HANCOCK GALILEE PTY LTD

Kevin's Corner Project Environmental Impact Statement

P | Noise and Vibration

Report

Noise and Vibration Impact Assessment

Kevin's Corner Mine

5 APRIL 2011

Prepared for

Hancock Galilee Pty Ltd

Hancock House
355 Queen Street, Brisbane, QLD 4000

42626674

URS

Project Manager:

....
Chris Pratt
Principal Environmental Scientist

Principal-In-Charge:

C M Pigott

....
Chris Pigott
Senior Principal Environmental Scientist

Author:

....
Sean Flaherty
Senior Acoustics Engineer

Reviewer:

....
Arnold Cho
Senior Associate Acoustics Engineer

URS Australia Pty Ltd

Level 17, 240 Queen Street
Brisbane, QLD 4000
GPO Box 302, QLD 4001
Australia
T: 61 7 3243 2111
F: 61 7 3243 2199

Date:	**5 April 2011**
Reference:	42626674/REP-001/A
Status:	Final

Document delivery

URS Australia provides this document in either printed format, electronic format or both. URS considers the printed version to be binding. The electronic format is provided for the client's convenience and URS requests that the client ensures the integrity of this electronic information is maintained. Storage of this electronic information should at a minimum comply with the requirements of the Commonwealth Electronic Transactions Act (ETA) 2000.

Where an electronic only version is provided to the client, a signed hard copy of this document is held on file by URS and a copy will be provided if requested.

Table of Contents

Tables

Figures

Appendices

Abbreviations

Abbreviation	Description
HGPL	Hancock Galilee Pty Ltd
HCPL	Hancock Coal Pty Ltd
KC	Kevin's Corner
ACP	Alpha Coal Project
AARC	Australasian Resource Consultants
WHO	World Health Organisation
EPA	Environmental Protection Act 1994 (Queensland);
EPP(Noise)	Environmental Protection (Noise) Policy 2008
ANZEC	Australian and New Zealand Environment Council
NSW RTA	New South Wales Road Traffic Authority
ToR	Terms of Reference
PFS	Pre Feasibility Study
CoP	Code of Practice
EMP	Environmental Management Plan
ML	Mining Lease
MLA70425	Subject Mining Lease
IPPC	In Pit Crusher Conveyor
CHPP	Coal Handling Preparation Plant
TLO	Train Load Out Facility
ROM	Run of Mine
OLC	Overland Conveyor
STP	Sewerage Treatment Plant
MIA	Mine Industrial Area
m	Metres
km	Kilometres
m/s	Metres per second
mm/s	Millimetres per second
km/h	Kilometres per hour
m^3	Cubic metres
T	Tonnes
Mt	Megatonnes
Mtpa	Megatonnes per annum
Ha	Hectares
PPV	Peak Particle Velocity
P	Pressure (Overpressure)

Executive Summary

URS Australia Pty Ltd has been commissioned by Hancock Galilee Pty Ltd to undertake a noise and vibration impact assessment for the proposed Kevin's Corner Project, a 30 Mtpa combined underground and open-cast thermal coal mine in the Galilee Basin of Queensland, Australia. The mine would be supported by privately owned and operated rail and port infrastructure facilities, a fly in fly out airport and an on-site accommodation village. The initial mine life is 30 years, with the Project construction planned to commence in 2012 and the first coal to be produced in 2014.

The noise and vibration impact assessment has considered the mine infrastructure construction phase, the 30-year operation of the mine, blasting, operational rail movements, off-site traffic movements and aircraft movements.

The nearest potentially affected sensitive receptor locations have been identified, including the on-site accommodation village proposed by HGPL. The predicted noise and vibration impacts on these receptors have been assessed with consideration to the following relevant state legislation and guidelines:

- *Terms of Reference for an environmental impact statement, Kevin's Corner Project* (Coordinator General, February 2010);
- *Environmental Protection Act 1994 (Queensland);*
- *Environmental Protection (Noise) Policy 2008;*
- *EPA Ecoaccess Guideline: Planning for Noise Control;*
- *EPA Ecoaccess Guideline: Noise and Vibration from Blasting;* and
- *EPA Ecoaccess Guideline: Assessment of Low Frequency Noise.*
- *Interest in Planning Schemes No. 3 (Queensland Transport) and Queensland Rail Code of Practice for Railway Noise Management* (November, 2007);
- *Australian Standard, AS 2021, 2000 – Acoustics, Aircraft Noise Intrusion, Building Siting and Construction*
- *The Health Effects of Environmental Noise – other than hearing loss* (enHealth) Council, 2004); and
- *World Health Organisation Guidelines for Community Noise,* 1999.

As the mine would operate on a 24 hour, 7 days per week basis, an assessment of sleep disturbance for the nearest potentially affected noise sensitive receptors has been considered in this study.

The proposed construction activities have been assessed with consideration to the *Environmental Protection (Noise) Policy 2008* and the *World Health Organisation (WHO)* guideline for sleep protection.

The noise criteria have been conservatively established by adopting the lowest permissible noise limits to assess the proposed mining operations with consideration to the above guidelines and background noise monitoring results. Detailed results of noise measurements and the noise criteria applicable to the Project are presented in **Sections 3** and **4**. Daily noise logging plots are also provided in **Appendix F**.

Noise levels from the proposed construction and operation have been predicted using an acoustic computer model created in SoundPLAN Version 7.0. Details of the area's topography, receptor locations and sound power levels of the noise sources have been incorporated into the noise model. Typical and 'worst-case' scenarios have been taken into consideration throughout the noise modelling, assuming for each construction and operational stage that all plant equipment is continuously and simultaneously operational on a 24 hour per day, 7 days per week basis. Detailed results of the predictive modelling are provided in **Sections 5.4** and **5.5**.

Noise modelling indicates that the proposed operational and construction activities would comply with the established criteria at the existing receptor locations without the requirement for any specific construction noise mitigation measures. It has been identified however, that re-directing the ventilation discharge from the northern underground mine would be an effective measure in reducing the noise expose to the most noise affected receptor and this is recommended. Further practical measures to effectively reduce construction and operational noise from the site have been provided in **Section 6**.

Exceedances of the operational and nominated construction noise limits are predicted at the on-site accommodation village. It is noted that the key amenity issue for the accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers between shifts. Acoustic design requirements have been provided for the accommodation village, in order to ensure satisfactory internal noise limits and sleep disturbance criteria are achieved within the sleeping areas.

At all receptor locations, with the adoption of suitable blasting controls, compliance with the relevant blasting noise and vibration control guidelines is predicted.

The predicted increase in off-site road traffic volume due to the proposed construction and operation is significant. Whilst full compliance with the relevant road traffic noise criteria is predicted during all construction and operational stages, noticeably increased noise levels are likely to be perceived by the most affected receptors.

Full compliance with the nominated rail noise and vibration and aircraft noise criteria is predicted at all receptor locations.

Potential noise and vibration impacts on terrestrial animals and avifauna are not included in this assessment. The findings of the potential impacts on fauna from the ecology assessment of the neighbouring Alpha Coal site are addressed in **Section 5.12**.

On the basis of this assessment, it is concluded that, with the incorporation of the recommended mitigation measures, noise and vibration impacts from construction activities and operation of the proposed mine are not expected to significantly degrade the existing acoustic environment nor create undue annoyance to the surrounding community.

Introduction

URS Australia Pty Ltd (URS) has been commissioned by Hancock Galilee Pty Ltd (HGPL), the Proponent, to undertake a noise and vibration impact assessment for the proposed Kevin's Corner Project (The Project). The Project comprises a 30 Mtpa capacity combined underground and open-cast thermal coal mine in the Galilee Basin of Queensland, Australia. This assessment has been prepared in accordance with the *Terms of Reference* (ToR) dated February 2010, the *Environmental Protection Act 1994* and the *Environmental Protection (Noise) Policy 2008.*

Noise and vibration impacts associated with the site's proposed construction and operation have been assessed in accordance with the relevant draft EPA Ecoaccess guidelines:

- *EPA Ecoaccess Guideline Planning for Noise Control;*
- *EPA Ecoaccess Guideline Noise and Vibration from Blasting; and*
- *EPA Ecoaccess Guideline Assessment of Low Frequency Noise.*

Off-site road traffic noise has been assessed against the Department of Main Roads' Road Traffic Noise Management Code of Practice (CoP) criteria.

Rail noise associated with the Project has been assessed in accordance with the Queensland Rail Code of Practice for Railway Noise Management.

Aircraft noise has been assessed in accordance with Australian Standard, AS 2021, 2000 – Acoustics, Aircraft Noise Intrusion, Building Siting and Construction.

Additionally, the following guidelines and standards have been considered:

- *AS1055.1 and AS1055.2, 1997 - Description and Measurement of Environment Noise;*
- *Queensland Transport, Interest in Planning Schemes No. 3*;
- *AS 2187.2, 2006 – Explosives, Storage and Use, part 2, Use of Explosives;*
- *BS7385 Part 2*, 1993 - *Evaluation and Measurement for Vibration in Buildings, Guide to Damage Levels from Ground-borne Vibration;*
- *BS6472, 1992 - Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*;
- *The Health Effects of Environmental Noise – other than hearing loss* (enHealth) Council, 2004);
- *Australian/New Zealand Standard AS/NZS 2107-2000, Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*; and
- *World Health Organisation Guidelines for Community Noise,* 1999.

1.1 Scope of Assessment

The scope of this assessment is to:

- Provide a description of the existing acoustic environment and the proposed development;
- Establish project-specific noise criteria;
- Establish ground vibration and overpressure criteria for blasting;
- Predict potential noise, overpressure and ground vibration impacts by means of noise modelling and calculations;
- Assess predicted noise, overpressure and vibration levels against the established criteria;
- Provide a statement of potential impacts;
- Provide recommendations on noise and vibration mitigation controls, where required; and
- Report the findings of the assessment.

1 Introduction

This assessment concerns potential construction and operational noise and vibration impacts of the mine site and associated infrastructure, including the operations of a proposed Fly-In Fly-Out (FIFO) airport and railway spur, approximately 17 km in length, connecting the mine to the proposed HCPL Alpha Coal Project railway.

An independent study of the rail noise and vibration impact has been undertaken by GHD consultants. As GHD’s assessment did not consider potential noise and vibration impacts of the Kevin’s Corner rail spur, URS has undertaken additional assessment with reference to the GHD report. A summary of this is provided in **Section 5.10**.

Potential noise and vibration impacts on terrestrial animals and avifauna are not included in this assessment. The findings of the potential impacts on fauna from the ecology assessment are addressed in **Section 5.1.**

Project and Site Description

2.1 Project Description

The proposed Kevin's Corner Project (the Project), comprises a 30 Mtpa combined underground and open-cast thermal coal mine in the Galilee Basin of Queensland, Australia. The mine would be supported by privately owned and operated rail and port infrastructure facilities and a Fly-In Fly-Out (FIFO) airport, additionally an on-site accommodation village for the mine workers is proposed.

The Project consists of two opencut pits (Central and Northern Opencut Pit), extending over a total strike length of 6.5 km and in time reducing to a steady strike length of 4 km and three underground longwall operations (Southern, Central and Northern Underground) proposed in three independent mines.

The coal from the opencut operations will be mined and transported by truck and shovel operations. Raw coal will be processed at two Run of Mine (ROM) facilities where it will be reduced in size for further processing at the Coal Handling and Preparation Plant (CHPP). For the underground longwall operations, all ROM coal will be transported directly to the CHPP via an overland conveyor. Once treated at the CHPP the coal will be conveyed to a rail loadout facility. The Project will involve the development of a rail spur, approximately 17 km in length, connecting the mine to the proposed HCPL Alpha Coal Project railway, which would extend more than 450 km to the east coast of Australia to the port facility of Abbot Point.

The construction phase of the Project is envisaged to take nominally four years, commencing in 2012 to initially establish access roads to the mine and to construct the airport and accommodation village. The scheduled life of mine (LOM) for the Kevin's Corner Project is 30 years, commencing in 2014, with first coal the same year. However, there are resources to extend the Project life beyond 30 years.

The potential for noise and vibration effects associated with the Project arise from the mine infrastructure construction phase, the 30-year operation of the mine, blasting, operational rail movements, off-site traffic movements and aircraft movements.

Details of the project's principal noise generating construction and operational equipment for the various stages of the mine have been provided by HGPL. These are set out in **Section 5**.

2.2 Site Location

The project site is located in the Galilee Basin, Central Queensland, approximately 65 km north of the township of Alpha; 110 km south-west of the township of Clermont and approximately 340 km south-west of Mackay (see **Figure 2-1**).

Existing land uses within and adjacent to the mine site are predominantly low intensity cattle grazing and the site and surrounding areas are relatively flat and vegetated.

2.3 Noise Sensitive Receptors

Table 2-1 sets out the nearest potentially affected noise sensitive receptor locations and their respective distances from the mining lease boundary and closest opencast pit area boundary. These include five existing dwellings located within 15 km of the mining lease boundary to the north, east and west and the proposed Kevin's Corner and neighbouring Alpha Coal Accommodation Villages.

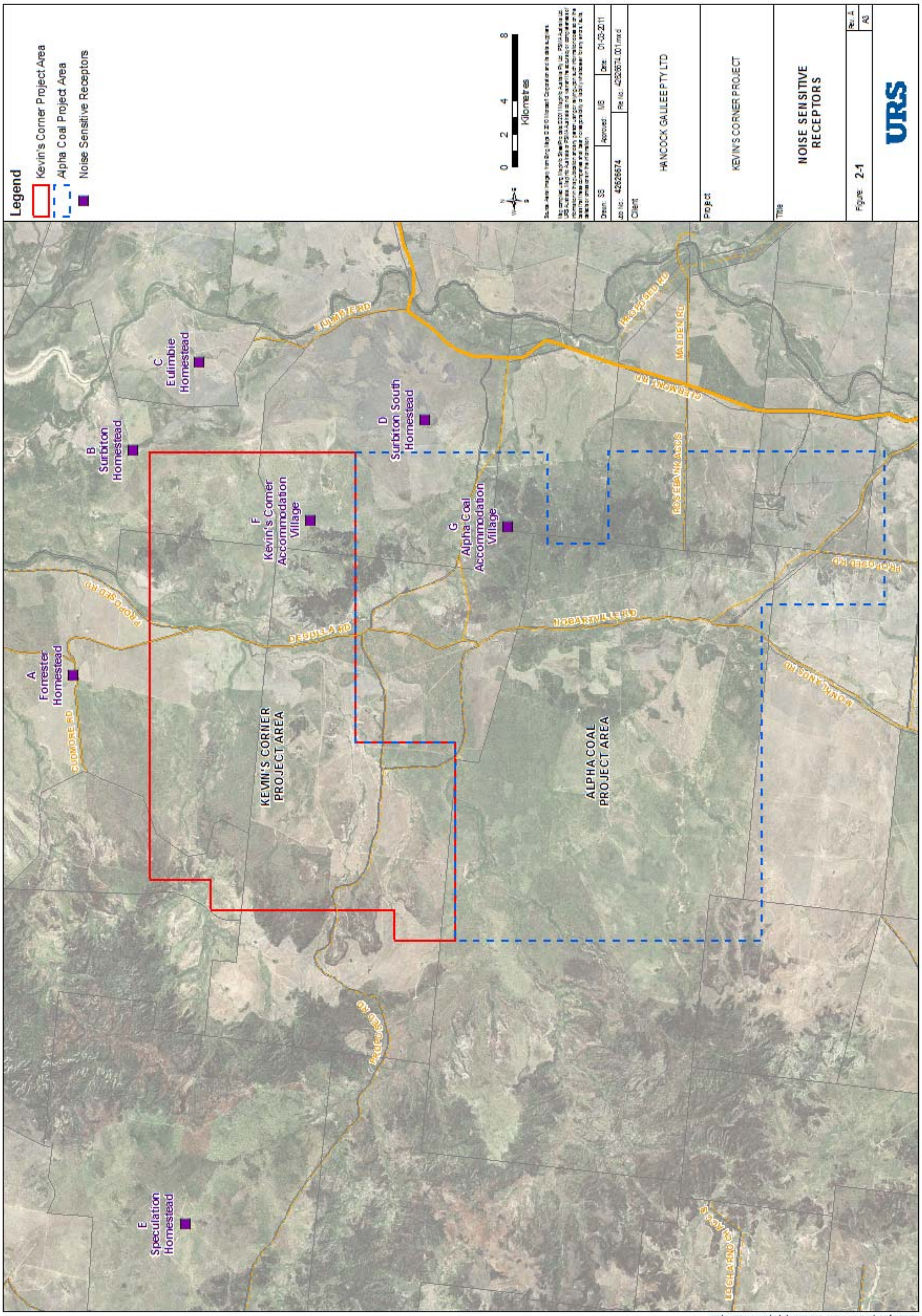
These receptor locations are indicated on the site location plan shown in **Figure 2-1**, whilst **Figure 2-2** shows the proposed site layout, indicating the proposed locations of the key mine infrastructure and ancillary facilities.

Table 2-1 Noise Sensitive Receptors

Receptor	Address	Approx. Distance from MLA70425 Mining Lease Boundary (km)	Approx. Distance from Open Cast Pit Area Boundary (km)
A	Forrester Homestead	4	7
B	Surbiton Homestead	1	10
C	Eulimbie Homestead	5	15
D	Surbiton South Station	4	12
E	Speculation Homestead	19	31
F	KC Accommodation Village	n/a	8
G	ACP Accommodation Village	9	12

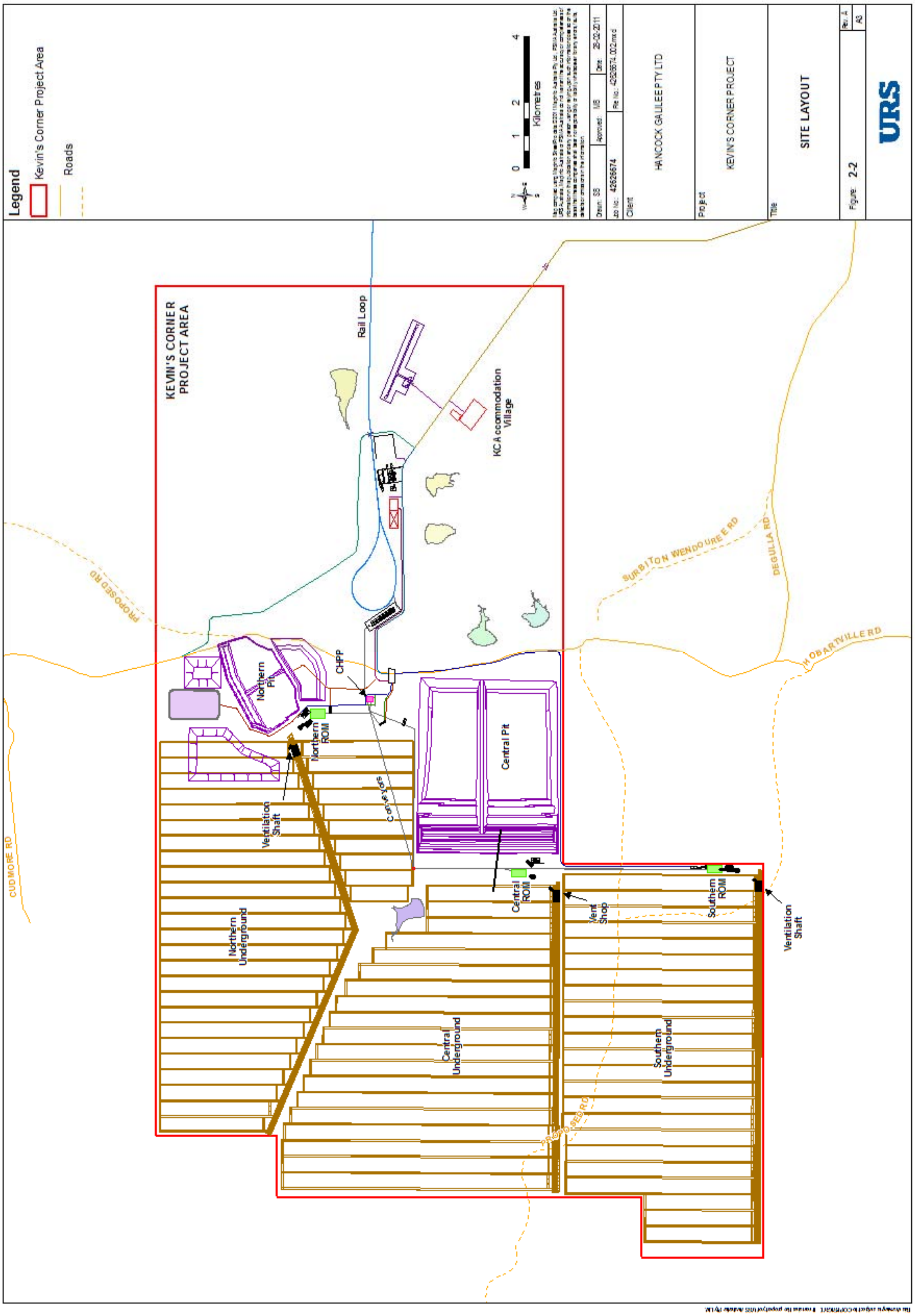
2 Project and Site Description

Figure 2-1 Location Plan Indicating Mining Lease Boundary and Receptor Locations



2 Project and Site Description

Figure 2-2 Proposed Site Layout Plan Indicating Key Mine Infrastructure



3

Existing Acoustic Environment

3.1 Noise Measurement Methodology

Long-term unattended and short-term attended noise monitoring has been conducted by URS at the locations of three of the potentially most affected dwellings, namely Receptors A (Forrester Homestead), C (Eulimbie Homestead) and D (Surbiton South Homestead). The monitoring took place between 13 September and 24 September 2010 at Receptors A and C and between 13 September and 26 September at Receptor D.

Measurements were undertaken in general accordance with AS1055:1997 "*Acoustics – Description and Measurement of Environmental Noise*" and the Queensland's EPA "*Noise Measurement Manual*" third edition.

The equipment detailed in **Table 3-1** as used in the survey. These instruments comply with AS IEC 61672.1 – 2004 "*Electroacoustics – Sound level meters – Specifications*", and have valid and current calibration certificates traceable to a NATA certified laboratory.

Table 3-1 Equipment Used for Noise Monitoring

Monitoring Location	Item	Make	Model	Serial No.
Forrester Homestead (A)	Noise Logger	RION	NL-21	487697
Eulimbie Homestead (C)	Noise Logger	RION	NL-21	487669
Surbiton South Station (D)	Noise Logger	RION	NL-21	598492
A, C and D	Sound Level Meter – Spectrum Analyser	SVAN	959	11248

The noise loggers were set to statistically process and store the measured noise levels every 15 minutes for the whole monitoring period, with the measuring microphones set at 1.2 metres above ground level. The noise loggers were calibrated before logging and the calibration was checked after logging using an acoustic calibrator. No significant discrepancies (greater than 0.2 dB) were reported in the pre and post measurement reference calibration tests.

The EPA's EcoAccess guideline, Planning for Noise Control, recommends that in order to determine representative background noise levels for the purposes of assessment, noise monitoring should be conducted over a duration of least one week. Due to the presence of rain during the survey period, monitoring was extended for a total of eleven days of data at locations A and C, and fourteen days at location D. Rain affected data were discarded during analysis of the monitoring results in determining representative natural background noise levels around the monitoring locations. Noise measurements of uncharacteristically high level, affected by rainfall or other extraneous noise sources were excluded from calculations.

The attended noise monitoring was conducted to supplement the unattended monitoring results. Additionally, the attended monitoring allowed for elevated levels of noise generated by insects to be quantified and for appropriate correction factors to be developed for these sources, as discussed in **Section 3.2**.

When analysing measured long-term noise levels, it is usual practice to make reference to the meteorological data provided by the nearest Bureau of Meteorology (BOM) Automatic Weather Station (AWS) to the site. The nearest BOM AWS is located in Clermont (Clermont AWS ID: 35124), which is some 100 km NNE of the noise monitoring locations. Due to the separation distance between the Clermont AWS and the monitoring sites, the BOM data cannot be considered to be wholly representative of the subject site conditions. Notwithstanding this, analysis of hourly rainfall data from the Clermont AWS and feedback from site personnel indicated significant periods of rain in the region during the monitoring and evidence of heavy rainfall was found during field visits between 13 September and 15 September and between 28 September and 29 September 2010.

Some periods of uncharacteristically high noise levels, inconsistent with the general noise trends, were indicated during analysis of the unattended monitoring data. Circumstantial evidence would suggest that several of these periods were rain affected. All discrete measurements with noise levels exceeding the general trend were conservatively excluded from calculations of representative levels.

3.2 Noise Measurement Results

For the purpose of this assessment, the following times of day are defined:

Table 3-2 Time of Day

Time of Day	Time
Day	0700 – 1800
Evening	1800 – 2200
Night	2200 – 0700

The long-term unattended monitoring results for the three identified locations are presented graphically in **Appendix F**. Periods affected by adverse weather conditions or other extraneous noise sources, which have been excluded from calculations of the representative levels, are indicated on the plots.

During the site visits, insect noise was observed to influence the measured noise levels at all monitoring locations during the evening and night-time periods. No other notable sources other than birds were observed. On this basis, during periods where insect noise contributions are indicated in the long-term monitoring results, some corrections have been applied when analysing the measured data. The corrections, determined from analysis of the attended monitoring data, are based on the differences between the total (full audible bandwidth) A-weighted noise levels and the A-weighted levels re-calculated omitting the 1/3 octave sound pressure level components in the frequency bands clearly dominated by insect noise (between 3 kHz and 6 kHz). The long-term unattended monitoring results for the three identified locations are presented graphically in **Appendix G**.

It is noted that in very rural areas such as the subject site, in the presence of neutral meteorological conditions (zero or very low wind speed and no precipitation), background noise levels are typically controlled by insect noise. Somewhat higher background levels typically occur in the summer months when insect activity is generally higher. In this respect, it is considered that the project noise criteria established based on the corrected noise levels are conservative and appropriate for the cooler months of the year unaffected by insect noise.

During the daytime, intermittent but frequently recurring rural work activities around the homesteads, such as mowing, cattle mustering and operation of machinery and vehicles were observed to increase ambient noise levels, but have no material influence on the measured background noise levels. No adjustments to the measured levels have been made to account for these noise sources as they are considered to be part of the everyday acoustic environment.

The determined daily background and ambient noise levels during the daytime, evening and night-time periods for each location are respectively summarised in **Table 3-3**, **Table 3-4** and **Table 3-5**, with representative levels for each period indicated.

Given the very rural nature of the proposed mine site and far reaching surrounds, it is considered that the established representative background noise levels set out the tables below would reasonably be representative of the noise levels at the locations of Receptors A – G. These background noise levels are typical of those of a very rural environment with natural noise sources and minimal road traffic.

Table 3-3 Measured Noise Levels - Forrester Homestead (A)

Date	Background Noise Level L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Monday 13 September 2010	25	21[1]	23	41	35[1]	33
Tuesday 14 September 2010	25	26[1]	20	40	33[1]	35
Wednesday 15 September 2010	25	15[1]	18	40	28[1]	25
Thursday 16 September 2010	22	23[1]	19[1]	38	32[1]	27[1]
Friday 17 September 2010	24	18	19	40	28	34
Saturday 18 September 2010	21	23	26	38	32	30
Sunday 19 September 2010	-	-	-	-	-	-
Monday 20 September 2010	22	-	21	39	-	31
Tuesday 21 September 2010	23	-	22	36	-	34
Wednesday 22 September 2010	26	27	-	40	38	-
Thursday 23 September 2010	22	-	-	41	-	-
Representative Value	**24**	**23**	**21**	**40**	**34**	**32**

Notes: All measurements in periods showing "-" were considered to be affected by extraneous noise.
[1] Corrected for insect noise (L_{A90} corrected by -7dB and L_{Aeq} corrected by -8 dB)

Table 3-4 Measured Noise Levels - Eulimbie Homestead (C)

Date	Background Noise Level L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Monday 13 September 2010	-	-	22	-	-	33
Tuesday 14 September 2010	24	24[1]	20	45	32[1]	25
Wednesday 15 September 2010	26	22	18	49	35	27
Thursday 16 September 2010	24	-	-	44	-	-
Friday 17 September 2010	25	20	17	45	33	26
Saturday 18 September 2010	23	23	23	45	30	29
Sunday 19 September 2010	-	-	-	-	-	-
Monday 20 September 2010	25	-	-	44	-	-
Tuesday 21 September 2010	25	-	21[1]	46	-	34[1]
Wednesday 22 September 2010	28	-	-	44	-	-
Thursday 23 September 2010	26	-	-	45	-	-
Friday 24 September 2010	-	-	22	-	-	33
Representative Value	**25**	**23**	**21**	**46**	**33**	**30**

Notes: All measurements in periods showing "-" were considered to be affected by extraneous noise.
[1] Corrected for insect noise (L_{A90} corrected by -5dB and L_{Aeq} corrected by -5 dB)

Table 3-5 Measured Noise Levels - Surbiton South Homestead (D)

Date	Background Noise Level L_{A90} dB(A)			Ambient Noise Level L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Monday 13 September 2010	-	26	20	-	30	24
Tuesday 14 September 2010	24	24	20	44	30	26
Wednesday 15 September 2010	29	20	22	50	34	28
Thursday 16 September 2010	23	23	24	49	29	27
Friday 17 September 2010	23	19	21	49	25	27
Saturday 18 September 2010	20	23	22	49	28	27
Sunday 19 September 2010	-	-	-	-	-	-
Monday 20 September 2010	22	23[1]	21	49	26[1]	28
Tuesday 21 September 2010	23	25[1]	20	47	28[1]	25
Wednesday 22 September 2010	28	-	-	52	-	-
Thursday 23 September 2010	25	25[1]	20	53	28[1]	24
Friday 24 September 2010	25	24[1]	20	46	27[1]	24
Saturday 25 September 2010	23	25[1]	18	47	29[1]	26
Sunday 26 September 2010	20	-	21	48	-	26
Representative Value	**23**	**24**	**20**	**49**	**29**	**26**

Notes: All measurements in periods showing "-" were considered to be affected by extraneous noise.
[1] Corrected for insect noise (L_{A90} corrected by -2dB and L_{Aeq} corrected by -3 dB)

3 Existing Acoustic Environment

As indicated in the tables above, the representative background noise levels at each of the identified monitoring locations were determined to be no greater than L_{A90} 25 dB(A). The Ecoaccess guideline notes that it may not be possible to maintain background noise levels in very rural areas below 25 dB(A) as developments occur. In such cases the guideline recommends the adoption of a threshold background level of 25 dB(A).

A summary of the rating background noise levels (RBLs, $minL_{A90,1hour}$) and ambient noise levels (ALs) for the daytime, evening and night-time periods at each location determined in accordance wit the EcoAccess guideline are set out in **Table 3-6**.

Operational noise criteria based on these levels are detailed in **Section 4.**

Table 3-6 Summary of Rating Background Noise Levels and Ambient Noise Levels

Location	Rating Background Noise Level (RBL), L_{A90} dB(A)			Ambient Noise Level (AL) L_{Aeq} dB(A)		
	Day	Evening	Night	Day	Evening	Night
Forrester (A)	25	25	25	40	34	32
Eulimbie (C)	25	25	25	46	33	30
Surbiton South (D)	25	25	25	49	29	26

Notes: RBLs set to the 25 dB(A) threshold level in accordance with EcoAccess Guideline, Planning for Noise Control.

Project Acoustic Criteria

The project relevant assessment criteria for general construction and general operations are provided in **Sections 4.1** and **4.2** respectively. Due to nature of the mining activities, it is noted that there may be some crossover between operational and construction activities.

Both construction and operations have the potential to cause sleep disturbance and to generate low frequency noise effects. Additionally blasting, the only activity considered likely to have the potential to result in ground vibration effects over significant distances and overpressure effects, is also proposed both during construction and operational phases of the project.

Accordingly, criteria for the assessment of sleep disturbance, low frequency noise and noise and vibration from blasting are provided in **Sections 4.3**, **4.4** and **4.5** respectively.

4.1 Construction Noise Criteria

In the absence of specific guidelines for the assessment of construction noise in Queensland, the potential construction noise impacts from the site have been assessed with consideration of the following documents:

- *Environmental Protection Act (1994)*;
- *Environmental Protection Regulation 2008*; and
- *Environmental Protection (Noise) Policy 2008.*

URS considers the Queensland *Environmental Protection (Noise) Policy 2008* [EPP(Noise)] to be most appropriate for the purpose of this assessment.

Environmental Protection (Noise) Policy 2008

The EPP(Noise) does not include construction noise limits. It does, however, provide acoustic quality objectives for the protection of amenity, human health and wellbeing, including sleep protection. Construction noise effects have been assessed against these criteria, which are set out in **Table 4-1**.

Table 4-1 Environmental Protection (Noise) Policy 2008 - Acoustic Quality Objectives

Sensitive Receptor	Time of Day	Acoustic quality objectives (measured at the receptor) dB(A)			Environmental value
		$L_{Aeq,1hour}$	$L_{A10,1hour}$	$L_{A1,1hour}$	
Dwelling (external)	Daytime and Evening	50	55	65	Health & wellbeing
Dwelling (internal)	Daytime and Evening	35	40	45	Health & wellbeing
Dwelling (internal)	Night-time	30	35	40	Health & wellbeing in relation to the ability to sleep

It is noted that these criteria were developed for the protection of amenity and health and not for the control of construction noise, which is generally regarded as a temporary activity and therefore often afforded greater tolerance. WHO,1999 recommends for quality sleep, maximum indoor noise levels should not exceed 45 dB(A).

4.2 Operational Noise Criteria

The potential operational noise impacts of the site have been assessed in accordance with the provisions of the following documents:

- *Environmental Protection (Noise) Policy 2008;* and
- *EPA EcoAccess Guideline: Planning for Noise Control.*

The *EcoAccess Guideline: Planning for Noise Control* prescribes a process which takes account of:

— the control and prevention of background creep in the case of steady noise;
— the containment of variable noise levels and short term noise events; and
— the prevention of sleep disturbance.

Background Creep

For the prevention of background noise levels from progressively increasing over time with the establishment of new developments, the Planning for Noise Control guideline provides recommended outdoor background planning noise levels (RBL, min$L_{A90,1hour}$) not to be exceeded for the daytime, evening and night-time periods for various land uses. The land uses surrounding the Project site fit the 'Purely Residential, Very Rural' land use classification described by the guideline. RBLs for this category are set out in **Table 4-2** whilst **Table 4-3** summarises the recommended adjustments to these levels that would control and prevent $L_{A90,1hour}$ background noise creep occurring.

Table 4-2 Recommended Outdoor Background Noise Planning Levels (in terms of min$L_{A90,1hour}$)

Receptor Area Dominant Land Use (description of neighbourhood)	Applicable Locations	Background Noise Level (RBL), min$L_{A90,1hour}$ (dBA)		
		Day	Evening	Night
Purely Residential, Very Rural	All Identified Receptors (Locations A-G)	35	30	25

Table 4-3 Adjustments to Recommended RBL to Prevent Background Creep

Existing Background Level at Receptor	Recommended $L_{A90,1hour}$ Maximum Noise Level Contribution from Kevin's Corner Mine Activity
Existing Background Level > Recommended RBL	Existing Background – 10 dB(A)
Existing Background Level = Recommended RBL	Recommended RBL – 10 dB(A)
Existing Background Level = Recommended RBL – 1	Recommended RBL – 9 dB(A)
Existing Background Level = Recommended RBL – 2	Recommended RBL – 5 dB(A)
Existing Background Level = Recommended RBL – 3	Recommended RBL – 3 dB(A)
Existing Background Level = Recommended RBL – 4	Recommended RBL – 2 dB(A)
Existing Background Level = Recommended RBL – 5	Recommended RBL – 2 dB(A)
Existing Background Level ≤ Recommended RBL – 6	Existing Background + 5 dB(A)

The EcoAccess guideline notes that it may not be possible to maintain background noise levels in very rural areas below 25 dB(A) as developments occur and in such cases a threshold background level of

25 dB(A) is to be used. The resultant background creep criteria applied for each receptor based on the noise monitoring results are set out in **Table 4-4**.

Table 4-4 Background Creep Criteria

Receptor	$minL_{A90,1hour}$ (dBA)		
	Day	Evening	Night (*)
A - G	30	28	25

Notes: * Set at 25 dB(A) threshold in accordance with EcoAccess Guideline, Planning for Noise Control.

Planning Noise Levels

The EcoAccess guideline recommends the adoption of adjusted continuous L_{Aeq} noise criteria for planning purposes. The estimated maximum Planning Noise Levels (PNL) with respect to the day, evening and night-time periods as recommended by the EcoAccess guideline for the applicable 'Very Rural Noise Area' category are set out in **Table 4-5**. Restricting emissions to these levels would help to protect against noise impacts such as speech interference, community annoyance and sleep disturbance. Where the existing noise level from specific noise sources is close to the maximum planning level, however, the noise from any new source(s) must be controlled to protect the amenity of the area. **Table 4-6** summarises the EcoAccess guideline recommended adjustments to be applied to the recommended maximum PNLs where existing noise levels approach the maximum PNL.

Table 4-5 Recommended Maximum Values of Planning Noise Levels (PNL)

Noise Area Category	Description of Neighbourhood	Maximum Hourly Sound Pressure Level $L_{Aeq,1hour}$ (PNL)		
		Day	Evening	Night
Z1	Very rural, purely residential. Less than 40 vehicles an hour	40	35	30

Table 4-6 Modifications to Recommended Maximum Planning Noise level (PNL) to Account for Existing Level of Specific Noise to Preserve Amenity

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

Modifications to the PNLs have not been considered as existing specific noise sources have not been identified.

Specific Noise Levels

For the containment of short term emissions, the EcoAccess guideline identifies Specific Noise Level (SNL) $L_{Aeq,1hour}$ criteria to be determined as follows:

- SNL = RBL + 3 dB(A) – k1 – k2

where k1 and k2 are penalty adjustments to be applied for the presence of tonality and/or impulsiveness respectively. Penalty adjustments of 2 dB(A) apply where these characteristics are just detectable and adjustments of 5 dB(A) apply where they are clearly audible.

The resultant SNLs based on the noise monitoring results are set out in **Table 4-7**. No penalties for impulsiveness or tonality have been applied as the noise sources under assessment are not considered to possess these characteristics.

Table 4-7 Specific Noise Level Criteria

Receptor	SNL $L_{Aeq,1hour}$ dB(A)		
	Day	Evening	Night
A - G	33	31	28

In accordance with the EcoAccess guideline, the Specific Noise Level criteria are applied for the purposes of this assessment, as in this case, they are more stringent than the Planning Noise Levels. Compliance with the Specific Noise Level criteria will ensure the Planning Noise Levels are readily achieved. A summary of operational noise criteria applicable to the Project is provided in **Table 4-8**.
It is noted that due to the relatively very low background noise levels in the vicinity of the subject site, the resultant operational noise limits are notably stringent.

Table 4-8 Summary of Operational Noise Design Criteria

Receptor	Daytime Criteria		Evening Criteria		Night Criteria	
	$L_{A90,1hour}$ dB(A)	$L_{Aeq,1hour}$ dB(A)	$L_{A90,1hour}$ dB(A)	$L_{Aeq,1hour}$ dB(A)	$L_{A90,1hour}$ dB(A)	$L_{Aeq,1hour}$ dB(A)
A - G	30	33	28	31	25	28

4.3 Sleep Disturbance Criteria

Where there exists the possibility that instantaneous, short-duration, high-level noise events may occur during night-time hours (2200 – 0700), consideration should be given to the potential for the disturbance of sleep within residences and the accommodation villages.

The EcoAccess guideline makes reference to the World Health Organisation (WHO)'s *Guidelines for Community Noise (Berglund B, Lindvall T and Schwela D H 1999)* for sleep disturbance caused by noise impacts.

The WHO suggests that noise levels inside bedrooms should be limited to 45 dB(A) L_{Amax} and 30 dB(A) L_{Aeq}. In addition, the Australian/New Zealand Standard *AS/NZS 2107:2000 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* recommends a satisfactory continuous noise levels inside bedrooms of 30 dB(A) L_{Aeq}.

When considering internal noise levels from an external noise source, it is common practice to assume that windows are partially open to allow natural ventilation on warm nights. The noise reduction through partially opened windows is estimated to be 10 dB(A), as noted in the EcoAccess guideline and specified in *AS 3671-1989: Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction*. To achieve the internal noise levels described above and for the avoidance of sleep disturbance, the noise levels outside bedroom windows, should be limited to 40 dB(A) L_{Aeq} and 55 dB(A) L_{Amax}.

As set out in **Section 4.1**, for the protection of sleep, the EPP (Noise) recommends that internal noise levels do not exceed 40 dB(A) $L_{A1,1hour}$. Assuming a 10 dB(A) reduction through a partially opened window, this is approximately equivalent to an external level of 50 dB(A) L_{A1} and therefore represents a more stringent requirement than proposed by the WHO.

For the purposes of this assessment, the more stringent 50 dB(A) L_{A1} (external level) sleep protection criterion is adopted.

4.4 Low Frequency Noise Criteria

The Queensland EPA's draft *EcoAccess Guideline: Assessment of Low Frequency Noise* provides guidance for the assessment of low frequency noise impacts. The intent of the criteria is to assess annoyance and discomfort to persons at noise sensitive premises caused by low frequency noise with a frequency range from 10 Hz to 200 Hz. The guideline uses the G-weighting function to determine annoyance due to infrasound in the frequency range from 1 Hz to 20 Hz and low frequency noise criterion for initial screening inside home environments in terms of Linear, A-weighted and one-third octave band sound pressure levels in the range 20 to 200 Hz.

Infrasound

The recommended infrasound (1 Hz to 20 Hz) draft guideline limits are:

- 85 dB(G) inside dwellings during the day, evening and night and inside classrooms and offices; and
- 90 dB(G) for occupied rooms in commercial enterprises.

Low Frequency Noise

With respect to low frequency noise, the draft guideline recommends that:

- in the case of noise sources emitting an unbalanced frequency spectra, the overall sound pressure level inside residences should not exceed 50 dB(Linear) to avoid complaints of low frequency noise annoyance; and
- if broad band $L_{LINeq} – L_{Aeq}$ > 15 dB, a 1/3 octave frequency analysis should be carried out. This involves an analysis of 1/3 octave band levels in the 5 Hz to 200 Hz range and comparison with the respective 1/3 octave median hearing threshold levels for the best 10% of the older population (55-60 years old) to determine the degree of low frequency noise audibility.

The draft guideline additionally prescribes a process to determine annoyance due to tonality in low frequency noise whereby a noise is determined tonal should the sound pressure level in a particular 1/3 octave be 5 dB or more above the levels in the two neighbouring bands. To determine annoyance for tonal noise, the level in the 1/3 octave band(s) is compared to the hearing threshold level in the corresponding band(s).

Table 4-9 sets out acceptable exceedances of the 1/3 octave threshold levels for the avoidance of annoyance due to low frequency tonal noise.

Table 4-9 Annoyance due to Tonal Noise Threshold Criteria

Period	1/3 Octave Frequency Band			
	8 Hz – 63 Hz	80 Hz	100 Hz	>100 Hz and < 200 Hz
Day	5	10	15	17
Night	0	5	10	12

To establish annoyance for non-tonal noise in the frequency range 10 Hz to 160 Hz the draft guideline recommends the one third octave band spectra measured indoors is A-weighted and the resulting A-weighted values between 10-160 Hz are summed to yield the A-weighted noise level $L_{pA,LF}$.

Table 4-10 sets out acceptable indoor $L_{pA,LF}$ levels for various types of space as recommended by the guideline.

Table 4-10 Acceptable Indoor Criteria for Non-Tonal Noise

Type of Space	$L_{pA,LF}$ (dB(A))
Dwelling, evening and night	20
Dwelling, day	25
Classroom, office etc	30
Rooms with commercial enterprises	35

It is considered appropriate to apply a 3 dB increase to the levels set out in the table above in determining appropriate outdoor noise limits for the corresponding uses. This assumes a conservative 3 dB low frequency range attenuation through a façade with open windows.

4.5 Blasting Noise and Vibration Criteria

Section 440ZB of the Environmental Protection and Other Legislation Amendment Act (No. 2) 2008 (Part 2 Amendment of Environmental Protection Act 1994) provides the following criteria for the control of air blast overpressure and ground vibration:

"A person must not conduct blasting if—

(a) the airblast overpressure is more than 115 dB Z Peak for 4 out of any 5 consecutive blasts; or

(b) the airblast overpressure is more than 120 dB Z Peak for any blast; or

(c) the ground vibration is—

(i) for vibrations of more than 35 Hz—more than 25 mm a second ground vibration, peak particle velocity; or

(ii) for vibrations of no more than 35 Hz—more than 10 mm a second ground vibration, peak particle velocity."

The Act does not provide time controls for blasting, however, the Queensland EPA's *EcoAccess Guideline: Noise and Vibration from Blasting* provides the following:

Noise criteria

Blasting activities must be carried out in such a manner that if blasting noise should propagate to a noise-sensitive place, then

(a) the airblast overpressure must be not more than 115 dB(linear) peak for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and

(b) the airblast overpressure must not exceed 120 dB(linear) peak for any blast.

Vibration criteria

Blasting operations must be carried out in such a manner that if ground vibration should propagate to a noise-sensitive place:

(a) the ground-borne vibration must not exceed a peak particle velocity of 5 mm per second for nine out of any 10 consecutive blasts initiated, regardless of the interval between blasts; and

(b) the ground-borne vibration must not exceed a peak particle velocity of 10 mm per second for any blast.

Times of Blasting

Blasting should generally only be permitted during the hours of 9 am to 3 pm, Monday to Friday, and from 9 am to 1 pm on Saturdays. Blasting should not generally take place on Sundays or public holidays.

Blasting outside these recommended times should be approved only where:

(a) blasting during the preferred times is clearly impracticable (in such situations blasts should be limited in number and stricter airblast overpressure and ground vibration limits should apply); or

(b) There is no likelihood of persons in a noise-sensitive place being affected because of the remote location of the blast site.

Weather Effects

When a temperature inversion or a heavy low cloud cover is present, values of airblast overpressure would be higher than normal in surrounding areas. Accordingly, blasting should be avoided if predicted values of airblast overpressure in noise-sensitive places exceed acceptable levels. If this is not practicable, blasting should be scheduled to minimise noise annoyance. An appropriate period is generally between 11 am and 1 pm. Similarly, blasting should be avoided at times when strong winds are blowing from the blasting site towards noise sensitive places.

The ground vibration and overpressure limits set out in the Ecoaccess guideline are more stringent than those provided under Section 440ZB and on this basis have been adopted for the purposes of this assessment. However, whilst limiting blasting to between the times suggested by the Ecoaccess guideline is not considered practicable nor necessary, limiting the activity to less sensitive times of the day, is recommended where practicable. The following blasting time controls are considered appropriate for the purposes of this assessment:

Times of Blasting

— Blasting should only be permitted between 0700 -1800; and
— Preferably blasting should only be carried out between 0900 -1700.

A summary of the overpressure and ground vibration criteria adopted for the purposes of assessment is provided in **Table 4-11.**

Table 4-11 Summary of Blasting Overpressure and Ground Vibration Design Criteria

Airblast Overpressure and Vibration Parameter	Between 0700-1800 and Preferably between 0900-1700
Airblast Overpressure	115 dB(L) for 9 out of any 10 consecutive blasts regardless of interval between blasts. Any single blast must not exceed 120 dB(L).
Peak Particle Velocity	5 mm/s for 9 out of any 10 consecutive blasts regardless of interval between blasts. Any single blast must not exceed 10 mm/s.

4.6 Off-Site Road Traffic Noise Criteria

The Department of Main Roads' Road Traffic Noise Management Code of Practice (CoP) criteria have been adopted for the purposes of this assessment. The CoP aims to protect sensitive receptors in the vicinity of new road projects, road upgrades and existing roads with no roadworks.

Table 4-12 sets out the applicable CoP criterion for existing residences nearby existing roads with no roadworks.

Table 4-12 Department of Main Roads' Road Traffic Noise Management Code of Practice (CoP) Criteria

Activity	Road traffic noise level within a 10 year horizon, $L_{A10(18hour)}$ dB(A)
Existing Residences	68

4.7 Rail Noise Criteria

Queensland Rail's *Code of Practice (CoP) for Railway Noise Managemen*t (Ver 2, 2007) criteria have been adopted for the purposes of this assessment. As set out in the CoP, the balancing of the community's need for efficient transport systems with the need to manage the impacts of that system is given formal recognition in the EPP Noise in which a railway is described as a Beneficial Asset.

The EPP Noise recognises that:

"Although the operation or use of Beneficial Assets may have significantly adverse effects on the Environmental Values, they are necessary for the community's environmental, social and economic wellbeing.

However, it is intended that, so far as practicable, any significantly adverse effects from their use or operation be progressively reduced."

The EPP Noise nominates “Planning Levels” for a Beneficial Asset such as a railway which may be used as a guide in deciding a reasonable noise level for its use or operation. These Planning Levels are set out in **Table 4-13**.

Table 4-13 Queensland Rail’s Code of Practice (CoP) for Railway Noise Management Criteria

Activity	Rail Noise Level $L_{Aeq(24hour)}$ dB(A)	Rail Noise Level L_{Amax} dB(A)
Existing Residences	65	87

4.8 Aircraft Noise Intrusion Criteria

Australian Standard, *AS 2021, 2000 – Acoustics, Aircraft Noise Intrusion, Building Siting and Construction* provides guidance on the siting and construction of buildings in the vicinity of airports to minimise aircraft noise intrusion. The assessment of potential aircraft noise exposure at a given site is based on the Australian Noise Exposure Forecast (ANEF) system (details provided in Appendix A of AS 2021).

Appendix D of AS 2021, 2000 provides a method for determining building site acceptability for light general aviation aerodromes without ANEF charts.

Table 4-14 sets out acceptable, conditionally acceptable and unacceptable aircraft noise level ranges for residential building sites as recommended by the standard.

Table 4-14 Building Site Acceptability Based on Aircraft Noise Levels

Activity	Aircraft Noise Level Expected at Building Site, dB(A)					
	20 or Less Flights per Day			Greater than 20 Flights per Day		
	Acceptable	Conditionally Acceptable	Unacceptable	Acceptable	Conditionally Acceptable	Unacceptable
Residences	< 80	80 to 90	> 90	< 75	75 to 85	> 85

5

Assessment of Potential Noise Impacts

5.1 Calculation Method

Noise levels due to the proposed construction and the operation of the site at the identified noise sensitive receptor locations have been predicted using an acoustics computer model created in SoundPLAN Version 7.0. This program is used internationally and recognised by regulators and authorities throughout Australia.

The noise model was constructed to allow the prediction of cumulative noise levels from the site including the contribution of each noise source. The noise model takes into account:

- sound power levels of each source;
- receptor locations;
- screening effects due to topography;
- meteorological effects and attenuation due to distance; and
- ground and atmospheric absorption.

The noise calculations have been carried out using the L_{Aeq} descriptor to assess the operational and construction noise impacts.

The program allows the use of various noise prediction algorithms. To calculate noise emission levels under neutral and adverse meteorological conditions, the CONCAWE algorithm which is designed for industrial sites has been used.

The CONCAWE method was especially designed for the requirements of large industrial facilities such as petroleum and petrochemical complexes, and is now widely used for calculating noise emissions from all types of industrial facilities in Australia. CONCAWE provides calculation methods for predicting noise levels under the influence of wind and the stability of the atmosphere.

CONCAWE is implemented in SoundPLAN to calculate the sound pressure level at the receptor location taking into consideration the following:

- attenuation due to distance between the source and the receptor;
- attenuation due to air absorption which is evaluated in accordance with ISO9613, ISO3891 or ANSI 126;
- ground attenuation considering hard or soft surfaces;
- correction due to sound refractions by wind and temperature gradients which is based on the Pasquil meteorological atmosphere categories (Pasquil Stability Class);
- correction due to wind speed and direction; and
- screening based on the Nordic General Prediction method.

The effects of meteorological conditions are explained in more detail in **Section 5.2** below.

5.2 Meteorological Conditions

Adverse meteorological conditions have the potential to increase noise levels at a receptor. Such phenomena generally occur during temperature inversions or where there is a wind gradient with wind direction from the source to the receptor. These meteorological effects typically increase noise levels by 5 to 10 dB, and even greater than 10 dB in extreme conditions.

Temperature inversions generally occur during the night-time and early morning periods, thus the most significant meteorological effect during the daytime period is wind.

The prevailing meteorological conditions for the site have been assessed using data extracted from the meteorological model, CALMET, for the year 2009. In addition to assessment of the annual data, consideration has been given to seasonal variations, with summer (December to February); autumn (March to May); winter (June to August); and spring (September to November) periods. Additionally the daytime (0700-1800); evening (1800-2200); and night-time (2200-0700) periods have been considered. Results of this analysis are presented graphically in the form of windroses and wind class frequency distributions in **Appendix B**. Further details of the meteorological analysis including CALMET modelling used for this assessment are provided in the Air Quality Impact Assessment (Section 13 of the EIS).

Based on analysis of the CALMET data, the prevailing meteorological conditions for the daytime and evening / night-time periods are summarised in **Table 5-1**. SoundPLAN modelling for adverse meteorological conditions has conservatively assumed moderate inversion (F-class stability category) conditions (3°C/100 m temperature inversion strength for all receptors) and 3 m/s windspeed, with all receptors downwind of the site.

Adverse meteorological conditions are expected for a significant amount of the time. In this respect, the data extracted from CALMET indicates the F-Class stability category (moderate strength inversion) for 47 % of the time and prevailing windspeed in the 2.1-3.6 m/s range (**Appendix B**). Therefore consideration to predicted levels for adverse meteorological conditions is appropriate.

Table 5-1 Prevailing Meteorological Conditions

Time of Day	Pasquil Stability Class	Wind Speed (m/s)	Wind Direction
Day (0700 – 1800)	B/C	3	ENE
Evening & Night (1800 – 0700)	F	3	E & ENE

5.3 Noise Modelling Assumptions

Potential noise impacts have been predicted separately for neutral and adverse meteorological conditions. Since the most sensitive period is the night time, the noise modelling results for neutral and adverse conditions are fore mostly compared with the night-time criteria, with source-to-receptor wind.

Table 5-2 provides a summary of the meteorological scenarios considered which are based on the meteorological data presented in **Appendix B**.

Table 5-2 Meteorological Conditions Used in Noise Modelling

Met. Scenario (Evening and Night-time)	Meteorological Condition				
	Temperature (°C)	Relative Humidity (%)	Pasquil Stability Class	Wind Speed (m/s)	Wind Direction
A: Operation – Neutral Met Conditions	10	50	D	0	n/a
B: Operation – Adverse Met. Conditions	10	50	F	3	Source-to-receptor

The noise modelling has been conducted based on likely maximum operating conditions for installed and mobile equipment. In setting up the noise model, all sources were positioned according to the proposed site layout (**Figure 2-2**) for the respective stages. In sensitivity tests, slight changes to the positioning of the sources were found not to significantly affect the results.

For the purposes of assessment it has been conservatively assumed that the noise generating activities for each stage occur simultaneously and all equipment identified for each scenario operates continuously.

5.4 Operational Noise

5.4.1 Sound Power Levels – Operational Noise Sources

Table 5-3 presents sound power levels (L_w) for the equipment identified as the primary on-site operational noise sources. Schedules of equipment have been compiled for the different stages of the project including fixed plant and mobile equipment associated with mine operation works. These schedules are based on Appendices 8C and 6A-14 of the Pre-Feasibility Study (PFS) report and updated accordingly based on information provided by HGPL on 16 November 2010.

Sound power levels in octave frequency bands for these sources have been obtained from the SoundPLAN technical library, Australian Standard AS2436:1981, British Standard BS5228 and data published in previous EIS studies. The references are listed as footnotes in each relevant table.

The major installed equipment and most of the minor equipment would operate between 10 to 20 hours per day. For the purposes of this assessment, all plant has been conservatively assumed to operate 24 hours per day, 7 days a week.

Coal Handling Preparation Plant (CHPP)

Sound power levels for the Coal Handling Preparation Plant (CHPP) have been calculated using details provided in Appendix 8B of the PFS. Each one of the CHPP's four modules was modelled as two vertically aligned point sources with equivalent total sound energy for the module. The CHPP noise levels listed in **Table 5-3** are resultant noise levels for each module. These noise levels were also compared with previous measurements undertaken in similar CHPP environments and coal wash plants. Octave band data for the CHPP was taken from data of other plants adjusted to account for the size of equipment for this project. Most of the noise producing equipment within the CHPP are pumps and drives; typical sound power levels of 90 dB(A) have been assumed for each of them. The dominant noise sources associated with the CHPP are the sizers and crushers which were modelled separately.

Underground Mine Mechanical Ventilation

Mechanical ventilation plant is proposed for the northern, central and southern underground mining areas, with one ventilation system required for each underground mine. The principal noise generating components from the proposed ventilation systems are twin centrifugal fans, which would be sited at ground surface level above the underground mines, enclosed within 6 mm steel casing and provided with 9.5 m high ventilation discharge shafts. The standard system design would be provided with vertical discharge stacks. Ventilation equipment supplier, Howden Australia Pty Ltd (Howden), has confirmed, however, that providing the systems with horizontal discharge stacks may be readily achieved.

The initial locations of the ventilation shafts are shown in **Figure 2-2**. It is expected that over the life of the mine, each ventilation system will be required to be relocated once, to approximately halfway along the southern faces of the underground mines.

Octave band noise specifications for single fan units and engineering drawings of the system (Dwg No: S2811-0000) have been provided by Howden. For implementation in the SoundPLAN model, each ventilation system has been defined as series of area sources with dimensions based on the identified Howden drawing. These area sources have been assigned sound power levels based on the octave band sound power levels of the fans, applying corrections to account for the octave band transmission losses achieved through 6 mm steel panels. Additionally the radiated sound power from the stacks' discharge points has taken account of the ducting's internal transmission losses and frequency dependent source directivities have been defined.

The sound power levels presented in the table have been applied in the SoundPLAN noise model. These levels do not consider any noise mitigation measures, such as acoustic enclosures, silencers, mufflers etc.

Equipment schedules vary for the different stages and operational scenarios assessed. Noise source quantities for individual stages are specified in **Section 5.4.2**, whilst full details are provided in **Appendix C**.

Noise generated by the underground mining equipment will be inherently shielded by the land above it. On this basis, as environmental noise contributions from these sources would be expected to be negligible, the underground sources have been disregarded in this assessment.

Table 5-3 Sound Power Levels – Operational Equipment

Operational Noise Source		Estimated Overall Sound Power Level	
		dB(Lin)	dB(A)
Mine Equipment Installed Major Equipment	Marion BE8200 Dragline	125	115
	Marion BE495HR Rope Shovel	117	113
	Liebherr R9800 Excavator	129	123
	Liebherr R996B Excavator	125	119
	Liebherr R9350 Excavator	125	119
	CAT 994D FEL Loader	118	111
	Liebherr T282C Dump Truck	125	117
	CAT 789C Dump Truck	125	117
	CAT 789C Water truck	125	117
	CAT D11T Dozer	121	109
	CAT D10T Dozer	121	109
	CAT 24M Grader	119	109
	Drill SKS Blast Hole 86k	125	119
	Drill SKF Blast Hole 60k	125	119
	Kress 200-II Coal haulers	121	121

5 Assessment of Potential Noise Impacts

Operational Noise Source		Estimated Overall Sound Power Level	
		dB(Lin)	dB(A)
Mine Equipment Installed Minor equipment	Pit Pumps / Compressors	102	102
	Lighting Plant (Electric Generator)	104	102
	Low Loader	118	117
	Telescopic Crane 50t/25t/160t	105	102
	Truck	115	107
	Forklift	110	100
	Light vehicle	100	98
CHPP	Module 1	126	107
	Module 2	135	107
	Module 3	130	108
	Module 4	130	107
Stockpiles	Crusher/Sizer	131	116
	Reclaimer	115	115
Train load out facilities	Sampling system / Washdown sump	115	118
Conveyors[2]	Southern Underground– Southern MIA	123	119
	Southern MIA – Central MIA – Ropecon	131	127
	Ropecon Conveyor	128	124
	ROM 2 Dump - CHPP	122	118
	Northern Underground – Northern MIA	122	118
	Northern MIA – CHPP	124	120
	CHPP – Stockpiles	125	121
	Stockpiles – TLO	122	118
	CHPP Feeder Conveyor	117	113
	Reject Conveyor	119	115
Underground Mine Ventilation Plant[3]	Northern UG Mine - Twin Centrifugal Fans	132 per fan	123 per fan
	Central UG Mine - Twin Centrifugal Fans	132 per fan	123 per fan
	Southern UG Mine - Twin Centrifugal Fans	132 per fan	123 per fan

Notes:
1. Based on Alpha Coal Project EIS
2. Conveyor sound power levels are resulting levels from using 89 dB(A) / metre
3. Provided by ventilation equipment suppliers, Howden Australia Pty Ltd, based on centrifugal fan type MVC150 3050 1350 kW. Modifications to these levels are applied to take account of the transmission losses achieved through the steel casing and ductwork.

5.4.2 Operational Noise Modelling Scenarios

Table 5-4 summarises the noise modelling scenarios, indicating the numbers of major and minor operational equipment units applied in the noise modelling. **Appendix C** provides a full detailed schedule of equipment applied in the noise modelling for each operational stage.

Table 5-4 Operation Noise - Modelling Scenarios

Scenario	Period	Description	Equipment			
			Mine Equipment		Fixed Plant	
			Major	Minor	CHPP	Conveyors
1	2014	• Roads, rail, airport, workshops, MIAs are fully operational. • Coal mining begins second half of 2014. Truck-excavator fleets servicing the initial excavations. No draglines at this stage. • Underground ventilation equipment in initial locations.	56 units	41 units	CHPP stage 1 operative	All conveyors operative
2	2015	Number of coal haulers significantly increased.	64 units	41 units	CHPP stage 1 operative	All conveyors operative
3	2016	Maximum rate of production 30 Mtpa assumed from this point	64 units	41 units	CHPP Stage 2 finished	All conveyors operative
4	2017	30 Mtpa	64 units	41 units	Fully operational	
5	2018	30 Mtpa	61 units	41 units	Fully operational	
6	2023	• Two draglines installed at the open cut pits. • Excavator, coal hauler and dump truck fleets reduced.	39 units	41 units	Fully operational	
7	2028	• 30 Mtpa • Underground ventilation equipment relocated halfway along the southern faces of the underground mines.	39 units	41 units	Fully operational	
8	2033	30 Mtpa	45 units	41 units	Fully operational	
9	2042	Mine ceases production at the end of 2042.	53 units	41 units	Fully operational	

5.4.3 Predicted Operational Noise Levels

Detailed results of the noise modelling, considering neutral and adverse meteorological conditions, for each operational stage are provided in **Appendix D,** with predicted $L_{Aeq,1hour}$ results provided in **Tables D1 to D9** and $L_{A90,1hour}$ results in **Tables D10 to D18**. A summary of the range of results for each operational stage is presented in **Table 5-5**.

Predicted noise contour maps for the mine during each operational stage, under adverse night-time meteorological conditions are presented in **Appendix E**. It should be noted that these noise contours are indicative only due to interpolation within the calculation grid.

Table 5-5 Summary of Predicted Operational Noise Levels for All Operational Stages

Receptor	Predicted Noise Levels		Operational Noise Level Criteria		Exceedance
	L_{A90} [dB(A)]	L_{Aeq} [dB(A)]	L_{A90} [dB(A)]	L_{Aeq} [dB(A)]	
	Neutral / Adverse Weather	Neutral / Adverse Weather	D / E / N	D / E / N	D / E / N
A: Forrester Homestead	17 – 19 / 22 – 24	21 – 24 / 25 – 28	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
B: Surbiton Homestead	12 – 14 / 16 – 17	19 – 20 / 22 – 24	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
C: Eulimbie Homestead	up to 2 / up to 5	10 – 12 / 14 – 16	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
D: Surbiton South Homestead	21 – 24 / 21 – 24	13 – 15 / 17 – 19	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
E: Speculation Homestead	< 10	< 10	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
F: KC Accommodation Village	up to 23 / up to 28	up to 33 / up to 38	30 / 28 / 25	33 / 31 / 28	5 / 7 / 10
G: ACP Accomm Village	7 – 12 / 11 - 16	14 – 18 / 18 – 22	30 / 28 / 25	33 / 31 / 28	Nil / Nil / Nil
Notes	D: Daytime (0700-1800); E: Evening (1800-2200); N: Night-time (2200-0700)				

At All Receptors except for Receptor F (Accommodation Village)

As shown in **Table 5-5**, with the exception of the on-site accommodation village, no exceedances of the established operational noise limits are predicted at any of the identified sensitive receptor locations.

Of the existing residential receptors, Location A (Forrester Homestead) is predicted to be exposed to the highest operational noise levels from the site. Analysis of the modelling results indicate that the predicted L_{A90} noise levels at the Forrester site would principally be controlled by the northern underground mine's ventilation equipment. At this location, the predicted L_{Aeq} levels are additionally influenced by excavators operating within the northern opencut pit and mobile plant operating in the northern aspect of the site, principally to the north of the northern open-cut pit.

The operational noise levels at Forrester are predicted to reduce marginally over the life of the mine as the inherent acoustic shielding is increased by the progression of the opencut mine face and the reduction in mobile plant due to the introduction of draglines; reducing further with the relocation of the underground mine ventilation equipment (assumed in this assessment to occur in 2028 – Scenario 7).

Specific noise mitigation measures are not deemed necessary to control operational noise at the existing receptor locations as compliance with the operational noise criteria is expected. Notwithstanding this, measures to effectively reduce operational noise from the site, including the re-direction of the northern underground mine's ventilation discharge are recommended. These are set out in **Section 6**.

As previously noted, due to the relatively very low background noise levels in the vicinity of the subject site, the resultant operational noise limits are notably stringent. With reference to the background noise monitoring data, operational noise (with the exception of blasting) from the site is expected to be barely audible or inaudible at the receptor locations outside the mining lease boundary during the day-time period. In low background noise conditions, occurring during the night-time period, the site operation may be audible externally at all the identified receptors with the exception of location E, (Speculation Homestead). The predicted noise levels are generally no higher than the measured ambient noise levels. Considering the attenuation afforded through the dwellings' external façades, operational noise from the mine is not expected to be audible inside any of the identified dwellings located outside the mining lease boundary.

Location F, Kevin's Corner Accommodation Village

The key amenity issue for the HGPL Kevin's Corner accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers between shifts. On this basis, achieving the internal noise criteria is considered the principal performance requirement with respect to the acoustic design of the accommodation village.

External noise levels of up to 38 dB(A) L_{Aeq} are predicted at this location under adverse meteorological conditions and as such the internal noise criteria would be met with windows open during the operational stages. Notwithstanding this, the accommodation would be air conditioned and provided with mechanical ventilation, allowing for windows to be kept closed.

5.5 Construction Noise

5.5.1 Sound Power Levels

Construction equipment has been nominated for the different stages of the construction works. Typical construction equipment expected on this site and noise levels are summarised in **Table 5-6**. The sound power levels of these items have been taken from British Standard BS 5228 and other similar projects.

5 Assessment of Potential Noise Impacts

Table 5-6 Sound Power Levels - Construction Noise Sources

Construction Noise Source		Sound Power Level	
		dB(Lin)	dB(A)
Cranes[1]	Crawler 400t	105	102
	Crawler 200t		
	Crawler 100t		
	Hydraulic 80t		
	Hydraulic 50t		
	Rough terrain 30t		
	Franna 20t		
Plant[1]	Welders	101	101
	Compressors	103	102
	Diesel electric generators	104	102
	Drill	125	119
	Electric Generator 5 kVA	104	102
	Electric Generator 15 kVA	109	106
	Electric Generator 150 kVA	116	113
	Electric Generator 300 kVA	116	113
Water Truck[2]	CAT 798C	125	117
Dozer[3]	CAT D11T/ D10T	121	109
	CAT 854K	127	121
Grader[3]	CAT 24M	119	109
Loader[3]	Face Loader – CAT 994D	118	111
	Low Loader	115	99
Forklift[4]	Forklift Diesel Continuous Work	110	100
Trucks[4]	Service/Trailers/Semis	115	108

Sources:
1. Based on British Standard BS5228
2. EIS for Caval Ridge Mine Project Construction and Operational Noise and Vibration Impact Assessment
3. EIS for Ensham Central Project Environmental Noise Assessment
4. SoundPLAN emissions' library

5.5.2 Noise Modelling Scenarios

Construction works would include three stages, over a duration of three years, to complete the CHPP, dump station ROM pads, overland conveyors (OLC) and product handling conveyors, stockyards, train load out (TLO) facility, rail loop, airport, road upgrades and mine services such as the sewerage treatment plant (STP), electrical substations, mine industrial areas (MIA) and accommodation village.

The main construction activities would involve the following stages:

- Stage 1: Road upgrades, airport, camp, creek diversions, civil foundations, overland conveyors, CHPP stg 1 and stacker reclaimer;
- Stage 2: CHPP, stg 1, stacker reclaimer, rail loop; and
- Stage 3: CHPP stg 2.

Table 5-7 summarises the major construction equipment units considered for each stage in the modelling scenarios.

Table 5-7 Construction Noise - Modelling Scenarios

Type of Equipment	Scenario / Year :	0 / 2013	1 / 2014	2 / 2015
	Height (m)	Quantities per year		
Cranes	10	12	8	12
Dozers - CATD10T/D11	2	4	4	4
Graders - CAT24N	1	2	2	2
Loaders - Face Loader CAT994D	3	2	2	2
Loaders - Low Loaders	1	15	15	15
Water Truck - CAT789C	3	1	1	1
Welders Diesel	1	18	12	18
Compressors	1	12	6	12
Electric Generators - 5/15/150/300 kVA	1	183	183	183
Forklifts	1	36	36	36
Trucks	1	82	82	82

5.5.3 Predicted Construction Noise Levels

The noise levels at each receptor location generated by the construction activities have been predicted by modelling of the noise sources listed in **Table 5-6**. The noise modelling has been carried out considering neutral and adverse meteorological conditions. The results for the predicted noise levels during construction of the mine site are presented in **Appendix D, Tables D-19 to D-21** and summarised in **Table 5-8**. It should be noted that the predicted noise levels presented in **Appendix D** and **Table 5-8** result from a conservative noise modelling approach where it has been assumed that all equipment would operate continuously and simultaneously during the assessment period.

Table 5-8 Summary of Predicted Construction Noise Levels for All Construction Stages

Receptor	Noise Level - L_{Aeq} [dB(A)]		Criterion, $L_{Aeq,1hour}$ [dB(A)]			Exceedance
	Neutral Weather	Adverse Weather	Day	Evening	Night	
A: Forrester Homestead	up to 15	up to 19	50	45	40	Nil
B: Surbiton Homestead	up to 15	up to 20	50	45	40	Nil
C: Eulimbie Homestead	up to 13	up to 18	50	45	40	Nil
D: Surbiton South Homestead	up to 13	up to 18	50	45	40	Nil
E: Speculation Homestead	< 10	< 10	50	45	40	Nil
F: KC Accommodation Village	up to 55	up to 59	50	45	40	Up to 9 dB(A) Daytime; Up to 14 dB(A) Evening; and Up to 19 dB(A) Night-time.
G: ACP Accommodation Village	up to 10	up to 14	50	45	40	Nil

Relatively consistent construction equipment schedules are anticipated over the various construction stages considered, hence substantially consistent noise levels are predicted for the three stages. Throughout the mine construction stages, no exceedances of the EPP(Noise) daytime, evening and night-time noise limits are predicted at the receptors located outside the mining lease boundary. With respect to these residential receptors, no specific physical construction noise mitigation measures are considered necessary.

HGPL Kevin's Corner Accommodation Village

At the HGPL Kevin's Corner Accommodation Village, external noise levels of up to L_{Aeq} 59 dB(A) are predicted under adverse meteorological conditions. This would indicate the potential for exceedance of the EPP(Noise) limits by up to 9 dB(A) during the daytime, 14 dB(A) during the evening period and 19 dB(A) at night.

As previously noted, the key amenity issue for the accommodation village is sleep protection. On this basis, achieving the internal noise criteria is considered the principal performance requirement with respect to the acoustic design of the accommodation village.

In order to ensure that satisfactory internal noise levels are achieved, based on the predicted external noise levels, the accommodation building envelope design will be required to achieve an attenuation of 30 dB(A). Walls and roofs can be readily designed to provide at least this level of attenuation with the use of appropriate materials. The overall noise reduction through the buildings' facades will, therefore, be dependent upon the type of glazing used in windows and doors.

Acoustic design requirements for the accommodation village buildings, in order to ensure that satisfactory internal noise levels are achieved are discussed in **Section 6**.

The adoption of noise management strategies implementing good industry practice is recommended to minimise noise emissions from the proposed construction works. Recommendations on construction noise management strategies are provided in **Section 6.1**. It would be expected that these would be incorporated into a construction phase Environmental Management Plan (EMP).

5.6 Sleep Disturbance

Predicted night-time noise levels throughout the construction and operational phases of the project are below 50 dB(A) L_{A1} at all receptors (external level) outside the mining lease boundary (locations A-E). Therefore, the proposed activities are not expected to give rise to sleep disturbance at these locations.

As discussed in **Section 5.5.3**, the on-site accommodation village buildings will be appropriately acoustically designed and provided with mechanical ventilation and air-conditioning to satisfy the internal noise criteria. The sleep protection criterion is expected to be readily achieved within the HGPL Accommodation Village.

5.7 Low Frequency Noise

The Ecoaccess low frequency impact assessment process requires initial screening tests to determine whether predicted levels at receptor locations would exceed 50 dB(L) and whether linear levels would exceed A-weighted levels by 15 dB or more. In the case of an exceedance of these indicator limits further investigation is then required.

It is noted that the mining equipment noise sources under assessment emit noise typically of a broadband nature and have not been known to generate the dominant low frequencies that the Ecoaccess guideline was intended to address. Notwithstanding this SoundPLAN predictive noise modelling estimated the noise levels to be no more than 45 dB(L) at the receptor locations outside the mining lease boundary. Additionally, whilst linear noise levels of up to 51 dB(L) are predicted at Location F, no more than 15 dB difference between linear levels and A-weighted levels is predicted at this location.

On this basis it is concluded that low frequency noise would not be at a level to cause annoyance to the identified sensitive receptors and compliance with the 20 dB $L_{pA,LF}$ criterion inside all dwellings and accommodation villages is predicted. Accordingly, no adjustment to the A-weighted operational noise criteria is deemed necessary.

5.8 Blasting Noise and Vibration

Blasting would be carried out using ammonium nitrate/fuel oil (ANFO) explosive. The transportation, storage and use of explosives would be in accordance with the relevant Australian Standards (i.e. AS 2187 Explosives – storage, transport and use) and all state legislation (i.e. Explosive Act 1999).

One 4-man blast crew has been allowed for per 15,000 tonnes of explosives per year. The maximum number of blast crew personnel is eight, including shot firers. It has been assumed that the explosives supplier will operate the explosives depot and supply the explosives trucks and operators.

The first 15-20m of the tertiary truck-shovel overburden would be excavated whilst the rest of the tertiary and weathered Permian overburden would require some blasting to maintain excavation productivity. All fresh overburden and the inter-burden between the C and D seams require blasting. It is understood that all blast holes would be confined and standard central Queensland strip mining blasting techniques would be used. Additionally, it is understood that electronic initiation would be used to optimise blast performance and to limit the MIC values.

The maximum range of MIC is 350 kg – 1,300 kg, whilst the likely range of MIC is 550 kg – 1,000 kg. No waste excavation blasting is anticipated beyond the pit areas.

5.8.1 Ground Vibration

The peak particle velocity (PPV) due to blast induced ground vibration experienced at the identified sensitive receptor locations would be dependent on the maximum charge per delay, the distance from the blast site and ground geology. For the purposes of assessment the PPV has been estimated by applying the following standard empirical formulae and site constants as set out in AS 2187.2,2006:

$$PPV = 1140\left(\frac{R}{Q^{1/2}}\right)^{-1.6}$$

- Where
  - R = distance between charge and point of measurement [m]; and
  - Q = maximum instantaneous charge (effective charge mass per delay) [kg].

In applying this method calculations indicate that blasts requiring up to the maximum 1,300 kg MIC would not exceed the most stringent 5 mm/s ground vibration criterion (Ecoaccess criterion for 90 % of blasts) at the closest sensitive receptor locations based on minimum setback distance to the pit area.

PPVs substantially less than 1 mm/s would be expected at the identified receptor locations. Vibrations of this magnitude would be considerably below accepted thresholds for structural damage to buildings.

For lower capacity MIC blasts and at greater setback distance the predicted magnitude of vibration reduces substantially.

Therefore, it is considered that with respect to ground vibration, the proposed blasting schedule may be undertaken in full compliance with the established criteria, without risk of damage to the receptor properties or undue community annoyance.

Vibration Effects on Underground Pipelines

Standard DIN 4150.3-1999 recommends offset distances for buried pipelines constructed from various materials for the prevention of damage from vibration effects. Masonry or plastic pipes are most susceptible; for these pipeline types an offset distance of 510 m is recommended. There are no known buried pipelines within 510 m of the proposed blasting areas and therefore no adverse effects on pipelines due to blasting are expected.

Vibration Effects on Underground Communications Cabling

Optic fibre cables would supply communications to the site, and would likely enter the mine site along the Powerlink powerlines and/or rail corridor. It is understood that the cable network would not be sited within 500 m of the proposed blasting areas and therefore no adverse effects on communications networks due to blasting are expected.

5.8.2 Overpressure

The resultant overpressure due to confined blasting experienced at the identified sensitive receptor locations would be dependent on the maximum charge per delay, the distance from the blast site and ground geology. Additionally, it should be noted that air blast overpressure propagation can be increased under certain meteorological conditions (with the occurrence of temperature inversions and/or source-to-receptor wind direction) and decreased with topographic shielding.

For the purposes of assessment the overpressure (P) has been estimated by applying the following standard empirical formulae and site constants as set out in AS 2187.2,2006:

$$P = Ka\left(\frac{R}{Q^{1/3}}\right)^{a}$$

- Where
  - P = pressure [kilopascals];
  - R = distance from charge [m];
  - Q = explosive charge mass [kg];
  - K_a = site constant; and
  - a = site exponent.

For confined blasthole charges, a conservative site constant (k_a) value of 100 has been assumed with a site exponent (a) value of -1.45. The predicted levels disregard any meteorological and shielding effects.

Calculations indicate that blasts requiring up to the maximum 1,300 kg MIC would not exceed the most stringent 115 dB(L) overpressure criterion (Ecoaccess criterion for 90 % of blasts) at any of the identified sensitive receptor locations based on minimum setback distance to the pit areas.

It should be noted that the predictions detailed above are based on site constants which are generally regarded to provide conservative results and hence the predicted levels should only be used as a guide. It is recommended that calculations are revised and predictions refined on the availability of site specific constants and once the exact locations for blasting are known. Blast monitoring should be undertaken to assess compliance, determine the site constants and confirm the predictions.

Blasting carried out within the recommended hours (0900 – 1700) is not expected to be affected by the presence of temperature inversions as these generally occur during the night-time and early morning period. Source-to-receptor wind direction may be expected to give rise to increased noise levels at the receptors, however, and should be considered when planning blasting.

It is therefore considered that provided blasting is properly managed, the proposed blasting program can be carried out to meet the overpressure criteria at all receptor locations. Reducing the MIC capacity and increasing distance is the most effective way of reducing blasting impacts. Recommendations on the management of overpressure from blasting are provided in **Section 6.2.** It is expected that these would be provided to the blasting contractor for consideration and would be incorporated into a Blasting Management Plan (BMP).

5.9 Off-Site Road Traffic Noise

The potential off-site traffic noise impact associated with the proposed operation and construction of Kevin's Corner Mine has been assessed based on traffic volume predictions undertaken for the development. The increases in traffic volumes for each road section have been estimated for trips to and from the site. The following route sections were identified:

- A: Alpha to Kevin's Corner Mine site, via Clermont-Alpha Road;
- B: Site Access Road, via Degulla Road;
- C: East of Alpha to Alpha, via Capricorn Highway; and
- D: West of Alpha to Alpha, via Capricorn Highway.

The changes in traffic volumes would alter the noise emission from roadways, increasing the $L_{A10(18hour)}$, which is an average of the L_{A10} traffic noise levels produced between 0600 and 0000 hours (18 hours). The level of noise emission increase depends on the increase rate of the annual average daily traffic (AADT). AADT figures and predicted traffic volumes for the Project's construction and operational stages were obtained from the draft Traffic Assessment prepared by URS.

5.9.1 Predicted Off-Site Road Traffic Noise Impact

Calculations were undertaken following the CoRTN (U.K. Department of Transport) prediction method for the following existing and predicted conditions for the peak years during construction and operation:

Table 5-9 Baseline Road Traffic Parameters

Road	Year 2009		Construction Year 2013		Operation Year 2017	
	AADT	% Heavy Vehicle	AADT	% Heavy Vehicle	AADT	% Heavy Vehicle
A: Clermont-Alpha Road (Between Hobartville Road and Degulla Road)	16	31	122 [1]	38	167 [2]	29
B: Site Access Road (Between Degulla Road and the Site)	n/a [3]	n/a [3]	103 [1]	39	146 [2]	29

Notes:
1. Includes predicted traffic volume during the busiest year of construction works (2013), plus existing traffic incremented by 3 % growth rate.
2. Includes predicted traffic volume during the busiest year of operations (2017), plus existing traffic incremented by 3 % growth rate.
3. New road

Table 5-10 provides a summary of the calculated $L_{A10(18hour)}$ road traffic noise levels for the subject road sections at the affected sensitive receptor locations.

Table 5-10 Predicted Road Traffic Noise Levels

Sensitive Receptor	Route	Setback (from Clermont-Alpha Rd)	Existing Traffic Noise $L_{A10(18hours)}$ yr 2009	Predicted Road Noise dB(A)		Relative Increase in Noise Level (dB)	
				Construction yr 2013	Operation yr 2017	Construction yr 2013	Operation yr 2017
Surbiton South Homestead	A	500 m	n/a [1]	31	32	n/a	n/a
Burtle Homestead	B	200 m	25	34	35	9	10
Tressillian South	B	600 m	21	30	31	9	10
Notes: New Road – No baseline AADT available							

The increase in operational traffic would be due principally to personnel transport, from Alpha town or Clermont to the mine site and Kevin's Corner airport to the accommodation village.

The predicted traffic volumes generated by the Project represent a significant increase when compared with the existing level of traffic. Whilst full compliance with the 68 dB(A) $L_{A10(18hour)}$ CoP criterion is expected to be achieved without the requirement for any specific mitigation, a perceived increase in road traffic noise experienced by the identified receptors is considered likely.

Relative noise level increases identified in **Table 5-10** are in the order of 10 dB(A), which represents an effective perceived doubling in subjective loudness. Noise management strategies to minimise the noise from the off-site road traffic associated with the proposed mine construction and operation have been provided in **Section 6.1** of this report.

5.10 Rail Noise and Vibration Impact Assessment

HGPL proposes to construct a standard gauge, 17 km long rail spur and loop to connect the Kevin's Corner mine site to the proposed 495 km long Alpha Coal railway line for the purposes of transporting processed coal from the mine site to the proposed Port of Abbot Point. The rail line would be designed to enable the export of 60 to 80 Mtpa of quality thermal coal to overseas markets.

GHD has undertaken an assessment of the potential noise and vibration impacts resulting from the construction and operation of the proposed Alpha Rail Corridor Project (*Report for Alpha Rail Project – Noise Assessment, August 2010 (Revision 0)*).

5.10.1 Operational Phase

To assess operational rail noise, GHD undertook modelling using the environmental noise prediction model CadnaA, employing the Nordic Rail Traffic Noise Prediction Method (Kilde 1984).

The GHD assessment did not, however, consider the Kevin's Corner rail spur or the sensitive receptor locations relevant to this assessment. URS has, therefore, undertaken additional rail noise modelling using the details and assumptions considered in the GHD assessment to predict potential rail noise emission levels at the receptors identified in **Table 2-1**.

5 Assessment of Potential Noise Impacts

The modelling assessment was based on peak production volumes of coal of 60 Mtpa, being transported by GE ES44DC diesel locomotive trains. In order to transport this volume of coal, based on 24,000 tonne payloads, 14 train trips (7 each way) per day were assumed.

The following assumptions were made with regards to the modelled rail movements and configuration:

- Based on standard coal wagons each of 106 tonne capacity, about 234 wagons would be needed to be attached to each locomotive 3-unit set to carry the proposed 24,000 tonnes of coal per train, resulting in a total length of 4 km;
- The expected coal train movements per day for peak production and transportation in 2016 (train movements spread out evenly over a 24-hour period) are 7 on the Up track and 7 on the Down track; and
- The design speed was assumed to be 80 km/h.

The following assumptions were made with regard to the model configuration:

- A general ground absorption coefficient of 0.5 was used throughout the model;
- Atmospheric conditions of 20 °C and 70 % humidity were used;
- Meteorological effects were disregarded; and
- A source sound power level of 94 dB(A) per linear metre was assumed, based on United Group rail noise measurement data, adapted to the Nordic train input data.

For the purpose of this assessment, the following additional assumptions were made:

- The Kevin's Corner Project rail spur will carry 50% of the total rail traffic (the other 50% assumed to be associated with the Alpha Coal Project), based on the understanding that the two Projects will both produce 30 Mtpa of thermal coal; and
- The speed of the train inside the Kevin’s Corner mining lease boundary (MLA 70425) is 40 km/h, as opposed to 80 km/h used by GHD.

The resultant predicted rail noise levels at the receptors due to the Kevin’s Corner rail movements are presented in **Table 5-11**, whilst the predicted rail noise levels with consideration to both the Kevin’s Corner and Alpha Coal rail movements are provided in **Table 5-12**.

Table 5-11 Rail Noise Modelling Results – Kevin's Corner Rail Movements Considered

Receptor	Noise Levels - L_{Aeq} dB(A)		Rail CoP $L_{Aeq,24hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	26	31	65	Nil
B: Surbiton Homestead	36	41	65	Nil
C: Eulimbie Homestead	51	56	65	Nil
D: Surbiton South Station	31	35	65	Nil
E: Speculation Homestead	< 10	< 10	65	Nil
F: KC Accommodation Village	40	46	65	Nil
G: ACP Accommodation Village.	26	31	65	Nil

Table 5-12 Rail Noise Modelling Results – Kevin's Corner and Alpha Coal Rail Movements Considered

Receptor	Noise Levels - L_{Aeq} dB(A)		Rail CoP $L_{Aeq,24hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	28	32	65	Nil
B: Surbiton Homestead	39	43	65	Nil
C: Eulimbie Homestead	54	59	65	Nil
D: Surbiton South Station	38	43	65	Nil
E: Speculation Homestead	< 10	< 10	65	Nil
F: KC Accommodation Village	41	46	65	Nil
G: ACP Accommodation Village.	38	43	65	Nil

The results presented in **Table 5-11** indicate that the $L_{Aeq,\ 24\ hour}$ 65 dB(A) rail noise criterion would be satisfied at all the identified receptor locations. The highest rail noise levels are predicted at Location C (Eulimbie Homestead), this receptor being the closest to the rail line, set back from the line by approximately 1,600 m and from the mine site by approximately 16 km.

The GHD rail noise predictions indicate the train noise L_{Amax} levels would approximately be 15 dB(A) higher than the L_{Aeq} level. Based on this margin, it would be expected that L_{Amax} noise criterion of 87 dB(A) would be readily achieved at all the identified receptors.

Sleep Disturbance

Whilst the GHD and URS assessments predict compliant L_{Amax} noise levels at the sensitive receptors locations, it is noted that for some receptors, these levels are high enough potentially to give rise to sleep disturbance based on the recommendation of the WHO, 1999 and the EPP (Noise), 2008.

Rail Vibration

Given the setback distance to nearest sensitive receptors (A-G), no adverse community reaction due to operational vibration impacts would be expected. The GHD assessment additionally notes that ‘*recent vibration testing of coal trains in the Hunter Valley have indicated there is low probability of adverse comment for human comfort for receptors located more than 40 metres from the rail line*’.

5.10.2 Construction Phase

The construction of the rail spur will be transient in nature and any potential noise impacts would reduce as the rail construction progresses along the route away from receptors. Notwithstanding this, the EPP(Noise) daytime guideline noise level of 50 dB(A) $L_{Aeq,1hr}$ is predicted to be achieved at the identified receptor locations (A-G) during construction of the rail spur for all construction activities.

As previously noted, the EPP(Noise) criteria were developed for the protection of amenity and health and not for the control of construction noise, which is generally regarded as a temporary activity and therefore often afforded greater tolerance.

Construction Vibration

Given the setback distance to the nearest sensitive receptors from the rail spur, ground vibration levels associated with various items of construction plant would not be expected to be perceptible and therefore no adverse community reaction due to construction vibration impacts would be expected.

Construction Blasting

The GHD assessment notes that blasting may potentially be required for excavations of sections of the rail corridor where hydraulic excavators with hammer attachments are ineffective. It recommends that blasting should only occur between 0900 to 1700 Monday to Friday and 0900 to 1300 Saturday.

The report notes that a MIC of greater than 100 kg should not be required and a charge of 50 kg or less is likely to be appropriate. Estimates of air blast overpressure and ground vibration due to potential blasting are provided based on blasts in the MIC range of 10-100 kg. These are consistent with URS predictions.

With consideration to the maximum anticipated MICs (up to 100 kg), compliance with the Ecoaccess blasting noise and vibration criteria is predicted at all receptors A-G.

5.11 Aircraft Noise Impact Assessment

The determination of aircraft noise levels for the purpose of this assessment has been based on the methodology set out in AS2021-2000 (Part A). The method takes account of the distances (DL and DT) between the landing and take-off ends of the runway and the receptors and also considers set back distances (DS) from the flight path to the receptors.

The standard allows for aircraft noise levels received at receptor locations to be determined based on reference DL, DT and DS distances for various aircraft types. For the purpose of this assessment, a straight flight-path following the direction of the proposed runway has been assumed. Table 5-13 identifies the DL, DT and DS distances applied in this assessment.

Table 5-13 Receptor Setback Distances Based on AS2021-2000 Method

Receptor	DL (m)	DT (m)	DS (m)
Surbiton	296	2602	8634
Eulimbie	3515	5821	6979
Surbiton South	6189	8495	6719
KC Accommodation Village	750	1556	2313

Table 5-14 summarises the noise levels obtained. It is noted that the tables available in AS2021-2000 do not generally consider DS values over 2,300 meters and therefore only approximate noise levels are available for the receptors with DS greater than 2,300 m.

Table 5-14 Predicted Aircraft Noise Levels Based on AS2021-2000

Aircraft Types	Operation	Maximum Noise Levels Predicted at Receptors within 10 Km of Airstrip, dB(A)				Criteria, dB(A)	
		Surbiton *	Eulimbie *	Surbiton South *	Kevin's Corner Accommodation Village	20 or Less Flights per Day	Greater than 20 Flights per Day
Boeing 727	Take off	62	65	64	61	< 80	< 75
	Landing	53	57	58	57	< 80	< 75
Boeing 737-300 Boeing 737-400 Airbus A320	Take off	58	64	66	62	< 80	< 75
	Landing	61	66	66	52	< 80	< 75
Saab 340 Boeing Dash 8 Fokker F50	Take off	51	45	47	51	< 80	< 75
	Landing	44	49	50	43	< 80	< 75
Corporate Jet	Take off	51	51	51	50	< 80	< 75
	Landing	45	45	47	49	< 80	< 75
Typical Light General Aviation Aircraft	Take off	50	48	49	50	< 80	< 75
	Landing	43	48	49	41	< 80	< 75
Notes	* Distances from the extended line of the proposed runway to these receptors are greater than data available in AS2021-2000, therefore noise levels are approximate.						

The predicted aircraft noise levels presented in the table above are all within the acceptable limits set out in AS2021-2000.

Noise levels from smaller light aircraft types will be 50 dB(A) or below. Of the aircraft types considered, the Airbus A320, would provide the highest noise levels, generating external noise levels of up to 66 dB(A) at Eulimbie and Surbiton South and 62 dB(A) at the accommodation village during take-offs.

5.12 Impacts on Fauna

Section 9 of the Environmental Impact Statement (EIS) describes the environmental values identified onsite, in terms of terrestrial flora and fauna, amphibians, reptiles, birds and mammals. In relation to the potential noise and vibration impacts upon these ecological values, the findings of the ecology assessment are as follows:

- An increase in noise, vibration and dust associated with the construction and operational phases of the Project may lead to the displacement of native species from their current home ranges;
- The increase in noise and vibration emissions which would result from construction and operational activities may discourage the Southern Squatter Pigeon (*Geophaps scripta scripta*) and Little Pied Bat (*Chalinolobus picatus*) from utilising the immediate area. These impacts may also affect insect abundance, water quality and reproductive behaviour.
- Indirect impacts upon breeding and feeding activities due to noise and vibration disturbance are also possible.
- Whilst no literature on the effects of blasting on tree roosting bat species was found, it is probable that some concussive impacts would occur in nearby roost trees which may lead to short-term displacement of bats from the affected areas. Therefore, the blasting process could potentially impact the Little Pied Bat (*Chalinolobus picatus*) via increased predation, if blasting occurred when avian predators – both raptors and owls – were active; and
- Whilst the effects of blasting and vibration on cave-dwelling bat species are poorly understood, the observations of one study found the noise and vibration from blasting had no apparent impact upon the observed colony.

With reference to noise and vibration, the ecolocical assessment recommends the following management strategies for species of conservational significance:

- Consider undertaking blasting in intensive bursts (over days or weeks rather than every day) so that prolonged impacts upon the Little Pied Bat (*Chalinolobus picatus*) and other potentially vibration and / or noise-sensitive species are minimised.
- If blasting does need to occur on a daily basis, restrict blasting to one or two periods of short duration during the day and avoid periods when avian predators are most active (i.e. when bats are likely to fly out of their roost sites and could be opportunistically attacked).
  - Where possible, consider using earthen banks and / or noise barriers to baffle blasting.
  - Where possible, consider using plant machinery (scraper, D10 bulldozer etc) instead of blasting.

5.13 Summary of Potential Noise and Vibration Impacts

The following provides a summary of the outcomes of the assessment of potential noise impacts:

- Operation:
  - Noise levels generated by the proposed operation are predicted to be within the established noise limits at all existing receptor locations except for at location F (the proposed Kevin's Corner Accommodation Village). At this location exceedances of the criteria by up to 5 dB(A)

during the daytime, 7 dB(A) during the evening and 10 dB(A) during the night-time are anticipated. The key amenity issue for the HGPL Kevin's Corner accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers between shifts. On this basis, achieving the internal noise criteria is considered the principal performance requirement with respect to the acoustic design of the accommodation village. External noise levels of up to 38 dB(A) L_{Aeq} are predicted at this location under adverse meteorological conditions and as such it is expected that the internal noise criteria would be met with windows open during the operational stages. Notwithstanding this, the accommodation would be air conditioned and provided with mechanical ventilation, allowing for windows to be kept closed.

- Construction Noise:
  - Whilst no specific limits exist for the control of construction noise, throughout the mine construction stages no exceedances of the EPP(Noise) daytime, evening and night-time noise limits are predicted at the receptors located outside the mining lease boundary. At the HGPL Kevin's Corner Accommodation Village, exceedances of the EPP(Noise) limits are predicted by up to 9 dB(A) during the daytime, 14 dB(A) during the evening period and 19 dB(A) at night. The key amenity issue for the accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers between shifts. On this basis, achieving the internal noise criteria is considered the principal performance requirement with respect to the acoustic design of the accommodation village.
- Sleep Disturbance:
  - Predicted noise levels are within the sleep disturbance noise limit for all receptors beyond the mining lease boundary. Noise levels that could give rise to sleep disturbance are predicted at the Kevin's Corner Accommodation Village.
- Low Frequency Noise:
  - The proposed operation assessed using the Ecoaccess guideline indicates that low frequency noise would not be at a level to cause annoyance to the closest residential receptors.
- Blasting:
  - No overpressure or ground vibration exceedances are anticipated at any of the identified receptor locations
- Off-Site Traffic Noise;
  - Full compliance with the Department of Main Roads' Road Traffic Noise Management CoP criteria is predicted for all construction and operational stages. Due to the relative increase in vehicle volumes, however, noticeably increased noise levels are likely to be perceived by the most affected receptors.
- Rail Noise:
  - URS concurs with the general findings of the rail noise and vibration assessment carried out by GHD. Full compliance with the Queensland Rail's CoP is predicted at all identified receptors. No construction noise or vibration impacts on the identified receptors are predicted.
- Aircraft Noise
  - Predicted aircraft noise levels are within the acceptable limits set out in AS2021-2000.

Noise Mitigation Measures

6.1 Construction and Operational Noise

Accommodation Village Building Design Requirements

In order to ensure satisfactory internal noise limits are achieved within the accommodation village sleeping quarters, windows should be specified to achieve 30 dB(A) in noise attenuation. Additionally, all windows and doors must be fitted with high quality compression seals capable of achieving an air-tight seal.

Mechanical ventilation will be required within the sleeping areas of the accommodation village as satisfactory internal noise levels may not be maintained throughout the construction stages with windows open. All air conditioning and/or mechanical ventilation systems provided within the sleeping areas should be designed to achieve a noise level of no more than L_{Aeq} 30 dB(A) at 1 m from any diffuser.

Incorporation of these recommended noise control measures will ensure satisfactory internal noise levels of $L_{Aeq,24\ hours}$ 35 dB(A) in sleeping areas with windows closed. These levels are within the maximum recommended internal levels identified by AS/NZS 2107:2000.

Northern Underground Mine Ventilation System Design Recommendations

Whilst not a requirement for compliance, the noise contribution from the northern underground mine ventilation system can be effectively reduced at the Forrester location by re-orientating the discharge stacks so that the discharge is directed horizontally to the south, away from Forrester. Modelling indicates that this would be expected to reduce the ventilation equipment's relative noise contribution by up to some 5 dB and the cumulative L_{A90} noise level by some 3 dB at Location A.

It is understood that this measure could be implemented with relative ease and therefore it is recommended.

Operational Design Recommendations

In addition to the specific physical construction and operational noise mitigation measures identified above, the following noise management strategies are recommended, which would further reduce the potential for noise issues during the proposed construction and operation periods:

- Where practicable carrying out all construction works using noisiest equipment or plant items within the day-time period;
- Scheduling construction to minimise multiple use of the noisiest equipment or plant items where practicable;
- Strategic positioning of plant items and maintenance work areas to reduce the noise emission to noise sensitive receptors, where possible;
- Ensuring machinery engine covers are closed, equipment is well maintained and silencers/mufflers are used. Maintenance for major items of construction equipment that are significant contributors to construction noise levels;
- Awareness training for staff and contractors in environmental noise issues including:
  - Minimising the use of horn signals and maintaining to a low volume. Alternative methods of communication should be considered;

  - Avoiding any unnecessary noise when carrying out manual operations and when operating plant; and
  - Switching off any equipment not in use for extended periods during construction work;
- Restricting heavy vehicles' entry to site and departure from site to the nominated construction hours;
- Community consultation with local residents and building owners to assist in the alleviation of community concerns. Previous experience on similar projects has demonstrated that affected noise sensitive receptors may be willing to endure higher construction noise levels for a shorter duration if they have been provided with sufficient warning in the place of intermittent but extended periods of construction noise at lower levels; and
- Maintaining a suitable complaints register. Should noise complaints be received, undertake noise monitoring at the locations concerned. Reasonable and feasible measures would need to be implemented to reduce noise impacts.

6.2 Blasting

It is recommended that a Blasting Management Plan (BMP) be prepared which should include a monitoring program. This should be made available to the relevant authority as required.

Prior to any blasting, it is recommended that building condition surveys at all potentially impacted dwellings are carried out and repeated at completion of works.

It is recommended that the following are considered and documented in the BMP:

- Restricted blasting times (between 0900-1700 recommended);
- Blast design including direction and detonation and designing the detonation sequence with delays between holes so that the blast waves from individual holes do not arrive simultaneously at a residence;
- Avoiding blasting during adverse weather conditions;
- Orientation of the blast face and directing energy away from sensitive sites;
- Maximum Instantaneous Charge;
- Dimensions of the blast – spacing between holes, distance from the free face to the first row of holes, distance between rows of holes; and
- Type and depth of stemming.

If required, overpressure noise and ground vibration levels due to blasting may be reduced by:

- Reducing the MIC by using delays, reduced hole diameter and/or deck loading;
- Changing the burden and spacing by altering the drilling pattern and/or delay layout, or altering the hole inclination;
- Exercising strict control over spacing and orienting of all blast drill holes;
- Using minimum practicable sub-drilling which gives satisfactory toe conditions; and
- Using alternative rock breaking techniques where practicable.

6.3 Off-Site Road Traffic

Specific noise mitigation measures are not considered necessary to control off-site road noise. However, the following noise management strategies can be applied, which would further reduce the potential for noise issues during the proposed construction and operation periods:

6 Noise Mitigation Measures

- Ensuring all road going heavy vehicles are properly maintained;
- Restricting heavy vehicles' entry to site and departure from site to the nominated construction hours;
- Awareness training for staff and contractors in environmental noise issues including:
  - Minimising the use of horn signals and maintaining to a low volume; and
  - Avoiding any unnecessary vehicle noise such as that caused by the application of engine brakes in the vicinity of homestead locations.
- Community consultation with local residents and building owners to assist in the alleviation of community concerns; and
- Maintaining a suitable complaints register. Should noise complaints be received, investigate at the locations concerned.

Conclusions

Hancock Galilee Pty Ltd (HGPL) proposes to develop the Kevin's Corner Project, a 30 Mtpa combined underground and opencut thermal coal mine in the Galilee Basin of Queensland, Australia.

The initial mine life is 30 years, with the Project construction planned to commence in 2012 and the first coal to be produced in 2014.

URS Australia Pty Ltd (URS) has completed a noise and vibration impact assessment for the proposed coal mine project, considering the mine infrastructure construction phase, the 30-year operation of the mine, blasting, operational rail movements, off-site traffic movements and aircraft movements.

The nearest potentially affected sensitive receptor locations have been identified, including an on-site accommodation village proposed by HGPL. The assessment of potential noise impacts of the proposed construction and operation of the mine, on surrounding noise sensitive receptor locations, has been carried out in accordance with relevant Queensland EPA and WHO noise guidelines. Throughout the assessment, 'worst-case' construction and operational conditions have been considered, assuming for each construction and operational stage that all plant equipment is continuously and simultaneously operational on a 24 hour per day, 7 days per week basis.

Noise modelling indicates that the proposed operational and construction activities would comply with the established noise limit criteria at the off-site receptor locations without the requirement for any specific noise mitigation measures. Of the existing residential receptors, Location A (Forrester Homestead) is predicted to be exposed to the highest general operational noise levels from the site, with northern underground mine's ventilation equipment controlling the predicted background noise level at this location. Modelling indicates that the noise contribution from the northern underground mine ventilation system can be effectively reduced at the Forrester location by re-orientating the discharge stacks so that the discharge is directed horizontally to the south, away from Forrester. As it is understood that this measure may be readily implemented, it is recommended.

Specific noise mitigation measures are not deemed necessary to control operational or construction noise at the existing receptor locations as full compliance with the respective criteria is indicated. Notwithstanding measures to effectively reduce construction and operational noise from the site have been provided.

The key amenity issue for the on-site accommodation village is sleep protection as limited external activity is expected and its primary function is to provide sleeping facilities for mine workers between shifts. Acoustic design requirements have been provided for the accommodation village, in order to ensure satisfactory internal noise limits and sleep disturbance criteria are achieved within the sleeping areas.

At all receptor locations, with the adoption of suitable blasting controls, compliance with the relevant blasting noise and vibration control guidelines is predicted.

The predicted increase in off-site road traffic volume due to the proposed construction and operation is significant. Whilst full compliance with the relevant road traffic noise criteria is predicted during all construction and operational stages, noticeably increased noise levels are likely to be perceived by the most affected receptors.

Full compliance with the nominated rail noise and vibration criteria is predicted at all receptor locations and predicted aircraft noise levels are within the acceptable limits set out in AS2021-2000.

7 Conclusions

On the basis of this assessment, it is concluded that with the incorporation of the identified mitigation measures, noise impacts from construction activities and operation of the proposed mine are not expected to significantly degrade the existing acoustic environment nor create undue annoyance to the indentified sensitive receptors.

It is recommended that a number of good practice construction and operational noise control measures are adopted to minimise noise emissions from the mine site.

The predicted noise levels should be verified periodically during the mine's development, and in the unlikely event of any significant discrepancies from this assessment, there is scope to provide additional noise control measures.

References

- Terms of Reference for an environmental impact statement, Alpha Coal Project (Coordinator General, June 2009)
- Environment Protection Act 1994 (Queensland);
- Environmental Protection and Other Legislation Amendment Act (No. 2) 2008 (Queensland);
- Environment Protection (Noise) Policy 2008 (Queensland);
- Ecoaccess Guideline: Planning For Noise Control (Queensland EPA, 2004);
- Ecoaccess Guideline: Noise and Vibration from Blasting (Queensland EPA, 2006);
- Ecoaccess Guideline: Assessment of Low Frequency Noise ((Queensland EPA, 2004);
- World Health Organisation Guidelines for Community Noise, 1999;
- Australian/New Zealand Standard AS/NZS 2107-2000, Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors;
- New Zealand Standard NZS 6803:1999 Acoustics – Construction Noise;
- Australian Standard AS 3671-1989: Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction;
- Australian Standards AS1055.1 and AS1055.2, 1997. Description and Measurement of Environment Noise;
- Australian Standard AS 2187.2-2006: Explosives – Storage and Use, part 2, Use of Explosives;
- British Standard BS7385, part 2, 1993 - Evaluation and Measurement for Vibration in Buildings, Guide to Damage Levels from Ground-borne Vibration;
- Road Traffic Noise Management: Code of Practice (Department of Main Roads, 2007);
- Queensland Rail Code of Practice for Railway Noise Management, Interest in Planning Schemes No. 3 (Queensland Transport), November, 2007;
- British Standard BS6472, Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80 Hz), 1992;
- The Health Effects of Environmental Noise – other than hearing loss (enHealth Council, 2004); and
- The propagation of noise from petroleum and petrochemical complexes to neighbouring communities (Conservation of Clean Air and Water in Europe (CONCAWE), 1981).
- ISO 9613-1: Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere; and
- Caval Ridge Mine Project, Construction and Operational Noise and Vibration Impact Assessment (Heggies REPORT 20-2028-R2, Revision 3, May 2008);
- Ensham Central Project, Environmental Noise Impact Assessment (Bassett Acoustics, April 2006).

Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Hancock Galilee Pty Ltd (HGPL) and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated May 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between January to April 2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A Glossary of Acoustical Terminology

A wide range of acoustic parameters and technical terms are used in this report. To assist in understanding the technical contents, a brief description of the acoustic terms is provided in this section.

Typical Noise Levels: Compared to the static air pressure (10^5 Pa), the audible sound pressure variations are very small ranging from about 20 μPa ($20x10^{-6}$ Pa), which is called “threshold of hearing” to 100 Pa. A sound pressure of approximately 100 Pa is so loud that it causes pain and is therefore called “threshold of pain”.

dB (Decibel): A unit of sound level measurement. The human ear responds to sound logarithmically rather than linearly, so it is convenient to deal in logarithmic units in expressing sound levels. To avoid a scale which is too compressed, a factor of 10 is introduced, giving rise to the decibel. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Perception of Sound: The number of sound pressure variation per second is called the frequency of sound, and is measured in Hertz (Hz). The normal hearing for a healthy young person ranges from approximately 20 Hz to 20 kHz. In terms of sound pressure levels, audible sound ranges from the threshold of hearing at 0 dB to the threshold of pain at 130 dB and over. A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to small but noticeable change in loudness. An increase of about 8 – 10 dB is required before the sound subjectively appears to be significantly louder.

Sound Pressure (SPL): Sound pressure is the measure of the level or loudness of sound. Like sound power level, it is measured in logarithmic units. The symbol used for sound pressure level is SPL, and it is generally specified in dB. 0 dB is taken as the threshold of human hearing.

Table A-1 Sound Pressure Levels of Some Common Sources

Sound Pressure Level (dB)	Sound Source	Typical Subjective Description
140	Propeller aircraft; artillery fire, gunner’s position	Intolerable
120	Riveter; rock concert, close to speakers; ship’s engine room	
110	Grinding; sawing	
100	Punch press and wood planers, at operator’s position; pneumatic hammer or drilling (at 2 m)	Very noisy
80	Kerbside of busy highway; shouting; Loud radio or TV	Noisy
70	Kerbside of busy traffic	
60	Department store, restaurant, conversational speech	
50	General office	Moderate
40	Private office; Quiet residential area	Quiet
30	Unoccupied theatre; quiet bedroom at night	
20	Unoccupied recording studio; Leaves rustling	Very quiet
10	Hearing threshold, good ears at frequency of maximum sensitivity	
0	Hearing threshold, excellent ears at frequency maximum response	

Appendix A

Sound Power (SWL): Sound power is the energy radiated from a sound source. This power is essentially independent of the surroundings, while the sound pressure depends on the surroundings (e.g. reflecting surfaces) and distance to the receptor. If the sound power is known, the sound pressure at a point can be calculated. Sound power is also measured in logarithmic units, 0 dB sound power level corresponding to 1 pW (10^{-12} W). The symbol used for sound power level is SWL or Lw, and it is specified in dB.

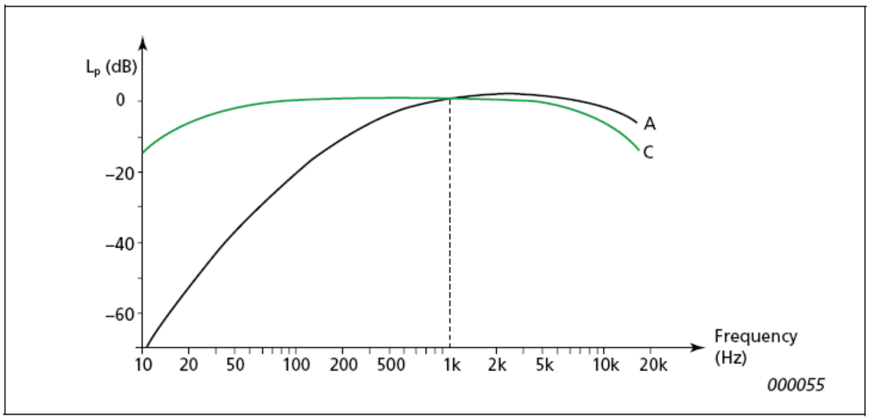
Frequency: Frequency is synonymous to pitch and is measured in units of Hz.

Frequency Spectrum: In environmental noise investigations, it is often found that the single-number indices, such as L_{Aeq}, do not fully represent the characteristics of the noise. If the source generates noise with distinct frequency components, then it is useful to measure the frequency content in octave or one-third octave frequency bands. For calculating noise levels, octave spectra are often used to account for the frequency characteristics of propagation.

"A" Frequency Weighting: The method of frequency weighting the electrical signal with a noise measuring instrument to simulate the way the human ear responds to a range of acoustic frequencies. It is based on the 40 dB equal loudness contour. The symbols for the noise parameters often include the letter "A" (e.g. L_{Aeq}) to indicate that frequency weighting has been included in the measurement. See the graph below.

"C" Frequency Weighting: The response of the human ear varies with the sound level. At higher levels, 100 dB and above, the ear's response is flatter, as shown in the C-Weighted Response below.

Although the A-Weighted response is used for most applications, C-Weighting is also available on many sound level meters. C-Weighting is usually used for Peak measurements and also in some industrial and entertainment noise measurement, where the transmission of low frequency noise can be a problem. C-weighted measurements are expressed as dBC or dB(C).



***"Z"* Frequency Weighting:** Z or Zero frequency-weighting was introduced in 2003 with the intent of replacing the "Flat" or "Linear" frequency weighting, in order to standardise previously arbitrary low and high frequency filter characteristics (roll-offs) in measuring instruments. The Z weighting is preferred when peak sound levels are measured and the C-frequency-weighting, (with –3dB points at 31.5Hz and 8 kHz) does not provide a sufficient bandpass to allow the accurate measurement of true peak noise (Lpk).

Adverse Weather: Weather effects (wind and temperature inversions) that enhance noise. The prescribed conditions are for wind occurring more than 30 % of the time in any assessment period in any season and/or for temperature inversions occurring more than 30 % of the nights in winter.

Assessment Period: The period in a day over which assessments are made: day (7.00 am – 6.00 pm, Monday to Saturday; or 8.00 am – 6.00 pm on Sundays and public holidays), evening (6.00 pm – 10.00 pm, all days) or night (10.00 pm – 7.00 am, Monday to Saturday; or 10.00 pm – 8.00 am on Sundays and public holidays).

Ambient Noise: The all-encompassing sound at a site comprising all sources such as industry, traffic, domestic, and natural noises. This is represented as the L_{Aeq} noise level in environmental noise assessment. (See also L_{Aeq})

Background Noise: Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is measured statistically as the A-weighted noise level exceed for ninety per cent of a sample period. This is represented as the L_{A90} noise level (See also L_{A90}).

Free Field: An environment in which a sound wave may propagate in all directions without obstructions or reflections. Free field noise measurements are carried out outdoors at least 3.5 m from any acoustic reflecting structures other than the ground.

Extraneous Noise: Noise resulting from activities that are not typical of the area. Untypical 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.

Impulsive Noise: Noise having a high peak of short duration or a sequence of such peaks. Noise from impacts or explosions, e.g., from a pile driver, punch press or gunshot, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of the sound pressure level.

Intermittent Noise: Noise with a level that abruptly drops to the level of or below the background noise several times during the period of observation. The time during which the level remains at a constant value different from that of the ambient being of the order of 1 s or more.

Meteorological Conditions/Effects: Wind and temperature inversion conditions.

Noise Barrier: Solid walls or partitions, solid fences, earth mounds, earth berms, buildings. Etc used to reduce noise without eliminating it.

Temperature Inversion: An atmospheric condition in which temperature increases with height above the ground.

Tonality: Noise containing a prominent frequency and characterised by a definite pitch.

L_{Aeq}: A-weighted equivalent continuous noise level. This parameter is widely used and is the constant level of noise that would have the same energy content as the varying noise signal being measured. The letter “A” denotes that the A-weighting has been included and “eq” indicates that an equivalent level has been calculated. This is referred to as the ambient noise level. (See Ambient Noise)

L_{A90}: The A-weighted sound pressure level which is exceeded for 90 % of the measurement period. It is determined by calculating the 90^{th} percentile (lowest 10 %) noise level of the period. This is referred to as the background noise level. (See Background Noise)

Appendix A

L_{A10}: The A-weighted sound pressure level which is exceeded for 10 % of the measurement period.

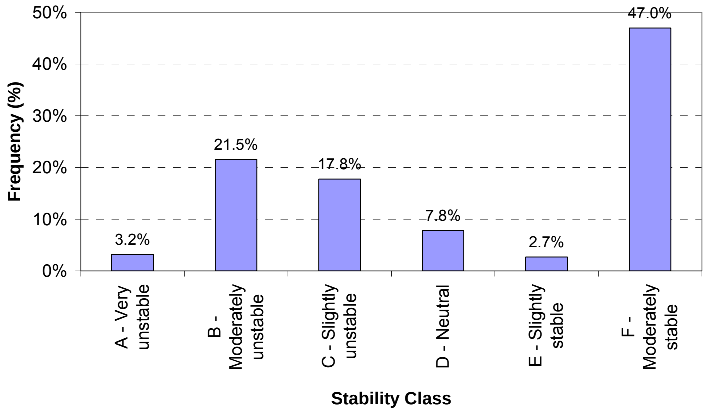
L_{A1}: The A-weighted sound pressure level which is exceeded for 1 % of the measurement period.

L_{Amax}: The A-weighted maximum Root Mean Square (RMS) sound pressure level measured during the sample period.

L_{LF}: Low frequency noise level in the frequency range 20 Hz to 200 Hz.

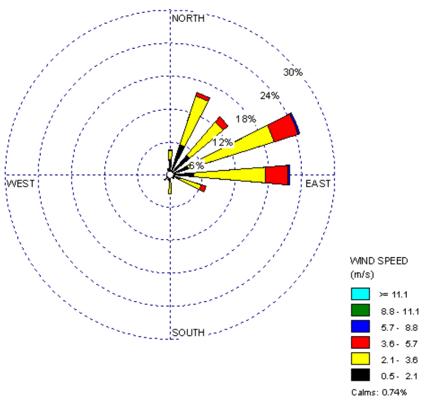
Appendix B Analysis of Meteorological Data

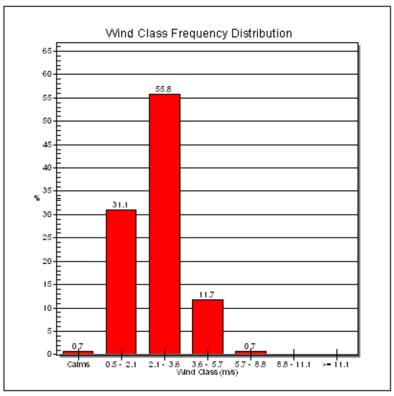
CALMET Stability Categories



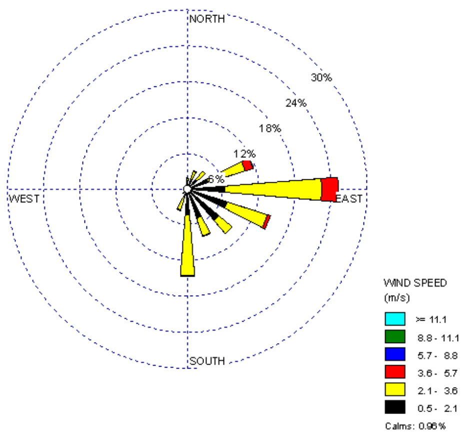
Wind Rose based on CALMET modelling

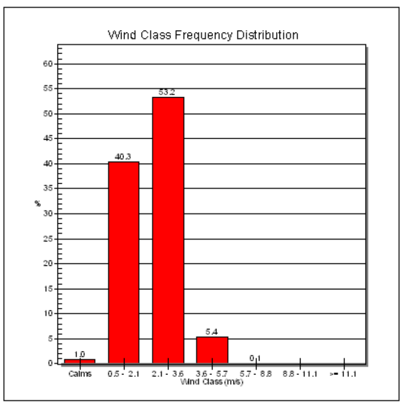
Summer (December – February)





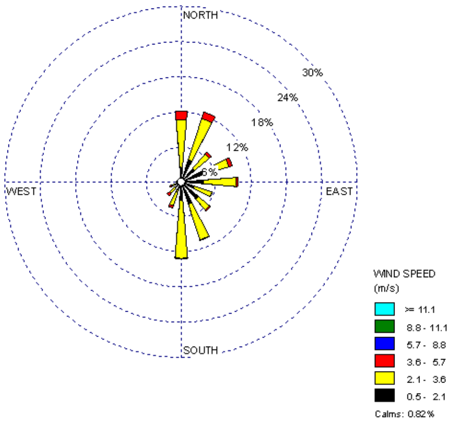
Autumn (March – May)

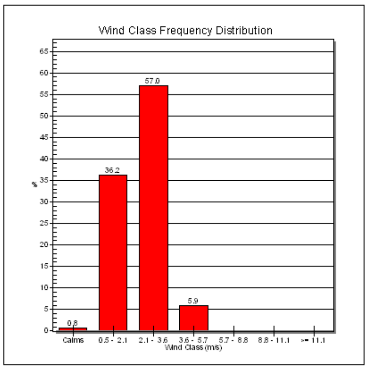




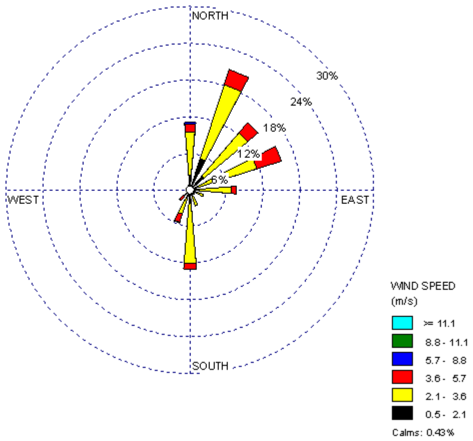
Appendix B

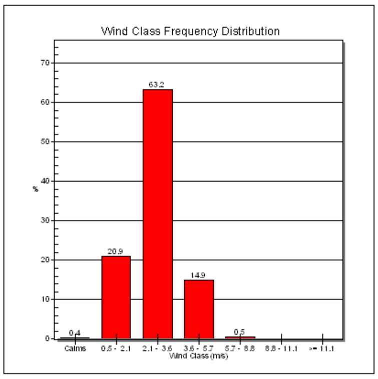
Winter (June – August)



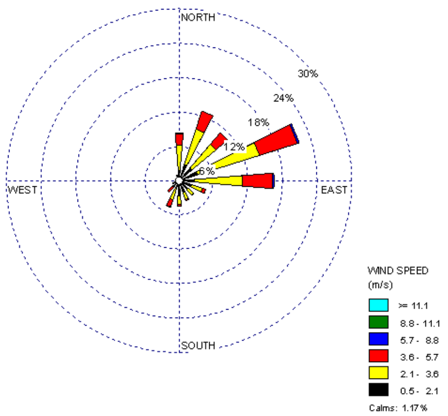


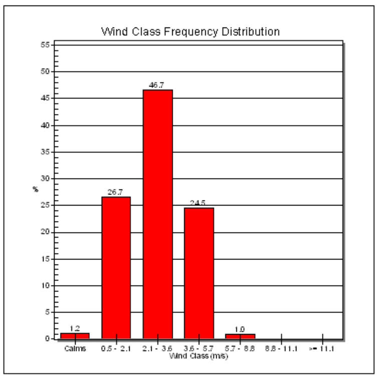
Spring (September – November)



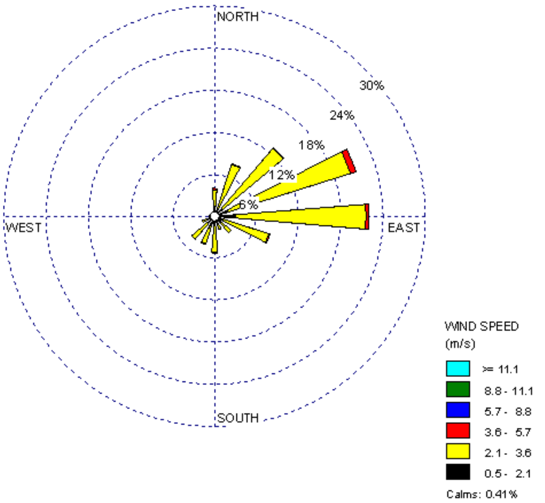


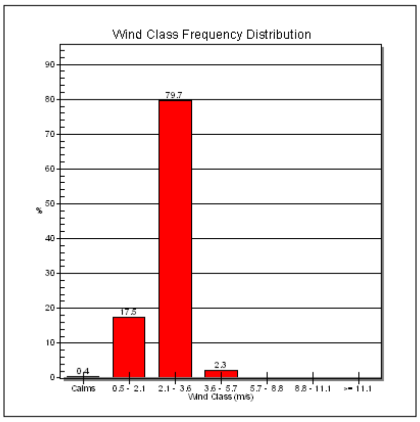
Daytime (0700 – 1800)



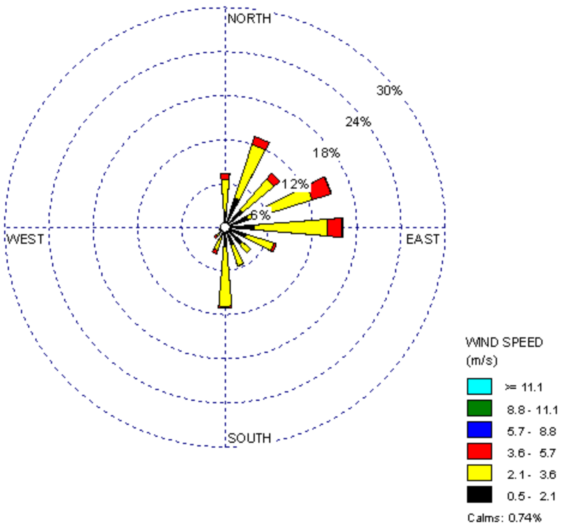


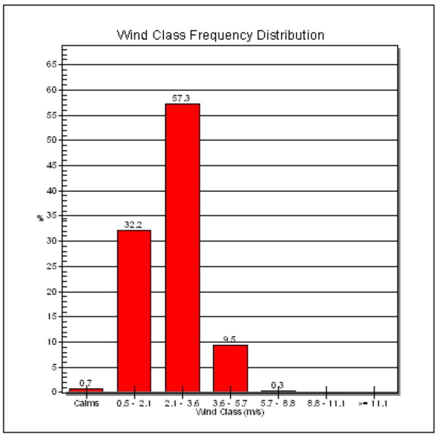
Evening (1800 – 2200)





Night-time (2200 – 0700)





C

Appendix C Detailed Schedules of Equipment

Detailed List of Equipment and Schedule: Operations

	Type of Equipment	Scenario:	1	2	3	4	5	6	7	8	9
		Height (m)	**2014**	**2015**	**2016**	**2017**	**2018**	**2023**	**2028**	**2033**	**2042**
Major Equipment	Marion BE8200R Dragline 120m3	10	-	-	-	-	-	2	2	2	2
	Marion BE495HR Rope Shovel 110t	6	-	-	-	-	-	-	-	1	1
	Liebherr R9800 Excavator 800t	8	1	1	1	1	1	1	1	1	1
	Liebherr R996B Excavator 650t	8	3	3	3	3	3	-	-	-	1
	Liebherr R9350 Excavator 320t	8	4	4	4	4	3	2	2	2	2
	Cat 994D High Lift FEL Loader	3	1	1	1	1	1	1	1	1	1
	Liebherr T282C Dump Truck 360t	3	13	13	13	13	13	5	5	9	13
	Cat 789C Dump Truck 190t	3	8	8	8	8	8	4	4	4	3
	Cat 789C_WT Water Truck 190t	3	5	5	5	5	4	3	3	3	3
	Cat D11T Dozer	2	6	5	4	4	4	2	2	2	3
	Cat D11T_DL Dozer for Dragline assist	2	-	-	-	-	-	2	2	2	2
	Cat D11T_CHPP Dozer for CHPP	2	-	1	1	1	1	1	1	1	1
	Cat D10T Dozer	2	5	5	6	6	5	4	4	4	4
	Cat 24M Grader	1	5	6	5	5	5	3	3	3	4
	Drill SKS Blast Hole 86k	1	-	-	1	1	1	1	1	1	1
	Drill SKF Blast Hole 60k	1	1	2	2	2	2	2	2	2	2
	Kress 200-II COAL HAULERS	3	4	10	10	10	10	6	6	7	9
		Total Units - Major Equipment :	*56*	*64*	*64*	*64*	*61*	*39*	*39*	*45*	*53*
Minor Equipment	Compressors	1	4	4	4	4	4	4	4	4	4
	Lighting Plant (Generators)	1	2	2	2	2	2	2	2	2	2
	Low Loader 150t	1	1	1	1	1	1	1	1	1	1
	Cranes	5	2	2	2	2	2	2	2	2	2
	Trucks	2	3	3	3	3	3	3	3	3	3
	Forklifts	1	2	2	2	2	2	2	2	2	2
	Light Vehicles	1	27	27	27	27	27	27	27	27	27
		Total Units - Minor Equipment :	*41*								

Appendix D Noise Modelling Results

Predicted Operational Noise Levels ($L_{Aeq,1hour}$)

Table D-2 Operational Noise - Scenario 1 – 2014

Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	24	28	28	Nil
B: Surbiton Homestead	20	24	28	Nil
C: Eulimbie Homestead	12	16	28	Nil
D: Surbiton South Station	14	18	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	16	20	28	Nil

Table D-3 Operational Noise - Scenario 2 – 2015

Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	24	28	28	Nil
B: Surbiton Homestead	20	24	28	Nil
C: Eulimbie Homestead	12	16	28	Nil
D: Surbiton South Station	15	19	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	17	20	28	Nil

Table D-4 Operational Noise - Scenario 3 – 2016

Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	24	28	28	Nil
B: Surbiton Homestead	20	24	28	Nil
C: Eulimbie Homestead	12	16	28	Nil
D: Surbiton South Station	15	19	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	17	21	28	Nil

Appendix D

Table D-5 Operational Noise - Scenario 4 – 2017

Receptor	Noise Levels – L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	23	28	28	Nil
B: Surbiton Homestead	20	24	28	Nil
C: Eulimbie Homestead	12	16	28	Nil
D: Surbiton South Station	15	19	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	17	20	28	Nil

Table D-6 Operational Noise - Scenario 5 – 2018

Receptor	Noise Levels – L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	23	27	28	Nil
B: Surbiton Homestead	20	24	28	Nil
C: Eulimbie Homestead	11	15	28	Nil
D: Surbiton South Station	15	19	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	18	22	28	Nil

Table D-7 Operational Noise - Scenario 6 – 2023

22Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	22	27	28	Nil
B: Surbiton Homestead	20	23	28	Nil
C: Eulimbie Homestead	11	15	28	Nil
D: Surbiton South Station	13	17	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	16	19	28	Nil

Table D-8 Operational Noise - Scenario 7 – 2028

Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	21	25	28	Nil
B: Surbiton Homestead	19	23	28	Nil
C: Eulimbie Homestead	11	15	28	Nil
D: Surbiton South Station	13	17	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	14	18	28	Nil

Table D-9 Operational Noise - Scenario 8 – 2033

Receptor	Noise Levels – L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	21	25	28	Nil
B: Surbiton Homestead	19	23	28	Nil
C: Eulimbie Homestead	11	15	28	Nil
D: Surbiton South Station	14	18	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	15	19	28	Nil

Table D-10 Operational Noise - Scenario 9 – 2042

Receptor	Noise Levels – L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	22	26	28	Nil
B: Surbiton Homestead	19	22	28	Nil
C: Eulimbie Homestead	10	14	28	Nil
D: Surbiton South Station	15	19	28	Nil
E: Speculation Homestead	< 10	< 10	28	Nil
F: KC Accommodation Village	33	38	28	10
G: ACP Accommodation Village	16	20	28	Nil

Appendix D

Predicted Operational Background Noise ($L_{A90,1hour}$)

Table D-11 Operational Background Noise - Scenario 1 – 2014

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	19	23	25	Nil
B: Surbiton Homestead	13	17	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	12	16	25	Nil

Table D-12 Operational Background Noise - Scenario 2 – 2015

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	19	23	25	Nil
B: Surbiton Homestead	13	17	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	12	16	25	Nil

Table D-13 Operational Background Noise - Scenario 3 – 2016

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	19	24	25	Nil
B: Surbiton Homestead	14	17	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	12	16	25	Nil

Table D-14 Operational Background Noise - Scenario 4 – 2017

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	19	24	25	Nil
B: Surbiton Homestead	14	17	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	12	16	25	Nil

Table D-15 Operational Background Noise - Scenario 5 – 2018

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	19	24	25	Nil
B: Surbiton Homestead	14	17	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	12	16	25	Nil

Table D-16 Operational Background Noise - Scenario 6 – 2023

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	19	24	25	Nil
B: Surbiton Homestead	14	17	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	12	16	25	Nil

Appendix D

Table D-17 Operational Background Noise - Scenario 7 – 2028

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	17	22	25	Nil
B: Surbiton Homestead	12	16	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	7	11	25	Nil

Table D-18 Operational Background Noise - Scenario 8 – 2033

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	17	22	25	Nil
B: Surbiton Homestead	12	16	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	7	11	25	Nil

Table D-19 Operational Background Noise - Scenario 9 – 2042

Receptor	Noise Levels - L_{A90} dB(A)		Night-Time L_{A90} dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	17	22	25	Nil
B: Surbiton Homestead	12	16	25	Nil
C: Eulimbie Homestead	2	5	25	Nil
D: Surbiton South Station	2	5	25	Nil
E: Speculation Homestead	< 10	< 10	25	Nil
F: KC Accommodation Village	23	28	25	3
G: ACP Accommodation Village	7	11	25	Nil

Predicted Construction Noise Levels

Table D-20 Construction Noise - Scenario 0 - 2013

Receptor	Noise Levels – L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	14	19	40	Nil
B: Surbiton Homestead	15	20	40	Nil
C: Eulimbie Homestead	13	18	40	Nil
D: Surbiton South Station	13	18	40	Nil
E: Speculation Homestead	< 10	< 10	40	Nil
F: KC Accommodation Village	55	59	40	19
G: ACP Accommodation Village	10	14	40	Nil

Table D-21 Construction Noise – Scenario 1 - 2014

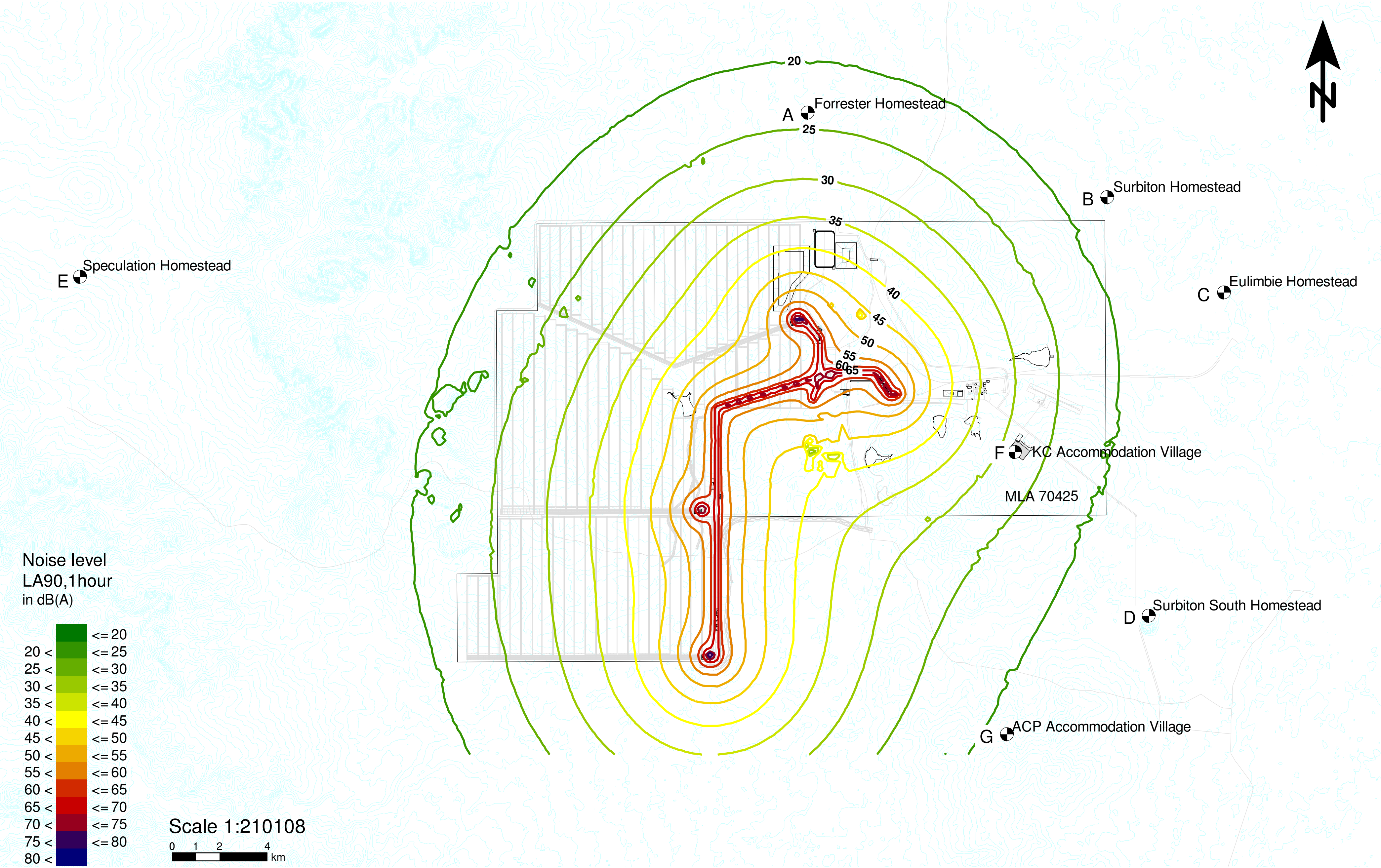
Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	14	19	40	Nil
B: Surbiton Homestead	15	20	40	Nil
C: Eulimbie Homestead	13	18	40	Nil
D: Surbiton South Station	13	18	40	Nil
E: Speculation Homestead	< 10	< 10	40	Nil
F: KC Accommodation Village	54	59	40	19
G: ACP Accommodation Village	10	14	40	Nil

Table D-22 Construction Noise - Scenario 2 - 2015

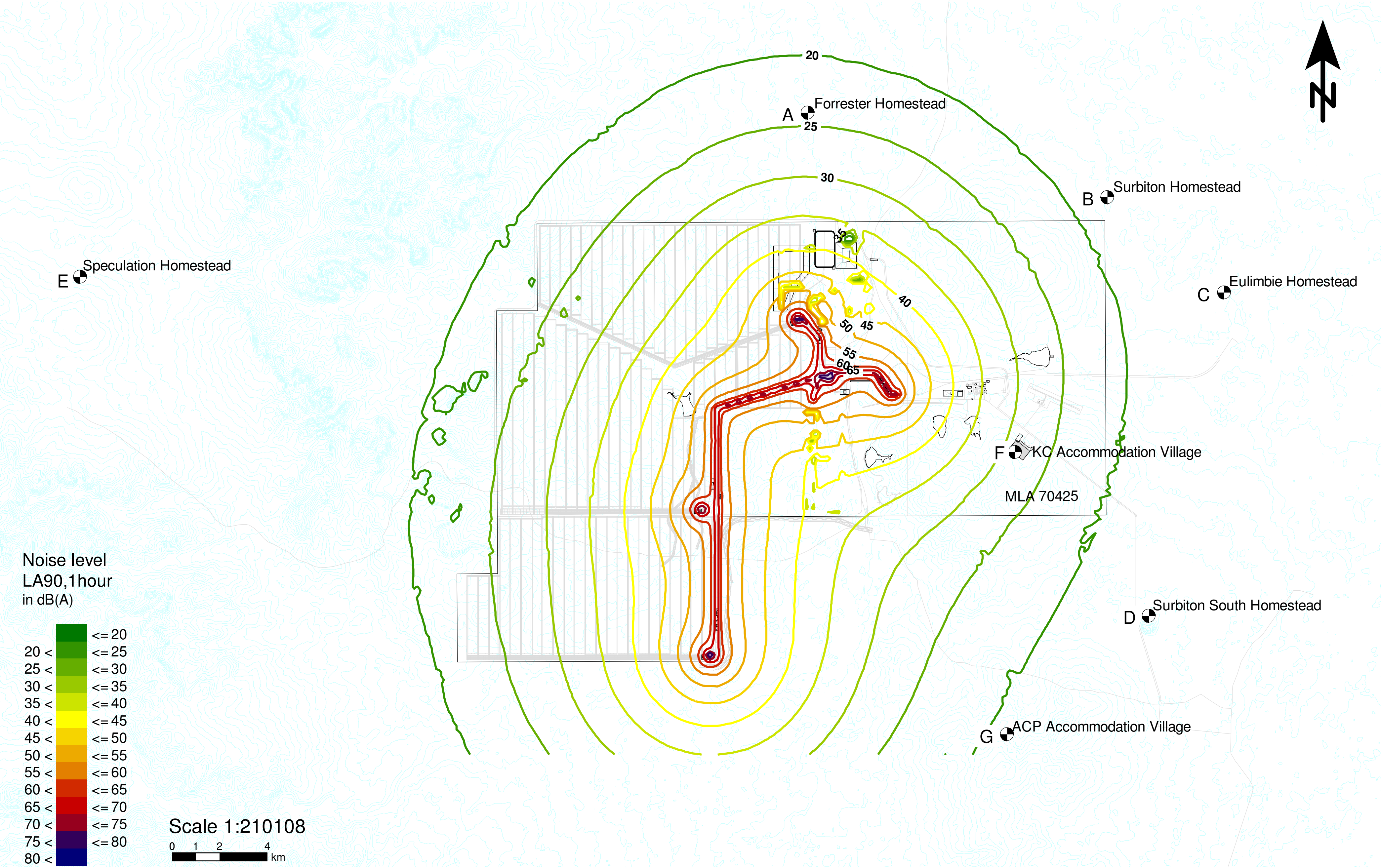
Receptor	Noise Levels - L_{Aeq} dB(A)		Night-Time $L_{Aeq,1hour}$ dB(A) Criterion	Exceedance
	Neutral Weather	Adverse Weather		
A: Forrester Homestead	15	19	40	Nil
B: Surbiton Homestead	13	18	40	Nil
C: Eulimbie Homestead	10	15	40	Nil
D: Surbiton South Station	11	15	40	Nil
E: Speculation Homestead	< 10	< 10	40	Nil
F: KC Accommodation Village	55	59	40	19
G: ACP Accommodation Village	< 10	12	40	Nil

Appendix E Noise Contours

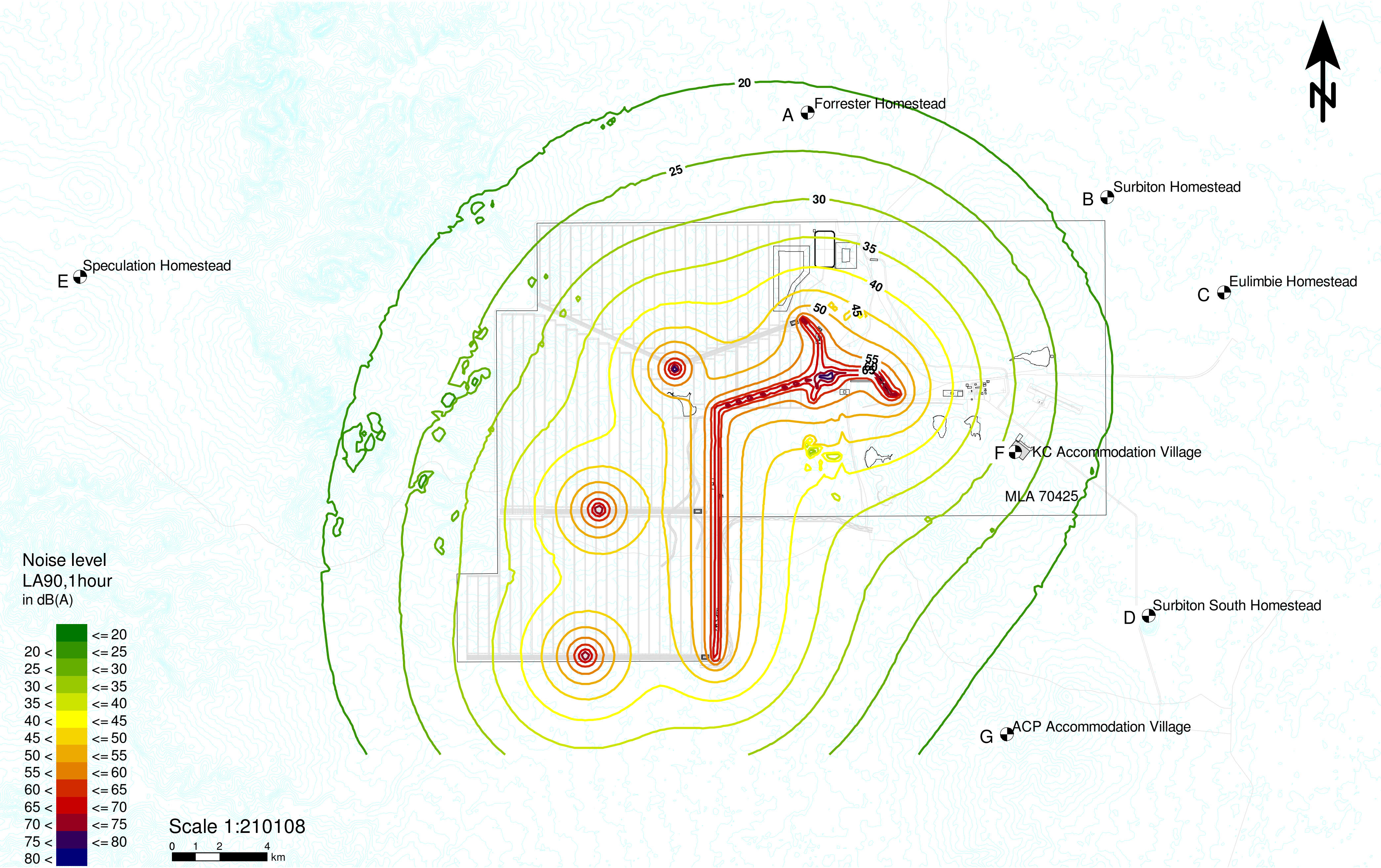
Kevin's Corner Project - Operational Background Noise Contours $L_{A90,\ 1hour}$
Scenario 1 to 2 (2014-2015): Adverse Weather Conditions



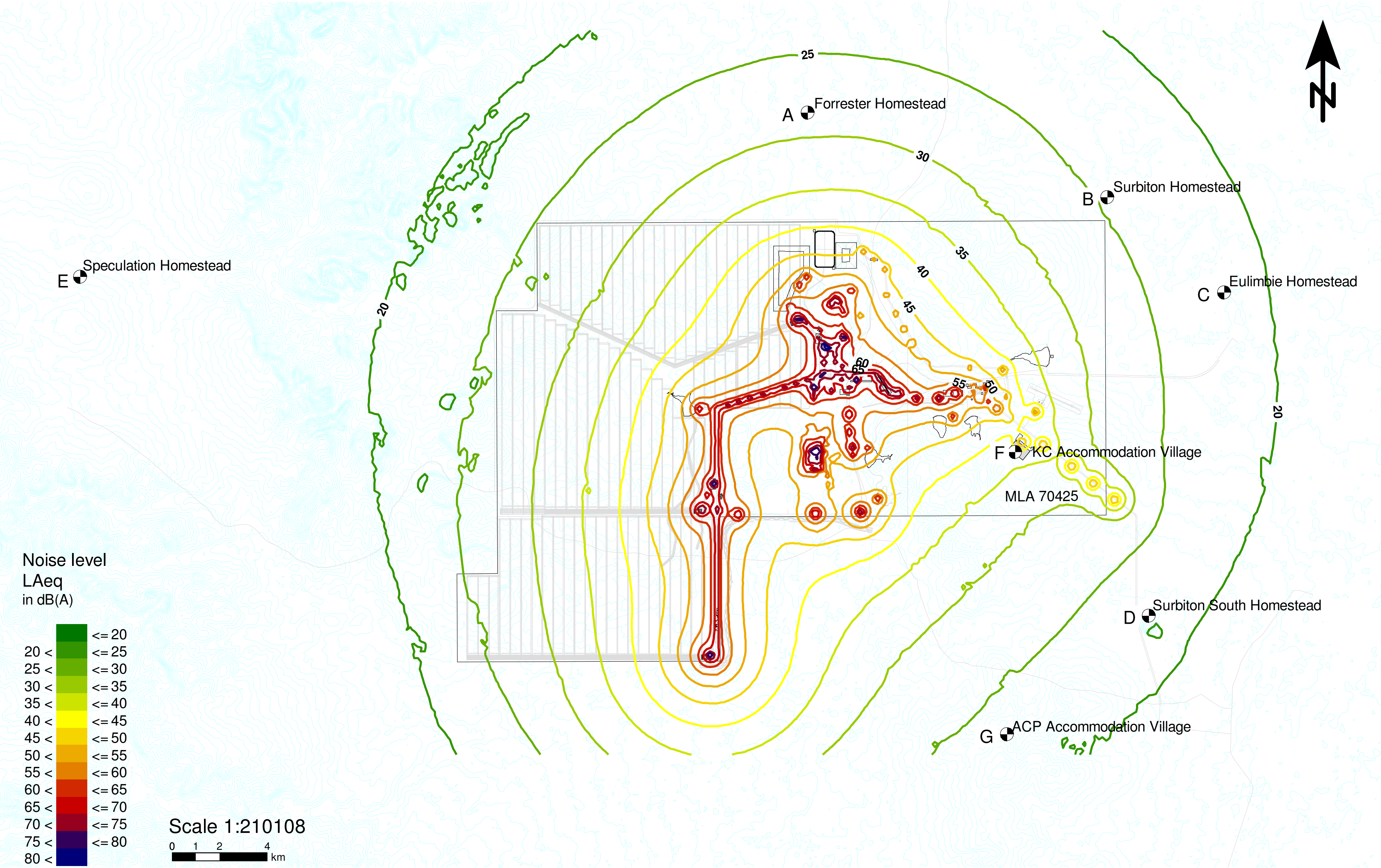
Kevin's Corner Project - Operational Background Noise Contours $L_{A90,1hour}$
Scenario 3 to 6 (2016 - 2027): Adverse Weather Conditions



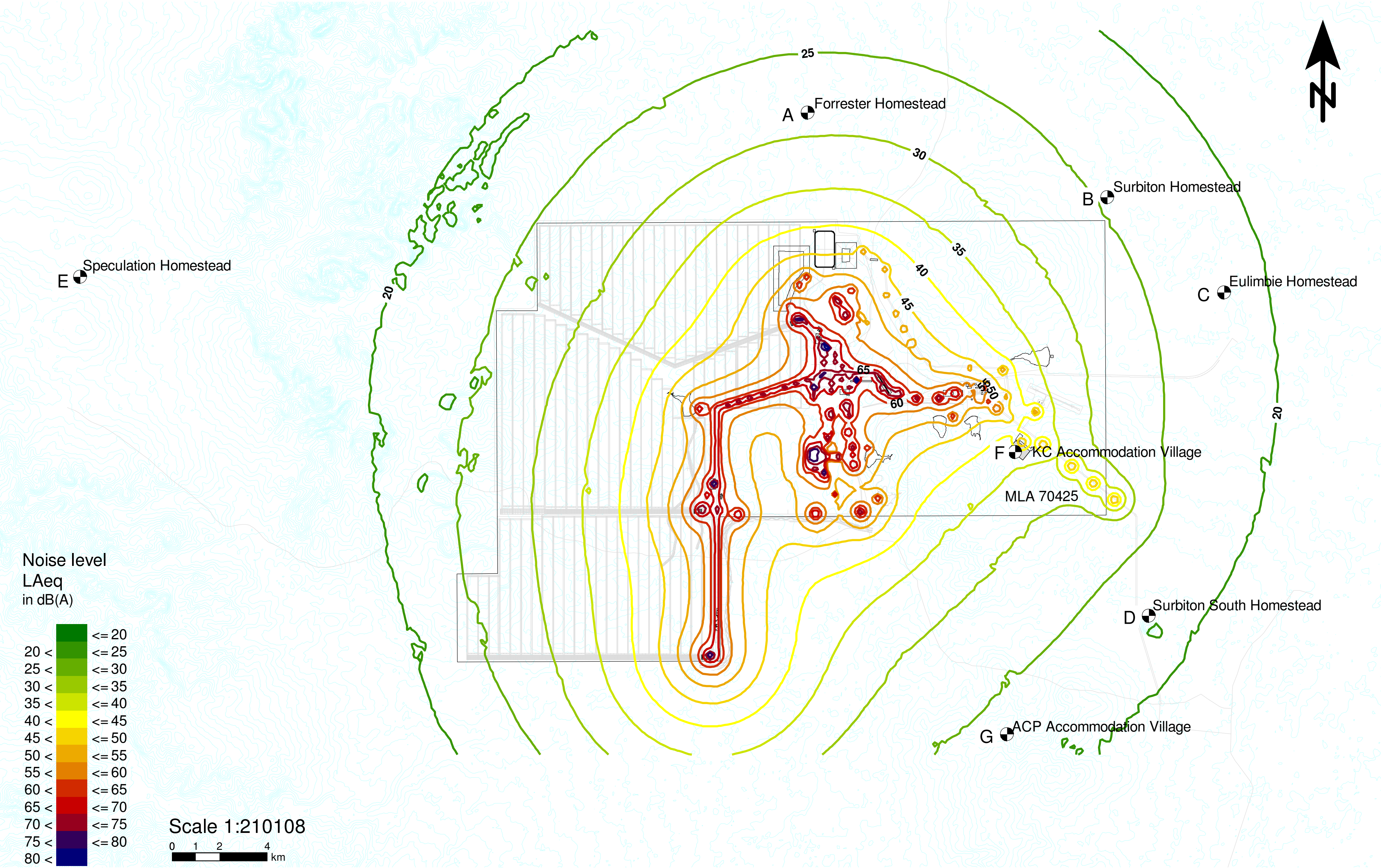
Kevin's Corner Project - Operational Background Noise Contours $L_{A90,1hour}$
Scenario 7 to 9 (2028 - 2042): Adverse Weather Conditions



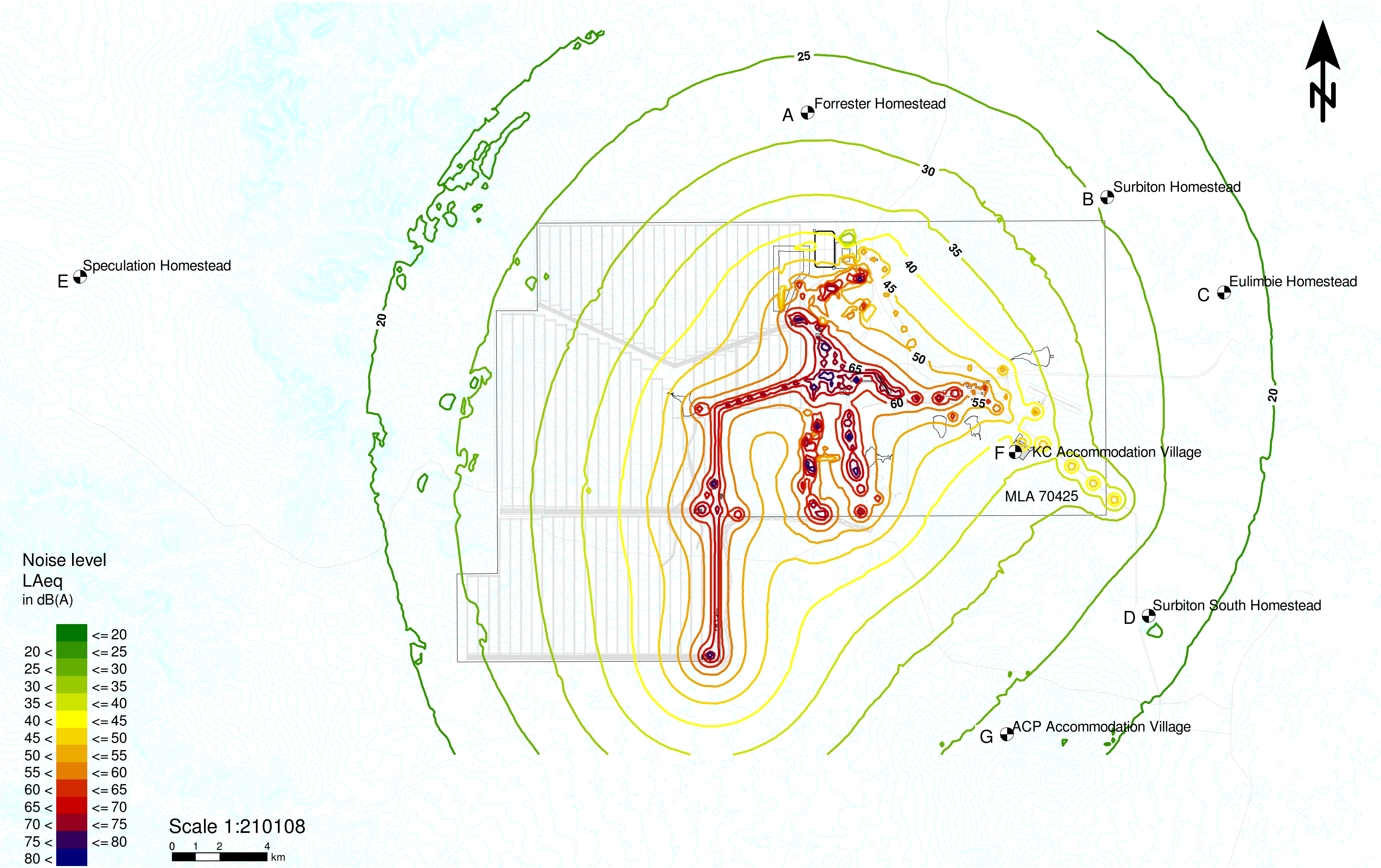
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 1 (2014): Adverse Weather Conditions



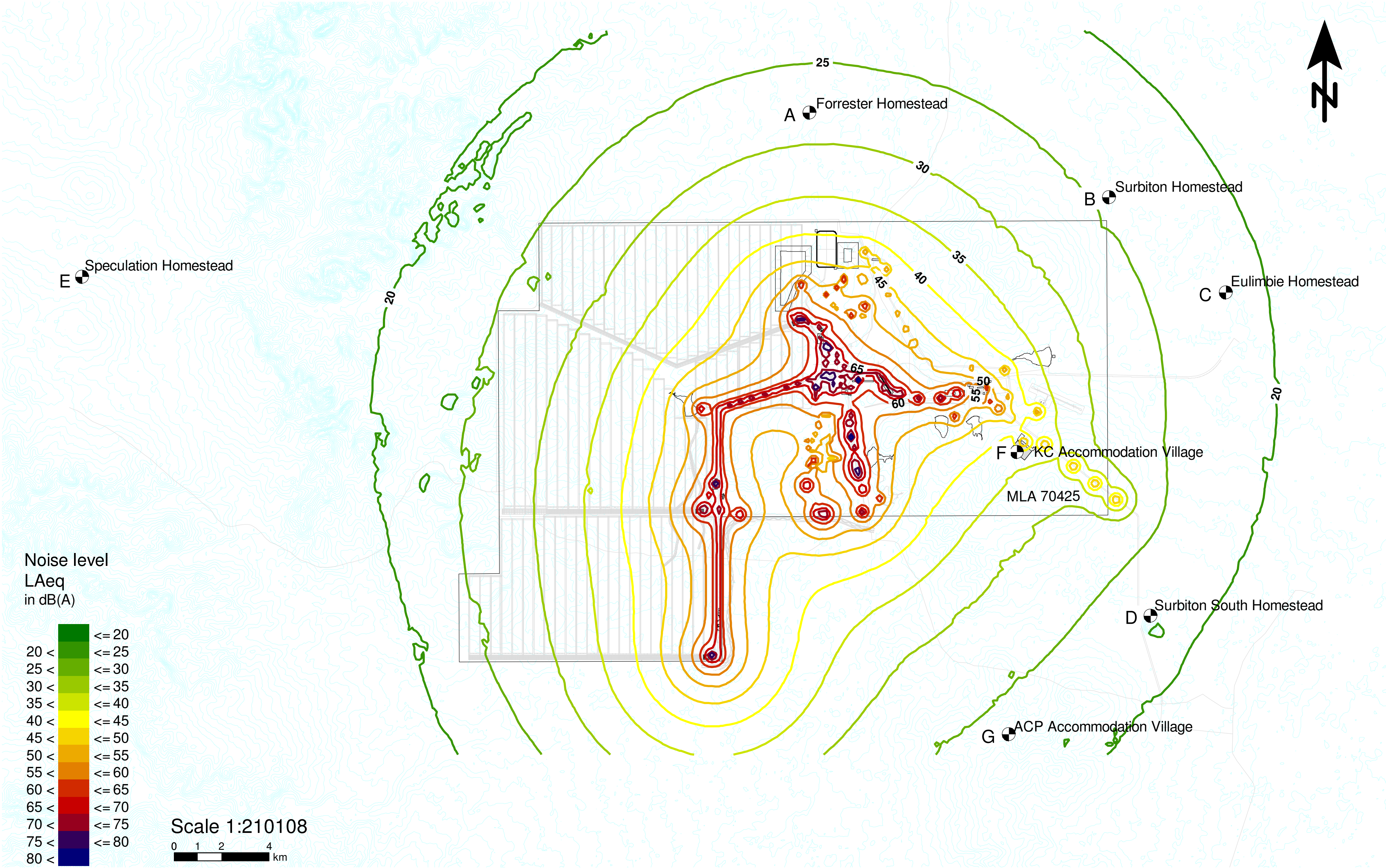
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 2 (2015): Adverse Weather Conditions



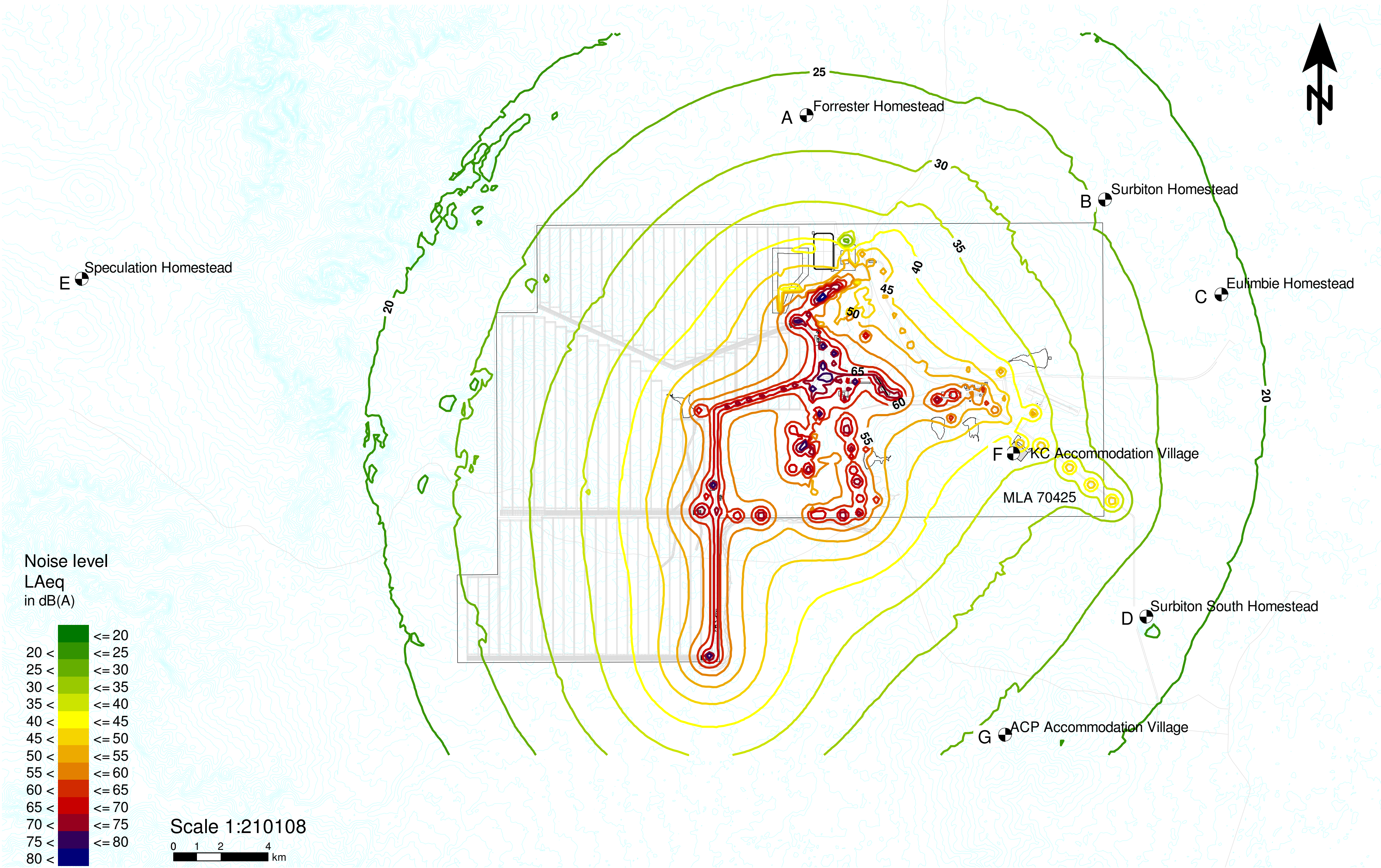
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 3 (2016): Adverse Weather Conditions



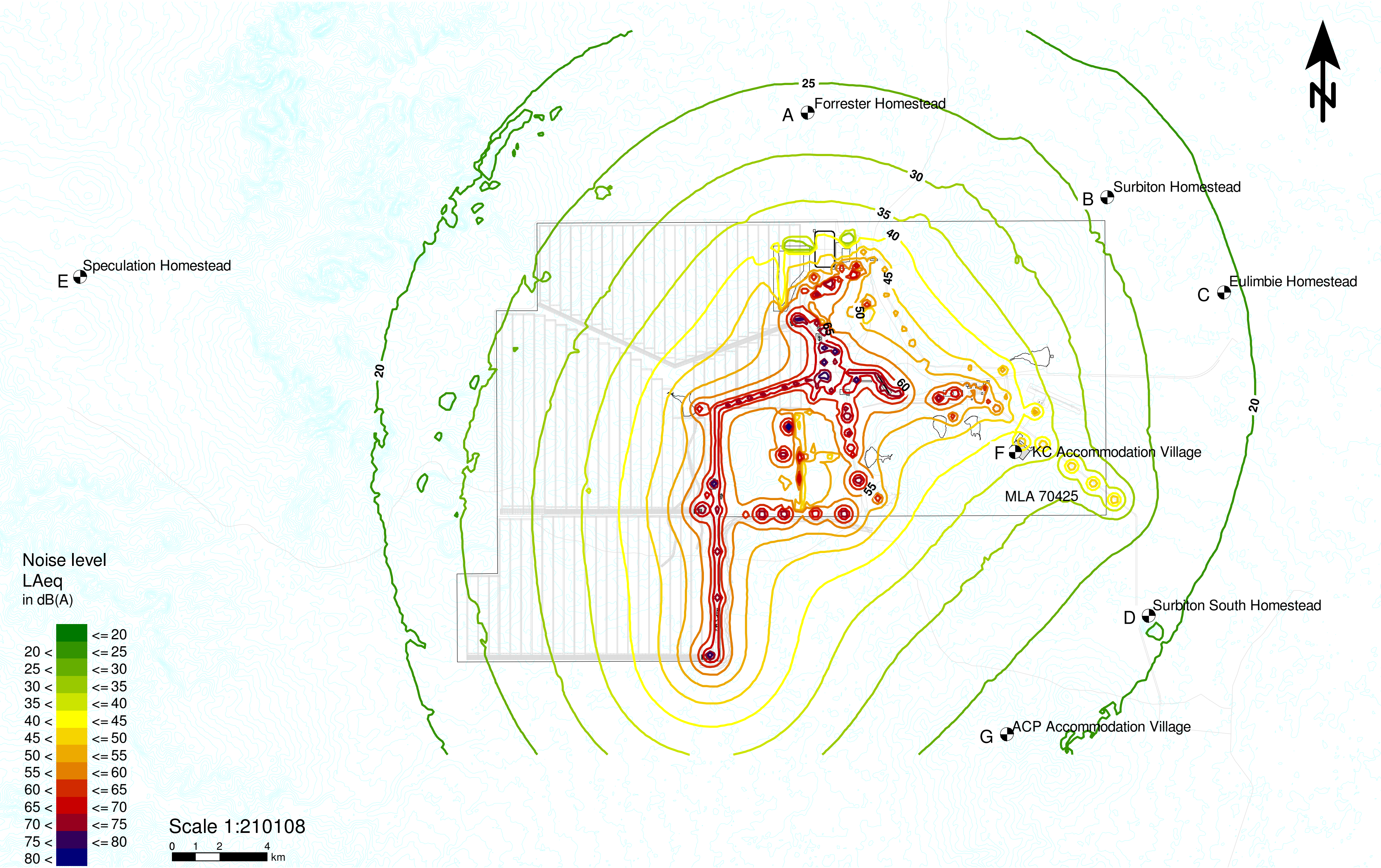
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 4 (2017): Adverse Weather Conditions



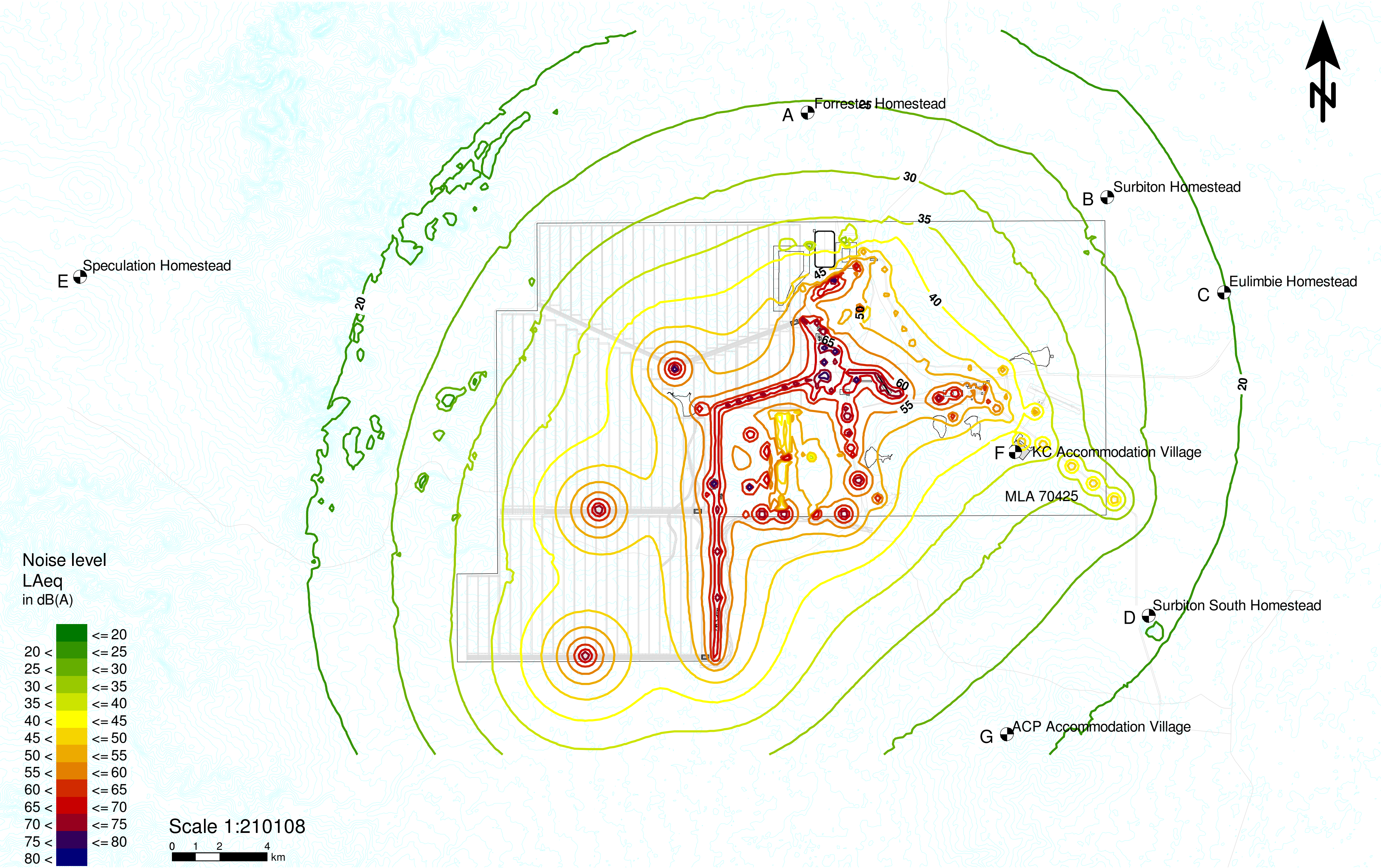
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 5 (2018): Adverse Weather Conditions



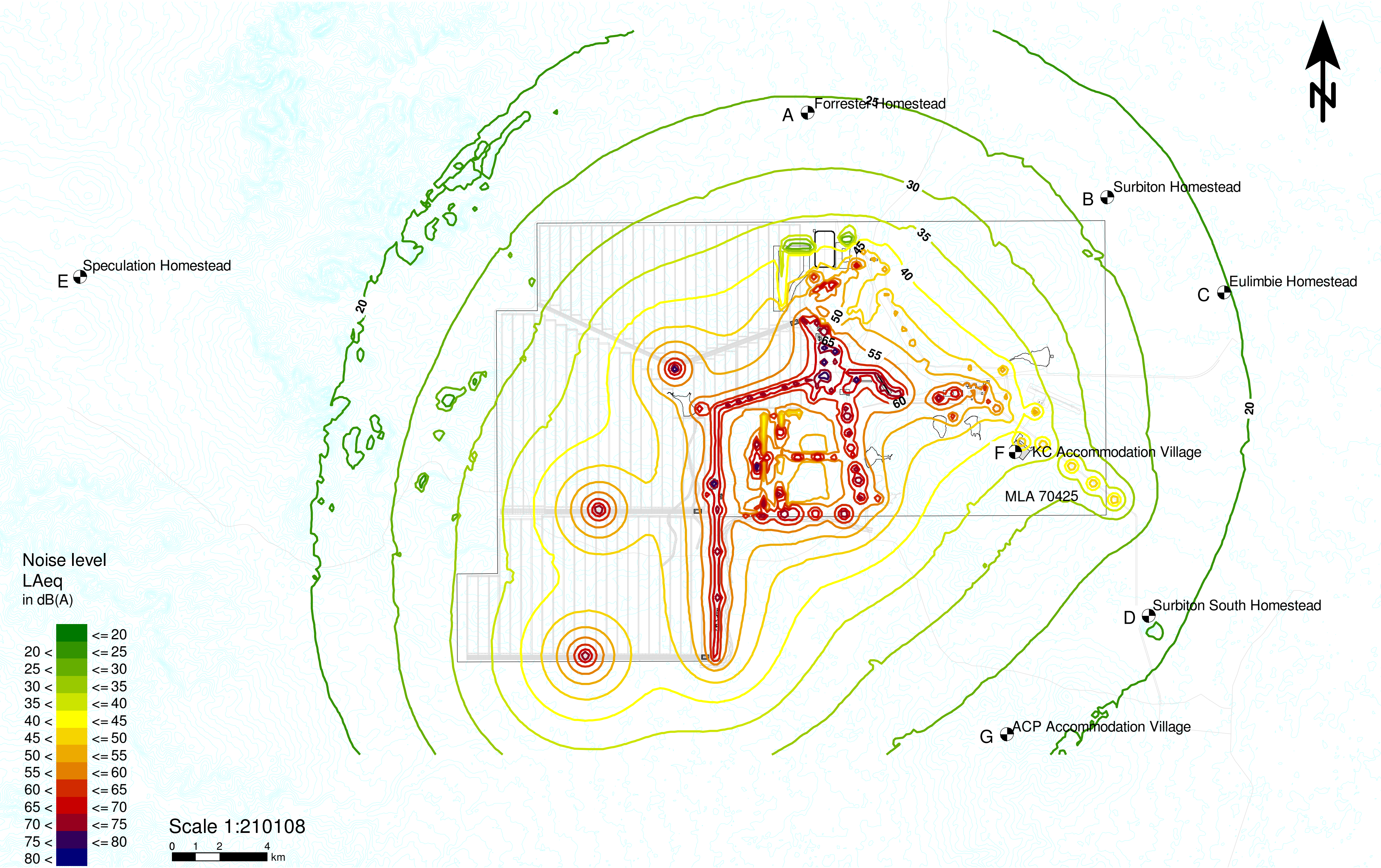
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 6 (2019 - 2023): Adverse Weather Conditions



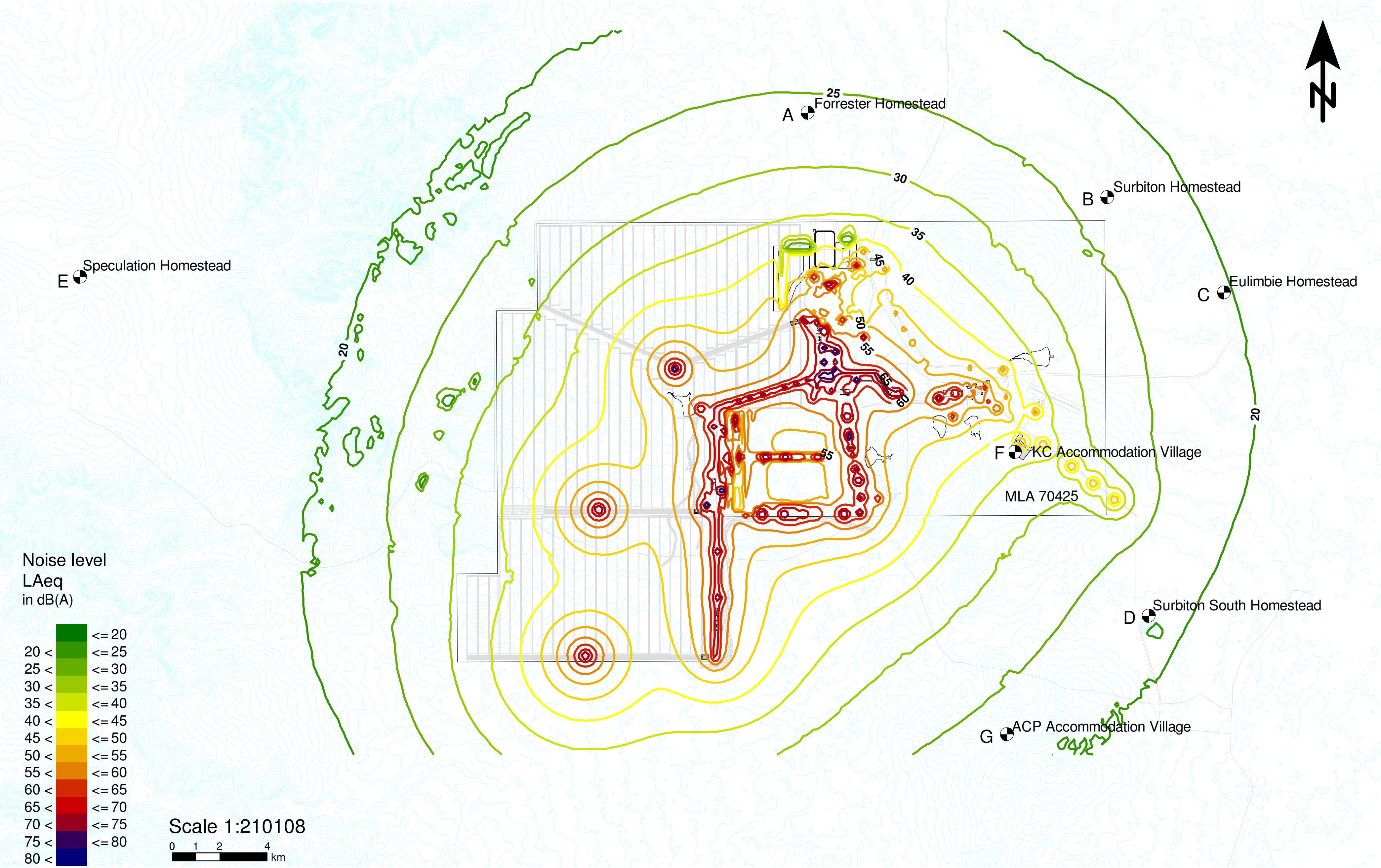
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 7 (2024 - 2028): Adverse Weather Conditions



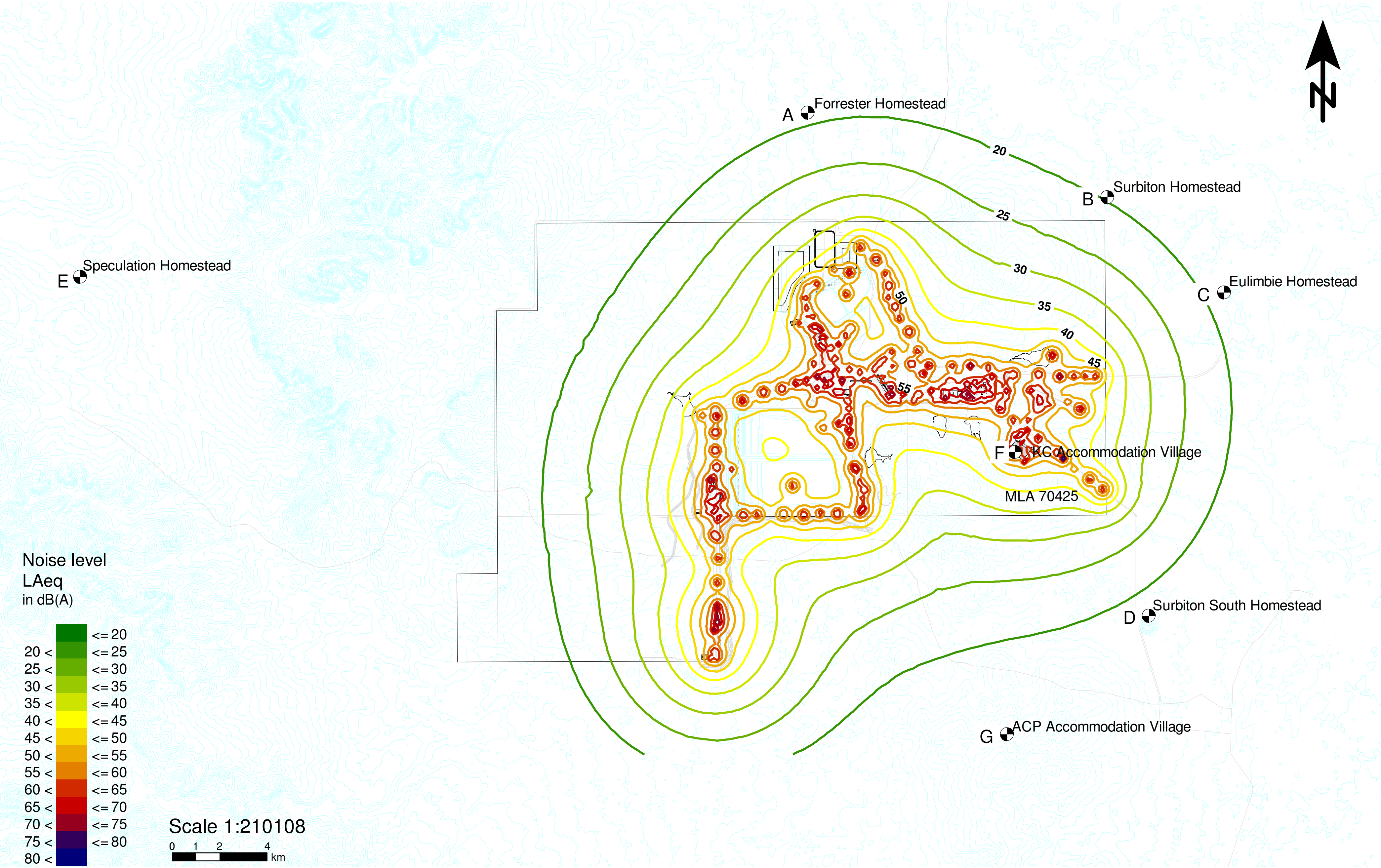
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 8 (2029 - 2033): Adverse Weather Conditions



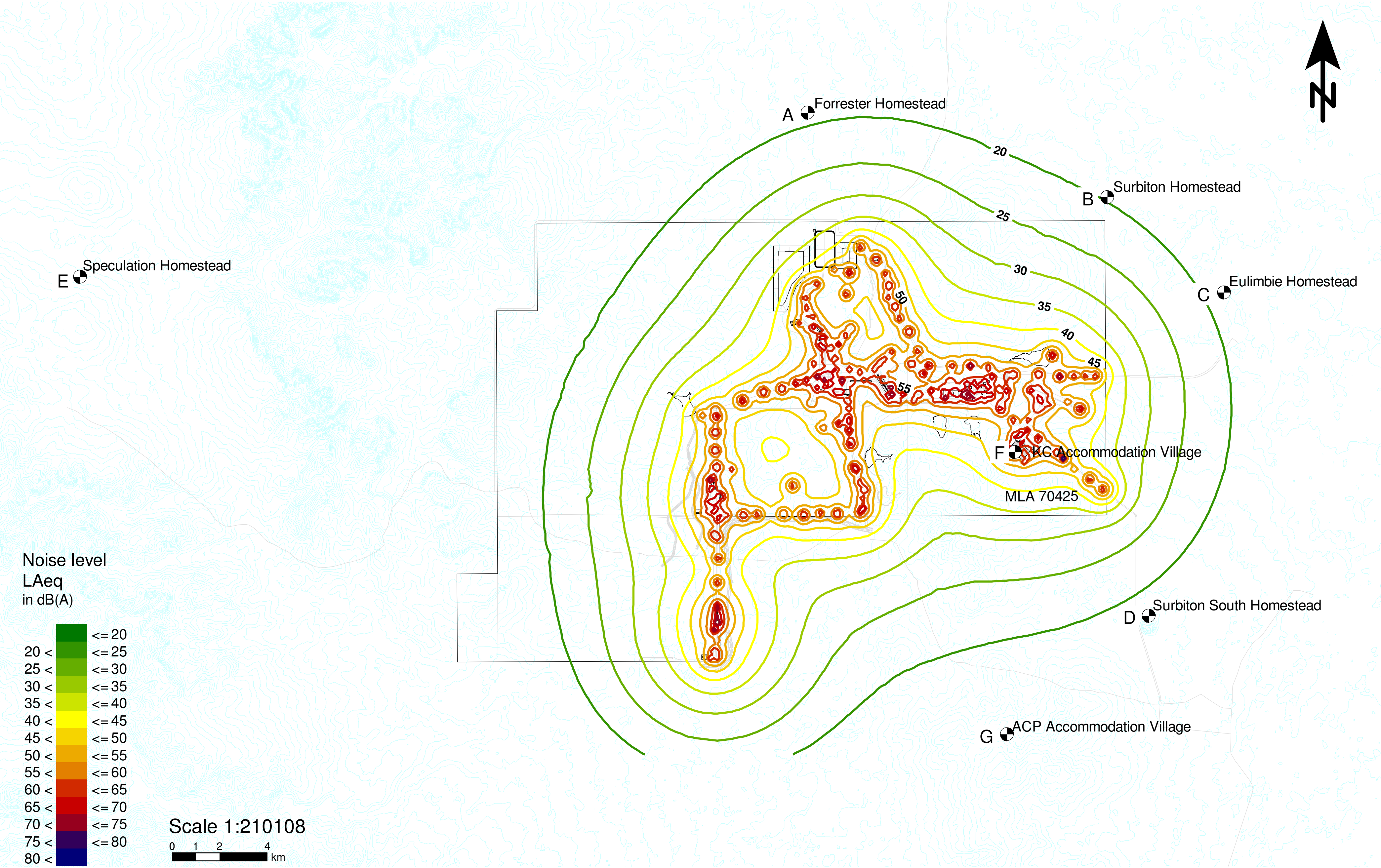
Kevin's Corner Project - Operational Noise Contours $L_{Aeq,1hour}$
Scenario 9 (2034 - 2042): Adverse Weather Conditions



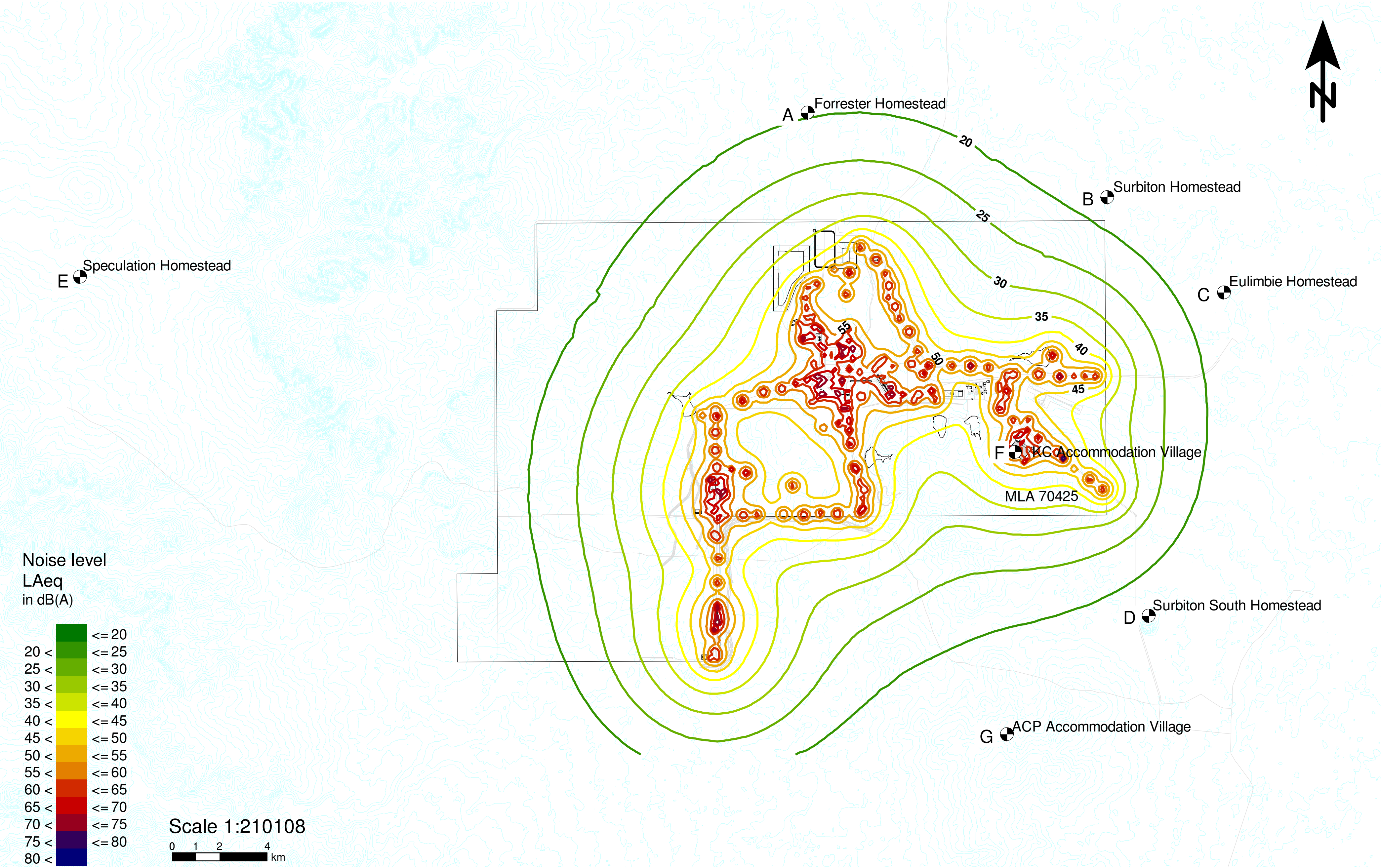
Kevin's Corner Project - Construction Noise Contours L_{Aeq}
Scenario 0 (2013): Adverse Weather Conditions



Kevin's Corner Project - Construction Noise Contours L_{Aeq}
Scenario 1 (2014): Adverse Weather Conditions



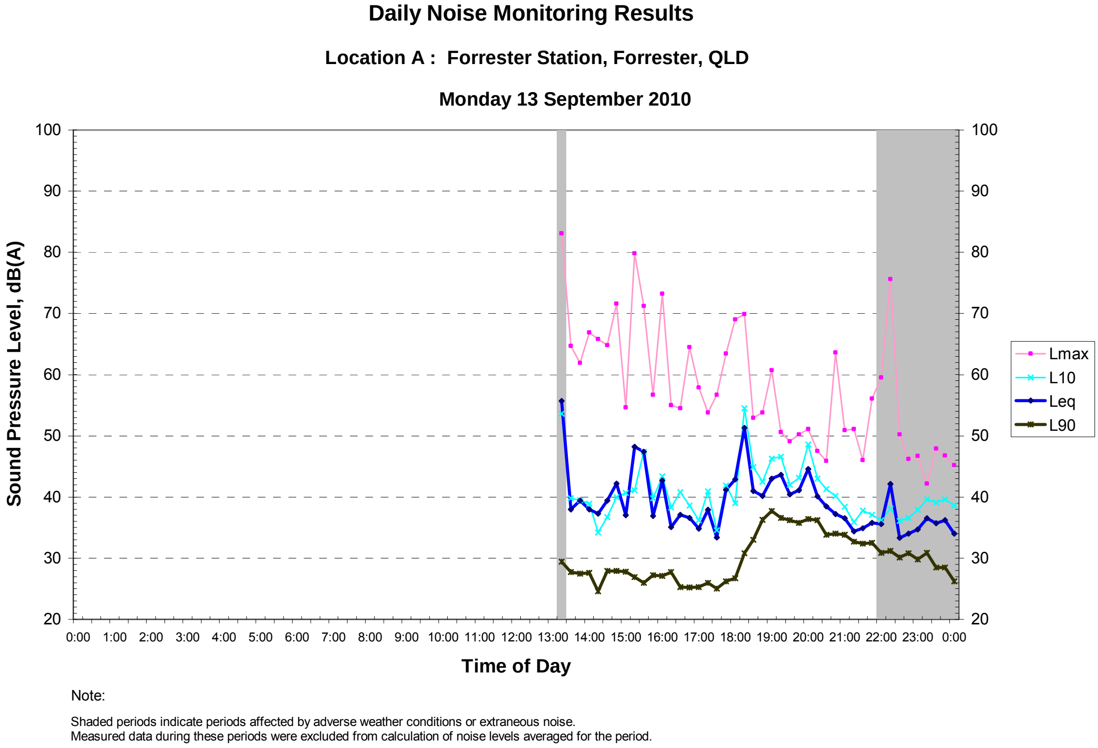
Kevin's Corner Project - Construction Noise Contours L_{Aeq}
Scenario 2 (2015): Adverse Weather Conditions

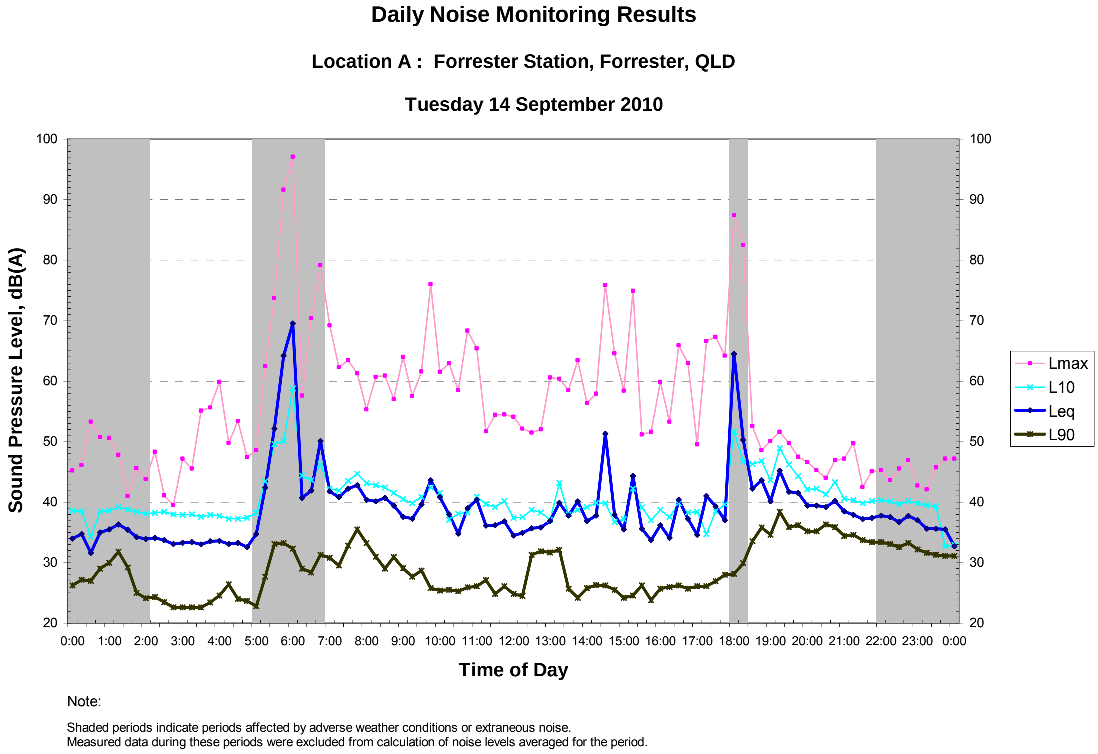


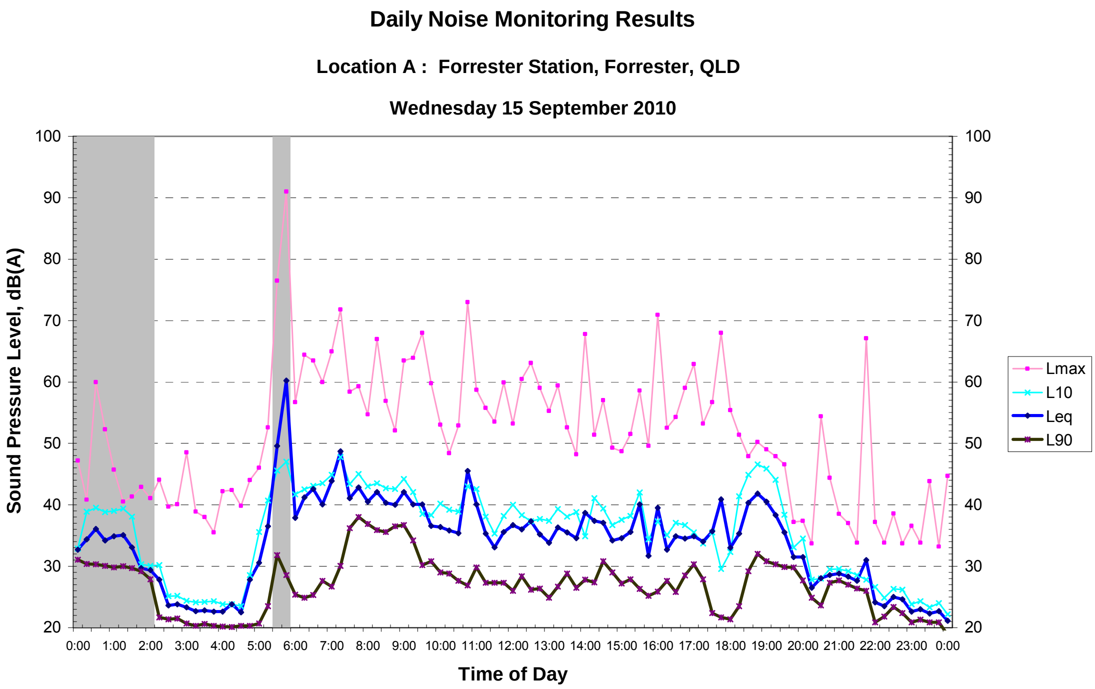
Appendix F Daily Noise Monitoring Plots

Appendix F

F.1 Forrester:

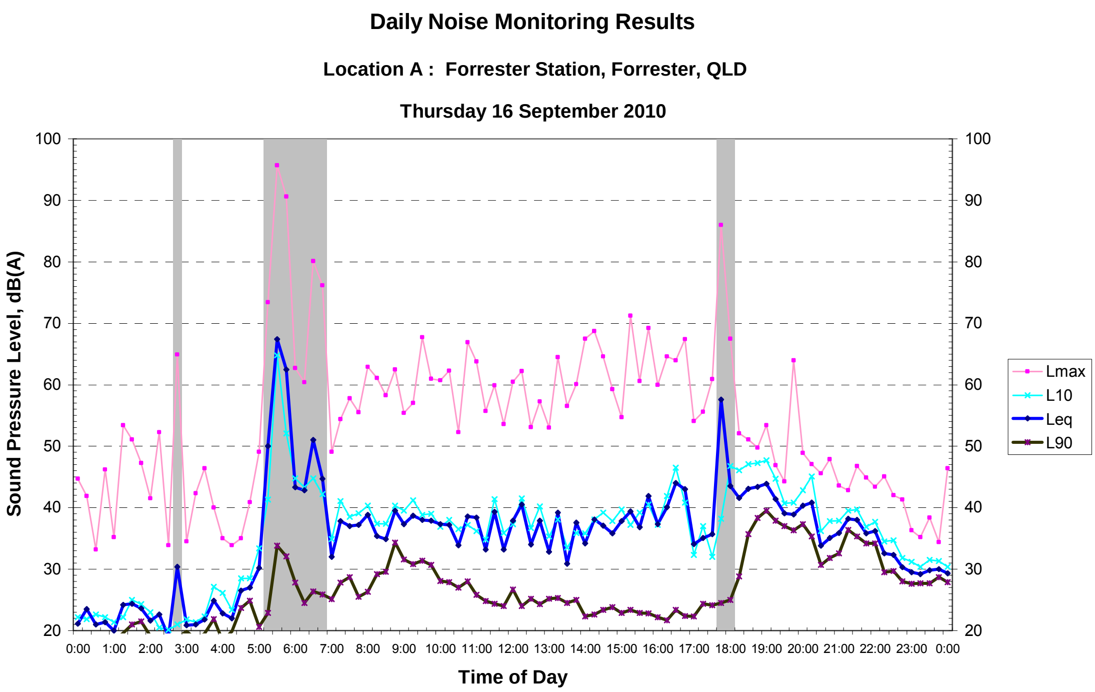






Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

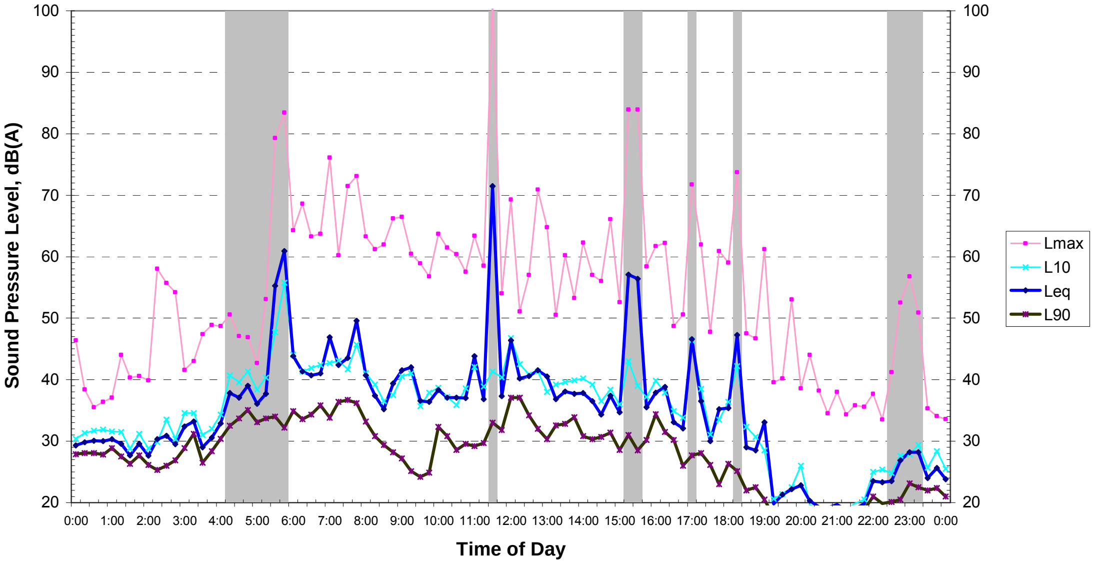
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

Daily Noise Monitoring Results

Location A : Forrester Station, Forrester, QLD

Friday 17 September 2010



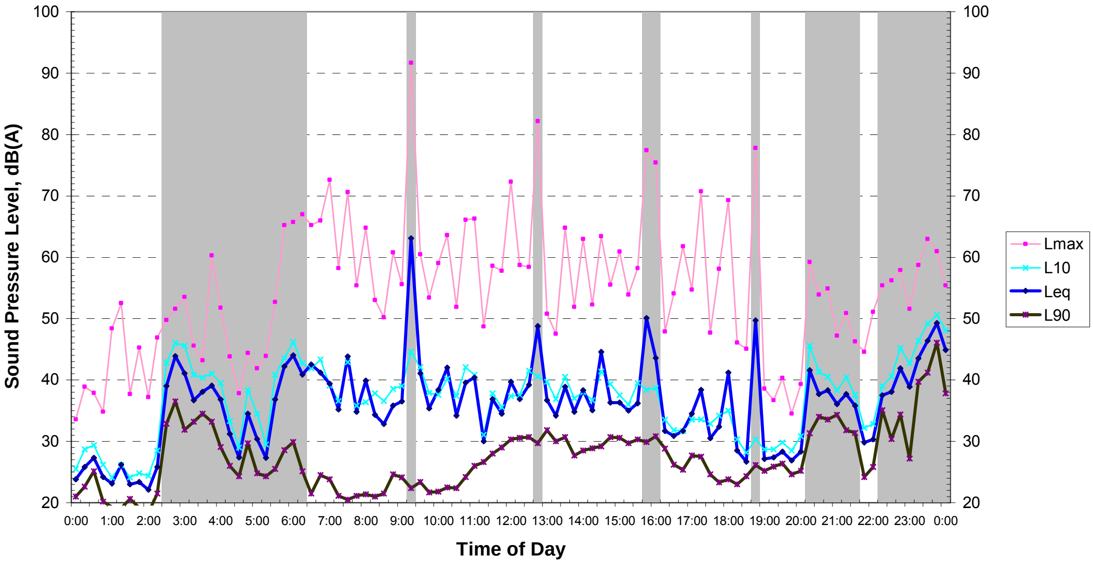
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

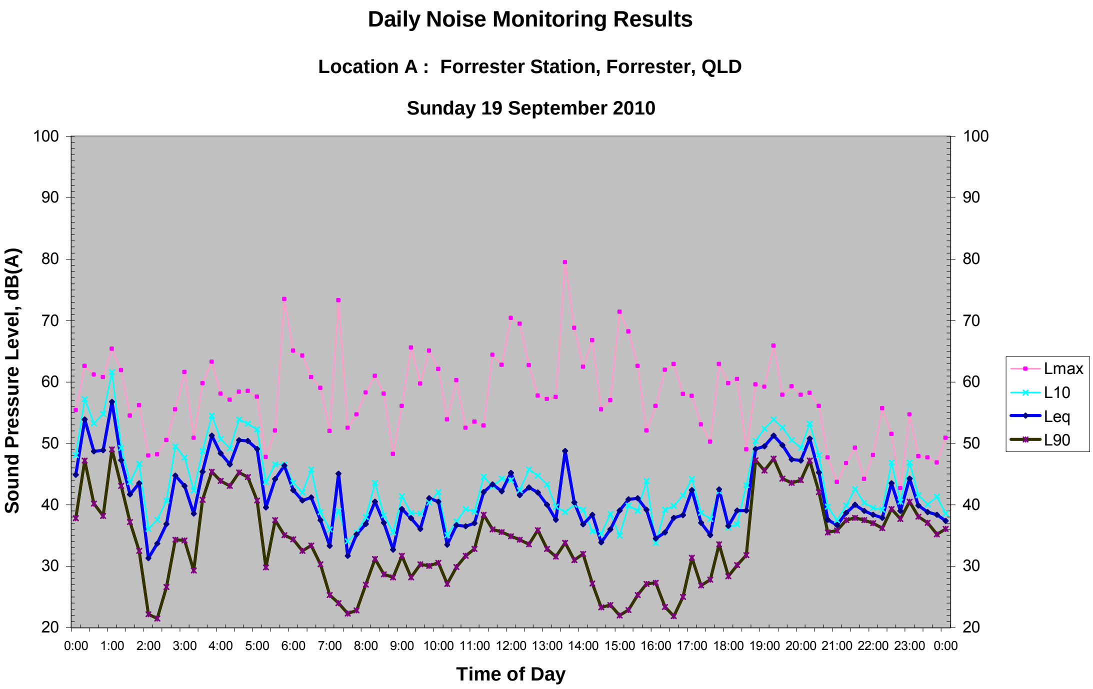
Location A : Forrester Station, Forrester, QLD

Saturday 18 September 2010



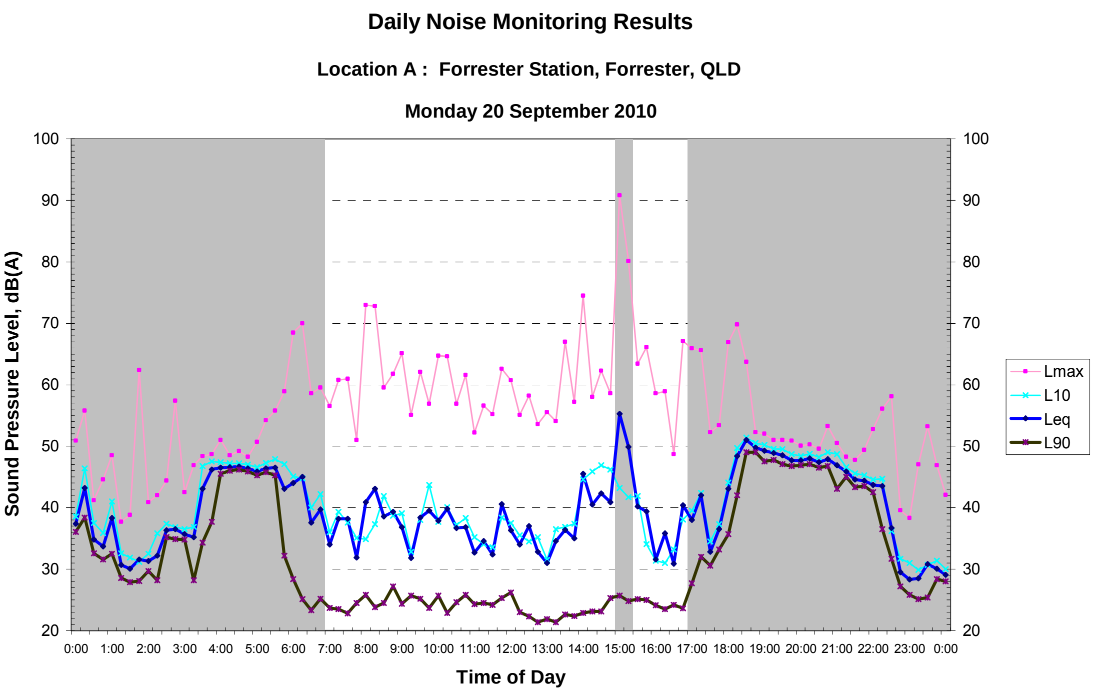
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

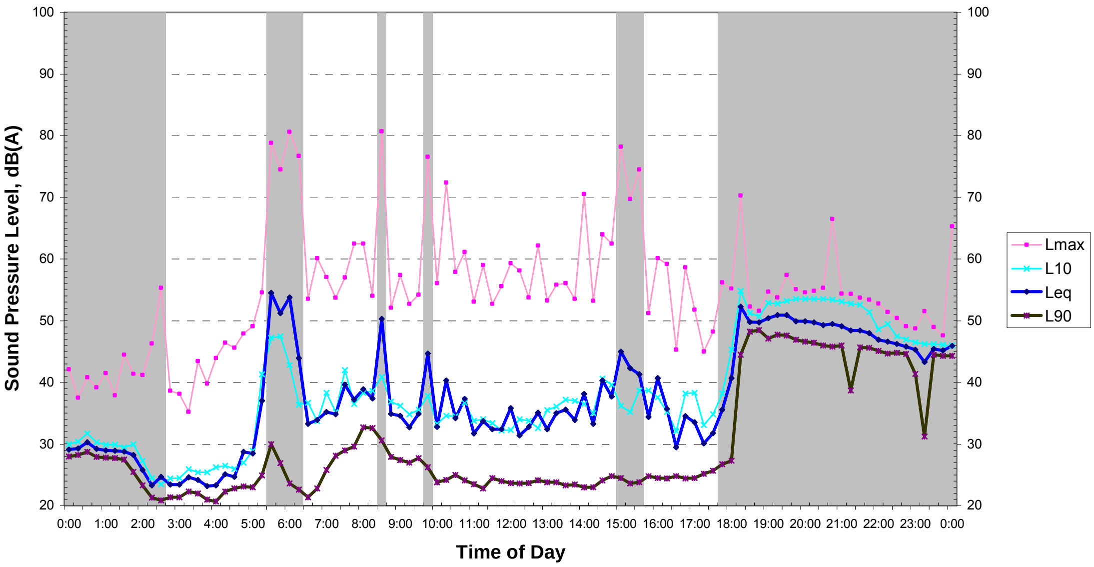
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

Daily Noise Monitoring Results

Location A : Forrester Station, Forrester, QLD

Tuesday 21 September 2010



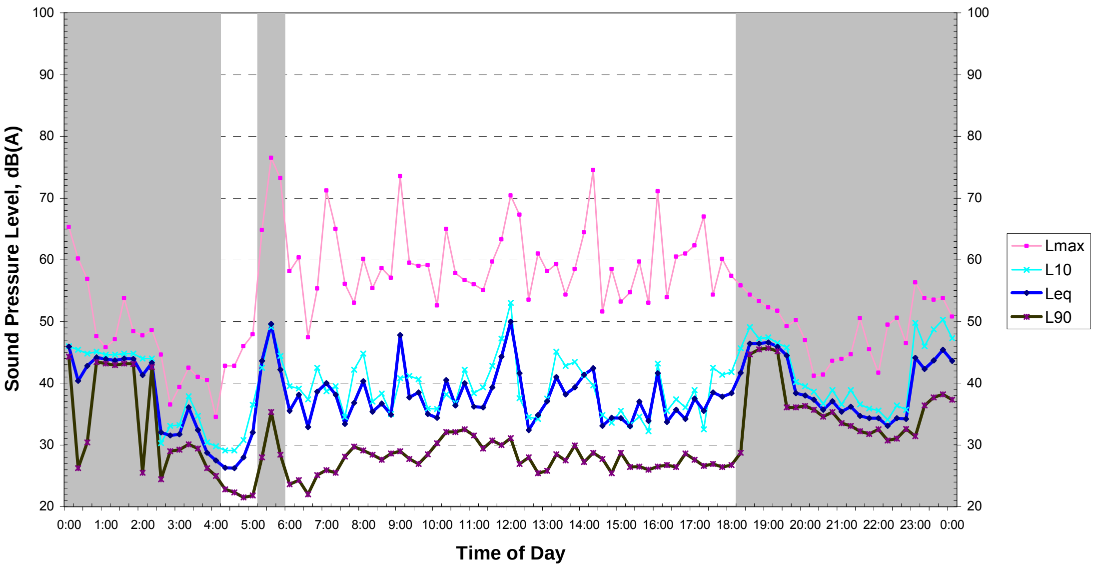
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location A : Forrester Station, Forrester, QLD

Wednesday 22 September 2010



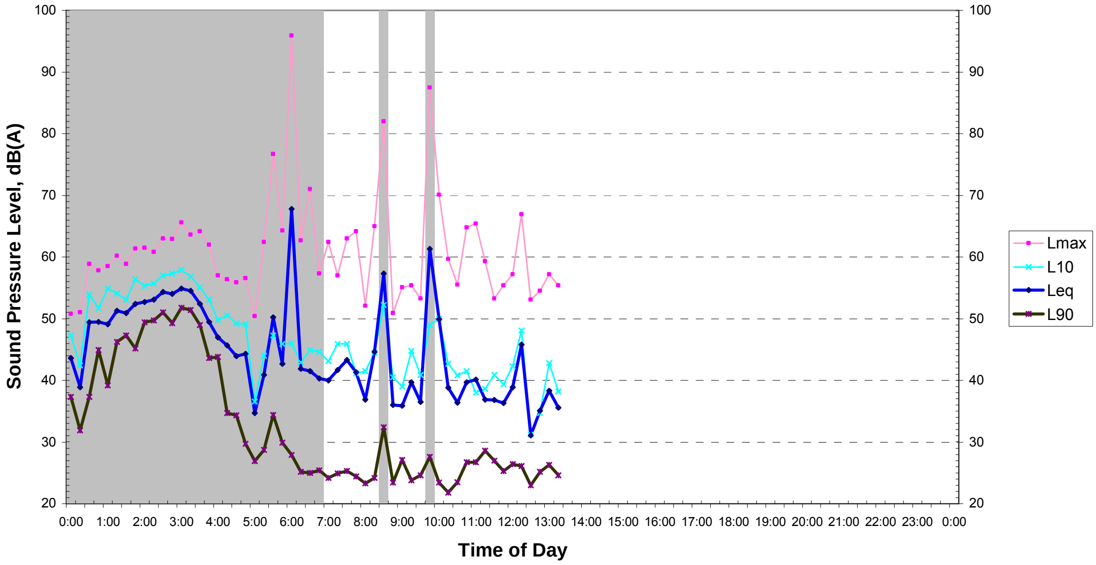
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location A : Forrester Station, Forrester, QLD

Thursday 23 September 2010

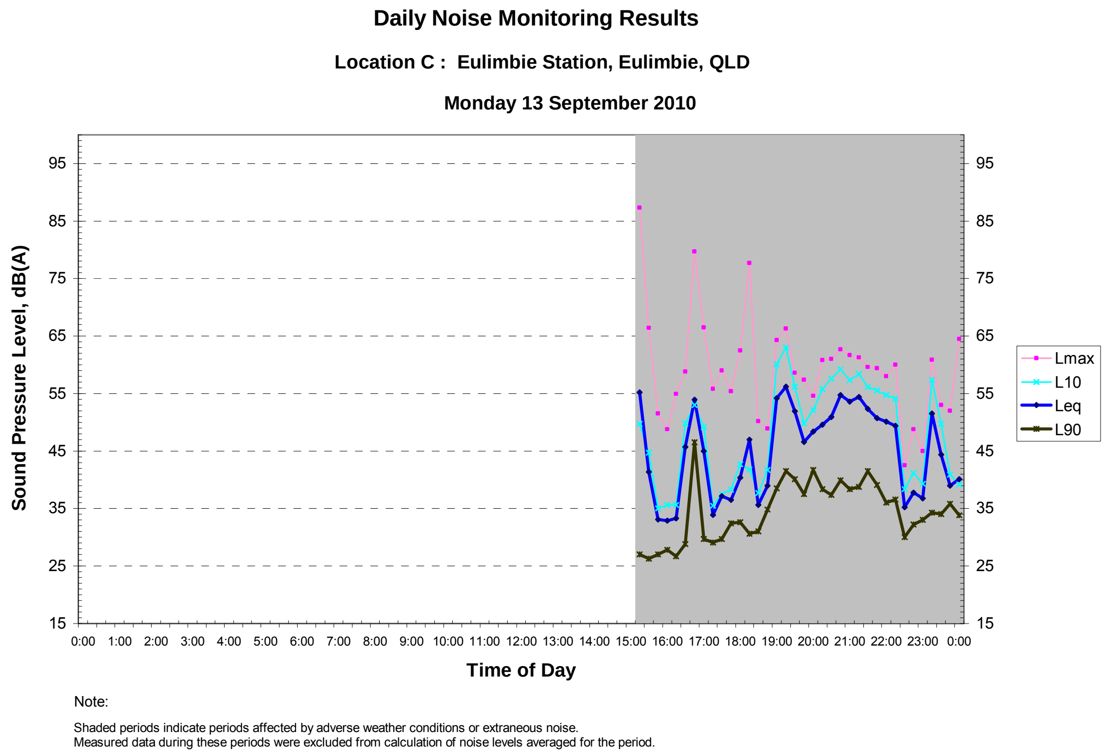


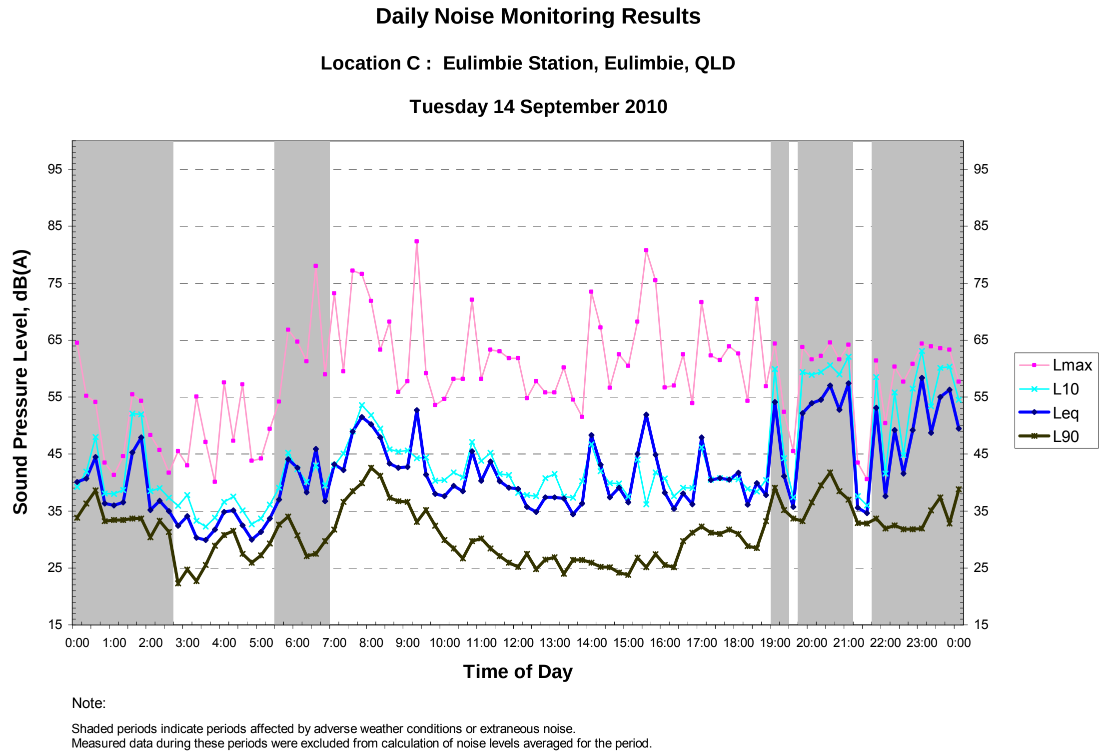
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

F.2 Eulimbie:

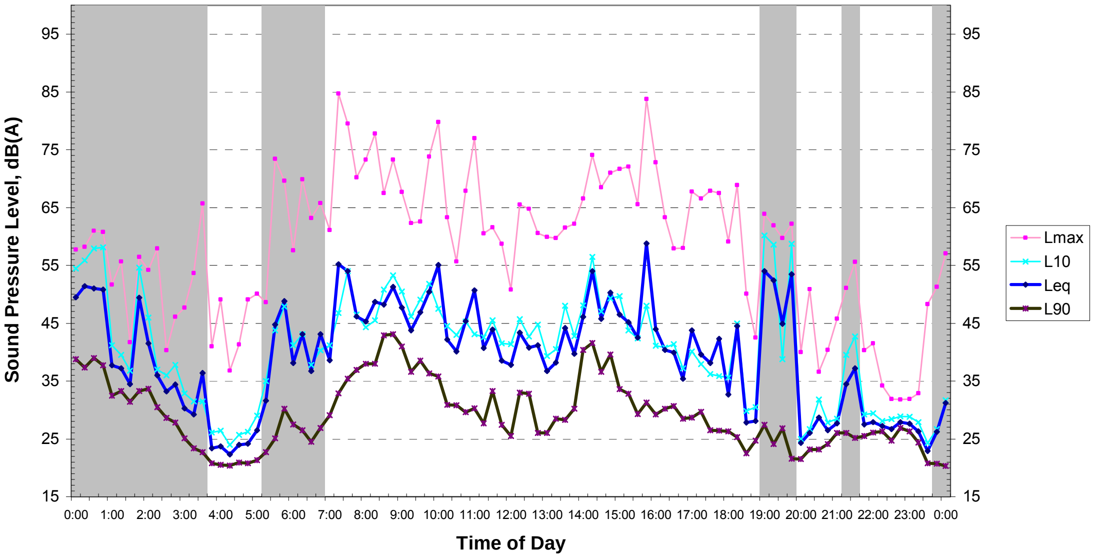




Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Wednesday 15 September 2010



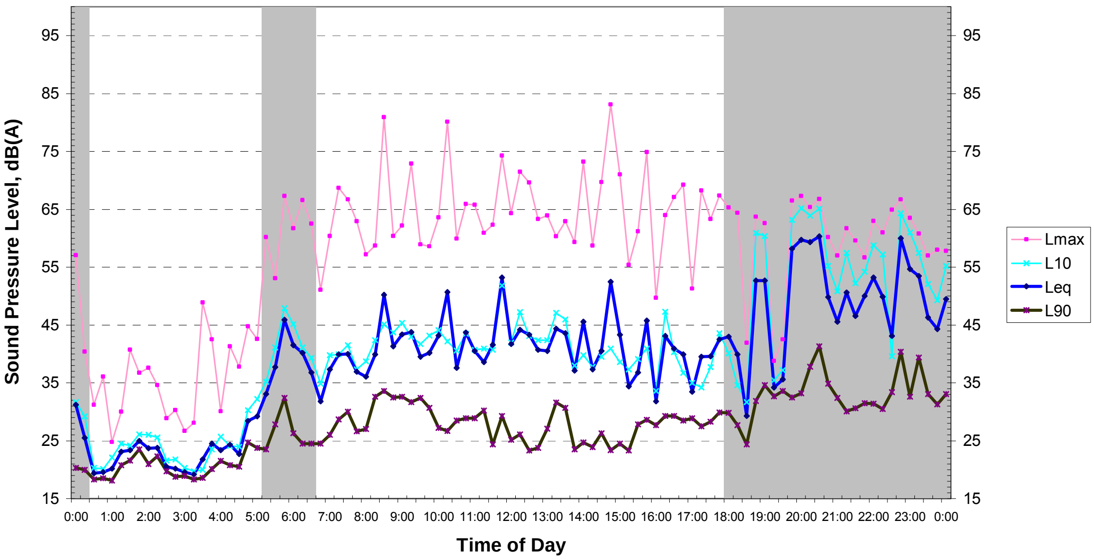
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Thursday 16 September 2010



Note:

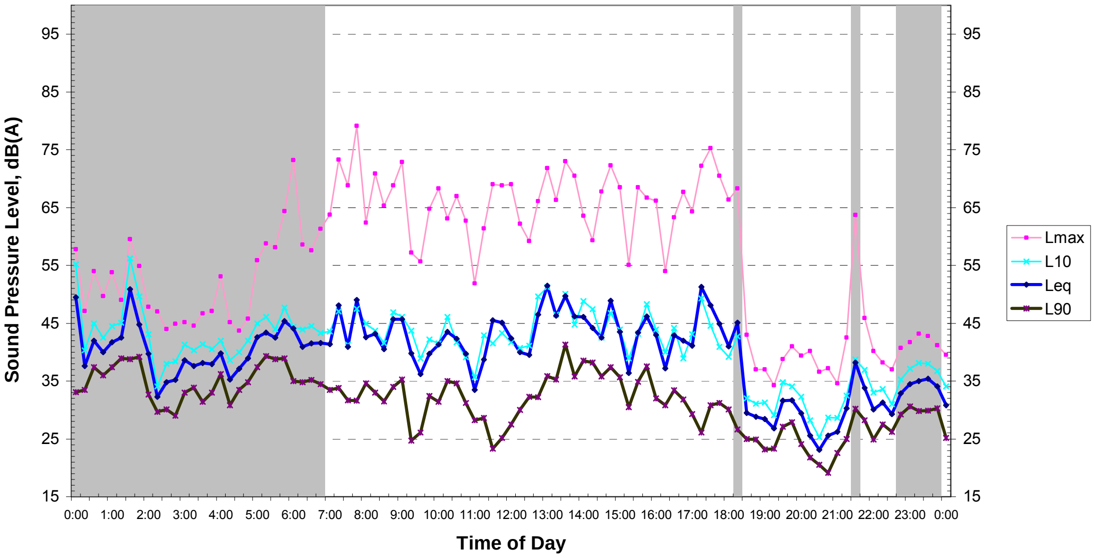
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Friday 17 September 2010



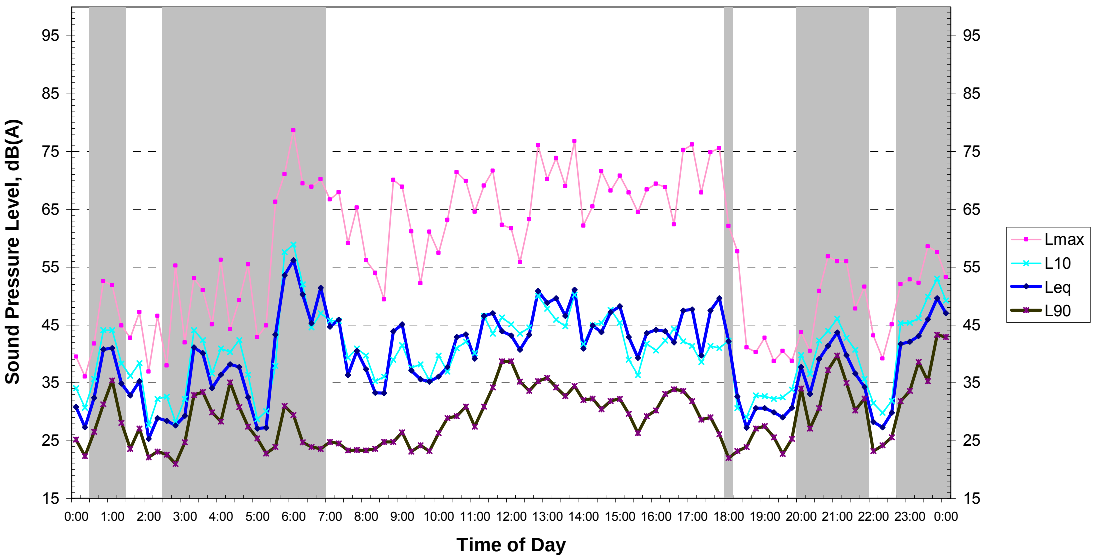
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Saturday 18 September 2010



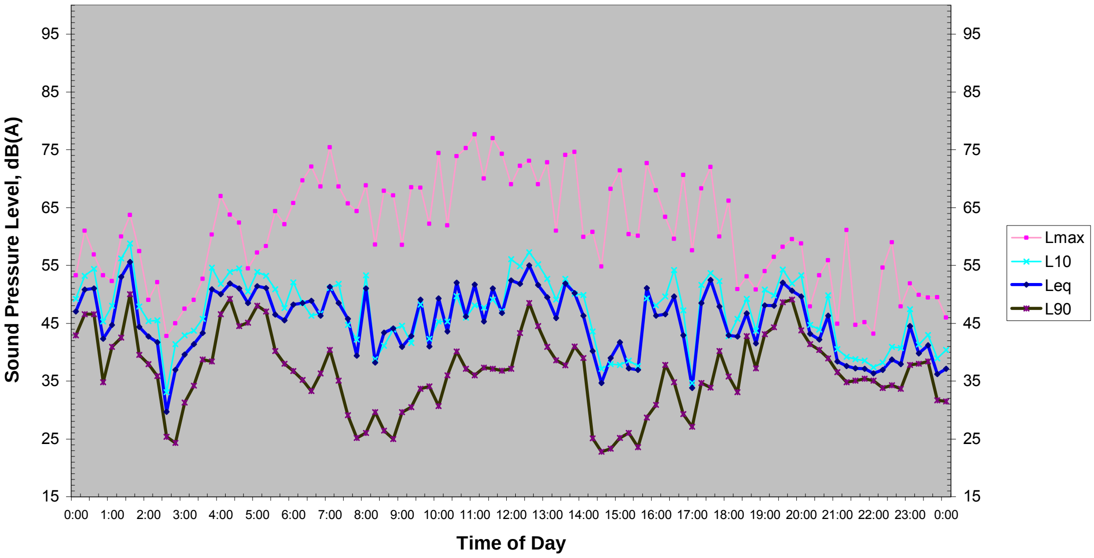
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Sunday 19 September 2010



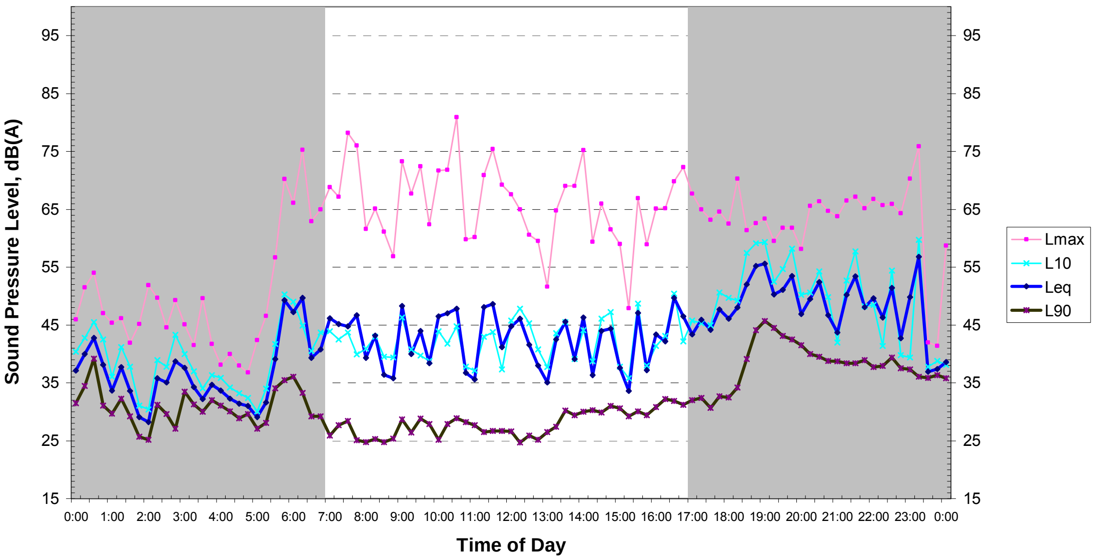
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

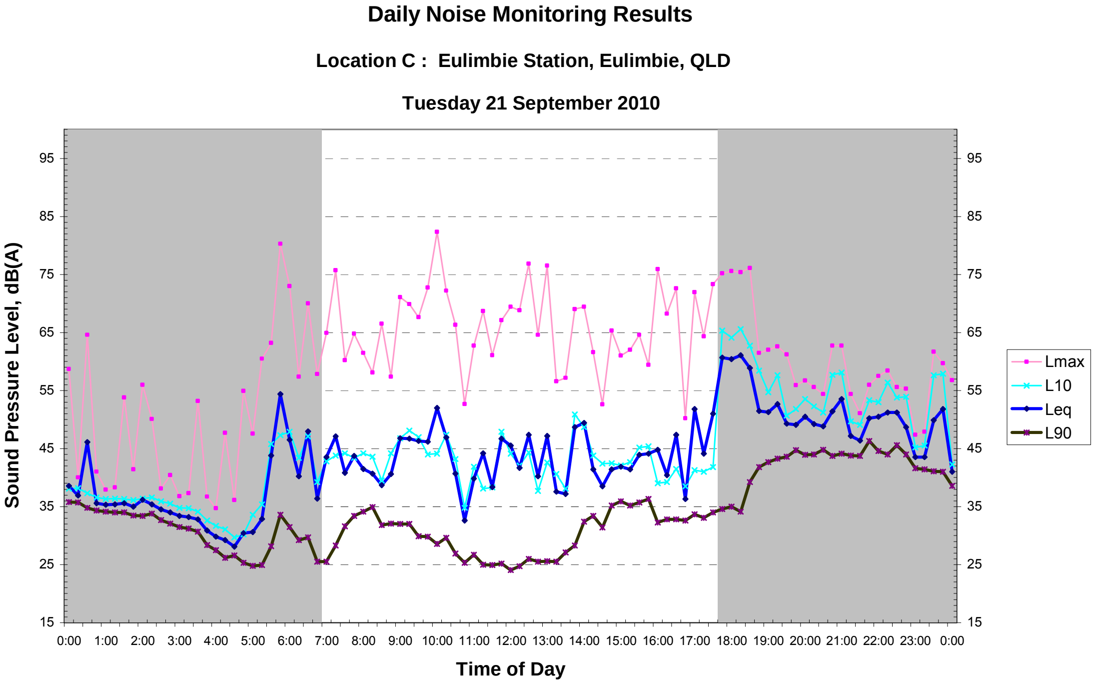
Monday 20 September 2010



Note:

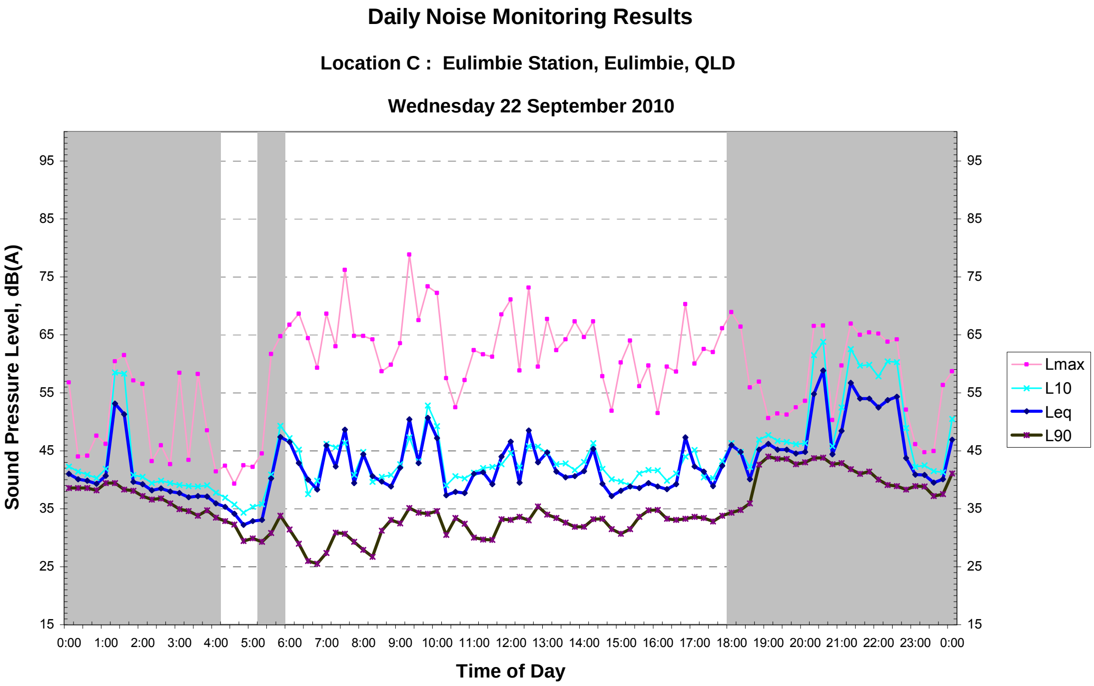
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



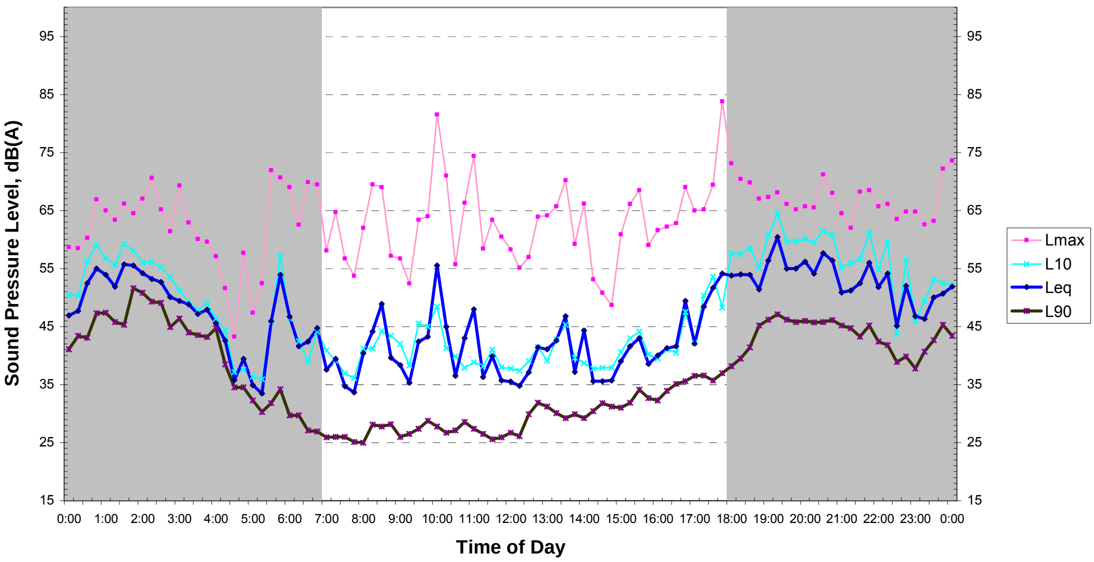
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Thursday 23 September 2010



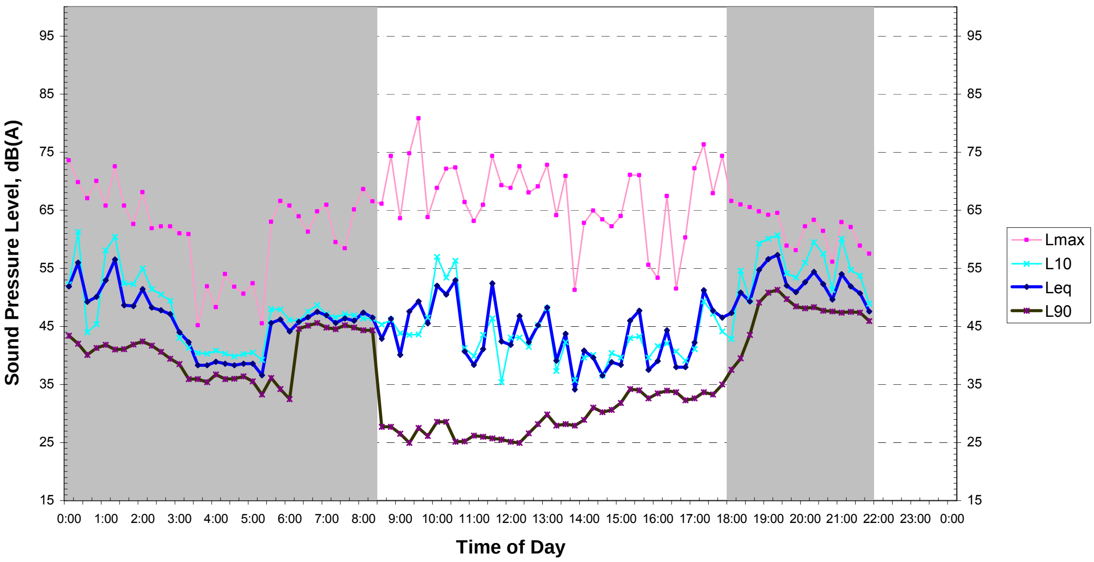
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location C : Eulimbie Station, Eulimbie, QLD

Friday 24 September 2010

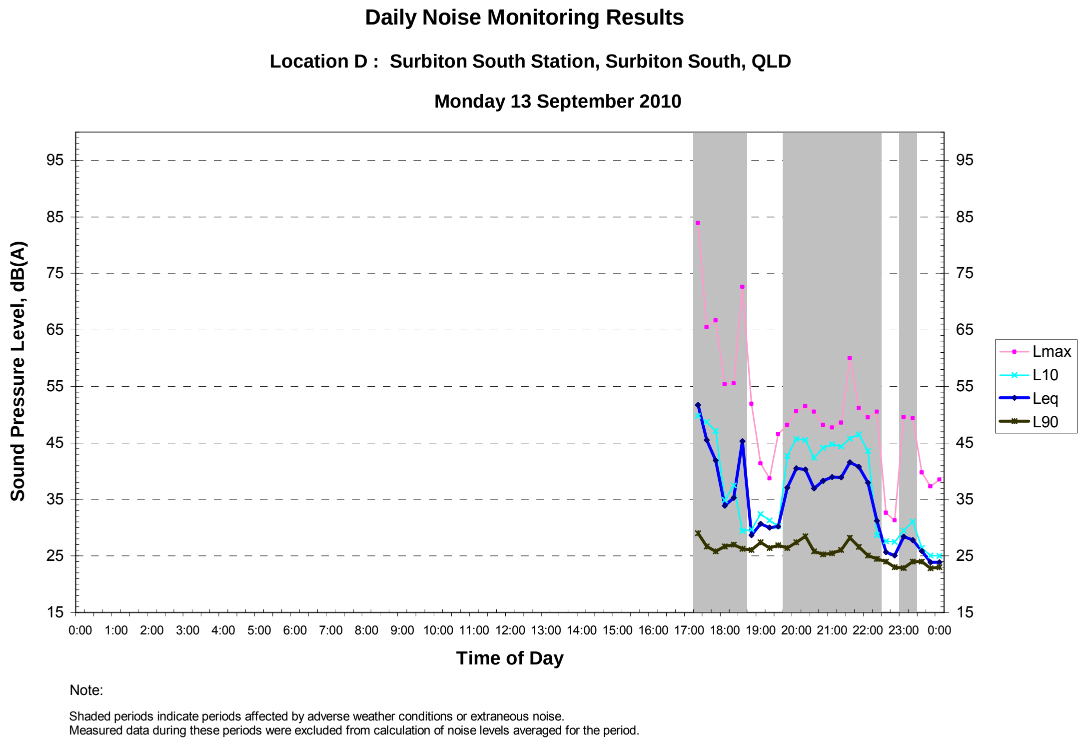


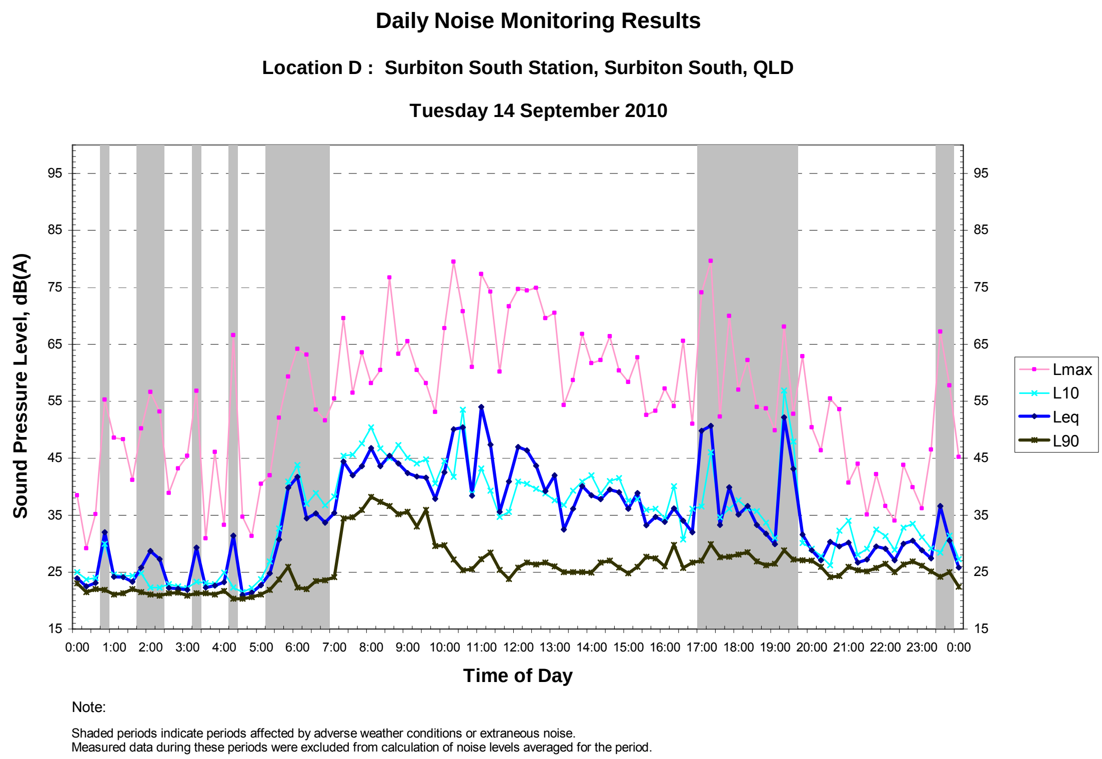
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

F.3 Surbiton South:

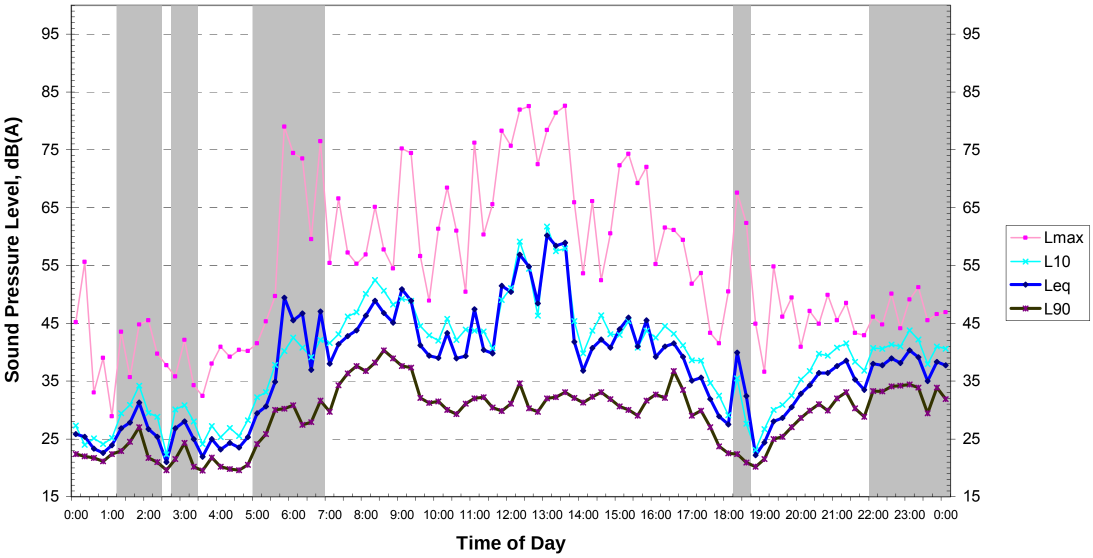




Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

Wednesday 15 September 2010



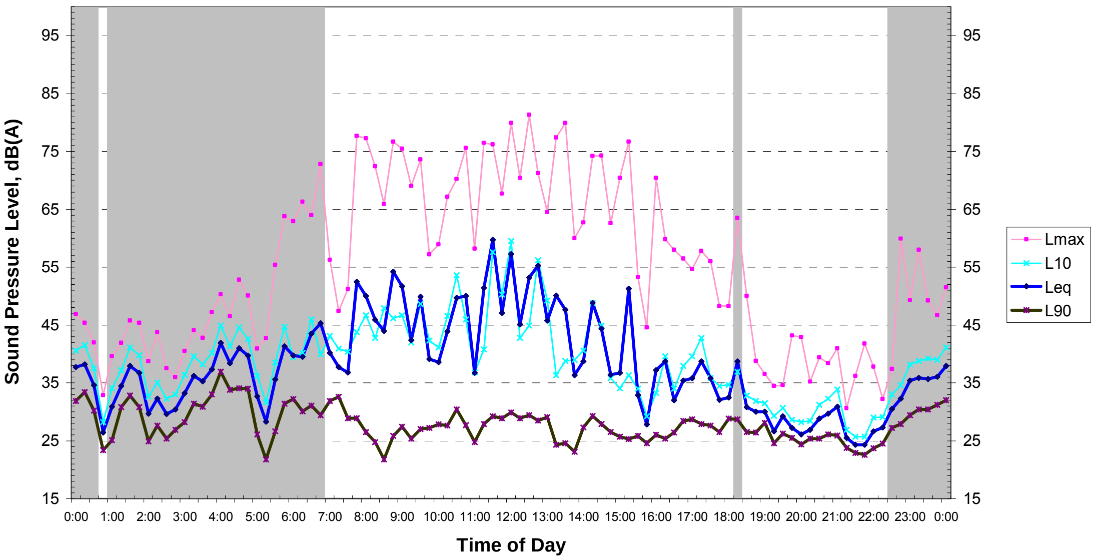
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

Thursday 16 September 2010



Note:

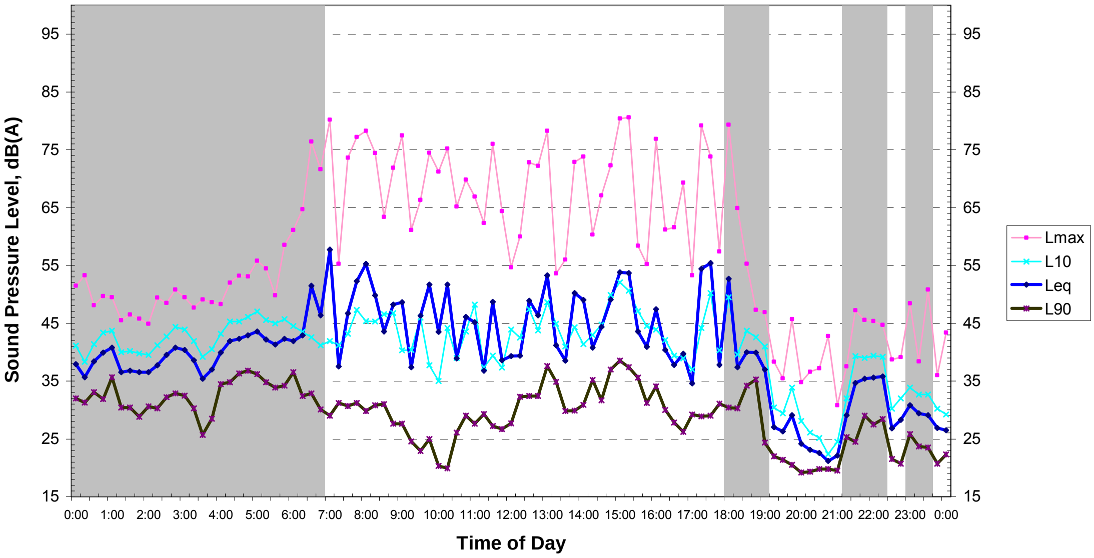
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

Friday 17 September 2010



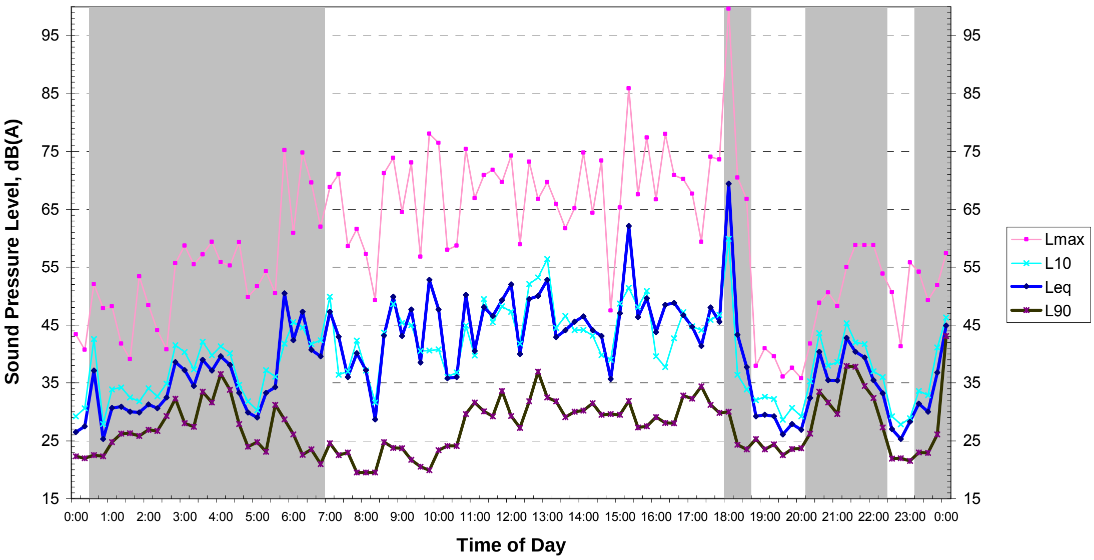
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

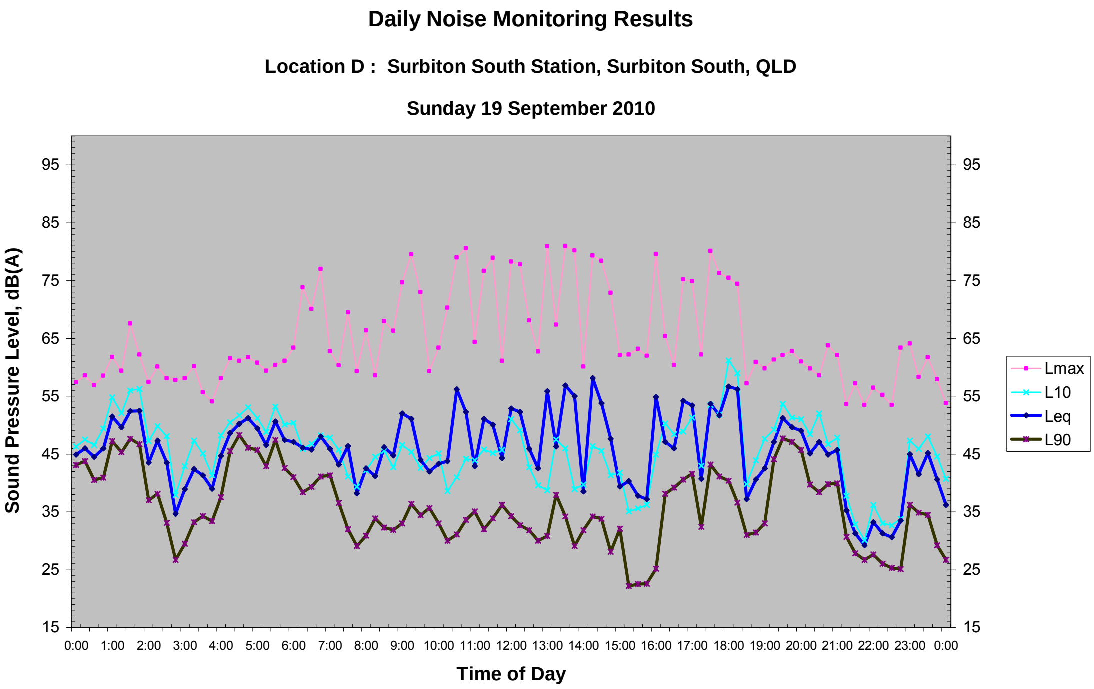
Location D : Surbiton South Station, Surbiton South, QLD

Saturday 18 September 2010



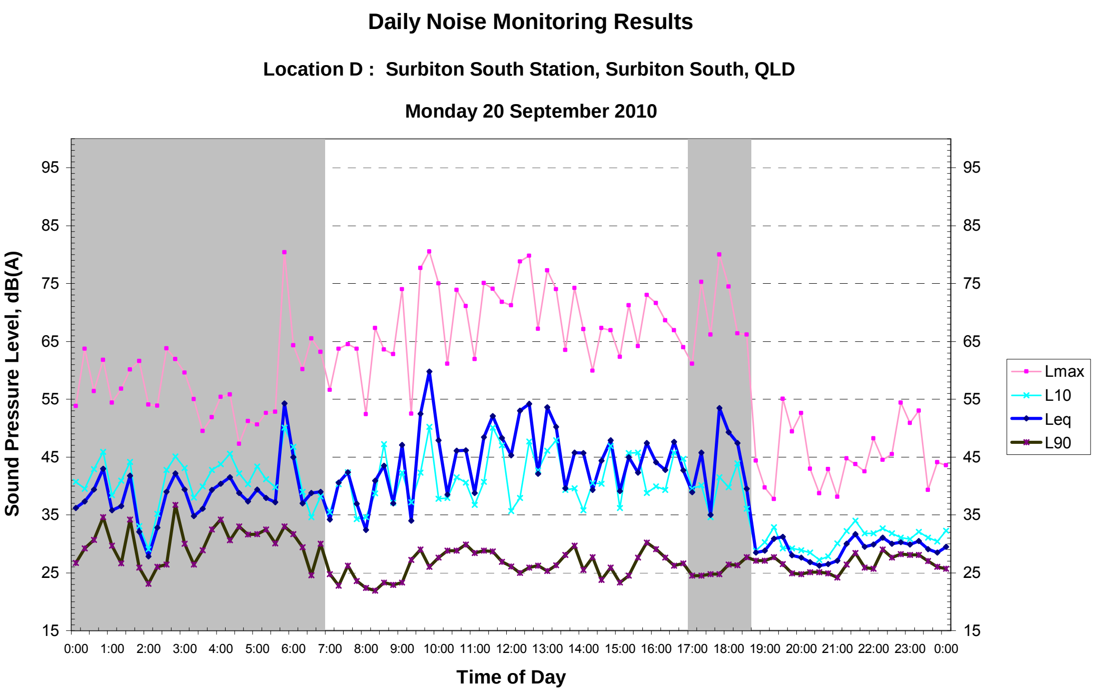
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

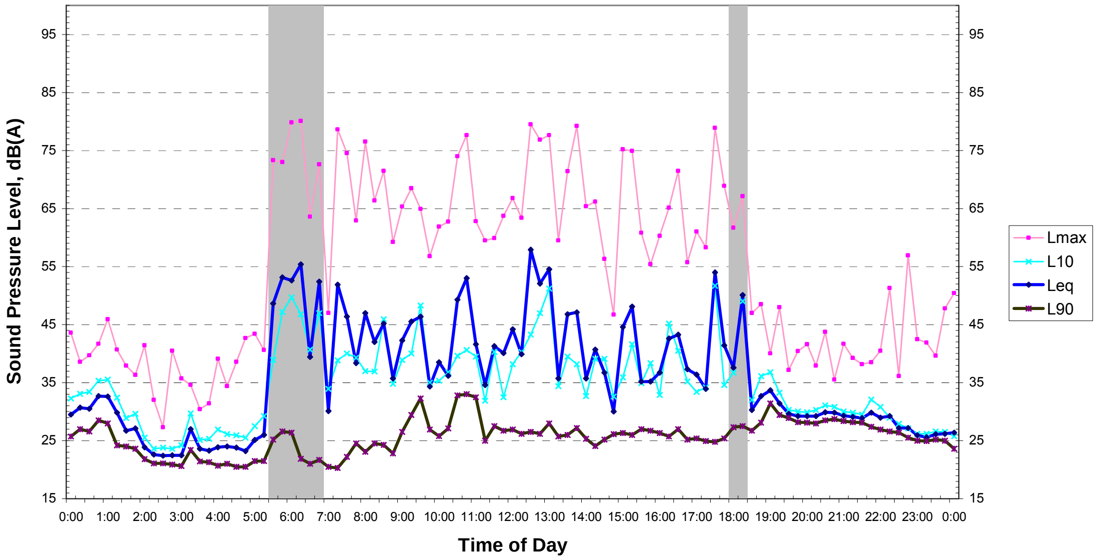
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F

Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

Tuesday 21 September 2010



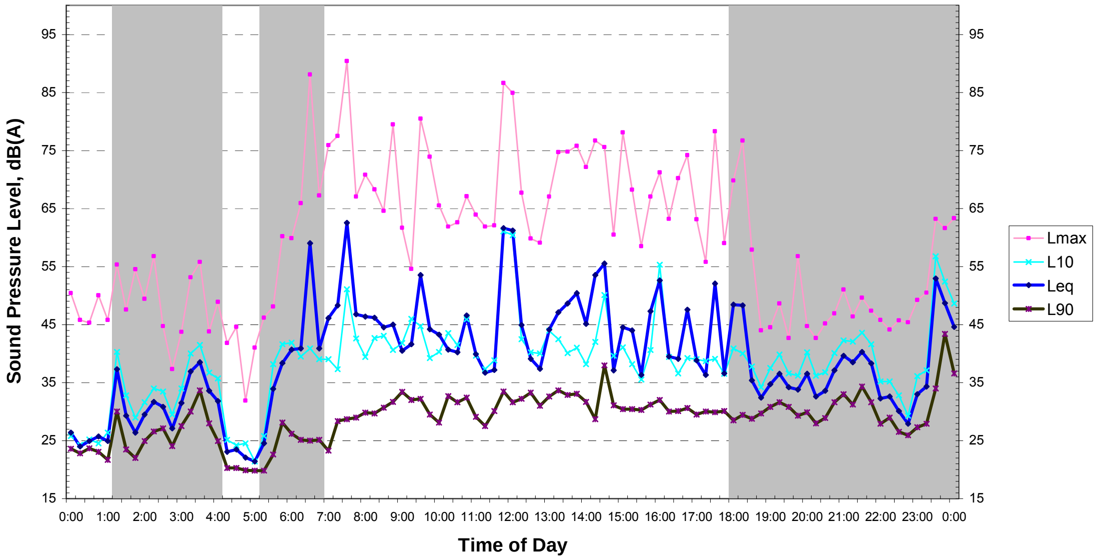
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

Wednesday 22 September 2010



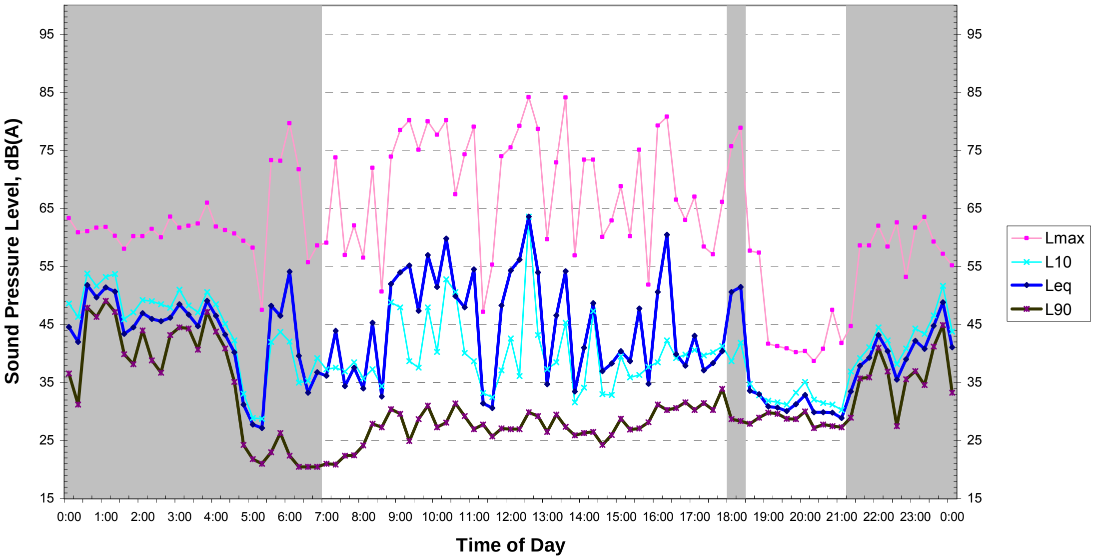
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

Thursday 23 September 2010



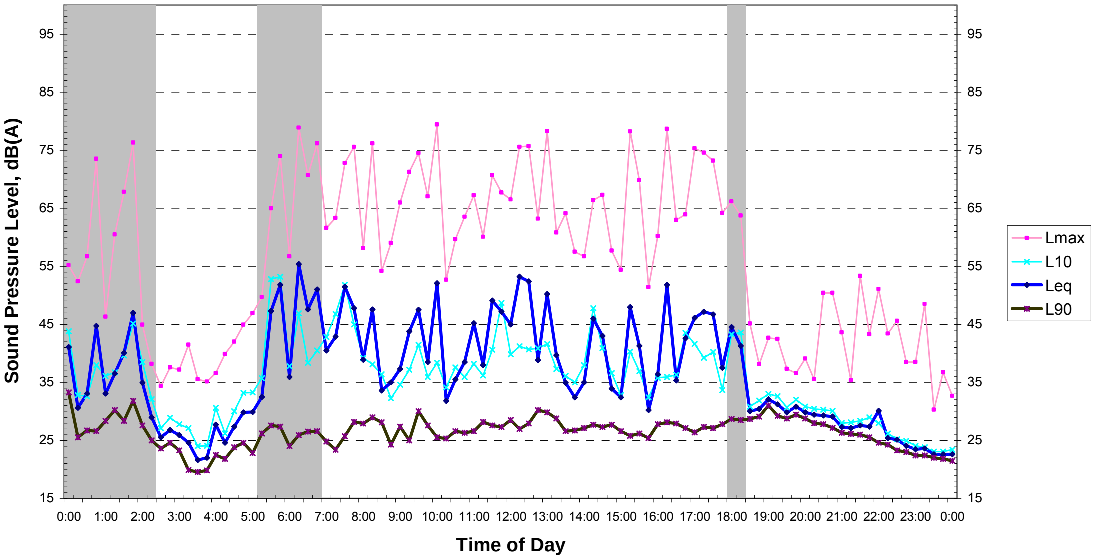
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Daily Noise Monitoring Results

Location D : Surbiton South Station, Surbiton South, QLD

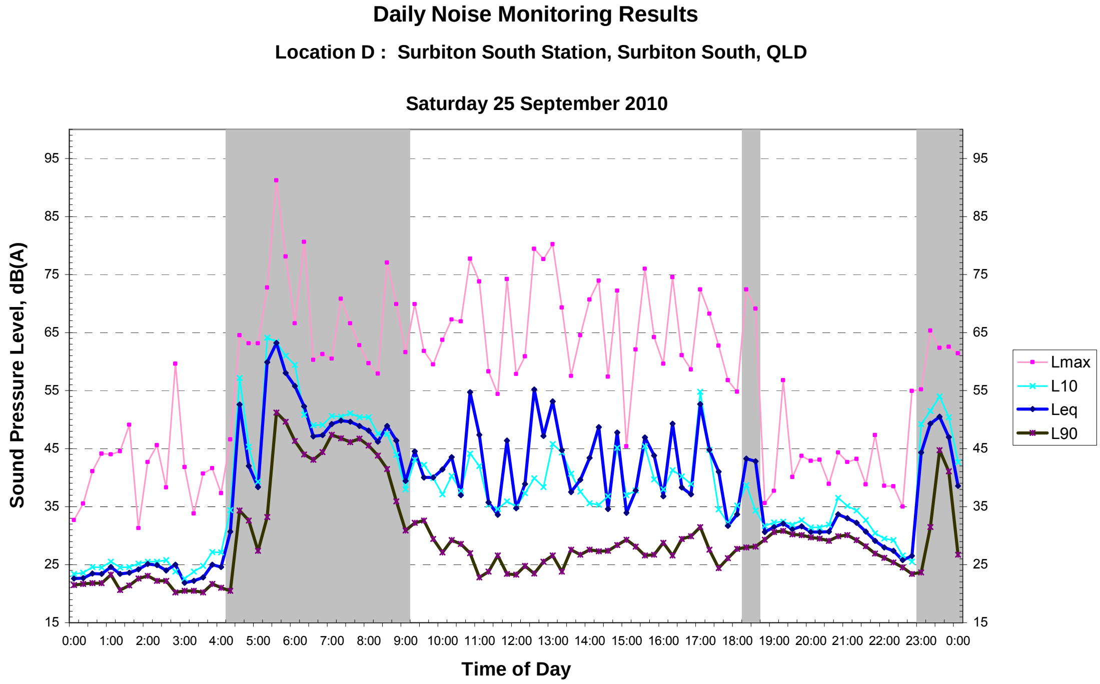
Friday 24 September 2010



Note:

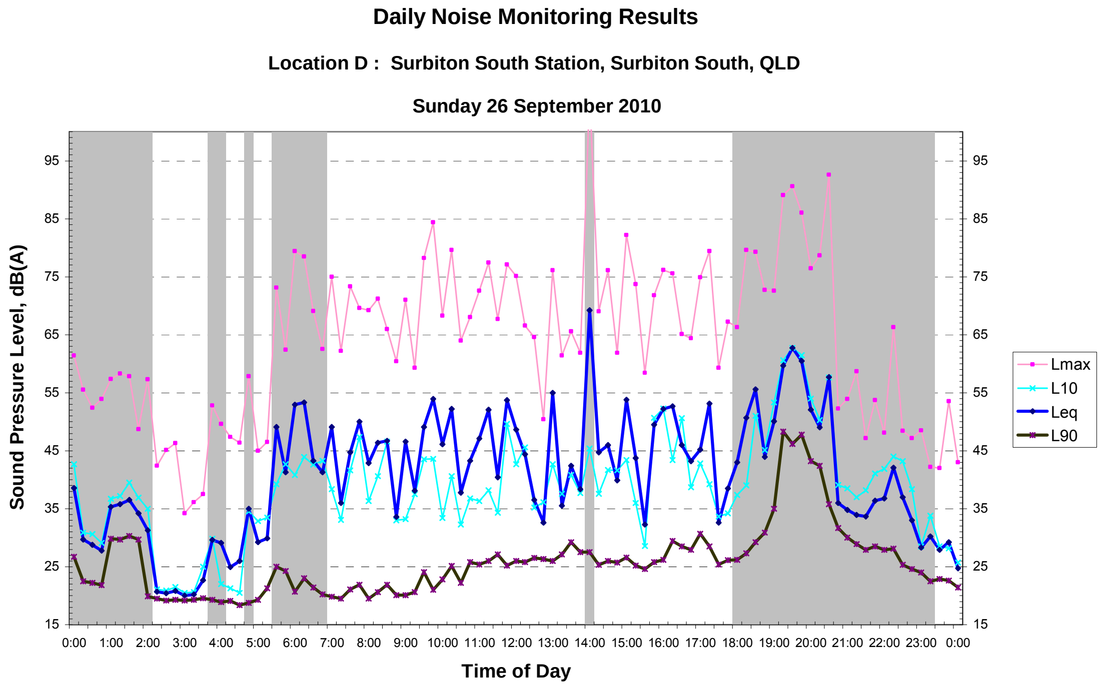
Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

Appendix F



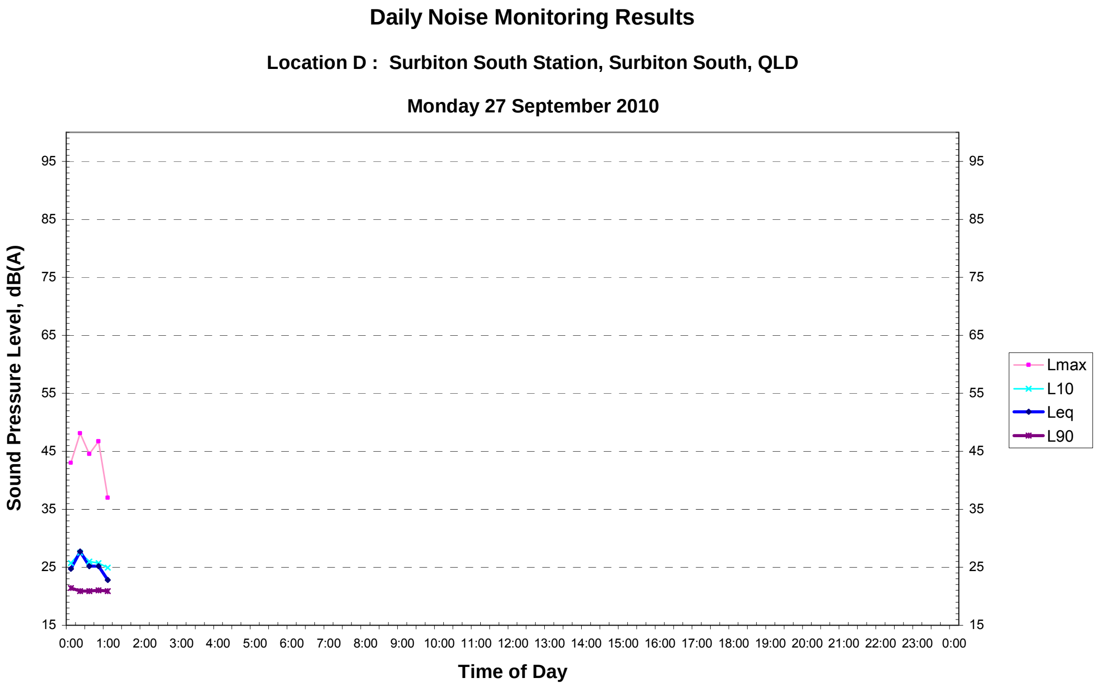
Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.



Note:

Shaded periods indicate periods affected by adverse weather conditions or extraneous noise.
Measured data during these periods were excluded from calculation of noise levels averaged for the period.

G

Appendix G Attended Noise Monitoring Results

Part I

Location	Type	Measurement			1/3 Octave Measured Noise Levels – dB(A)								
		Period	Date	Time	20	25	32	40	50	63	80	100	125
Forrester	L90, 15min	Daytime	13/09/ 2010	13:33	4	0	0	6	0	1	7	7	10
		Evening	29/09/ 2010	19:51	4	1	1	7	1	4	8	8	9
		Night time	13/09/ 2010	22:12	4	0	0	7	0	0	7	0	1
	Leq, 15min	Daytime	13/09/ 2010	13:33	12	12	15	16	16	16	17	18	20
		Evening	29/09/ 2010	19:51	18	18	20	22	22	22	22	20	18
		Night time	13/09/ 2010	22:12	10	0	4	10	3	5	9	7	8
Eulimbie	L90, 15min	Daytime	13/09/ 2010	15:20	4	0	0	7	0	0	7	0	1
		Evening	29/09/ 2010	21:04	4	0	0	7	0	0	7	2	0
		Night time	13/09/ 2010	23:51	4	0	0	7	0	0	7	0	0
	Leq, 15min	Daytime	13/09/ 2010	15:20	9	0	4	9	2	5	10	5	8
		Evening	29/09/ 2010	21:04	10	-3	3	9	-3	4	10	2	3
		Night time	13/09/ 2010	23:51	10	-3	3	9	-3	4	10	2	6
Surbiton South	L90, 15min	Daytime	13/09/ 2010	17:20	4	0	0	7	0	2	8	10	14
		Evening	13:09/ 2010	18:00	4	0	0	7	0	0	7	0	0
		Night time	13/09/ 2010	23:07	4	0	0	7	0	0	7	0	0
	Leq, 15min	Daytime	13/09/ 2010	17:20	10	0	4	10	9	13	17	22	23
		Evening	13:09/ 2010	18:00	9	-3	3	10	7	9	13	13	16
		Night time	13/09/ 2010	23:07	9	-3	0	9	-3	3	9	0	4

Appendix G

Part II

Location	Type	Measurement			1/3 Octave Measured Noise Levels – dB(A)								
		Period	Date	Time	160	200	250	315	400	500	630	800	1000
Forrester	L90, 15min	Daytime	13/09/2010	13:33	12	10	9	11	9	11	14	13	15
		Evening	29/09/2010	19:51	12	12	12	14	13	14	16	17	18
		Night time	13/09/2010	22:12	7	0	0	7	1	4	10	7	8
	Leq, 15min	Daytime	13/09/2010	13:33	20	19	18	18	18	19	20	20	22
		Evening	29/09/2010	19:51	18	18	19	20	20	20	21	23	24
		Night time	13/09/2010	22:12	16	16	10	13	14	12	14	17	16
Eulimbie	L90, 15min	Daytime	13/09/2010	15:20	7	5	7	10	7	9	12	11	12
		Evening	29/09/2010	21:04	7	2	4	8	1	5	8	5	8
		Night time	13/09/2010	23:51	7	0	0	7	1	4	9	5	7
	Leq, 15min	Daytime	13/09/2010	15:20	13	13	12	15	14	16	18	19	27
		Evening	29/09/2010	21:04	12	11	8	11	12	12	13	17	13
		Night time	13/09/2010	23:51	12	10	8	11	12	12	13	17	13
Surbiton South	L90, 15min	Daytime	13/09/2010	17:20	17	14	13	11	6	7	11	8	10
		Evening	13:09/2010	18:00	7	0	1	6	1	2	8	4	7
		Night time	13/09/2010	23:07	7	0	0	7	0	1	8	4	7
	Leq, 15min	Daytime	13/09/2010	17:20	26	24	22	22	24	25	23	25	24
		Evening	13:09/2010	18:00	17	18	16	17	16	15	18	16	18
		Night time	13/09/2010	23:07	10	5	7	10	7	10	13	13	14

Part III

Location	Type	Measurement			1/3 Octave Measured Noise Levels – dB(A)								
		Period	Date	Time	1250	1600	2000	2500	3150	4000	5000	6300	8000
Forrester	L90, 15min	Daytime	13/09/2010	13:33	18	19	19	19	19	19	18	16	15
		Evening	29/09/2010	19:51	20	21	23	21	27	29	29	24	16
		Night time	13/09/2010	22:12	14	17	14	13	25	28	25	14	13
	Leq, 15min	Daytime	13/09/2010	13:33	26	29	30	30	31	30	27	22	19
		Evening	29/09/2010	19:51	24	26	29	26	30	36	43	39	21
		Night time	13/09/2010	22:12	20	22	20	19	30	33	39	23	19
Eulimbie	L90, 15min	Daytime	13/09/2010	15:20	15	14	15	16	15	15	16	15	14
		Evening	29/09/2010	21:04	15	24	17	17	29	23	18	14	13
		Night time	13/09/2010	23:51	15	24	18	17	29	23	19	13	13
	Leq, 15min	Daytime	13/09/2010	15:20	26	28	29	30	31	32	32	28	25
		Evening	29/09/2010	21:04	19	28	23	20	33	27	34	20	17
		Night time	13/09/2010	23:51	19	28	22	21	32	26	34	19	17
Surbiton South	L90, 15min	Daytime	13/09/2010	17:20	13	12	12	14	13	13	18	24	14
		Evening	13:09/2010	18:00	11	8	10	12	17	21	23	14	13
		Night time	13/09/2010	23:07	10	7	9	12	17	21	23	13	13
	Leq, 15min	Daytime	13/09/2010	17:20	28	32	36	37	41	41	37	34	31
		Evening	13:09/2010	18:00	23	31	30	29	33	36	32	28	19
		Night time	13/09/2010	23:07	17	17	17	18	20	25	28	17	17

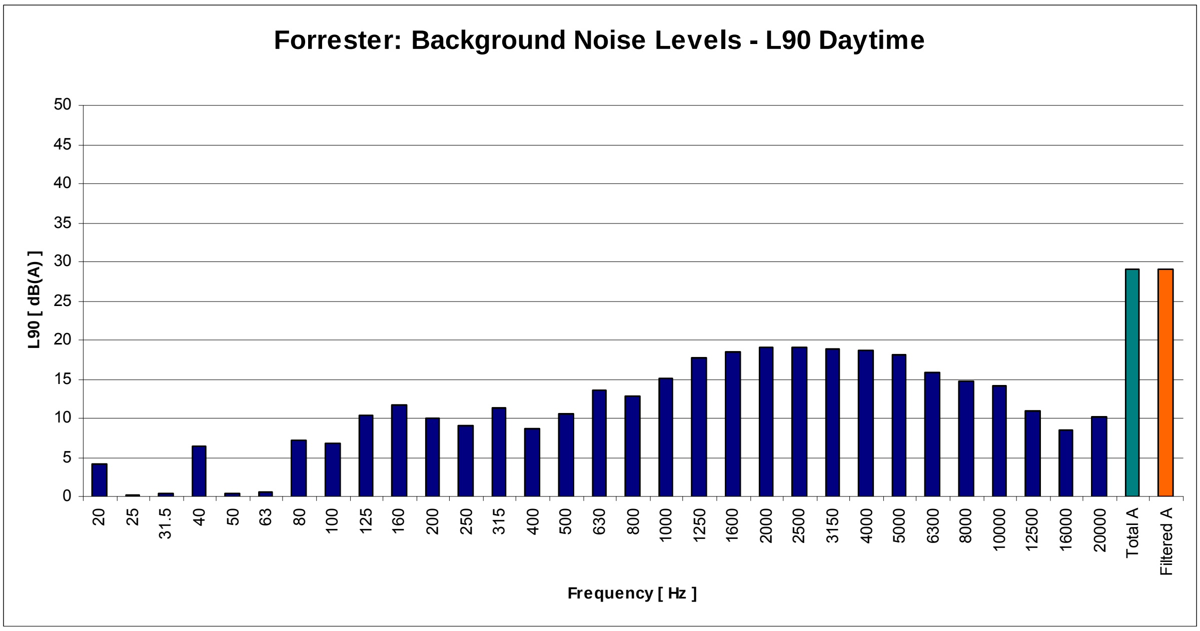
Appendix G

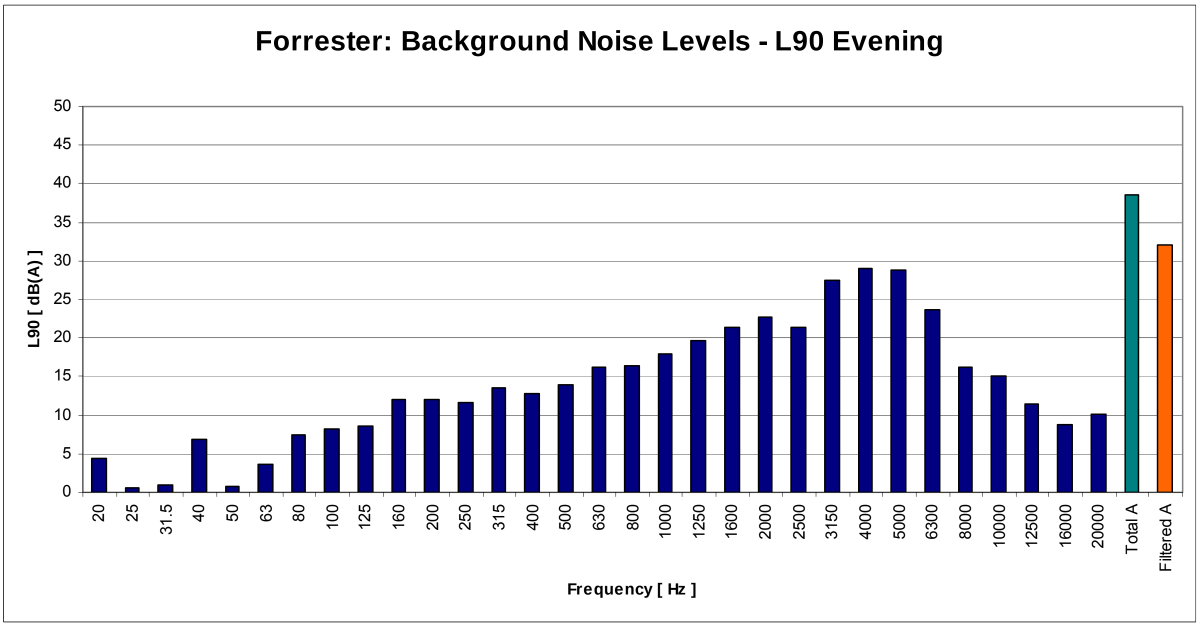
Part IV

Location	Type	Measurement Period	Measurement Date	Measurement Time	1/3 Octave Measured Noise Levels – dB(A) 10000	12500	16000	20000	Total A	Filtered A
Forrester	L90, 15min	Daytime	13/09/ 2010	13:33	14	11	9	10	29	29
		Evening	29/09/ 2010	19:51	15	11	9	10	39	32
		Night time	13/09/ 2010	22:12	14	10	8	10	34	25
	Leq, 15min	Daytime	13/09/ 2010	13:33	16	12	10	11	38	38
		Evening	29/09/ 2010	19:51	18	16	11	25	46	41
		Night time	13/09/ 2010	22:12	19	15	14	15	41	31
Eulimbie	L90, 15min	Daytime	13/09/ 2010	15:20	14	11	9	11	25	25
		Evening	29/09/ 2010	21:04	14	11	11	13	33	28
		Night time	13/09/ 2010	23:51	14	11	11	13	32	27
	Leq, 15min	Daytime	13/09/ 2010	15:20	19	15	12	12	39	39
		Evening	29/09/ 2010	21:04	16	14	23	21	38	32
		Night time	13/09/ 2010	23:51	16	13	22	21	38	32
Surbiton South	L90, 15min	Daytime	13/09/ 2010	17:20	14	11	9	11	30	30
		Evening	13:09/ 2010	18:00	14	11	9	10	26	24
		Night time	13/09/ 2010	23:07	14	11	9	11	26	24
	Leq, 15min	Daytime	13/09/ 2010	17:20	26	19	15	13	47	47
		Evening	13:09/ 2010	18:00	16	12	11	13	40	37
		Night time	13/09/ 2010	23:07	17	12	10	12	31	28

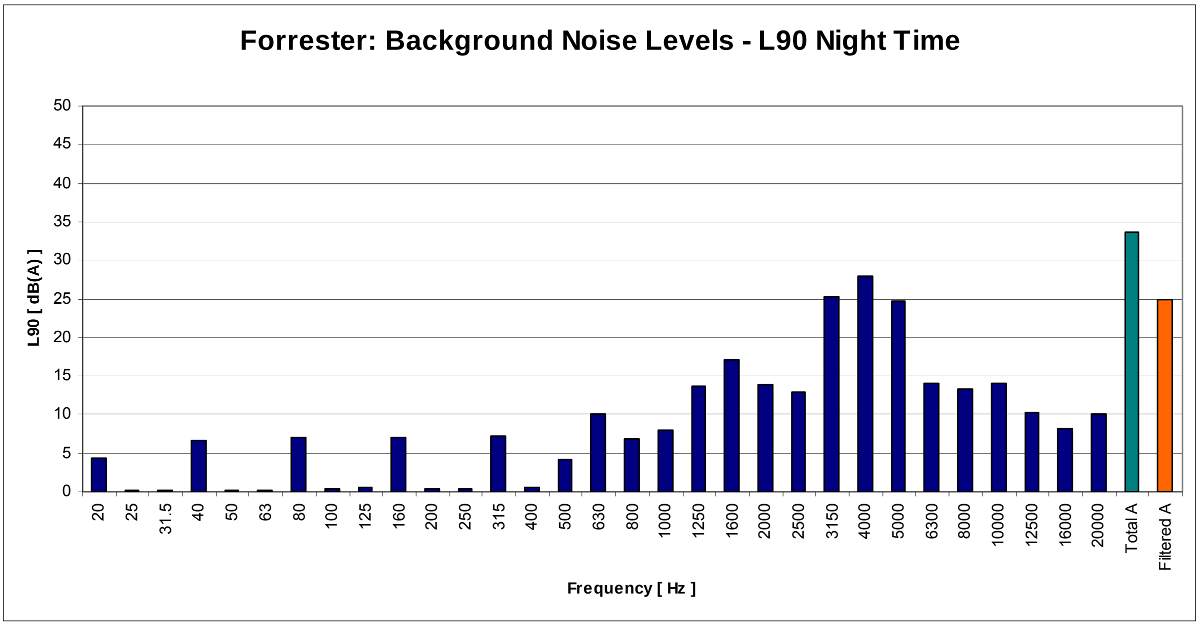
Appendix G

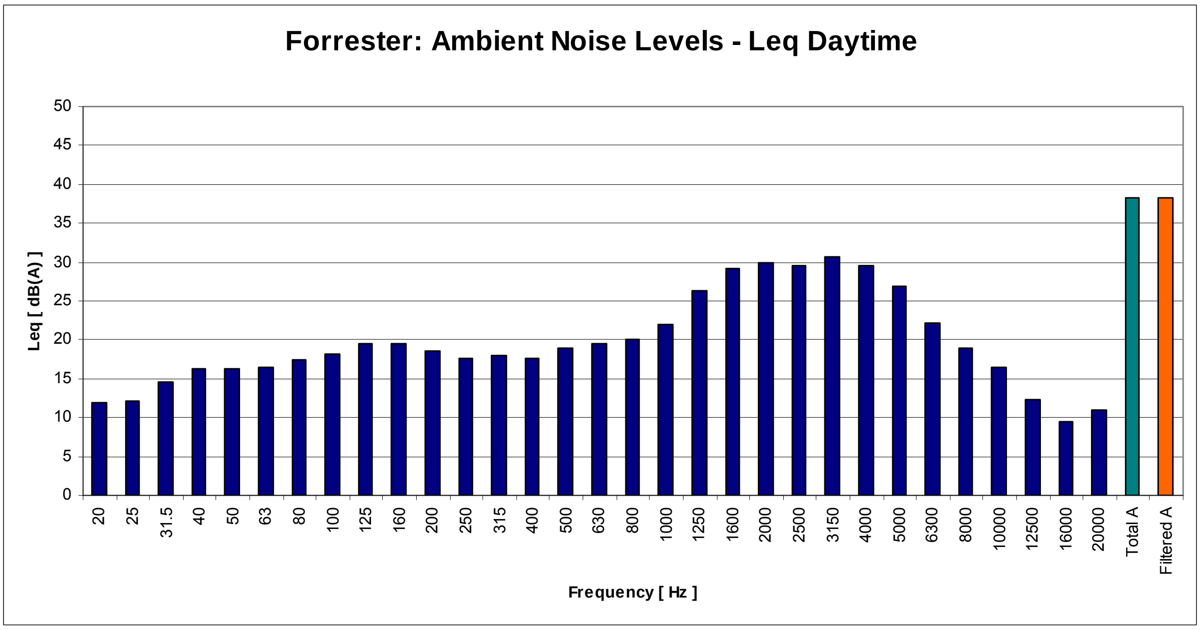
Forrester: 1/3 Octave Band Graphs



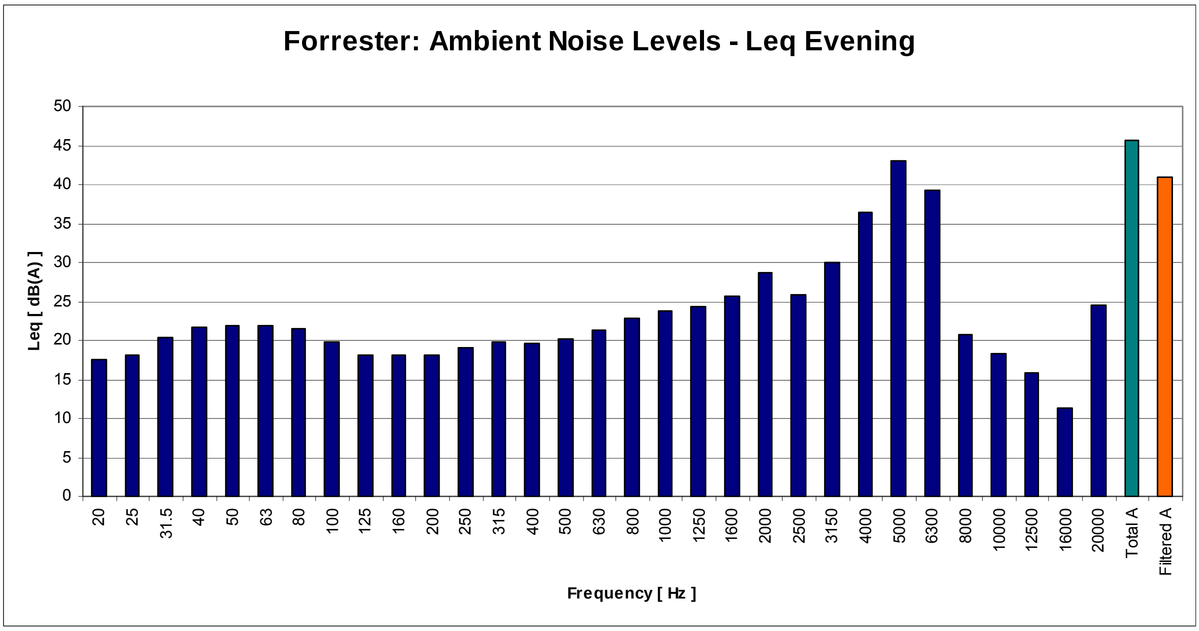


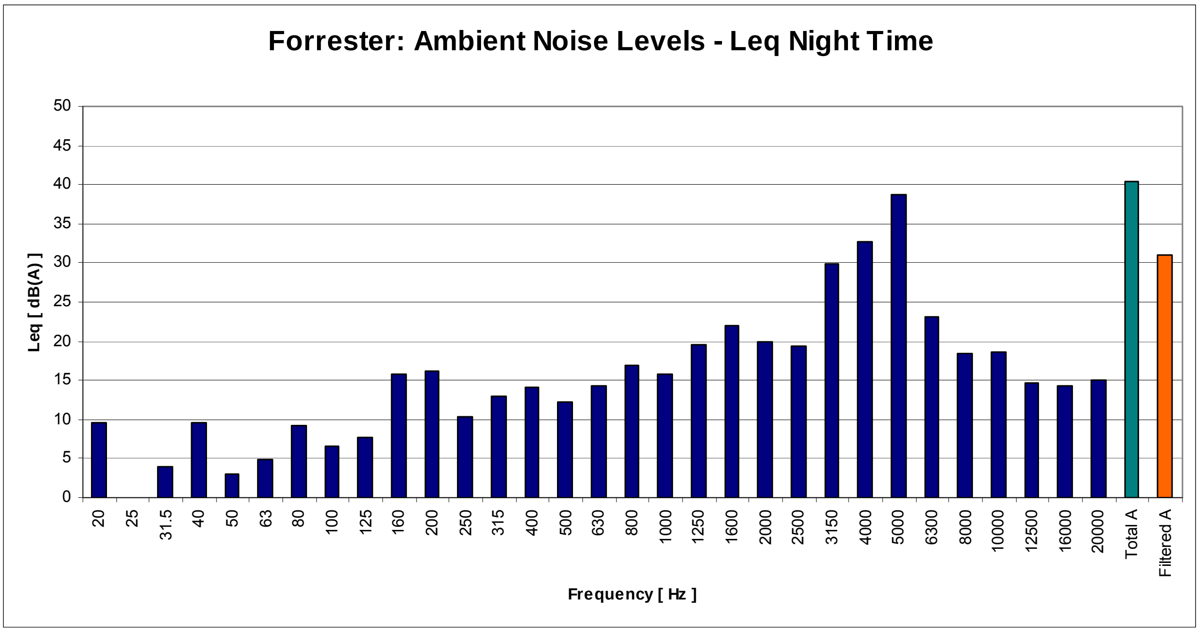
Appendix G


Forrester: Background Noise Levels - L90 Night Time
L90 [dB(A)]
0
5
10
15
20
25
30
35
40
45
50
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]


Forrester: Ambient Noise Levels - Leq Daytime
Leq [dB(A)]
0
5
10
15
20
25
30
35
40
45
50
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]

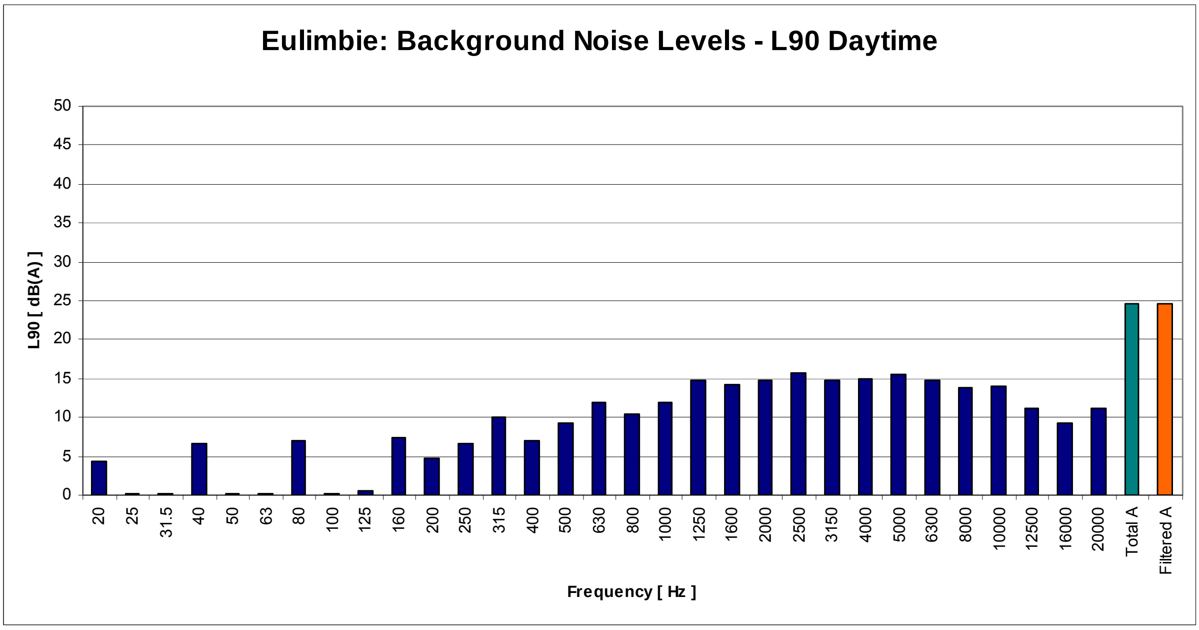
Appendix G

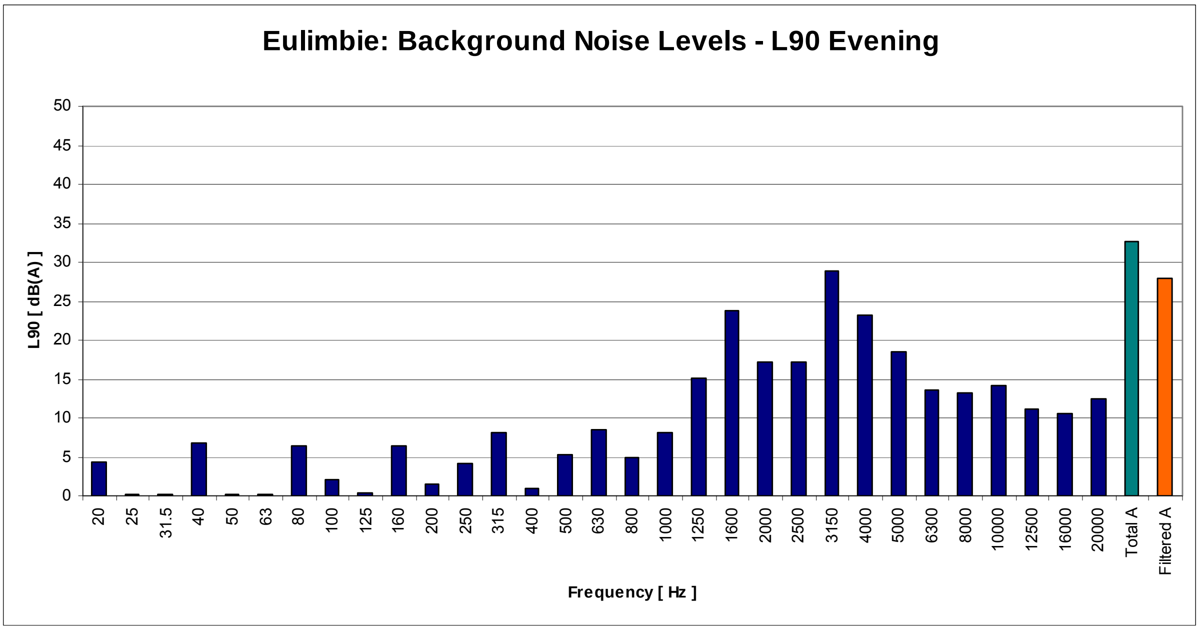

Forrester: Ambient Noise Levels - Leq Evening
Leq [dB(A)]
Frequency [Hz]
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A


Forrester: Ambient Noise Levels - Leq Night Time
Leq [dB(A)]
Frequency [Hz]
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A

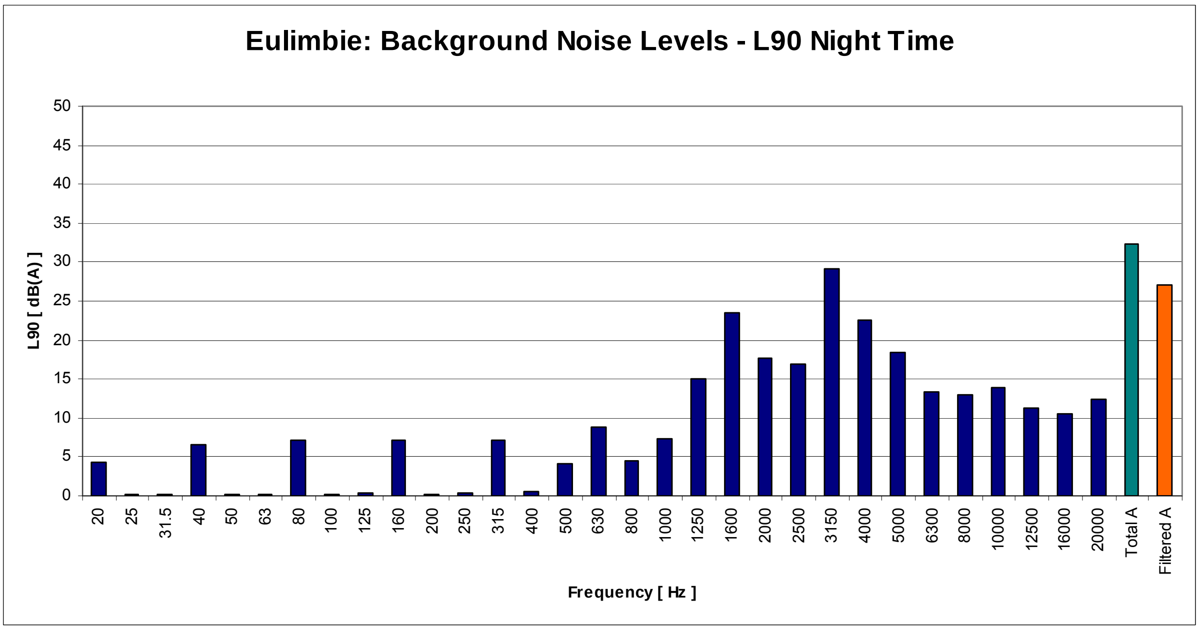
Appendix G

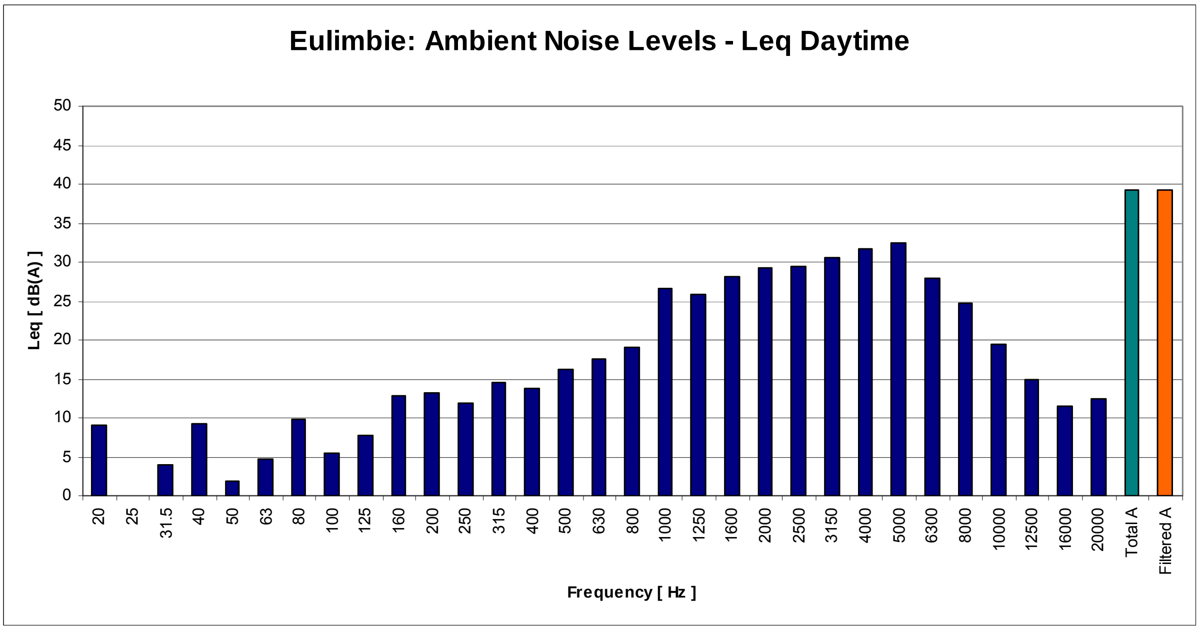
Eulimbie: 1/3 Octave Band Graphs



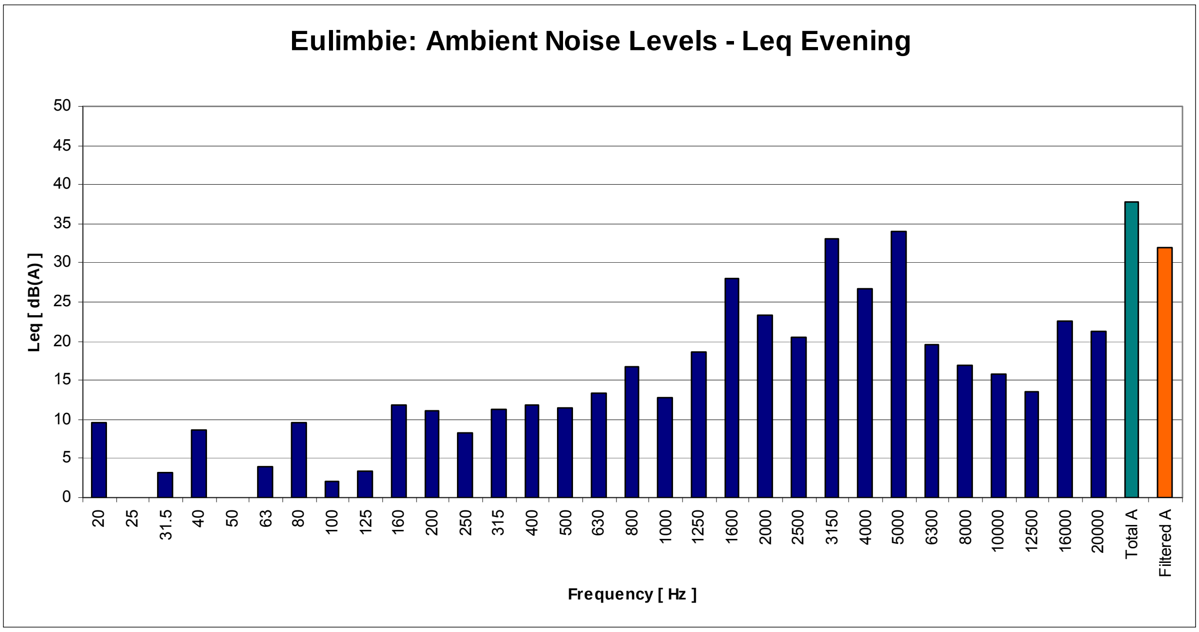


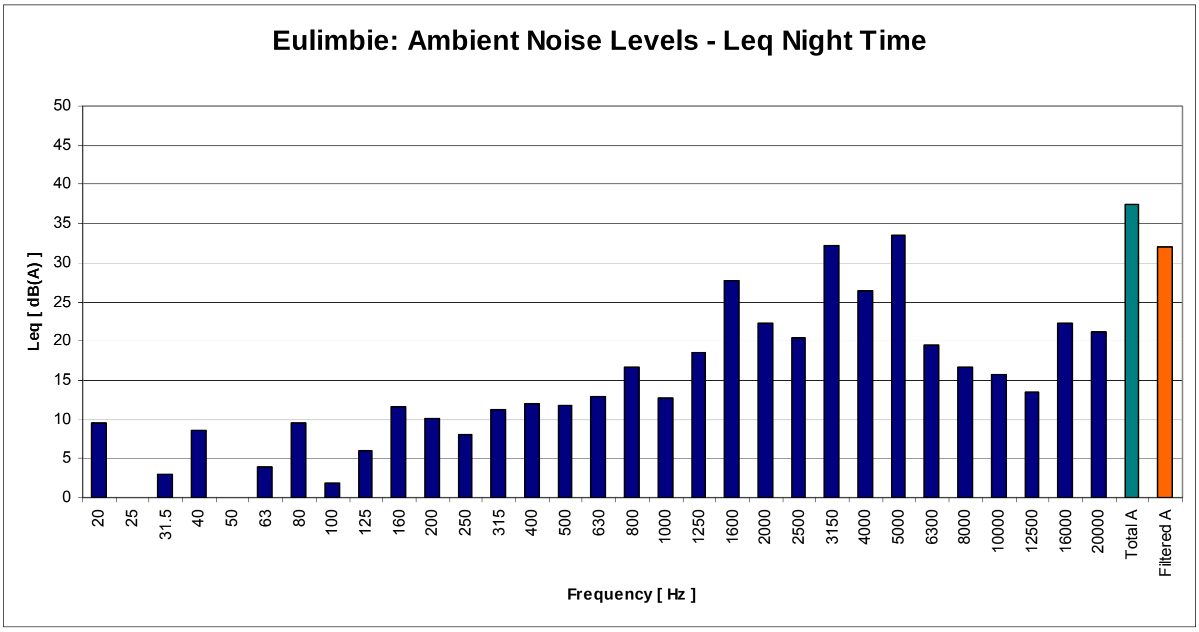
Appendix G


Eulimbie: Background Noise Levels - L90 Night Time
L90 [dB(A)]
50
45
40
35
30
25
20
15
10
5
0
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]


Eulimbie: Ambient Noise Levels - Leq Daytime
Leq [dB(A)]
50
45
40
35
30
25
20
15
10
5
0
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]

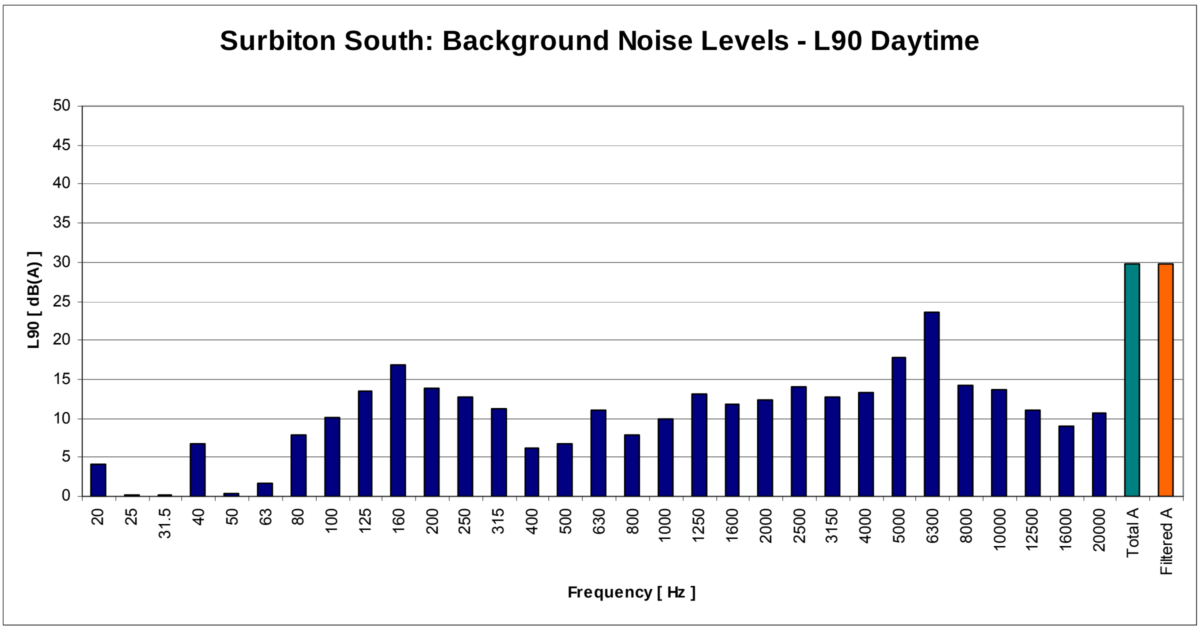
Appendix G

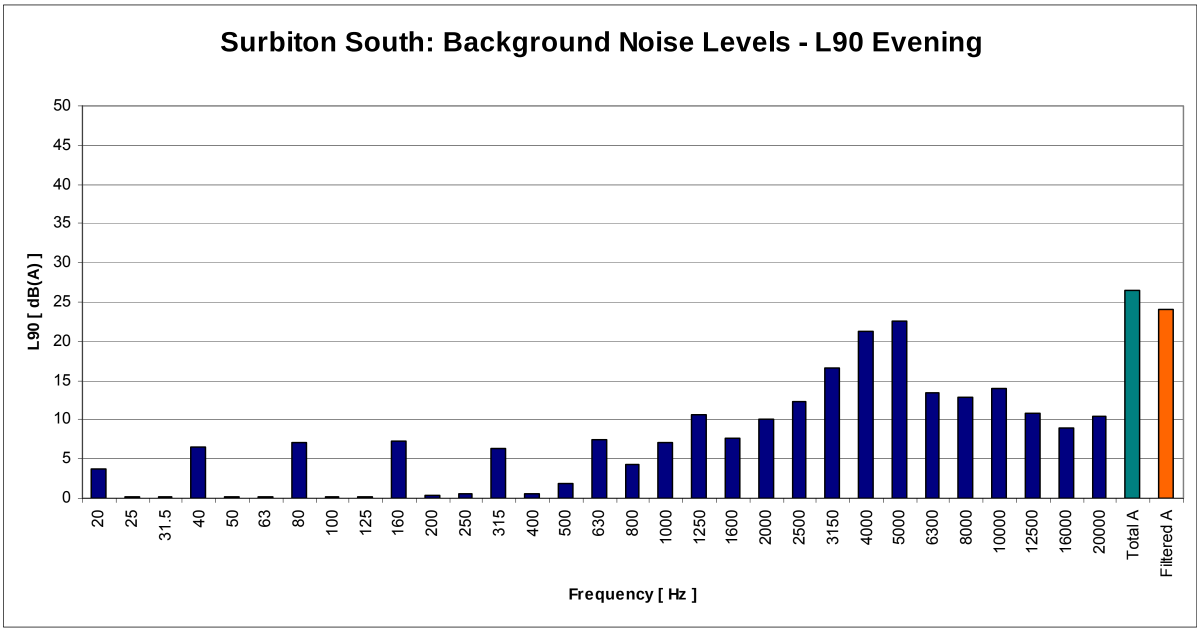

Eulimbie: Ambient Noise Levels - Leq Evening
Leq [dB(A)]
50
45
40
35
30
25
20
15
10
5
0
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]


Eulimbie: Ambient Noise Levels - Leq Night Time
Leq [dB(A)]
50
45
40
35
30
25
20
15
10
5
0
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]

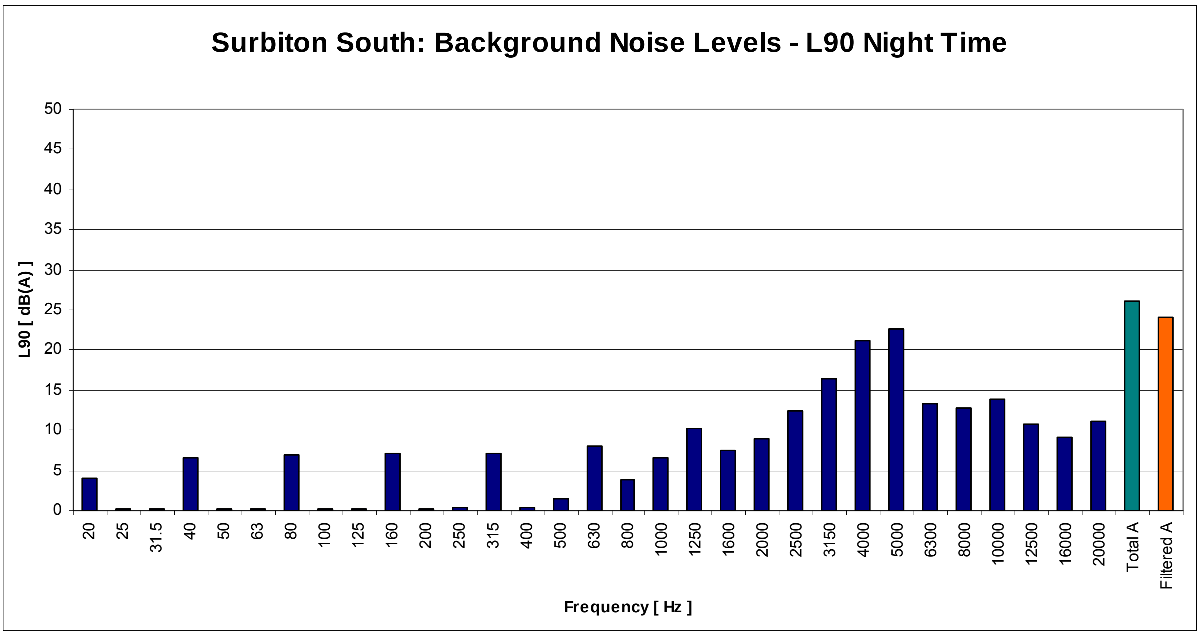
Appendix G

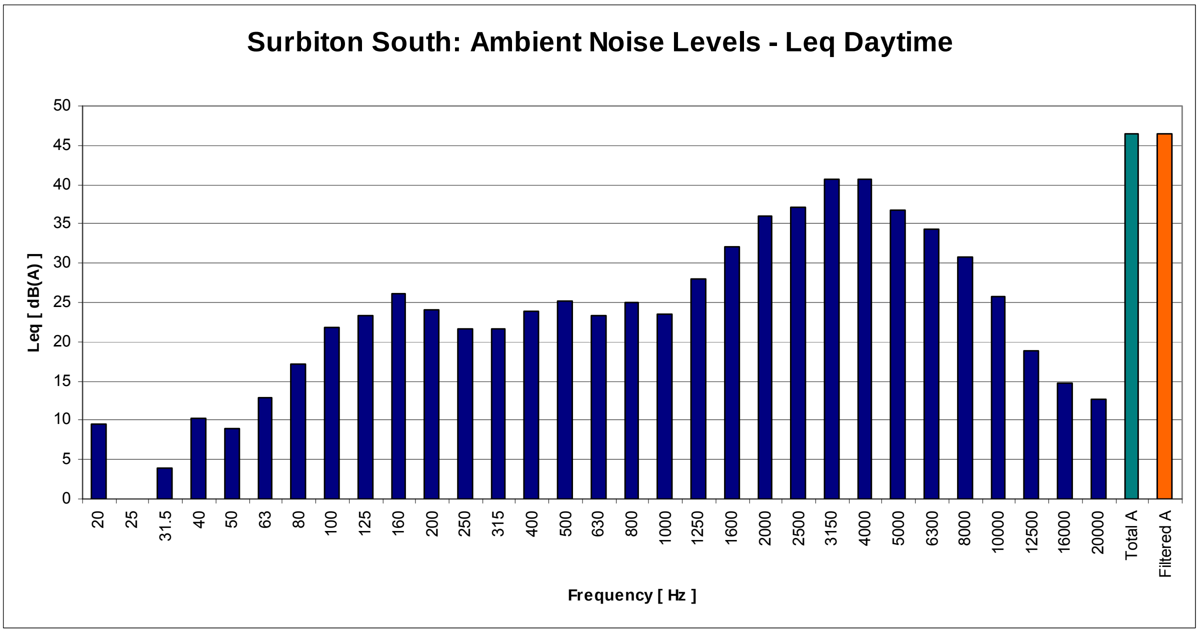
Surbiton South: 1/3 Octave Band Graphs



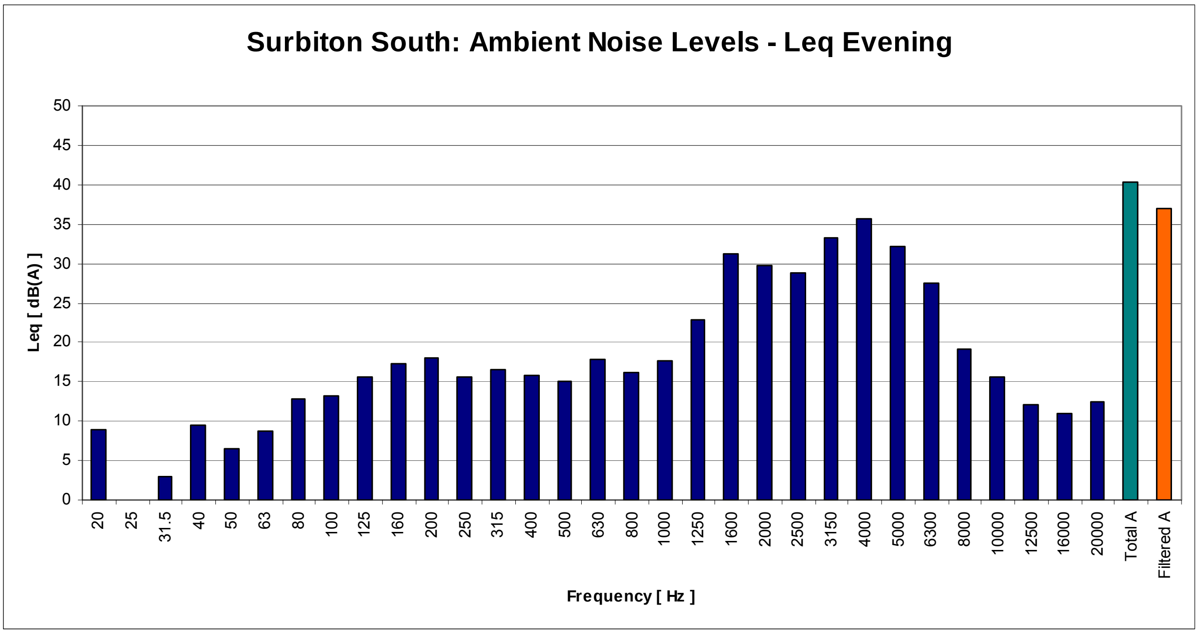


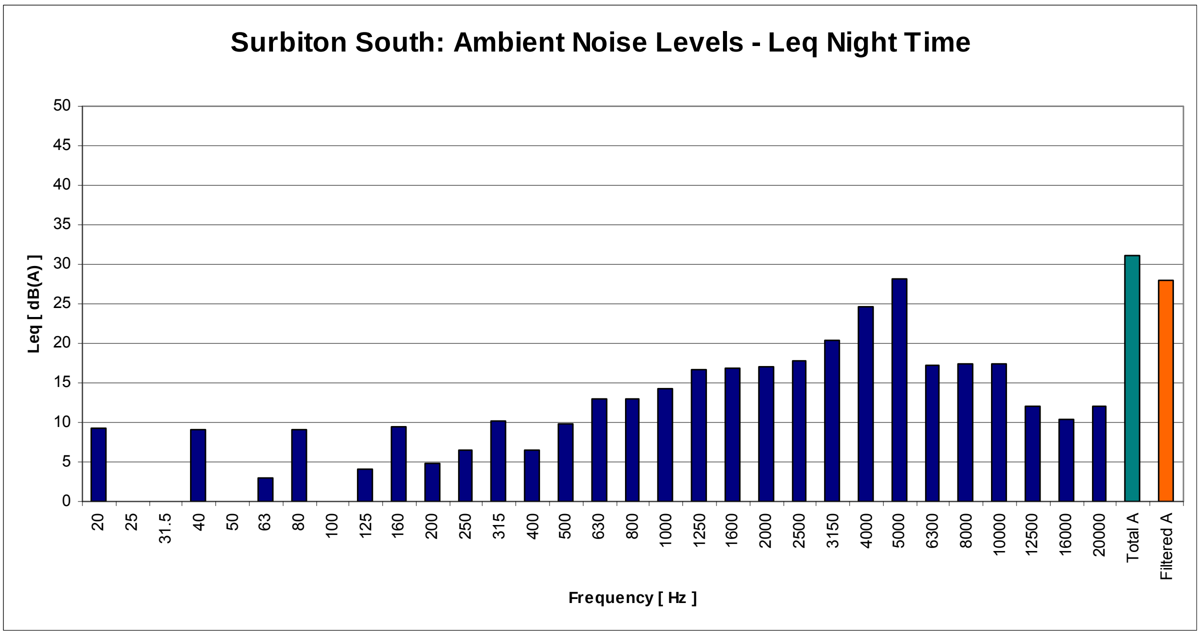
Appendix G


Surbiton South: Background Noise Levels - L90 Night Time
L90 [dB(A)]
0
5
10
15
20
25
30
35
40
45
50
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]


Surbiton South: Ambient Noise Levels - Leq Daytime
Leq [dB(A)]
0
5
10
15
20
25
30
35
40
45
50
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A
Frequency [Hz]

Appendix G


Surbiton South: Ambient Noise Levels - Leq Evening
Leq [dB(A)]
Frequency [Hz]
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A


Surbiton South: Ambient Noise Levels - Leq Night Time
Leq [dB(A)]
Frequency [Hz]
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
12500
16000
20000
Total A
Filtered A

URS Australia Pty Ltd
Level 17, 240 Queen Street
Brisbane, QLD 4000
GPO Box 302, QLD 4001
Australia
T: 61 7 3243 2111
F: 61 7 3243 2199

www.ap.urscorp.com