	WYONG COAL PTY LIMITED		
6	825848	1	WYONG COAL PTY LIMITED		
5	825848	1	WYONG COAL PTY LIMITED		
2	791157	1	WYONG COAL PTY LIMITED		
1	791157	1	WYONG COAL PTY LIMITED		
4	719762	1	WYONG COAL PTY LIMITED		
1	719762	1	WYONG COAL PTY LIMITED		
118	755245	1	WYONG COAL PTY LIMITED		
1	653780	1	WYONG COAL PTY LIMITED		
31	258692	1	WYONG COAL PTY LIMITED		
124	755245	1	WYONG COAL PTY LIMITED		
126	755245	1	WYONG COAL PTY LIMITED		
128	658436	1	WYONG COAL PTY LIMITED		
103	755245	1	WYONG COAL PTY LIMITED		
102	755245	1	WYONG COAL PTY LIMITED		
1	260217	1	WYONG COAL PTY LIMITED		
3	260217	1	WYONG COAL PTY LIMITED		
169	755271	2	THE STATE OF NEW SOUTH WALES		
181	823122	2	THE STATE OF NEW SOUTH WALES		
14	1118119	2	THE STATE OF NEW SOUTH WALES		
107	755245	2	THE STATE OF NEW SOUTH WALES		

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
193	1032847	2	THE STATE OF NEW SOUTH WALES		
110	755245	2	THE STATE OF NEW SOUTH WALES		
60	755245	2	THE STATE OF NEW SOUTH WALES		
168	705480	2	THE STATE OF NEW SOUTH WALES		
194	1032847	2	THE STATE OF NEW SOUTH WALES		
8	834953	2	THE STATE OF NEW SOUTH WALES		
201	1064536	2	THE STATE OF NEW SOUTH WALES		
189	48813	2	THE STATE OF NEW SOUTH WALES		
1257	1049672	3	IM GHYS	35	
1255	1031782	4	IA & MAH BEVERIDGE	35	
222	755271	5	KL TREVENAR	35	
24	731090	6	GOVWELL PTY LIMITED	35	
1	555826	7	BD & SA HARDWICK	35	
3	555826	8	EM NOMME	35	
110	755271	9	DG & JM SUTHERS & KL BLUNDEN	35	
111	755271	10	PB CHAPMAN	35	
23	731090	11	KC & J PHILLIPS	35	
235	755271	12	CR & JA SCULLY	35	
216	755271	13	WM & EC CLARK	35	
112	755271	14	DC ADAMS & WM BROWNLOW	35	
107	755271	15	PL & SH ADAMS	35	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
1	335191	16	DM AKHURST	35	
33	755271	17	MJ MCBRIDE & WJ BENNETT	35	
2	703391	18	OAKINGTON PTY LIMITED	35	
21	1018301	19	SJ & MM OLSEN & RP & JO JOHNSON	35	
22	1018301	20	KG & CM BAKER	35	
3	615333	21	DJ & CA NOBLE	35	
1	615334	22	AW & MS KIRK	35	
4	806729	23	BA & CL HUNTLEY	35	
2	806729	24	JRG KAVANAGH	35	
222	710526	25	EJ HASTINGS	35	
12	618001	26	GG & SF BALDWIN	35	
109	661855	27	JP & LD MORSON	35	
6101	1033538	28	MA & NI ANDERSON	35	
6102	1033538	29	H & H CHRISTIAN	35	
1	534677	30	DB & JA PRITCHARD	35	
2	534677	31	MA & LM CAMPBELL	35	
179	755271	32	MINISTER FOR EDUCATION AND TRAINING		
1	578580	32	MINISTER FOR EDUCATION		
22	715159	33	B & CME MORGAN	35	
21	715159	34	KS & R MATTHEWS	35	
79	657923	35	GW & S KITSON	35	
178	755271	36	SB HEMERS & VA LEWIS	35	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
611	867346	37	RF & PJ COAFIELD	35	
106	755271	38	SM DULLARD & SD CUTHBERTSON	35	
34	870564	39	IG EVERITT	35	
78	755271	40	LP & PC HIRSCH	35	
33	870564	41	KM & CD BROOMFIELD	35	
10	613648	42	AT ETHELL	35	
11	613648	43	ZS MUSLU	35	
4	246727	44	C TOHAMY & MUSLIM COMMUNITY CO-OPERATIVE (AUSTRALIA) LTD	35	
3	246727	45	S WONG & S LIN & PH LEE	35	
2	246727	46	LA & R ATCHISON	38	
102	773780	47	EM DUNN	35	
11	258965	48	KG & KA MACDONALD	35	
101	773780	49	MJ BAULCH	35	
9	258965	50	F & EM MERCIECA	35	
153	755271	51	THE COUNCIL OF THE SHIRE OF WYONG		
59	755271	51	THE COUNCIL OF THE SHIRE OF WYONG		
68	755271	51	THE COUNCIL OF THE SHIRE OF WYONG		
1	822126	51	THE COUNCIL OF THE SHIRE OF WYONG		
185	823132	51	WYONG SHIRE COUNCIL		
186	823132	51	WYONG SHIRE COUNCIL		
1	736035	51	WYONG COUNCIL		
1000	1035659	51	WYONG SHIRE COUNCIL		
995	1035659	51	WYONG SHIRE COUNCIL		

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
3	815400	51	THE COUNCIL OF THE SHIRE OF WYONG		
994	1035659	51	WYONG SHIRE COUNCIL		
10	239089	51	THE COUNCIL OF THE SHIRE OF WYONG		
11	239704	51	THE COUNCIL OF THE SHIRE OF WYONG		
3	1007500	51	THE COUNCIL OF THE SHIRE OF WYONG		
7	880403	51	WYONG SHIRE COUNCIL		
26	830153	51	THE COUNCIL OF THE SHIRE OF WYONG		
47	740438	51	THE COUNCIL OF THE SHIRE OF WYONG		
6	246727	51	THE COUNCIL OF THE SHIRE OF WYONG		
8	825848	51	THE COUNCIL OF THE SHIRE OF WYONG		
7	792003	51	THE COUNCIL OF THE SHIRE OF WYONG		
15	837287	51	WYONG COUNCIL		
1	843986	51	THE COUNCIL OF THE SHIRE OF WYONG		
3	719762	52	GB ARBOLINO	40	
2	719762	53	G & M ARBOLINO	40	
98	755245	54	L BYWATER	38	
97	755245	55	BJ & KR DRAKE	46	
5	260217	56	THE COMMISSIONER FOR MAIN ROADS		
4	260217	56	THE COMMISSIONER FOR MAIN ROADS		
6	258467	56	THE COMMISSIONER FOR MAIN ROADS		
3	603941	56	THE COMMISSIONER FOR MAIN ROADS		
6	259531	56	THE COMMISSIONER FOR MAIN ROADS		

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
99	755245	57	KR DRAKE	51	
2	260217	58	KL NORMAN	48	
6	260217	59	LM ASHCROFT	48	
2	552101	60	R BENVENUTO	38	
3	552101	61	RJ STAFFORD	39	
22	631659	62	N & A IORDANIDIS	40	
3	554743	63	B & JM CROSS	44	
2	554743	64	MBK & M LAMBERT	40	
2	559075	65	DJC SUAREZ	44	
1	559075	66	GRANOVU PTY LIMITED	45	
1	243858	67	AR MARSHALL	45	
403	755242	67	AR MARSHALL	45	
1	133311	68	DP PEMBERTON & AL BEGGAN	48	
161	1130083	69	JEMENA COLONGRA PTY LTD	48	
15	1118119	70	MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979		

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
195	1032847	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
191	1032847	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
108	755245	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
111	755245	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
204	1117900	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
196	1064536	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
197	1064536	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
3	1156997	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
2	1156997	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
1	1156997	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
132	755245	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
188	48813	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
190	1061009	71	DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL		
109	755245	72	LK & NM MANLEY	35	
32	586913	73	WOODBURY PARK ESTATES PTY LIMITED	42	
78	755245	73	WOODBURY PARK ESTATES PTY LIMITED	42	
762	746526	73	WOODBURY PARK ESTATES PTY LIMITED	42	
761	746526	74	RW & LG COLES	42	
93	755245	75	KERRY MOUNTAIN PTY LIMITED	40	
10	785375	76	JEMBY CORPORATION PTY LIMITED	42	
100	843919	77	RC & JP HOLMES	40	
18	218077	77	RC & JP HOLMES	40	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
19	218077	78	SSA ATTIA	40	
20	218077	79	CA & JI HOSKING	40	
5	218077	80	DJ & AF & R LAZZARONI	40	
1059	1035659	81	JA SWINFIELD & JC PHEGAN	40	
1058	1035659	82	KM & JT SCALES	40	
1057	1035659	83	JC & DP ATKINS	40	
1	218077	84	EI EDDY	40	
2	218077	85	JD MAGUIRE	40	
3	218077	86	WJ & KD BOURKE	40	
4	218077	87	M KHOURY	40	
1002	1035659	88	MD & KA WHITE	40	
1003	1035659	89	CL TAYLOR	40	
1001	1035659	90	I & JP DOHERTY	40	
1004	1035659	91	DPC & ML COWELL	40	
1005	1035659	92	AJ PITCAITHLY	42	
1006	1035659	93	MJ O'ROURKE	42	
1007	1035659	94	TN & IM PEREIRA	42	
1008	1035659	95	LT CARTWRIGHT	42	
1009	1035659	96	RA & CA JOHNSTONE	42	
1010	1035659	97	MG & KL SOLWAY	42	
1011	1035659	98	AL & KS HEIL	42	
1012	1035659	99	LJ & MJ FENECH	42	
1013	1035659	100	CB & KL DERBYSHIRE	42	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
1014	1035659	101	LJ FULLER	42	
1015	1035659	102	JJ JOHNSON & JE MCFARLAND	42	
1016	1035659	103	LR BELL	42	
1017	1035659	104	JD MOORE	42	
1018	1035659	105	SG & BJ STANFIELD	42	
1019	1035659	106	EP & H HUNT	42	
1020	1035659	107	PE & SE SUE	42	
1021	1035659	108	HK CALLAGHAN	42	
1022	1035659	109	TA MOXEY & BA ROBINS	42	
1023	1035659	110	CA MCKENZIE & PL DOUGLAS	42	
1024	1035659	111	N HANLEY	42	
1025	1035659	112	TT & LYZ LIN	40	
1026	1035659	113	RK CRAVERO	40	
1027	1035659	114	MML HAY	40	
1028	1035659	115	M & P NAIDU	42	
1029	1035659	116	RA & AM JONES	42	
1079	1035659	117	WG & JD BEEHAG	42	
1080	1035659	118	YA & V NAHAL	35	
1081	1035659	119	JA KEMP	35	
1082	1035659	120	D SUNDARAM	35	
1083	1035659	121	DJ ZANCANARO	35	
1060	1035659	122	RD & VR KERSHAW	35	
1061	1035659	123	CAJ OGG	40	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
1062	1035659	124	JA MYERS	40	
1063	1035659	125	TA & IF MARSHALL	40	
1064	1035659	126	DJ ABBEY & JC SEVESTER	40	
1065	1035659	127	SS & KL CHRISTIE	40	
1066	1035659	128	MM MIERNIK	35	
1067	1035659	128	MM MIERNIK	35	
1068	1035659	129	GM MCKENZIE	35	
1069	1035659	130	S KARPOWICZ	35	
1070	1035659	131	R SCAPPATURA	35	
1042	1035659	132	DA ABELL & LJ BELL	35	
1041	1035659	133	PL COOPER & MR KIDD	35	
1040	1035659	134	RW & KM SKINNER	35	
1039	1035659	135	B ALDCROFT	35	
1038	1035659	136	S PRESLAND	35	
1037	1035659	137	TTQ VO	40	
1036	1035659	138	MR & KM SHORT	40	
1035	1035659	139	RD & YN WILSON	40	
1034	1035659	140	SB & ML EAGLETON	40	
1033	1035659	141	MT & CJ ANDERSON & CG & SL FULLER	40	
1032	1035659	142	SM SWANSBOROUGH	40	
1031	1035659	143	LM & KA MORRIS	40	
1030	1035659	144	AN HAWKNIS & AN DONNELLY	35	
1048	1035659	145	CAM MOORE & CL WATSON	35	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
1047	1035659	146	CP BAKER & JP GLOVER	35	
1046	1035659	147	LJ JACKSON & RC SEVESTER	35	
1045	1035659	148	GJ & JA OLSEN	35	
1044	1035659	149	K MCALLISTER & J ANDREWS	35	
1043	1035659	150	JJ WAIN	35	
10	834953	151	HUNTER LAND HOLDINGS PTY LIMITED	35	
4	258467	152	ROADS AND TRAFFIC AUTHORITY OF NEW SOUTH WALES		
2	258467	152	ROADS AND TRAFFIC AUTHORITY OF NEW SOUTH WALES		
3	258584	152	ROADS AND TRAFFIC AUTHORITY OF NEW SOUTH WALES		
33	258692	152	ROADS AND TRAFFIC AUTHORITY OF NEW SOUTH WALES		
32	258692	152	ROADS AND TRAFFIC AUTHORITY OF NEW SOUTH WALES		
127	755245	153	JT & KE HUTCHINSON	42	
147	257158	154	FKI IHLENBURG	42	
13	26912	155	B LEES	40	
12	26912	156	AM & TJ QUENNELL	40	
11	26912	157	SN & LL MCINTYRE	40	
114	755245	158	G SILVIO & A IENNA & G CATALDO & V CARONNA	40	
113	755245	159	KINDIMINDO INVESTMENTS PTY LIMITED	40	
10	240205	160	JF & JM BROOKS	40	
9	240205	161	LJ GAUT	40	
8	240205	162	G RADAN	40	
7	240205	163	JN CASHIN	40	
6	240205	164	TR WILLIAMS	40	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
5	240205	165	STANDARD INDUSTRIES PTY LIMITED	40	
9	259531	166	R & A CICCONE	45	
8	259531	166	R & A CICCONE	45	
2	240205	167	ID MALLEY & LJ PINE	48	
5	259531	168	LG DELAHUNTY	48	
9	239704	169	DELCARE CONSTRUCTIONS PTY LIMITED	40	
8	239704	170	WARNER BUSINESS PARK PTY LIMITED		
7	239704	170	WARNER BUSINESS PARK PTY LIMITED		
6	239704	170	WARNER BUSINESS PARK PTY LIMITED		
19	259530	170	WARNER BUSINESS PARK PTY LIMITED		
26	259530	170	WARNER BUSINESS PARK PTY LIMITED		
25	259530	170	WARNER BUSINESS PARK PTY LIMITED		
4	239704	170	WARNER BUSINESS PARK PTY LIMITED		
18	259530	170	WARNER BUSINESS PARK PTY LIMITED		
17	259530	170	WARNER BUSINESS PARK PTY LIMITED		
16	259530	170	WARNER BUSINESS PARK PTY LIMITED		
15	259530	170	WARNER BUSINESS PARK PTY LIMITED		
7	259531	171	D & FJ TROY	48	
94	776142	172	DN & DB HORTON	45	
23	259530	173	SR JUDGE	45	
22	259530	174	KG & KA MACDONALD & AD & CM JAMESON	45	
21	259530	175	LE & JA WALDON	45	
27	259530	175	LE & JA WALDON	45	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
20	259530	175	LE & JA WALDON	45	
14	259530	175	LE & JA WALDON	45	
102	716736	175	LE & JA WALDON	45	
3	499011	176	AGL GAS NETWORKS LIMITED		
4	1154517	177	PEJR PTY LTD	40	
2	1105332	178	AMARCON PROPERTIES PTY LIMITED	40	
6	880403	179	BA MCNAUGHTON	45	
5	880403	180	PA & RB NAGLE	45	
4	880403	181	JM & K KENT	45	
3	880403	182	RS & B SANDES	45	
2	880403	183	LB & AR SPARKS	45	
1	880403	184	BA & SA HOWARD	45	
1	1005169	185	HELI-AUST LAND HOLDINGS PTY LTD	45	
14	830153	186	J STEKOVIC	40	
13	830153	187	TR & JA FIELD	40	
12	830153	188	JL & LJ FREEMAN	45	
11	830153	189	GFC & LF THOMPSON & IF THORNE	45	
10	830153	190	J & R DIMIS	45	
9	830153	191	B & B MITROVIC	45	
8	830153	192	RO & AE HOLLAND	45	
457	830153	193	DP HINGERTY	45	
640	830153	194	JL & JM TURNER	45	
5	830153	195	KJ & VJ RENWICK	45	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
4	830153	196	JR & S BUCIOR	45	
3	830153	197	AA & SL VAN VELZEN	40	
2	830153	198	IW HILL	40	
1	830153	199	PA & A ADAMS	45	
15	830153	200	J KEETLEY & SA TURTLE	45	
16	830153	201	GL FLETCHER & HE HUNT	40	
17	830153	202	PW & NV PURCHES	40	
18	830153	203	DE & LF BREW	40	
19	830153	204	KEJ & J CORLESS	40	
20	830153	205	DJ & RJ HALL	40	
21	830153	206	GR & RA EVERETT	40	
22	830153	207	AD & LM SYLVESTER	40	
23	830153	208	FK MCLEAY	40	
24	830153	209	NA PREST	40	
25	830153	210	DN GITEAU	40	
21	740438	211	IM MOYLE	40	
20	740438	212	AP & DG JENNINGS	40	
1	825848	213	CJ & L BAUERHUIT	40	
7	825848	214	JF & AP RITCHIE	40	
4	825848	215	ME & JE WALTERS	40	
3	825848	216	DKA & JA MOORE	40	
2	825848	217	N & M PANTSOS	40	
22	800814	218	DM & RG LUTZE	40	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
24	800814	219	GS & TL ARMSTRONG	40	
23	800814	220	MARINUS FRANCISCUS MUSTERS	35	
21	800814	221	AM & AJ MORLEY	35	
1	792003	222	RW & CP & BW IKIN	35	
2	792003	223	J EDINGTON	35	
3	792003	224	CJ CAMPBELL & EI HINSON	35	
61	810889	225	MRG & JA TAYLOR	35	
62	810889	226	RW & MT LOVELL	35	
63	810889	227	PM & MJ VANDENBERG	35	
64	810889	228	MWR & T WADE	35	
4	792003	229	RF & JM FOWLE	35	
5	792003	230	AR & M BALLARD	35	
10	861701	231	AF ZIETSCH & ME ROBERTS	40	
9	861701	232	PC & M SHADBOLT	40	
11	837287	233	INVERCAIRN PTY LTD	40	
10	837287	234	GW & VS JOB	35	
9	837287	235	G & J CARUANA	35	
8	837287	236	RJ & MA PRICE	35	
7	837287	237	SJ KENTWELL & MP HANSON-KENTWELL	35	
14	837287	238	CE & J GOLDING	35	
13	837287	239	AM & BM EVANS & MP CHURCH	35	
12	837287	240	MP & TL PENNYCAD	35	

LOT	DP	OWNER NO.	PROPERTY OWNER	Project Specific Noise Criteria $L_{Aeq,15min}$	
5	837287	241	LV MCNAMARA & FI COUGHRAN	35	
6	837287	242	PP & LAC BALL	35	
2	837287	243	IJ & CL THOMSON	35	
1	802323	244	JE & CR BATES	35	
2	802323	245	MC & SG BYRNES	35	
3	802323	246	RJ & JM SMITH	35	
4	802323	247	DJ & L CLARK	35	
7	802323	248	PW & SA GNAUCK	35	
6	802323	249	AB & CA BLYTH	35	
5	802323	250	PJ & JA VASSALLO	35	
9	802323	251	PE & SG COOKE	35	
109	661854	252	C FARMAKIS	35	
129	755246	253	IN MACLEOD	42	

ATTACHMENT 15: REFERENCES

- Environmental Protection Authority *(EPA)*, Industrial Noise Policy *(INP) (January 2000).*
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- Department of Environment & Climate Change *(DECCC),* Interim Construction Noise Guideline *(ICNG) (July 2009).*
- Department of Environment and Conservation (*DEC)* Assessing vibration: a technical guideline *(AVTG) (February 2006).*
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- *German Standard DIN 4150 Part 3, 'Structural Vibration in Buildings, Effects on Structures' (May 1986).*
- *Australian Standard 2436 1981 'Guide to Noise Control on Construction, Maintenance and Demolition Sites.*
- *ANZEC 'Technical Basis for Guidelines to Minimise Annoyance due to Blast Over Pressure and Ground Vibration' (September 1990).*

ATTACHMENT 16: TERMS AND DEFINITIONS

A-Weighted: See dB(A)

Adverse weather: Weather effects that enhance noise (that is, wind and temperature inversion) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more that 30% of the nights in winter).

Ambient noise: The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Assessment background level (ABL): The single figure background level representing each assessment period-day, evening and night (that is, three assessment background levels are determined for each 24-h period of the monitoring period). Its determination is by the tenth percentile method.

Assessment period: The period in a day over which assessments are made: day (0700-0800h), evening (1800 to 2200h) or night (2200 to 0700h).

Background Noise: The underlying level of noise present in the ambient noise, excluding the noise source under extraneous noise is removed. This is described using the L_{A90} descriptor.

Cumulative noise level: Refers to the total level of noise from all sources.

Day: The period between 0700 and 1800hrs (Monday-Saturday) and 0800-1800 (Sunday and Public Holidays).

dB: Abbreviation for decibel-a unit of sound measurement. Given sound pressure to a reference pressure.

dB(A): Unit used to measure "A-weighted" sound pressure levels. A-weighting is an adjustment made to sound level measurement to approximate the response of the human ear.

A change of 1dB(A) or dB(A) in the level of a sound is difficult to detect, whilst a 3dB(A) to 5dB(A) change corresponds to a small but noticeable change in loudness. A 10dB(A) change corresponds to an approximate doubling or halving in loudness.

The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Very noisy
100 90	Loud car hone at 3m Construction site with pneumatic hammering	Noisy
80 70	Kerbside of busy street Loud radio or TV	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quite
20	Unoccupied recording studio	Almost silent

Default parameters: In assessing meteorological enhancement of noise, refers to set values for weather parameters, such as wind speeds and temperature gradients, to be used in predicting source noise levels.

Equivalent Continuous Noise Levels: The level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Evening: Refers to the period between 1800-2200hrs.

Extraneous Noise: Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.

Feasible and reasonable measures: Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors:

- noise mitigation benefits (amount of noise reduction provided, number of people protected)
- cost of mitigation (cost of mitigation versus benefits provided)
- community views (aesthetic impacts and community wishes)
- noise levels for affected land uses (existing and future levels, and changes in noise levels).

Fluctuating Noise: Noise that varies continuously and to an appreciable extent over the period of observation.

Greenfield site: Undeveloped land.

Impulsive Noise: Noise having a high peak of short duration, or a sequence of such peaks. A sequence of such peaks. A sequence of such impulses in rapid succession is termed 'repetitive impulsive noise'.

Intrusive Noise: refers to noise that intrudes above the background level by more than 5 decibels.

L_{A90}: The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise.

L_{Aeq}: The equivalent continuous noise level – the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Long-term annoyance: Prolonged annoyance over months and years.

Median: The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value. If there is an even number of values the median is the arithmetic average of the two middle values.

Meteorological conditions: wind and temperature inversion conditions.

Most-affected locations(s): Locations that experience (or will experience) offensive noise from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source locations(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.

Negotiated agreement: An agreement involving the negotiation of an achievable noise limit in cases where the project specific noise levels cannot be met. The agreement is negotiated between the proponent and the EPA or the proponent and the community. Such an agreement is reached through balancing the merits of a development, the feasibility and reasonableness of available mitigation measures and the noise impacts produced.

Night: The period between 2200 and 0700 (Monday-Saturday) and 2200-0800 (Sunday and Public Holidays)

Noise criteria: The general set of non-mandatory noise level targets for protecting against intrusive noise (for example, background noise plus 5dB) and loss of amenity (for example, noise levels for various land uses).

Non-mandatory: With reference to the proposed policy, means not required by legislation. The proposed policy specifies criteria to be strived for, but the legislation does not make these criteria compulsory. However, the policy will be used as a guide to setting statutory (legally enforceable) limits for licences and consents.

Performed-based goals: Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.

Rating Background Level (RBL): the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-h period used for the assessment background level). This is the level used for assessment purposed. It is defined as the median value of:

- all the day assessment background levels over the monitoring period for the day
- all the evening assessment background levels over the monitoring period for the evening; or
- all the night assessment background levels over the monitoring period for the night.

Receiver: The noise-sensitive land at which noise from a development can be heard.

Stationary noise sources: Sources that do not generally move from place to place, eg. industrial or commercial sources. In general, these include:

Individual stationary sources such as:

- heating, ventilating and air conditioning (HVAC) equipment,
- rotating machinery,
- impacting mechanical sources,
- other mechanical equipment and machinery such as conveyors.

Mobile sources confined to particular location such as draglines and haul trucks.

Facilities, usually comprising many sources of sound, including:

- industrial premises,
- extractive industries,
- commercial premises,
- warehousing facilities,
- maintenance and repair facilities.

(In this case, the stationary source is understood to encompass all the activities taking place within the property boundary of the facility).

Temperature inversion: An atmospheric condition where temperature increases with height above the ground.