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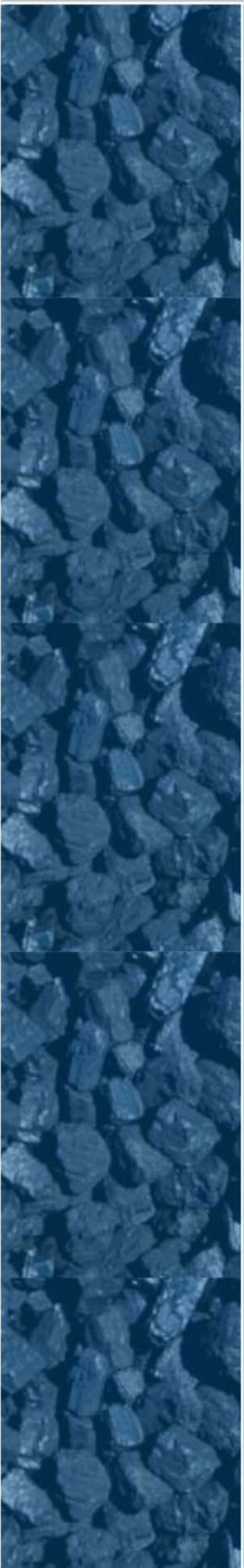

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project: Mine Technical Report

Noise and Vibration 25215-D-RP-0017

15 November 2012

Revision 1

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The services undertaken by GHD in connection with preparing the Report were limited to those specifically detailed in Section 1.2 of the Report.

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Abbreviations and Glossary

Project Specific Terminology	
Abbreviation	**Term**
the EIS	Carmichael Coal Mine and Rail Project Environmental Impact Statement- refers to the particular document that GHD is preparing to facilitate approval of the Project
the Project	Carmichael Coal Mine and Rail Project
the Proponent	Adani Mining Pty Ltd

Generic Terminology	
Abbreviation	**Term**
Airblast overpressure	The energy transmitted from the blast site within the atmosphere in the form of pressure waves. The maximum excess pressure in this wave is known as the peak air overpressure, generally measured in decibels using linear frequency weighting.
Blasting	The use of explosives to fracture rock, coal or other materials for later recovery
CHPP	Coal handling process plant
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dB(A)	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
DERM	Former Queensland Department of Environment and Resource Management
L_{A10}	The sound pressure level that is exceeded for 10 per cent of the measurement period.
L_{A90}	The sound pressure level that is exceeded for 90 per cent of the measurement period.
L_{Aeq}	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
L_{Amax}	The maximum sound level recorded during the measurement period.
L_{Amin}	The minimum sound level recorded during the measurement period.
LFN	Low frequency noise, sound in the frequency range 10 Hz to 200 Hz.
MIA	Mine infrastructure area
Mtpa	Million Tonnes Per Annum

Generic Terminology

Abbreviation	Term
Noise Sensitive Place/Receptor	With consideration to the Environmental Protection (Noise) Policy 2008 and of relevance to the Project (Mine) a noise sensitive place (that is a potential sensitive receptor) is defined as (amongst others): ◗ A dwelling ◗ A library, childcare centre, kindergarten, school, college, university or other educational institution ◗ A hospital, surgery or other medical institution ◗ A protected area, or an area identified under a conservation plan as a critical habitat or an area of major interest under the *Nature Conservation Act 1992* ◗ A marine park under the *Marine Parks Act 1982* • A park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment
PPV	Peak particle velocity, a measure of the ground vibration magnitude and is the maximum instantaneous particle velocity at a point during a given time interval in mm/s.
RBL	Rating background level, the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level). This is the level used for assessment purposes. It is defined as the median value of: ◗ All the day assessment background levels over the monitoring period for the day (7:00 am to 6:00 pm) ◗ All the evening assessment background levels over the monitoring period for the evening (6:00 pm to 10:00 pm) ◗ All the night assessment background levels over the monitoring period for the night (10:00 pm to 7:00 am)
SLM	Sound level meter, capable of measuring continuous sound pressure levels and able to record L_{Amin}, L_{A90}, L_{A10}, L_{Amax} and L_{Aeq} noise descriptors
SWL	Sound power level
ROM	Run of mine stockpile
TOR	Terms of Reference
VDV	Vibration Dose Value - As defined in BS6472 – 2008, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
Vibration	The variation of the magnitude of a quantity which is descriptive of the motion or position of a mechanical system, when the magnitude is alternately greater and smaller than some average value or reference. Vibration can be measured in terms of its displacement, velocity or acceleration. The common units for velocity are millimetres per second (mm/s).
WHO	World Health Organisation

Executive Summary

Adani Mining Pty Ltd (Adani) is proposing to develop a 60 million tonne (product) per annum thermal coal mine in the north Galilee Basin, Central Queensland. The Carmichael Coal Mine and Rail Project (the Project) comprises of two major components; the Project (Mine) and the Project (Rail).

This report has been prepared to assess potential noise and vibration impacts relevant to the construction and operation of the Project (Mine), and will form part of an Environmental Impact Statement (EIS) for the Project. Noise and vibration impacts from construction and operation of the Project (Mine) have been assessed against the Project EIS terms of reference (ToR), relevant Queensland legislation and guidelines as well as recognised international standards and guidelines, where required.

Baseline noise monitoring was conducted at two locations in the vicinity of the proposed Project (Mine). Based on the background noise monitoring results, operational noise criteria were determined with consideration to the *Planning for Noise Control* (PNC) Guideline (EPA 2004). This report also outlines construction and operational noise and vibration criteria, including blasting vibration and overpressure criteria.

Acoustic modelling was undertaken using CadnaA Version 4.2 and implementing the CONCAWE algorithm to predict the effects of construction and operational related noise from the Project (Mine).

Noise model results indicate construction noise is not expected to cause any significant impacts at noise sensitive receptors. Results indicate that predicted construction noise levels outside of normal hours are expected to be well under the 55 dB(A) World Health Organisation criteria for sleep at all sensitive receptors. Vibration levels produced by construction activities within the mining boundary are expected to be well below the most stringent structural damage criteria of 3 mm/s at receptors located at distances greater than 50 metres.

Operational noise modelling results including low frequency noise and traffic noise indicate that received noise levels are expected to comply with the project specific criteria at all assessed sensitive receptors under assessed neutral and adverse weather conditions. However, a marginal (1 dB) exceedance of the most stringent operation noise criteria has been predicted at receptor 4 during peak operation (year 2067). This exceedance is very minor and is still considered acceptable since it has been predicted using the conservative assumptions outlined in this report.

Predicted results indicate the estimated construction and operational noise level at the nearest potentially affected receptor due to vehicle movements along Elgin Moray Road is expected to be well under the Department of Transport and Main Roads (DTMR) 68 dB(A)$L_{10,18hr}$ criteria. Based on the provided traffic volumes, the buffer distance to comply with the criteria is approximately 45 m from the nearest edge of the road.

Vibration levels from blasting during removal of overburden and coal have been predicted to comply with the adopted blasting criteria. Airblast overpressure levels are also expected to comply with the criteria, however airblast overpressure levels are expected to approach the criteria at sensitive receptors 4 (Lignum) and 6 (Doongmabulla). It is recommended that blast monitoring be conducted during the initial blasts to assist with the optimisation of the blast parameters and confirmation of predictions.

Based on available literature it is unlikely that any adverse impacts on livestock and native fauna would be associated with the Project (Mine) (see Volume 4 Appendix N1 Mine Terrestrial Ecology Report). As such, mitigation measures are not recommended.

Although adverse noise impacts are not predicted, a range of management measures are provided in this report as corrective actions if noise impacts do occur and/or valid noise-related complaints are received.

1. Introduction

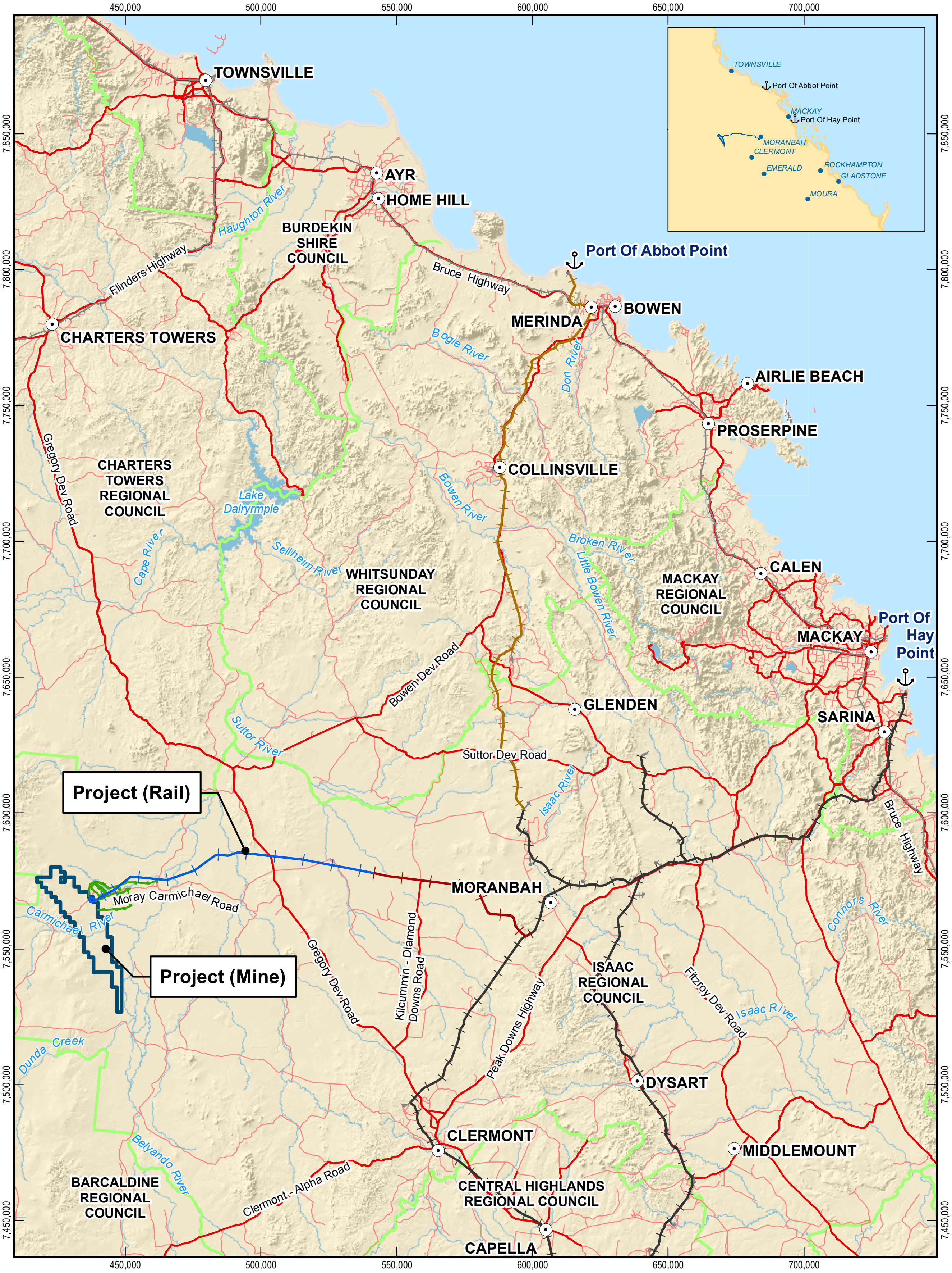
1.1 Project Overview

Adani Mining Pty Ltd (Adani) is proposing to develop a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the north Galilee Basin approximately 160 kilometres (km) north-west of the town of Clermont, Central Queensland. All coal will be railed via a privately owned rail line connecting to the existing QR National rail infrastructure, and shipped through coal terminal facilities at the Port of Abbot Point and the Port of Hay Point (Dudgeon Point expansion). The Carmichael Coal Mine and Rail Project (the Project) will have an operating life of approximately 90 years. The Project comprises of two major components:

- The Project (Mine): a greenfield coal mine over EPC1690 and the eastern portion of EPC1080, which includes both open cut and underground mining, on mine infrastructure and associated coal processing facilities (the Mine) and the Mine (offsite) infrastructure including:
  - A workers accommodation village and associated facilities
  - A permanent airport site
  - Water supply infrastructure
- The Project (Rail): greenfield rail lines connecting the Mine to the existing Goonyella and Newlands rail systems; including:
  - Rail (west): a 120 km dual gauge portion from the Mine site running west to east to a junction with proposed lines running south-east to the Goonyella rail system and north-east to the Newlands rail system
  - Rail (east): a 69 km narrow gauge portion connecting to the Goonyella rail system south of Moranbah to provide for export of coal via the Port of Hay Point (Dudgeon Point expansion)

The Project has been declared a 'significant project' under the *State Development and Public Works Organisation Act 1971* (SDPWO Act) and as such, an Environmental Impact Statement (EIS) is required for the Project. The Project is also a 'controlled action' and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Project EIS has been developed with the objective of avoiding or mitigating all potential adverse impacts to environmental, social and economic values and enhancing positive impacts. Detailed descriptions of the Project are provided in Volume 2 Section 2 Project Description (Mine) and Volume 3 Section 2 Project Description (Rail). The location of the Project is illustrated in Figure 1-1.



LEGEND

- Town
- Major Port
- Other Rail Network
- Goonyella System
- Newlands System
- State Road
- Local Road
- Watercourse
- Local Government Area
- Project (Rail)
  - Rail (West)
  - Rail (East)
- Project (Mine)
- Mine (Offsite)

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:2,000,000 (at A4)

0 10 20 30 40 50

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	L
Date	28-08-2012

Project Location

Figure: 1-1

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Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: © Commonwealth of Australia (Geoscience Australia): Town, Railways, Watercourses (2007); DERM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); Gassman/Hyder: Mine (Offsite) (2012); DME: EPC1690 (2010), EPC1080 (2011); Adani: Alignment Opt9 Rev3 (2012). Created by: BW, JVC

1.2 Scope of Reporting

This report addresses those elements of noise and vibration relevant to the Project (Mine) during construction and operation. Assessment of noise and vibration relevant to the Project (Rail) is provided in Volume 4 Appendix AF. This report has been prepared in accordance with Section 3.7.1 of the Project Terms of Reference (ToR); refer to Table 1-1 for a summary of the ToR cross reference and Appendix A for a detailed ToR cross reference.

Table 1-1 Terms of Reference Cross Reference

Terms of Reference Requirement/Section Number	Section of this report
Section 3.7.1 Description of environmental values	
Existing noise and vibration environment	Section 2
Identify sensitive noise receptors	Section 2.1
Discuss potential sensitivity of such receptors and nominate performance criteria	Sections 2.1 and 1.3
Map of sensitive receptor locations	Section 2.1 and Figure 1-2
Legislation, guidelines and criteria	Section 1.3
Section 3.7.2 Potential impacts and mitigation measures	
Construction noise and vibration impacts, including levels of noise and vibration generated	Sections 3.2
Operational noise and vibration impacts, including levels of noise and vibration generated	Section 3.3
Impacts to livestock and native fauna	Section 3.4 and Appendix N
Noise contours	Appendix F
Mitigation measures	Sections 3.2.2.2, 3.2.3.2 and 3.3.5.2

1.3 Legislation, Policies and Guidelines

1.3.1 Legislative Basis

The *Environmental Protection Act 1994* (EP Act) provides for the protection of environmental values, including environmental values relating to maintenance of public amenity. The EP Act establishes a number of environmental protection policies. In relation to noise, the EP Act is supported by the *Environmental Protection (Noise) Policy 2008* (EPP (Noise)). The EPP Noise Section 7 outlines the key environmental values for the acoustic environment, as set out below:

The environmental values to be enhanced or protected under this policy are-

- *a) The qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and*
- *b) The qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following –*
  - *(i) Sleep;*
  - *(ii) Study or learn;*
  - *(iii) Be involved in recreation, including relaxation and conversation; and*
  - *(iv) The qualities of the acoustic environment that are conducive to protecting the amenity of the community.*

To further assist in determining noise levels consistent with the identified environmental values, the EPP Noise also sets out acoustic quality objectives as shown in Table 1-2. Based on a typical dwelling façade noise reduction of 10 dB(A) through a partially open window, an external criterion of 40 dB(A) $L_{Aeq,adj,1hr}$ is recommended for health and well-being in relation to the ability to sleep. Measurement of this acoustic quality objective is at the receptor.

Table 1-2 Acoustic Quality Objectives for Dwellings

Sensitive Receptor	Time of Day	Acoustic Quality Objectives (measured at receptor) dB(A)			Environmental Value
		$L_{Aeq,adj,1hr}$	$L_{A10,adj,1hr}$	$L_{A1,adj,1hr}$	
Dwelling (for outdoors)	Daytime and evening	50	55	65	Health and wellbeing
Dwelling (for indoors)	Daytime and evening	35	40	45	Health and wellbeing
	Night-time	30	35	40	Health and wellbeing, in relation to the ability to sleep

1.3.2 Construction Noise Criteria

The construction phase for the Project (Mine) will include works such as construction of the open cut and underground mining operations, coal handling process plant (CHPP), workshops, equipment storage, administration building, and other components within the Mine infrastructure areas (MIA), and associated roads and offsite infrastructure. The majority of construction will occur over a period of 36 to 48 months however, will continue until the mine reaches full production in 2022. Construction activities will occur 24 hours per day, 7 days per week.

For construction work occurring during normal daytime hours, provided all mechanical powered plant is fitted with appropriate mufflers, specific noise limits are not prescribed in Queensland. In this regard, it is noted that the EPP Noise does not include construction noise limits.

In Queensland, it is generally accepted that construction activities should be in accordance with general building work hours as described under section 440R – "Building Work" of the EP Act. Under the EP Act, no audible noise is permitted:

- Between 6:30 pm and 6:30 am – Monday to Saturday
- On Sundays and public holidays

The time restrictions are designed to strike a balance between protecting noise amenity and the need to start construction activities early in the morning and also recognise the difficulties of controlling some types of construction noise.

Noise impacts during construction are therefore usually minimised by limiting the hours of operation and, in particular circumstances, scheduling the noisiest activities to occur at times when they would generate least disruption. Particular noise limits should be applied to construction works extending outside normal working hours. As such, the World Health Organisation (WHO) recommend for quality of sleep, maximum noise levels should not exceed 45 dB(A). This guideline is recommended for construction work occurring inside the hours listed above. Based on a typical building façade noise reduction of 10 dB(A) through a partially open window, an external criterion of 55 dB(A)L_{max} is recommended for sleep disturbance, assessable at 4 metres (m) from the building façade.

1.3.3 Residential Receptors - Operational Noise Criteria

Planning for Noise Control (The PNC Guideline; EPA 2004) provides guidance on the assessment of operational noise impacts. The guideline includes noise criteria designed to protect sensitive receptors from noise significantly louder than the background level, and to limit the total noise level from all sources near a receptor, hence protecting the amenity.

In line with the PNC Guideline, noise from continuous sources should be limited to 3 dB(A) above the rating background noise level for each period, unless the combined (ambient plus site contribution) noise level would exceed the recommended ambient noise level for the receptor zone. In that case, the noise limit for the site is set so that the combined noise level for the receptor zone does not exceed the recommended level. Table 1-3 shows the derivations of the $L_{A90,\ 1hr}$ and $L_{Aeq,\ 1hr}$ noise criteria with consideration to PNC Guideline for each monitoring location.

A rural residential area has been selected for setting the recommended outdoor background planning noise level. A Z1 noise area category (very rural, purely residential, less than 40 vehicles an hour) has been selected for determining the Planning Noise Level (PNL) at the assessed receptor locations.

Table 1-3 shows the Project (Mine) specific noise criteria adopted for this assessment. Refer to Section 1.4.2 (Figure 1-2) for noise monitoring locations. Comparison between the criteria shown in Table 1-3 and the EPP Noise external night-time criterion of 40 dB(A) $L_{Aeq,adj,1hr}$ indicates the PNC criteria are more stringent. The PNC criteria are therefore used in this assessment. By default, adoption of the PNC criteria for the Project (Mine) will ensure compliance with the EPP Noise 40 dB(A) $L_{Aeq,adj,1hr}$ criteria.

Table 1-3 Project (Mine) Specific Noise Levels

Criterion	Logger 1			Logger 2		
	Day dB(A)	**Evening** dB(A)	**Night** dB(A)	**Day** dB(A)	**Evening** dB(A)	**Night** dB(A)
Measured Background, L_{A90}	31	31	27	25	25	22[4]
Acceptable Measured Background L_{A90}	31	31	27	25	25	25
Recommended Background, $minL_{A90}$ (PNC Table 1)	35	30	25	35	30	25
Adjusted Background, $minL_{A90}$ (PNC Table 2)	33	25	25	30	28	25
Measured Ambient L_{Aeq}	48	41	43	44	41	39
Recommended PNL $L_{Aeq, 1hour}$ (PNC, Table 3, Category Z1)	40	35	30	40	35	30
Planning Noise Level (PNC Table 4 adjusted) [2]	38	31	33	34	31	29
Specific/Component Noise Level [1]	36	28	28	33	31	28
Project (Mine) Specific Level, $L_{Aeq, 1hour}$ [3,]	**36**	**28**	**28**	**33**	**31**	**28**

1 Project (Mine) Specific/Component Level, $L_{A,eq, 1 Hour}$ = min $L_{A90, 1 Hour}$ + 3
2 There is no significant contribution from existing industrial noise sources, therefore PNC Table 4 adjustments have been applied but not considered in the setting of the project specific noise criteria.
3 Project specific level is taken as the lower of the Specific/Component level and the adjusted PNL
4 As outlined in the PNC, where the measured background noise level is less than 25 dB (A), the minimum background noise level is set to 25 dB (A).

1.3.4 Low Frequency Noise

The Queensland Government *Assessment of Low Frequency Noise Guideline* (Ecoaccess, 2006) is considered to address noise sources with inherent dominant infrasound or (very) low frequency noise (LFN) characteristics. CHPPs have the potential to generate LFN components below 200 Hz. The procedure for the initial screening to determine if a more detailed assessment is required is as follows:

- The overall sound pressure level inside residences should not exceed 50 dB(Linear) to minimise risk of complaints of LFN annoyance.
- If the dB(Linear) measurement exceeds the dB(A) measurement by more than 15 dB, a one-third octave band measurement in the frequency range 20 to 200 Hz should be carried out.

1.3.5 Sleep Disturbance Criteria

The EPP Noise recommends that for the health and well-being of residents, in relation to the ability to sleep, the following acoustic quality objectives apply, when measured indoors:

- 30 $dBL_{Aeq, adj, 1hour}$

- 35 $dBL_{A10,\ adj,\ 1hour}$
- 40 $dBL_{A1,\ adj,\ 1hour}$

For these criteria, noise levels are measured over a one hour period and are adjusted for tonal character or impulsiveness.

Additionally, the purpose of the PNC Guideline is to limit the external maximum noise impact level, according to the likely number of occurrences and the potential noise reduction from outside to inside. Maximum noise levels over the night time period should be restricted to prevent sleep disturbance.

The Guideline recommends that instantaneous internal sound pressure levels do not exceed a maximum sound pressure level in the order of 45 dB(A)L_{max} more than 10-15 times per night as a rule in planning for short-term or transient events. On this basis, a “mid-range” external noise level of 55 dB(A)L_{max} more than 10-15 times per night is considered appropriate for assessment purposes, as the Guideline states a 10 dB outside to inside reduction in noise level through a partially open window is typical.

1.3.6 World Health Organisation Guidelines for Community Noise

The WHO discusses the effects of environmental noise in non-industrial environments in its Guideline for Community Noise (1999). This guideline examines aspects such as sleep disturbance, annoyance, and speech intelligibility and provides guidance for protecting people from adverse effects induced by excessive noise. The guideline is also referred to in the PNC Guideline’s section on sleep disturbance criteria.

Most people are likely to experience a high level of annoyance should daytime sound pressure levels at outdoor living areas exceed 55 dB(A)L_{eq} for a steady, continuous noise. Moderate annoyance may be felt should daytime outdoor sound pressure level exceed 50 dB(A)L_{eq}. Sound pressure levels during the evening and night should be 5 to 10 dB lower than the level during the day.

When the noise comprises of a large low frequency component, lower guideline values are recommended as LFN can disturb sleep at lower sound pressure levels. The recommendation of lower noise levels for LFN also applies for outdoor living areas. For intermittent noise, it is necessary to take into account the maximum sound pressure level as well as the number of noise events. Interference to speech intelligibility may be prevented by maintaining background noise to levels of about 35 dB(A) to 45 dB(A).

Table 1-4 summarises the WHO Guideline values.

Table 1-4 Summary of WHO Guidelines for Community Noise

Descriptor	Indoor Guideline Value	Outdoor Guideline Value
Speech intelligibility (dwellings indoors)	35 dB(A) L_{eq} (steady noise)	Not applicable.
Sleep disturbance (Bedrooms)	30 dB(A) L_{eq} (steady noise) 45 dB(A) L_{max} (intermittent noise)	45 dB(A) L_{eq} (steady noise) 60 dB(A) L_{max} (intermittent noise)
Annoyance (daytime and evening)	35 dB(A) L_{eq}	50 dB(A) L_{eq}

While the WHO Guidelines provide values for sleep disturbance, external amenity and speech intelligibility, these values are less stringent than the PNC Guideline goals outlined previously. The above 30 dB(A) L_{eq} guideline value shown in Table 1-4 equates to 40 dB(A) L_{eq} external (based on typical 10 dB(A) façade reduction – as per Australian Standard AS3671 and indeed WHO recommends 15 dB(A) façade reduction). Given the PNC Guideline criterion is 28 dB(A) $L_{eq,\ 1hour}$ outdoor at night-time, it is considered that the adoption of the PNC Guideline criteria for this Project (Mine) will also ensure compliance with the WHO guidelines.

1.3.7 Industrial and Commercial Receptor Noise Criterion

The Industrial precinct and airport, when developed, will be exposed to a certain degree of noise from mining operations. These areas are, however, less sensitive than residential receptors. The PNC Guideline recommends background noise planning levels for industrial and commercial noise receptors. The following noise targets have been adopted for commercial and industrial areas:

- Shop or commercial office: 55 dB(A) $L_{\neg Aeq,\ 1hour}$
- Industrial area or factory: 60 dB(A) $L_{\neg Aeq,\ 1hour}$

1.3.8 Blasting Overpressure and Vibration

Section 440 ZB of the EP Act provides criteria for the assessment of blasting impacts and states that blasting must not be conducted if:

> *(a) the airblast overpressure is more than 115dB Z Peak for 4 out of any 5 consecutive blasts;*
> *(b) the airblast overpressure is more than 120dB Z Peak for any blast; or*
> *(c) the ground vibration is —*
>> *(i) for vibrations of more than 35Hz--more than 25 mm a second ground vibration, peak particle velocity.*
>> *(ii) for vibrations of no more than 35Hz--more than 10 mm a second ground vibration, peak particle velocity.*

Additional blasting criteria are referred to in the *Noise and Vibration from Blasting Guideline* (EPA 2006).

The guideline recommends that blasting should generally only be permitted during the hours of 9:00 am to 3:00 pm, Monday to Friday, and from 9:00 am to 1:00 pm on Saturdays and that blasting should not generally take place on Sundays or public holidays where there are sensitive receptors in proximity to the blast location. Blasting outside these recommended times should be undertaken only where:

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

The guideline provides assessment criteria for blasting noise and vibration limits as shown in Table 1-5. The guideline values have been adopted for this assessment.

Table 1-5 Guideline Blasting Limits

Airblast Overpressure	Ground Vibration
115 dB(lin) peak	5 mm/s Peak Particle Velocity (PPV)
Must not be more than 115 dB(lin) peak for nine out of any ten consecutive blasts initiated, regardless of the interval between blasts, but never over 120 dB(lin) peak for any blast.	Must not exceed a PPV of 5 mm/s for nine out of any ten consecutive blasts initiated, regardless of the interval between blasts, but never over 10 mm/s for any blast.

1.3.9 Human Comfort Vibration Criteria

In the absence of any Queensland or Australian guidelines relating to human comfort criteria for vibration, criteria have been adopted with consideration to the British Standard BS 6472 – 2008, *Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting*, which is recognised as the preferred standard for assessing the “human comfort criteria” for residential buildings.

Typically, mine activities generate ground vibration of an intermittent nature. Under BS 6472:2008, intermittent vibration is assessed using the vibration dose value (VDV). Table 1-6 includes acceptable values of VDVs for residential receptors for daytime and night-time periods.

Table 1-6 Vibration Dose Value Ranges and Probabilities for Adverse Comment to Intermittent Vibration ($m/s^{1.75}$)

Location	Low probability of adverse comment[1]	Adverse comment possible	Adverse comment probable[2]
Residential buildings 16 hour day (0700 – 2300 hrs)	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 hour night (2300 to 0700 hrs)	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

1 Below these ranges adverse comment is not expected.
2 Above these ranges adverse comment is very likely.

These values represent the best judgement available at the time the standard was published and may be used for both vertical and horizontal vibration, providing that these components are correctly weighted. Because there is a range of values for each category, judgement can never be precise.

Whilst the assessment of response to vibration in BS 6472-1:2008 is based on VDV and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of PPV, since this parameter is more likely to be routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels well below those that risk damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in British Standard BS 5228-2:2009 *Code of practice for noise and vibration on construction and open sites – Part 2: Vibration* as shown below in Table 1-7.

Table 1-7 Guidance on the Effects of Vibration Levels

Approximate Vibration Level	Degree of Perception
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.30 mm/s	Vibration might be just perceptible in residential environments.
1.00 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10.00 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

1.3.10 Structural Vibration Criteria

Currently, there is no Australian Standard that sets the criteria for the assessment of building damage caused by vibration. Guidance for limiting vibration values is attained from reference to German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures.*

Table 1-8 presents the short-term vibration guideline values. The vibration criteria presented in this standard exceed the human comfort criteria presented above. Therefore, as indicated above, the human comfort criteria should be the over-riding criteria for the assessment of vibration impacts.

Table 1-8 Guideline Values for Vibration Velocity to be Used When Evaluating the Effects of Short-Term Vibration on Structures

Guideline Values for Velocity, vi(t)[1] [mm/s]				
Line	Type of Structure	Vibration at the Foundation at a Frequency of		
		1Hz to 10 Hz	10Hz to 50Hz	50Hz to 100Hz[2]
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10

1 The term v_i refers to vibration levels in any of the x, y or z axes.
2 At frequencies above 100Hz the values given in this column may be used as minimum values.

1.3.11 Road Traffic Noise

The Project (Mine) has the potential to generate traffic on public roads near sensitive receptors during construction and operation. Traffic volumes generated by the construction of the Mine will vary and will depend on the construction timetable.

The Department of Transport and Main Roads (DTMR) *Road Traffic Noise Management: Code of Practice* (DTMR, 2007) provides guidance for the assessment of road traffic noise. The traffic noise level of an existing state controlled road should not exceed $L_{A10(18hr)}$ 68 dB(A) assessed one metre in front of the most exposed part of an affected noise sensitive place.

1.4 Approach and Methodology

1.4.1 Overview

This report provides an assessment of potential impacts associated with noise and vibration generated during the construction and operation of the Project (Mine), by:

- Reviewing the existing noise and vibration environment
- Addressing the acoustic requirements detailed in the ToR in relation to the construction and operational phases of the Project (Mine)
- Evaluating the potential construction and operational noise and vibration impacts at sensitive locations in terms of planning levels identified in the PNC Guideline, and other standards and guidelines as applicable
- Defining noise and vibration goals by which potential construction and operational noise and vibration impacts at sensitive locations may be evaluated and assessed
- Evaluating and assessing the extent of resulting impacts and the scope for the reduction of these impacts through reasonable and feasible mitigation strategies
- Recommending appropriate impact mitigation measures

It should be noted that this assessment is based on ambient noise levels and disturbance to sensitive receptors in the community and environment, and does not consider occupational noise issues. Occupational noise is managed through the *Coal Mining Safety and Health Act 1999* (on-lease) and *Work Health and Safety Act 2011* (off-lease).

1.4.2 Noise Monitoring Methodology

In order to meet the ToR requirements for the Project (Mine) background and ambient noise monitoring was conducted as part of this assessment. Background noise levels were assessed using a combination of unattended and attended noise monitoring. Monitoring was conducted at two locations in the vicinity of the Project (Mine). Noise monitoring site locations are provided in Figure 1-2, together with the locations of potential sensitive receptors. A brief description of each monitoring site is provided in Table 1-9. Photographs of the monitoring sites are provided in Plate 1-1 and Plate 1-2.

Unattended noise logging was conducted to establish typical noise levels in the area of the potentially most affected receptors. Attended monitoring was also completed at these locations to better understand the noise sources contributing to overall existing noise levels. Locations selected are considered representative of the acoustic environment for the nearest potential sensitive receptors located in the vicinity to the Project (Mine). The monitoring locations were also chosen as being a safe and secure place for staff and unattended equipment, minimising the risk of theft, vandalism, or damage by natural causes. Land access permission was also a factor that contributed to the final selection of the locations.

Table 1-9 Noise Survey Location Details

Location	GPS coordinates	Description of noise survey location	Monitoring period
A	22^{o} 04.217' S 146^{o} 14.664' E	Doongmabulla Homestead	26 Aug 2011 – 7 Sept 2011
B	22^{o} 00.660' S 146^{o} 21.593' E	Labona Homestead [1]	26 Aug 2011 – 6 Sept 2011

1 Labona Homestead will be acquired and demolished and therefore not classified as a sensitive receptor. However, this location was selected as a monitoring location because it is considered representative of the acoustic climate for the mine workers accommodation village, being an area of low background noise level.

Plate 1-1 Monitoring Location A Doongmabulla Homestead

Plate 1-2 Monitoring Location B Labona Homestead

Unattended noise monitoring was undertaken using two Rion NL-21 environmental noise loggers from 26 August to 6 – 7 September 2011 at two locations within the vicinity of the Project (Mine). These loggers are capable of measuring continuous sound pressure levels and are able to record L_{A90}, L_{A10} and L_{Aeq} noise descriptors. The instruments were programmed to accumulate environmental noise data continuously over sampling periods of 15 minutes for the entire monitoring period. Prior to deployment, the loggers were calibrated with a sound pressure level of 94 dB at 1kHz using a RION NC-73 calibrator. At completion of the monitoring period, the loggers were retrieved and calibration was rechecked. The difference was less than +/- 0.5 dB.

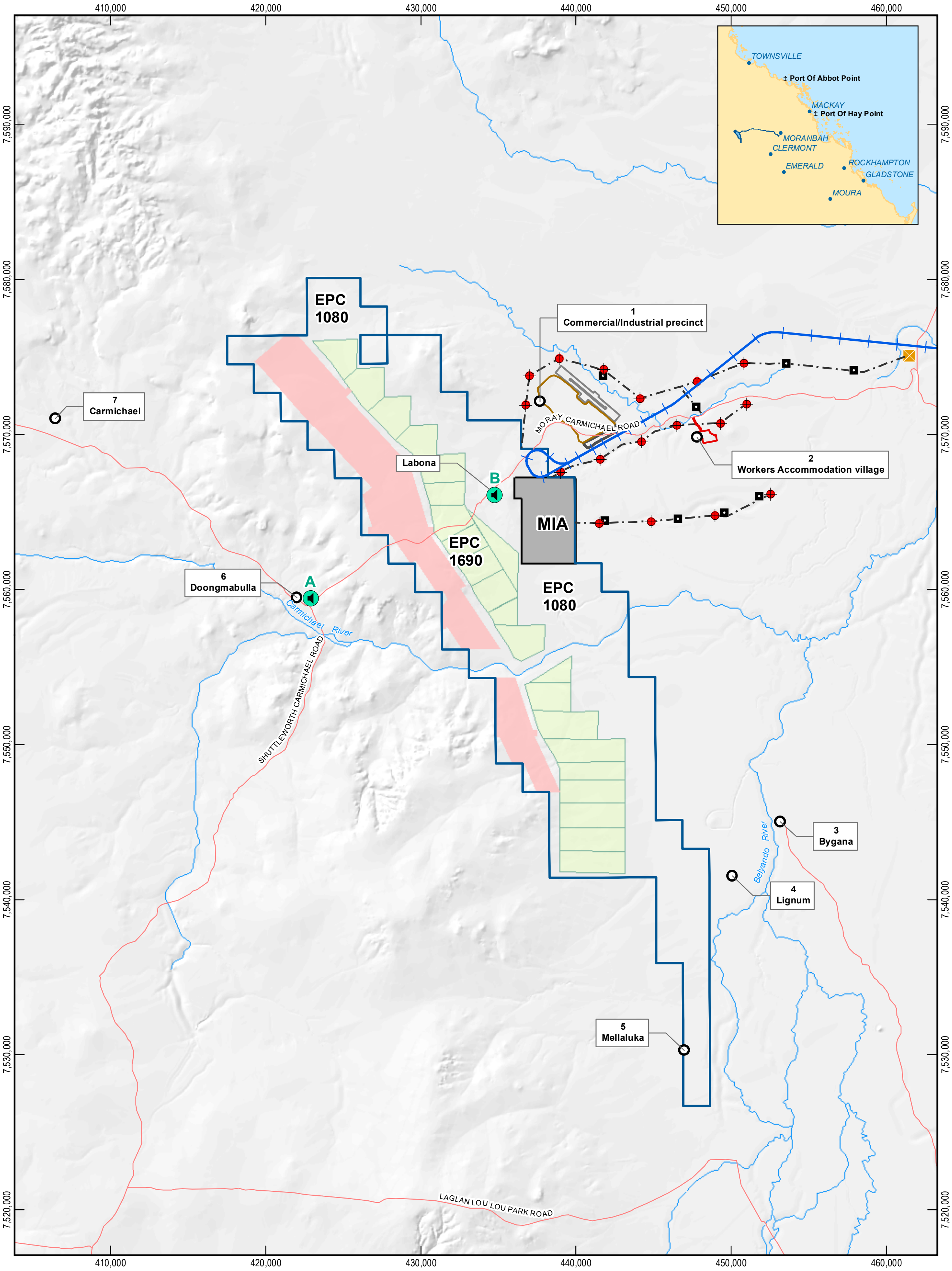
The data collected by the loggers was downloaded and analysed and any invalid data removed. Invalid data generally refers to periods where average wind speeds were greater than 5 m/s, or when rainfall occurred. Weather data over the monitoring period was collected from the Bureau of Meteorology Emerald Airport Automatic Weather Station. Table 1-10 provides details of the noise loggers at each monitoring location.

Table 1-10 Unattended Noise Logger Details

Monitoring location	Logger serial No.	Measurement started	Measurement ceased	Pre Cal	Post Cal	Frequency weighting	Time response
Location A Doongmabulla Homestead	1277353	26/08/11	07/09/11	93.6	93.9	A	Fast
Location B Labona Homestead	1043718	26/08/11	06/09/11	94.1	94.0	A	Fast

Attended measurements were taken at unattended monitoring locations to supplement logger data. Attended noise measurements were conducted on 26 August 2011 using a Rion NL-21 Sound Level Meter (SLM). This SLM is capable of measuring continuous sound pressure levels and is able to record L_{Amin}, L_{A90}, L_{A10}, L_{Amax} and L_{Aeq} noise descriptors. Prior to deployment, the meter was calibrated using a Rion NC-73 calibrator with a sound pressure level of 94 dB at 1 kHz. Calibration was checked prior to the commencement of measurements and at completion of the measurements. The difference was less than +/- 0.5 dB.

All sampling activities were undertaken with due consideration to the specifications outlined in AS 1055 (1997) *Description and Measurement of Environmental Noise* and the Queensland Government *Noise Measurement Manual* (EPA 2000).



LEGEND

- Sensitive Receptor
- Noise Logger
- Local Road
- Watercourse
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Rail (West)
- Mine (Onsite)
- Mine (Offsite)
  - Borehole
  - Storage Site (Instream)
  - Storage Facility (Offstream)
  - Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Potential Sensitive Receptors and Noise and Vibration Monitoring Locations

Job Number	41-25215
Revision	C
Date	19-10-2012

Figure 1-2

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_708_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Alignment Opt9 Rev3 (SP1 & 2) (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Sensitive Receptor, Noise Logger (2012). Created by: JVC

1.4.3 Vibration Monitoring Methodology

Vibration monitoring was undertaken on 26 August 2011 at the monitoring locations displayed in Figure 1-2.

Vibration measurements were conducted using an Instantel Minimate Plus vibration logger with a tri-axial geophone to monitor ground vibration PPV in each axial direction. The Minimate unit has an inbuilt data logger, downloadable to PC where analysis can be performed using Blastware software.

The geophone was adhered to a granite paver and positioned on relatively flat ground. Vibration monitoring was undertaken utilising a Minimate Plus (serial: BE12721), calibration expiry August 2012 recording in histogram mode. Histograms at one minute intervals were recorded with concurrent site observations. The Minimate Plus was configured with a range of 31.7 mm/s and a sampling rate of 2,048 /s.

1.4.4 Construction Noise Assessment Methodology

1.4.4.1 Construction Methods and Equipment

The Project (Mine) will use standard construction equipment, general trade equipment and specialised equipment as required. Table 1-11 shows the indicative number and type of construction equipment required, with the corresponding noise levels, based on GHD's noise source database. Typical construction equipment noise levels have been obtained from AS 2436 – 2010, *Guide to noise and vibration control on construction, demolition and maintenance sites* and GHD's noise database.

Note that final equipment types and numbers will not be known until shortly before commencement of construction, however it is unlikely that any significant differences to the indicative equipment listed in Table 1-11 would occur.

For the purposes of noise level predictions, it has been assumed that all construction equipment in each phase listed in Table 1-11 will be operating at maximum levels. Noise levels have been predicted for worst-case scenario where all phases operate simultaneously under adverse weather conditions. Equipment locations are based on the General Mine Layout (Runge Limited 2011).

In fact, construction machinery will likely move about the study area altering noise impacts with respect to individual receptors. During any given period, the machinery items to be used in the study area will operate at maximum sound power levels for only brief stages. At other times, the machinery may produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at maximum sound power levels at any one time and certain types of construction machinery will be present in the study area only for brief periods during construction. The predicted noise levels should therefore be considered as conservative estimates.

Note, the workers accommodation village and the industrial precinct are not assessed as sensitive receptors whilst the areas themselves are being constructed.

Table 1-11 Indicative Construction Equipment and Sound Power Levels (SWL)

Construction Phase	Indicative Number of Plant	SWL, dB(A) L_{max} Per Machine
Phase 1 Prepare works for MIA and mine camp construction. Access road construction to Gregory Developmental Road	Dozer x 1	116
	Truck x 2	108
	Excavator x 1	112
	Grader x 2	112
	Roller x 2	110
Phase 2 Construction of power, water supply and other external services	Excavator x 1	112
	Truck x 1	108
	Backhoe x 1	108
Phase 3 Permanent access road and rail spur	Scraper x 4	119
	Dozer x 3	116
	Truck x 4	108
	Excavator x 3	112
	Grader x 2	112
	Roller x 2	110
Phase 4 Dams construction	Scraper x 2	119
	Dozer x 1	116
	Truck x 2	108
	Excavator x 1	112
Phase 5 Project power supply	Mobile crane x 1	112
	Welder x 2	104
	Truck x 3	108
	Various hand tools including grinders	119
Phase 6 MIA and CHPP	Impact Piling Rig x 1	133
	Truck x 2	108
	Excavator x 1	112
	Grader x 1	112
	Roller x 1	110

Construction Phase	Indicative Number of Plant	SWL, dB(A) L_{max} Per Machine
	Backhoe/bobcat x 1	108
	Mobile crane x 1	112
	Various hand tools including grinders	119
Phase 7 ROMS and Vegetation Stripping	Impact Piling Rig x 1	133
	Truck x 4	108
	Excavator x 1	112
	Grader x 1	112
	Roller x 1	110
	Backhoe/bobcat x 1	108
	Mobile crane x 1	112
	Various hand tools including grinders	119
	Scraper x 4	119
Phase 8 Commercial/Industrial Precinct	Impact Piling Rig x 1	133
	Truck x 4	108
	Excavator x 1	112
	Grader x 1	112
	Roller x 1	110
	Backhoe/bobcat x 1	108
	Mobile crane x 1	112
	Various hand tools including grinders	119
	Scraper x 4	119

1.4.4.2 Construction Noise Prediction

Acoustic modelling was undertaken using Computer Aided Noise Abatement (CadnaA) Version 4.2 to predict the effects of construction related noise from the Project (Mine). CadnaA is a computer program for the calculation, assessment and prognosis of noise propagation. CadnaA calculates environmental noise propagation according to the CONCAWE[1] algorithm. Ground absorption, reflection and relevant shielding objects are taken into account in the calculations.

Atmospheric effects due to wind and temperature inversion are calculated using the CONCAWE algorithm. The Project (Mine) has been modelled based on available data at the time of assessment and is considered indicative for the Project (Mine) as currently proposed.

Continuous traffic flow related noise is typically calculated using the United Kingdom Calculation of Road Traffic Noise (CoRTN) algorithm, however due to the non-continuous nature of the heavy vehicle movements to and from the site, the United States EPA's Intermittent Traffic Noise guidelines has been utilised to determine potential impacts. The following equation outlines the mathematical formula used in calculating the $L_{eq,T}$ noise level for intermittent traffic noise.

$$L_{eq},T = L_b + 10\log\left[1 + \frac{ND}{T}\left(\frac{10^{(L\max - Lb)/10} - 1}{2.3} - \frac{(L_{\max} - L_b)}{10}\right)\right]$$

Where:

L_b is background noise level, dB(A)

L_{max} is vehicle maximum noise level, dB(A)

T is the time for each group of vehicles (min)

N is number of vehicle trips

D is duration of noise of each vehicle (min)

The parameters above were determined as follows:

- Background noise levels are based on the unattended noise monitoring conducted at Location A (Labona Homestead) i.e. 25 dB(A)
- The heavy vehicle maximum noise level was sourced from AS 2436 – 2010
- The duration of each vehicle passby was 30 seconds
- The time for each group of vehicles was 60 minutes

As the Intermittent Traffic Noise calculation outputs are $L_{Aeq(T)}$ values, these need to be converted to $L_{A10(18hr)}$ to suit the DTMR criteria.

Table 2 of Austroads document titled *"Modelling, Measuring and Mitigating Road Traffic Noise"* (Austroads 2005) AP-R277/05 outlines factors for simple conversion between road traffic noise descriptors. The document indicates $L_{Aeq(1hr)}$ and $L_{A10(18h)}$ are equivalent with a zero correction factor.

A façade correction factor of 2.5 dB(A) has been applied to the predicted noise levels to account for reflection.

[1] The CONCAWE method is a research paper especially designed for the requirements of large facilities. It was published in 1981 under the title, "The propagation of noise from petroleum and petrochemical complexes to neighbouring communities." This method is the only one dealing explicitly with the influence of wind and the stability of the atmosphere. Source: SoundPlan

1.4.5 Blasting Impacts Assessment Methodology

Blasting will be required to prepare both overburden and coal for removal. Airblast overpressure levels are dependent on a number of factors such as:

- Maximum Instantaneous Charge (MIC) per delay
- Distance from blast to receptor
- Burden depth
- Stemming height
- Meteorology

Ground vibration due to blasting is a function of numerous factors such as:

- Ground conditions including rock structure and strata type
- MIC per delay
- Distance from blast to receptor

Ground vibration levels depend on the maximum instantaneous charge (effective charge weight per delay), and not the total charge weight, provided the effective delay interval is appropriate.

Blast effects have been predicted having consideration to the equations given in AS 2187:2006 *Part 2 Explosives - Storage and Use - Use of Explosives*., It is very likely that ground conditions including rock structure and strata type can vary significantly in and surrounding a mine site. As such, typical site constants have been used in the blasting assessment.

Ground vibration has been estimated using the following equation:

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

Where:

V is the ground vibration PPV (mm/s)

R is the distance from charge (m)

Q is the MIC (kg)

k_g is the site constant

The ground vibration estimations are based on free face field conditions with site constants (K_g) of between 800 and 1600.

Airblast overpressure has been estimated using the following equation:

$$P = K_a \left(\frac{R}{Q^{1/3}} \right)^{-1.45}$$

Where:

P is the pressure (kPa)

R is the distance (m)

Q is the MIC (kg)

K_a is the site constant

The airblast overpressure estimations are based on site constants (K_a) of between 10 and 100 which are typical of confined charges. A typical blast includes a number of charged holes which are detonated in a specific pattern to maximise the effectiveness of the blast. Calculations of airblast overpressure and ground vibration in this assessment are based on a MIC of 1,000 kg per hole.

1.4.6 Offsite Infrastructure Noise Assessment Methodology

Offsite infrastructure is expected to comprise of the following:

- An industrial precinct comprising of general industrial uses such as freight unloading terminals, fuel storage, vehicle and equipment maintenance;
- A rail siding located adjacent to the Project (Rail);
- An airstrip;
- Workers accommodation village; and
- Water supply infrastructure, including pump stations for off-stream water storage.

Project (Mine) offsite infrastructure locations are shown in Figure 1-2. A review of potential sensitive receptors surrounding the offsite infrastructure identified that the nearest receptors were over 5 km from the proposed industrial precinct and rail siding, and over 1 km from any of the proposed pump stations.

The potential for noise impacts from pump stations at a separation distance of at least 1 km was considered to be very low and was not further assessed.

The details regarding the airstrip and associated noise sources are not known at this stage of the Project (Mine), therefore calculation of noise impacts from the operation of the airstrip is excluded from this assessment.

The parameters of noise modelling were based on noise levels measured by GHD at similar facilities, or typical noise levels for industrial areas.

1.4.6.1 Industrial Precinct Noise

Details of the exact nature and type of industry within the proposed industrial precinct were not available at the time of this assessment. In light of this, the noise impact assessment has been conducted based on typical sound emission levels for general types of industry sourced from available literature. Typical area-related sound power levels (SWL) are provided in Table 1-12 below for a variety of industrial areas.

Based on the Project (Mine) information, it was considered that a mix of Area Type 3 and Type 4 would conservatively represent the type of activities expected within the industrial precinct. It was also assumed that 50 per cent of the proposed surface area of the Industrial Precinct would have industrial noise sources operating. This takes into account areas such as stockpiles areas, and warehouse storage facilities that will generate minimal noise emissions. The industrial precinct was included in the noise model as part of the Project (Mine) operational noise assessment.

Table 1-12 Type of Industry and Area-Related Sound Power Levels – Industrial Precinct dB(A)

Area Type	Area-Related L_W dB(A)[1]	Type of Industry
1	70 – 75	Open air plants with few noise protection measures such as shipyards and refineries
2	65 – 70	Open air plants using state-of-the-art noise protection
3	60 – 65	Container terminal, louder equipment, steel mills, waste processing production mainly in buildings
4	55 – 60	Production mainly in buildings
5	50 – 55	All production in building, some transport noise, cooling towers
6	45 – 50	Indoor production without noticeable outdoor activities
7	35 – 45	No production. Warehouse with cooling..

1 The highest sound power value in the range was used in noise modelling.

1.4.6.2 Rail Siding Noise Level

Predicted noise impacts due to the operation of the rail siding at the industrial precinct were determined based on sound power levels measured by GHD for a similar facility (Nebo Maintenance and Provisioning Facility, GHD 2009). The sound power levels are shown below in Table 1-13.

Table 1-13 Rail Siding Sound Power Levels dB(A)

Noise source	Octave centre frequency (Hz) (A-weighted)									L_W dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
Diesel Locomotive (idling)	-	77	82	91	94	97	98	90	78	103
Coal wagon (braking)	72	93	99	107	107	106	107	110	106	115 [1]
Shunting vehicle	53	68	75	75	86	75	89	88	81	94 [2]

1 Empty coal wagon includes a 2 dB(A) adjustment to account for impulsive noise and is estimated to be operating for 10% of the time during the day-time period
2 Shunting vehicle includes a 2 dB(A) adjustment to account for impulsive noise

1.4.6.3 Water Supply Infrastructure Noise Level

Noise emitting components of water supply infrastructure will primarily comprise of water pumps to pump water to off-stream storage areas and then to the site for use.

Typical sound power data for a water pump has been sourced from measurements taken by GHD and is shown below in Table 1-14. Based on a minimum separation distance of 1 km to the nearest sensitive receptor, adverse noise impacts from water pumps are unlikely. As such, water supply infrastructure has been excluded from the operational noise impact assessment of the Project (Mine).

Table 1-14 Pump Sound Power Levels dB(A)

Noise source	Octave centre frequency (Hz) (A-weighted)									L_W dB(A)
	31.5	63	125	250	500	1000	2000	4000	8000	
Diesel surface water pump	-	72	87	80	83	93	95	88	89	99

1.4.7 Operational Noise Assessment Methodology

Acoustic modelling was undertaken using CadnaA Version 4.2 and implementing the CONCAWE algorithm to predict the effects of operational related noise from the Project (Mine). Ground absorption, ground terrain, reflection and relevant shielding objects are taken into account in the calculations. The proposed development has been modelled based on available data at the time of assessment and, as such, should be used for guidance purposes only.

1.4.7.1 Model Configuration

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

- Terrain topography at 10 m resolution has been included in the calculations
- A general ground absorption coefficient of 0.5 was used throughout the model
- Modelling is based on atmospheric conditions of 10°C and 70 per cent humidity

1.4.7.2 Project (Mine) Operational Equipment

For the proposed underground operations, exposed noise sources at the surface such as ventilation fans and overland conveyors have been included in the noise model. The proposed open cut mining method primarily involves draglines with truck and excavator operation with truck haulage to the processing facility. Coal will be hauled from the pit by truck and will be hauled directly to the run of mine stockpile (ROM) located adjacent to the CHPP or where mining is occurring distant from the CHPP, to a remote ROM for transport via overland conveyor to the CHPP. The CHPP facilities will be located adjacent to the rail loop.

Table 1-15 shows the proposed equipment for the scheduled mining, necessary to provide sufficient capacity to supply coal to meet planned output levels, based on the equipment list from the Macro-conceptual Mining Study (Runge Limited 2011). Table 1-16 shows the equipment list and corresponding noise levels. Typical mining equipment noise levels have been obtained from GHD’s noise source database and noise assessments conducted for similar projects, including Olympic Dam Expansion Draft EIS (2009), Clermont Coal Project EIS (2004), Cloncurry Copper Project (ASK 2009), Wandoan Coal Project EIS (2008), Maules Creek Coal Project EA (2011), Bengalla Coal Mine Development Consent Modification EA (2010) and Grosvenor Coal Project EIS (2010).

The model configuration for the noise sources was as follows:

- The sound power levels for the all equipment except for the conveyors were modeled as point sources. Conveyors were modeled as line sources.
- Equipment height above ground level was sourced from similar projects and GHD’s noise source database.
- Equipment assumed to be running at full power and, whilst operating continuously.

Noise sources were modeled based on the mine staging plans shown in Appendix E. The mine stages were selected on the basis of worst case scenarios in relation to equipment type, numbers and proximity of mining operations to sensitive receptors.

Table 1-15 Proposed Schedule of Mining Equipment

Mine Activity	Indicative Mine Equipment and Mine Year (Number of Plant)				
	Item	Year 2016	Year 2037	Year 2067	Year 2103[1]
Major Mobile Equipment	Marion 8750 dragline	1	3	4	1
	Liebherr R9800 excavator	8	13	16	6
	Liebherr R9350BH excavator	2	6	6	2
	Cat 994D front end loader	2	9	13	3
	Cat 797F rear dump truck	80	95	110	10
	Cat 793D rear dump truck	24	61	88	20
	Cat 789C water truck	6	9	11	3
	Cat 789C rear dump truck	24	61	88	20
	Cat D11T track dozer	9	15	18	6
	Cat D11T track dozer for dragline assist	1	3	4	2
	Cat D11T track dozer for CHPP	2	6	7	2
	Cat D10T track dozer	5	14	23	6
	Cat 854G rubber tyre dozer	5	12	16	4
	Cat 24M grader	5	10	13	4
	Sandvik DR460 overburden drill	5	10	12	0
	Sandvik D45KS coal drill	2	7	7	0
Major Fixed Equipment	ROM1	1	1	1	1
	ROM2	0	1	1	0
	ROM3	0	0	1	1
	Secondary Crusher	1	1	1	1
	Tertiary Crusher	1	1	1	1
	CHPP	0	1	1	1
	Train Loadout	0	2	2	1

Mine Activity	Indicative Mine Equipment and Mine Year (Number of Plant)				
	Item	Year 2016	Year 2037	Year 2067	Year 2103[1]
	Train on rail spur	0	3	3	1
	Overland Conveyor	2	3	4	1
	Stacker	9	9	9	5
	Transfer Station	21	23	23	17
	Ventilation Fans	4	5	7	0

1 Year 2103 represents the transition from Year 2102 to Year 2103, therefore the equipment numbers have been estimated based on the two mine stage years.

It should be noted that final equipment and plant types and numbers will not be known until closer to commencement of the proposed mining activity. Noise predictions should be reviewed once final equipment lists are available.

Table 1-16   Proposed Site Noise Source Sound Power Levels SWL (re: 20µPa)

Noise Source	Source Height (m)	Octave Centre Frequency (Hz) / dB (linear)									SWL dB(A)
		31.5[1]	63	125	250	500	1k	2k	4k	8k	
Marion 8750 dragline	6	121	121	119	113	118	116	116	106	95	121
Liebherr R9800 excavator	4	110	110	111	110	107	106	103	98	88	111
Liebherr R9350BH excavator	4	115	115	126	122	121	119	114	108	103	123
Cat 994D front end loader	4	111	111	122	118	117	115	110	104	99	119
Cat 797F rear dump truck	4	112	112	111	112	114	112	112	106	101	117
Cat 793D rear dump truck	4	117	117	121	118	119	116	114	107	101	121
Cat 789C water truck	4	114	114	120	115	116	114	113	109	97	119
Cat 789C rear dump truck	4	107	107	113	114	110	108	109	102	97	115
Cat D11T track dozer	3	121	121	111	112	119	112	113	103	92	119
Cat D11T track dozer for dragline assist	3	121	121	111	112	119	112	113	103	92	119

Noise Source	Source Height (m)	Octave Centre Frequency (Hz) / dB (linear)									SWL dB(A)
		31.5[1]	63	125	250	500	1k	2k	4k	8k	
Cat D11T track dozer for CHPP	3	121	121	111	112	119	112	113	103	92	119
Cat D10T track dozer	3	121	121	111	112	119	112	113	103	92	119
Cat 854G rubber tyre dozer	3	117	117	123	119	111	107	101	91	83	115
Cat 24M grader	3	129	129	128	119	112	109	107	98	89	117
Sandvik DR460 overburden drill	4	110	110	123	114	119	111	109	103	98	119
Sandvik D45KS coal drill	4	112	112	114	114	113	113	112	109	104	115
Central ROM1	5	109	109	107	107	108	105	100	93	83	109
Central ROM2	5	109	109	107	107	108	105	100	93	83	109
Northern ROM	5	109	109	107	107	108	105	100	93	83	109
Southern ROM	5	109	109	107	107	108	105	100	93	83	109
Secondary Crusher	5	115	115	116	111	111	107	102	95	88	112
Tertiary Crusher	5	115	115	116	111	111	107	102	95	88	112
CHPP	10	122	122	122	117	114	111	108	102	95	117
Train Loadout	4	107	107	109	103	99	97	94	92	82	103
Train on rail spur	4	108	108	105	101	100	101	103	100	97	108
Overland Conveyor	2	80	80	81	81	83	77	72	63	55	82
Stacker	4	111	111	109	106	101	96	94	90	80	104
Transfer Station	4	98	98	103	100	97	94	92	89	81	100
Ventilation Fans	4	103	103	108	105	102	99	97	94	86	105

1 No data available, therefore conservatively estimated as equal to 63 Hz values.

2. Existing Environment

2.1 Potential Sensitive Receptors

The land use surrounding the mine area is rural in nature with a limited number of potential sensitive receptors. Table 2-1 lists potential sensitive receptors identified within approximately 17 km of the Project. (Mine). Figure 1-2 (refer to Section 1.4.2) provides a map of the sensitive receptor locations.

The nearest identified sensitive receptor in relation to the proposed nearest operational noise sources is sensitive receptor 1 (Commercial/Industrial precinct) which is approximately 2.8 km away. The distance to the nearest operational noise source is the minimum distance of the assessed mining year scenarios.

The proposed workers accommodation village and industrial precinct have also been included as sensitive receptors to the Project (Mine) operations.

Receptors 3, 4 and 5 are located on the southern side of the Carmichael River and will not be subject to noise from mining activities until after year 2035 when mining is expected to commence in this area.

Table 2-1 Potential Sensitive Receptors

Potential Sensitive Receptor	Easting	Northing	Approximate Distance from Nearest Operational Noise Source(m)	Description/Comment
1	437661	7572108	2,800	Commercial/Industrial precinct
2	447799	7569804	6,100	Workers accommodation village
3	453157	7544999	7,800	Bygana Homestead
4	450080	7541530	4,800	Lignum Homestead
5	446973	7530251	11,800	Mellaluka Homestead
6	422016	7559462	7,100	Doongmabulla Homestead
7	406412	7571007	16,900	Carmichael Homestead

2.2 Background Noise

Section 1.4.2 provides a brief description of the noise monitoring sites, including their locations (see Figure 1-2). Unattended monitoring results are summarised in Table 2-2 to Table 2-4 and are presented in graphical format in Appendices A and B. Data was removed from the tabulated data during periods in which wind speeds were over 5 m/s or rainfall occurred, as described in the method included in Section 1.4.2.

Noise monitoring results at both locations are typical of a rural environment with low background noise levels, during day (7:00 am to 6:00 pm), evening (6:00 pm to 10:00 pm) and night (10:00 pm to 7:00 am) periods. The rating background level (RBL) for each period at monitoring Location A Doongmabulla is 31 dB(A), 31 dB(A) and 27 dB(A), respectively. At monitoring Location B Labona the RBL for each period, respectively, is 25 dB(A), 25 dB(A) and 22 dB(A).

The ambient noise level (L_{Aeq}) for each period, respectively, at monitoring Location A Doongmabulla was recorded as 48 dB(A), 41 dB(A) and 43 dB(A). At monitoring Location B Labona the ambient noise level for each period, respectively, was recorded as 44 dB(A), 41 dB(A) and 39 dB(A). The noise level graphs shown in Appendix B and Appendix C indicate background noise levels during night-time periods typically fall to below 25 dB(A) at monitoring Location B Labona and to a lesser extent at monitoring Location A Doongmabulla.

Noise levels at monitoring Location A Doongmabulla are generally higher due to the influence of birdlife and cattle. Notwithstanding this, both locations are dominated by natural noise sources including insects and birds. Attended noise monitoring results are summarised in Table 2-5.

Table 2-2 Summary of Noise Monitoring Results – Monitoring Location A Doongmabulla

Date	Background L_{A90} dB(A)			Ambient L_{Aeq} dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
26-Aug-11	27	27	25	44	40	41
27-Aug-11	27	26	28	42	37	44
28-Aug-11	27	26	31	46	41	44
29-Aug-11	28	30	33	48	42	47
30-Aug-11	29	31	32	46	42	41
31-Aug-11	31	33	31	52	40	45
01-Sep-11	30	32	25	47	40	42
02-Sep-11	33	32	28	47	44	42
03-Sep-11	39	32	25	51	45	43
04-Sep-11	34	31	22	50	42	42
05-Sep-11	33	30	24	49	38	44
06-Sep-11	33	30	21	48	40	42
RBL and Leq Overall	**31**	**31**	**27**	**48**	**41**	**43**

Table 2-3 Summary of Noise Monitoring Results – Monitoring Location B Labona

Date	Background L_{A90} dB(A)			Ambient L_{Aeq} dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
26-Aug-11	28	28	28	40	36	36
27-Aug-11	21	26	19	40	39	40
28-Aug-11	22	22	21	44	35	39
29-Aug-11	22	23	22	44	43	37
30-Aug-11	22	30	26	45	41	39
31-Aug-11	23	27	28	43	41	38
01-Sep-11	25	25	23	42	44	41
02-Sep-11	27	25	21	46	41	40
03-Sep-11	31	28	22	47	39	39
04-Sep-11	27	23	21	48	40	39
05-Sep-11	26	21	20	42	40	40
06-Sep-11	-	-	-	-	-	-
RBL and Leq Overall	**25**	**25**	**22**	**44**	**41**	**39**

(-) denotes data not available

Table 2-4 Summary of Noise Monitoring Results

Location	Background L_{A90} dB(A)			Ambient L_{Aeq} dB(A)		
	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)	Day (7 am to 6 pm)	Evening (6 pm to 10 pm)	Night (10 pm to 7 am)
Location A Doongmabulla	31	31	27	48	41	43
Location B Labona	25	25	22	44	41	39

Rounded to nearest integer

Table 2-5 Attended Noise Survey Summary

Location	Period Date	Duration (mins)	Time	dB(A) L90	dB(A) Leq	Comments (instantaneous Noise Levels dB(A))
Location A Doongmabulla	26/08/11	15	09:00	34.0	47.7	◗ Air conditioning unit barely audible (< 30) ◗ Birds (32-60)

Location	Period Date	Duration (mins)	Time	dB(A) L90	dB(A) Leq	Comments (instantaneous Noise Levels dB(A))
						◗ Insects (32-35) ◗ Cattle (35-42)
Location B Labona	26/08/11	15	12:00	27.6	38.2	◗ Birds (<30-46) ◗ Insects (<30-32) ◗ Truck pass by (40-44) ◗ Water tower (28-30)

2.3 Background Vibration

Measured ground vibration results indicate very low ground vibration levels (in the order of 0.1 mm/s) at all locations which confirms the lack of perceptible vibration at all sites.

Table 2-6 details the baseline vibration results.

Table 2-6 Vibration Measurement Results – Peak Particle Velocity (mm/s)

Measurement Location	Date/ Time	Direction			Sum	Observations
		Trans	Vert	Long		
Location A Doongmabulla	07/09/2011 13:04	0.0794	0.0635	0.0794	0.0926	No perceptible ground vibration
Location B Labona	06/09/2011 17:24	0.0794	0.0635	0.0635	0.0870	No perceptible ground vibration

2.4 Local Meteorology

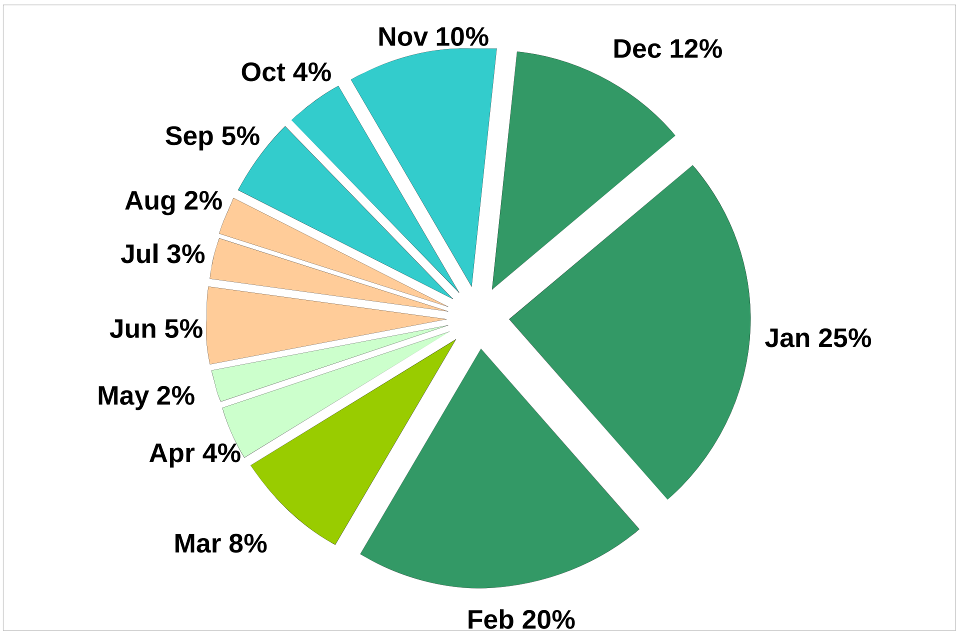
Noise propagation over long distances can be significantly affected by weather conditions. In particular, source to receptor winds and the presence of temperature inversions can enhance received noise levels. To account for these atmospheric phenomena, the PNC Guideline specifies procedures to determine the prevalent weather conditions and identify whether these conditions are a feature of the Project area.

Meteorological data was obtained from the Air Quality Assessment (refer to Volume 4 Appendix S Mine Air Quality Report) and used for determining the prevalent weather conditions. The wind rose charts for each season in each time period (day, evening and night) and the Pasquill / Gifford scale of atmospheric stability for the winter season in the night-time period are presented in Appendix D of this report.

The annual mean rainfall at Carmichael meteorological station, approximately 12 km west of the Project (Mine), is 524 mm and is dominated by the warm months producing convectively driven rainfall. Figure 2-1 provides a graphical representation of the annual mean rainfall at the Carmichael meteorological station. December through March, inclusive, account for 65 per cent of the annual mean rainfall. The wettest month is January with a mean of 129.1 mm and the driest month is May with a mean of 11.2 mm.

Given the annual mean rainfall is over 500 mm per year, the site is considered non-arid (as per the PNC Guideline).

Figure 2-1 Monthly Mean Rainfall (mm) Proportions at Carmichael Site Number 036122 (January 2003 to December 2010)



2.5 Temperature Inversions and Wind

Records of the Pasquill Stability Class, a parameter representing the degree of mixing in the atmosphere, can gauge the prevalence and magnitude of temperature inversions. Stability classes are categorised as A to G where Class A applies under sunny conditions with light winds when dispersion is most rapid. Stability Class D applies under windy and/or overcast conditions when dispersion is moderately rapid and Stability Classes F and G can occur at night when winds are light and the sky is clear. Stability Classes B, C and E are intermediate conditions between those described above. Temperature inversions may occur during stability classes E, F and G. In particular, stability class F generally represents a range of temperature gradients from 1.5 ºC/100 m to less than 4 ºC/100 m.

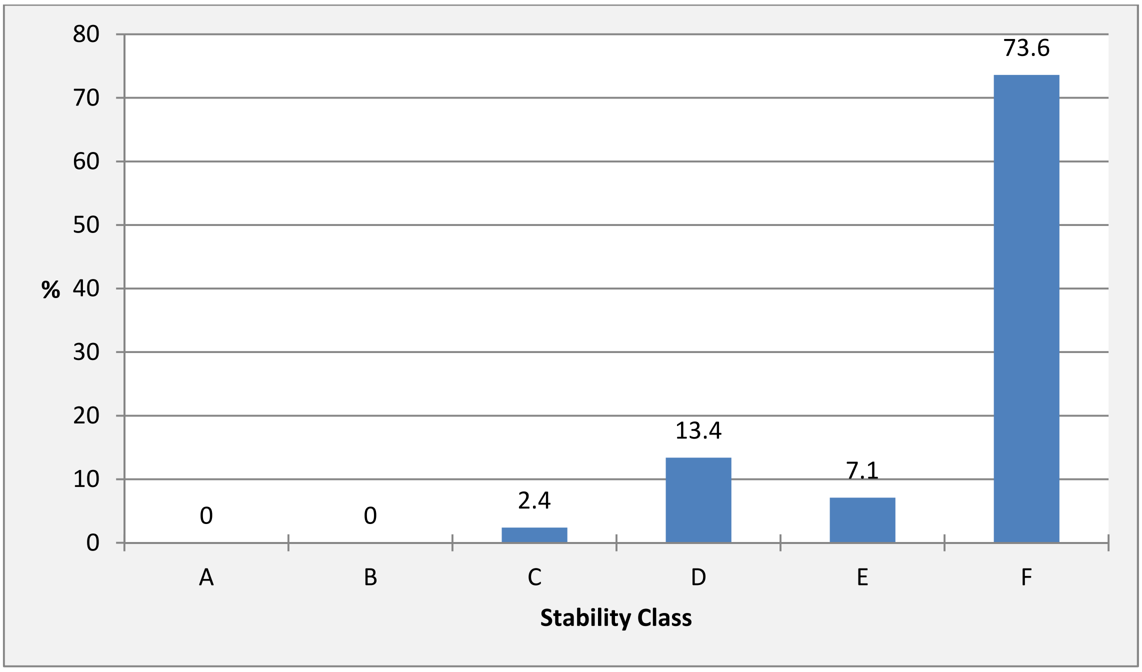
The Project (Mine) would operate 24 hours per day including the night-time period when temperature inversions are likely to occur. Analysis of the meteorological data (refer to Figure 2-2) indicates that class F temperature inversions occur more than 30% of the time during night-time in the winter season. As a result of this analysis and given the average annual rainfall is representative of a non-arid environment, moderate temperature inversion will be considered in this assessment (as per the requirements of the PNC Guideline).

Noise propagation can be increased by wind conditions. The PNC Guideline states that when there is greater than 30 per cent occurrence of wind of up to 3 m/s, in any period (day, evening, night) in any season, from source to receptor, wind should be considered in noise prediction calculations.

Analysis of the seasonal wind rose data (refer to Appendix D of this report) indicates that easterly winds up to 3 m/s occur more than 30 per cent of the time in autumn season during evening time. Therefore, therefore wind is considered a feature of the area and the noise model will include a 3 m/s easterly wind (as per the requirements of the PNC Guideline).

The actual percentage occurrence of wind (up to 3 m/s source to receptor) was also verified using the NSW Office of Environment and Heritage *Noise Enhancement Wind Analysis* software (Review Version).

Figure 2-2 Stability Class Frequency Distribution (Winter Night-time)



3. Potential Impacts and Mitigation

3.1 Introduction

The construction and operation of the Project (Mine) both have the potential to cause noise and vibration impacts on the surrounding environment.

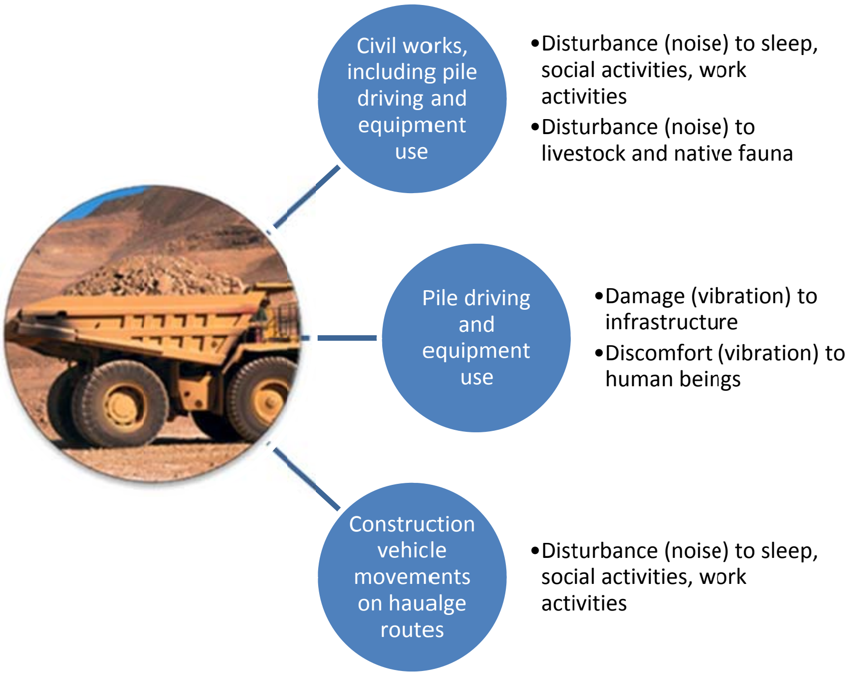
Potential construction and operational impacts have been identified and analysed on the basis of a desktop analysis combined with acoustic modelling considering the construction and operational methods, equipment proposed to be used and mine stage plans.

3.2 Mine Construction

3.2.1 Overview

With regard to the Project (Mine) construction phase, mining (fixed and mobile) equipment and blasting associated with the civil works and construction of the MIA are the primary aspects influencing noise and vibration. Figure 3-1 provides a conceptual overview of the potential construction impacts of the Project (Mine).

Figure 3-1 Conceptual Overview of Potential Construction Impacts



3.2.2 Noise from Civil Works

3.2.2.1 Potential Noise Impact

Construction activities, such as civil works including: earthworks, drainage construction, pile driving and equipment use, and mine construction have the potential to adversely impact on noise sensitive receptors through:

- Disturbance to sleep, social activities and/or work or study activities
- Disturbance of livestock and native fauna (see Section 3.3.5)

Table 3-1 shows the predicted construction noise level at each of the surrounding sensitive receptors for adverse meteorology (ISO 9613 algorithm of moderate downwind or inversion conditions). Worst case construction noise levels are predicted to be less than 10 dB(A) at all receptors except at sensitive receptor 2 (Workers accommodation village) where the noise levels are expected to be up to 19 dB(A). The predicted impact is conservative as it assumes that all construction phases are taking place simultaneously based on maximum sound power levels.

While most construction work would be completed during daytime hours, some construction activity will occur during evening and night periods to meet the proposed construction schedule. Any construction work outside of normal hours should be conducted with consideration to the WHO guideline recommended external noise criteria of 55 dB(A), as discussed in Section 1.3.6. This criteria addresses sleep disturbance, assessable at 4 m from the building façade.

In any case, it is clear from the results given in Table 3-1 that predicted construction noise levels are expected to be well under the 55 dB(A) WHO criteria at all sensitive receptors. It has been assumed that the industrial precinct would not be in operation during the Project (Mine) construction phase. Therefore, the industrial precinct has not been included as a sensitive receptor for Project (Mine) construction noise.

Table 3-1 Predicted Construction Noise Level at Sensitive Receptors

Sensitive Receptor	Predicted Construction Noise Level, dB(A) (Adverse Meteorology)
1 Commercial/Industrial precinct	Not in use during construction of the Project (Mine)
2 Workers accommodation village*	19
3 Bygana Homestead	<10
4 Lignum Homestead	<10
5 Mellaluka Homestead	<10
6 Doongmabulla Homestead	<10
7 Carmichael Homestead	<10

– * Note: workers accommodation village does not include noise from construction of the workers accommodation village itself, as there are no sensitive receptors at the workers accommodation village until it is constructed.

Heavy vehicle movements associated with the earthworks and supply of plant and material have been estimated based on vehicle movement volumes in the Logistics Study (November, 2012). It has been assumed that all vehicle movements would occur along the Gregory Developmental Road, Elign Moray Road and Moray Carmichael Road. The following assumptions were made:

- Construction vehicle movements were assumed to occur 365 days per year.
- Peak hour vehicle movements were assumed to be 20% of daily movements.

Table 3-2 provides the estimated worst-case daily construction vehicle movements that have been generated in the Logistics Study.

Table 3-2 Estimated Total Construction Vehicle Movements (Worst-case Scenario)

Access Roads	Maximum movements per year	Vehicles per day	Estimated Peak Hour movements
Gregory Developmental Road, Elign Moray Road, Moray Carmichael Road	27,011	74	15

It should be noted that the figures provided in Table 3-2 represent trips to and from site and are estimated on the basis of two truck movements per delivery.

The nearest identified sensitive receptor relative to the haulage route is the Moray Downs Homestead which is located approximately 130 metres from the Elgin Moray Road which joins into Gregory Developmental Road, as shown in Figure 1-2. Noise levels due to construction vehicle movements at this receptor have been predicted based on the Intermittent Traffic Noise calculation method shown in Section 1.4.4.2. Table 3-3 provides the estimated traffic noise level with consideration having regard to the DTMR noise criteria.

Based on the results, the estimated construction noise level at the nearest potentially affected receptor due to vehicle movements along Elgin Moray Road is expected to be well under the DTMR 68 dB(A)$L_{10,18hr}$ criterion.

Table 3-3 Estimated Traffic Noise Levels at Potentially Most Affected Sensitive Receptor (Moray Downs Homestead)

Noise Source	Criterion dB(A)$L_{10,18hr}$	Estimated Peak-Hour Traffic Noise Level dB(A)$L_{10,18hr}$
Construction vehicle movements on local roads	68	57

* Includes 2.5 dB(A) façade reflection.

3.2.2.2 Management Measures

Noise model results indicate construction noise levels are unlikely to cause adverse impacts, and therefore direct mitigation measures are not necessary.

Mitigation measures would only be required upon receipt of a valid complaint. Adani will maintain a stakeholder engagement program throughout construction including:

- Provision of information to nearby residents regarding construction activities and how to contact Adani if noise issues arise
- A continuously monitored community liaison phone number and email address that allows noise complaints to be received and addressed in a timely manner.

If noise complaints are received, these will be entered into Adani's Consultation Manager database and responsibilities assigned for contacting the complainant and investigating the complaint in a timely manner.

In the event that complaint investigations indicate that construction noise levels are unreasonable, there are a range of management measures that may be able to be implemented.

Table 3-4 presents noise control methods and expected noise reductions according to Australian Standard *AS 2436 – 2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*.

Table 3-4 Relative Effectiveness of Various Forms of Noise Control dB(A)

Noise Control Method	Typical noise reduction dB(A)	Maximum noise reduction dB(A)
Distance	Approximately 6 per doubling of distance	
Screening	5 to 10	15
Acoustic Enclosures	15 to 25	50
Engine Silencing	5 to 10	20

3.2.3 Vibration from Pile Driving and Heavy Equipment

3.2.3.1 Potential Vibration Impact

Construction activities and equipment such as pile driving can lead to high vibration levels potentially resulting in adverse impacts to structural integrity and personal comfort. Assessment of potential vibration impacts is necessary to minimise potential adverse impacts on the surrounding sensitive receptors. Pile driving is, as a minimum, expected to be required as part of the construction of the MIA. Ground vibration caused by blasting is covered in Section 3.3.5.

Table 3-5 provides details for the predicted ground vibrations levels at various distances for typical construction equipment.

Table 3-5 Predicted Construction Equipment Vibration Levels

Plant Item[1]	Human Perception Preferred Criteria Peak Velocity mm/s *(Maximum Criteria)*		Predicted Ground Vibration Levels (mm/s PPV)				
	Day	Night	10 m	30 m	50 m	100 m	300 m
Pile Driver (Impulsive)	8.6 *(17.0)*	2.8 *(5.6)*	21.0	4.0	1.9	0.7	0.1

Plant Item[1]	Human Perception Preferred Criteria Peak Velocity mm/s *(Maximum Criteria)*		Predicted Ground Vibration Levels (mm/s PPV)				
	Day	Night	10 m	30 m	50 m	100 m	300 m
15t Roller	0.28 *(0.56)*	0.2 *(0.4)*	7.5	1.4	0.7	0.2	<0.1
Dozer	0.28 *(0.56)*	0.2 *(0.4)*	3.3	0.6	0.3	0.1	<0.1
7t compactor	0.28 *(0.56)*	0.2 *(0.4)*	6.0	1.2	0.5	0.2	<0.1
Rock Breaking	0.28 *(0.56)*	0.2 *(0.4)*	7.0	1.3	0.6	0.2	<0.1
Backhoe	0.28 *(0.56)*	0.2 *(0.4)*	1.0	0.2	0.1	<0.1	<0.1

1 NSW RTA Environment noise management manual

Table 3-5 indicates vibration levels of 0.1 mm/s or less at a distance of approximately 300 m for all equipment identified. This is well below the adopted vibration criteria for all nominated plant items set out in Sections 1.3.9 and 1.3.10. Therefore, it is unlikely that ground vibration as a result of construction activities and equipment (excluding blasting) will adversely impact potentially sensitive receptors.

Vibration levels produced by construction activities are expected to be well below the most stringent structural damage criteria of 3 mm/s at receptors located at distances greater than 50 m.

3.2.3.2 Management Measures

As construction vibration levels are unlikely to cause adverse impacts, no direct mitigation and management measures are required.

3.3 Mine Operation

3.3.1 Overview

With regard to the Project (Mine) operational phase, mining (fixed and mobile) equipment and blasting are the primary aspects influencing noise and vibration.

Figure 3-2 provides a conceptual overview of the potential operational impacts of the Project (Mine).

Figure 3-2 Conceptual Overview of Potential Operational Impacts

3.3.2 Mine Operations

3.3.2.1 Potential Noise Impact

Mine operation has the potential to adversely impact on noise sensitive places through:

- Disturbance to sleep, social activities and/or work and study activities
- Disturbance of native fauna and livestock (see Section 3.3.5)

Predicted noise levels during neutral and adverse weather conditions considered the following mine operation scenarios:

- Scenario 1 – Mining operation (Year 2016)
- Scenario 2 – Mining operation (Year 2037)
- Scenario 3 – Mining operation (Year 2067)
- Scenario 4 – Mining operation (Year 2103)

Table 3-6 and Table 3-7 show the predicted operational noise levels at the surrounding sensitive receptors for neutral and adverse weather conditions respectively. The most stringent night-time noise criterion has been provided for comparative purposes as mining will take place 24 hours per day. Predicted noise results are also provided in graphical format in Appendix F.

Noise model results indicate the predicted noise levels for year 2016, 2037 and 2103 are expected to be compliant with the most stringent night-time noise criteria at all assessed surrounding sensitive receptors under neutral and adverse weather conditions. The highest predicted noise level is expected to occur at sensitive receptor 4 with 29 dB(A) during year 2067, causing a marginal exceedance of the most stringent night-time criteria of 28dB(A). It should be noted this predicted exceedance is based on worst-case Project (Mine) operations under adverse weather conditions and with conservative assumptions for the location of noise sources relative to sensitive receptors.

This operational noise assessment also suggests that, based on the assumptions in Section 1.4.6, the proposed industrial precinct should not cause adverse noise impacts at sensitive receptors. It should be noted that the assessment represents potential worst case predictions where equipment is operating at full capacity and the night-time weather conditions are worst case for noise propagation. It is not expected that this situation would arise on a regular basis.

Table 3-6 Predicted Operational Noise Level at Receptors – Neutral Conditions

Receptor	Night-time criteria Leq dB(A)	Predicted operational noise level, dB(A)			
		Neutral meteorology			
		Year 2016	Year 2037	Year 2067	Year 2103
1 Commercial/Industrial precinct [1]	55	23	22	22	19
2 Workers accommodation village	28	21	23	24	19
3 Bygana Homestead		19	22	26	19
4 Lignum_Homestead		19	22	**29**	20
5 Mellaluka Homestead		13	16	18	12
6 Doongmabulla Homestead		12	16	17	11
7 Carmichael Homestead		11	13	14	8

1 Noise levels at Receptor 1 (Industrial precinct) only include noise from the Project (Mine) operations. Noise from within the industrial precinct is excluded.

Table 3-7 Predicted Operational Noise Level at Receptors – Adverse Conditions

Receptor	Night-time criteria Leq dB(A)	Predicted operational noise level, dB(A)			
		Adverse meteorology (F Class inversion + 2 m/s easterly wind)			
		Year 2016	Year 2037	Year 2067	Year 2103
1 Commercial/Industrial precinct [1]	55	33	34	34	30
2 Workers accommodation village	28	21	24	26	20
3 Bygana Homestead		19	22	26	19
4 Lignum Homestead		19	22	**29**	20
5 Mellaluka Homestead		14	19	22	14
6 Doongmabulla Homestead		16	20	20	14
7 Carmichael Homestead		14	16	17	11

1 Noise levels at Receptor 1 (Industrial precinct) only include noise from the Project (Mine) operations. Noise from within the industrial precinct is excluded.

3.3.2.2 Management Measures

Based on information available on equipment and plant types and numbers, operation noise levels are unlikely to cause adverse impacts, and therefore direct mitigation measures are not necessary. As noise prediction results indicate that noise levels at the Bygana and Lignum homesteads may approach or slightly exceed the night-time noise criteria, routine noise monitoring will be undertaken at Bygana and Lignum homestead as mining progresses towards these locations.

Noise level predictions should be revisited once final equipment and plant lists are available and to reflect any changes in the mine plan that occur as more detailed design and mine planning progresses. However, it is unlikely that any significant changes in noise levels will occur that cannot be addressed through noise mitigation and attenuation measures.

Adani will also maintain a stakeholder engagement program throughout operation including:

- Provision of information to nearby residents regarding mining activities and how to contact Adani if noise issues arise
- A continuously monitored community liaison phone number and email address that allows noise complaints to be received and addressed in a timely manner

If noise complaints are received, these will be entered into Adani's Consultation Manager database and responsibilities assigned for contacting the complainant and investigating the complaint in a timely manner. Similarly, if noise monitoring indicates that noise levels are exceeded, this will be treated as an incident. In either case, an investigation will follow the incident investigation procedure established for the mine site and corrective actions arising will be entered into the corrective action register. The stakeholder engagement program will ensure prompt and ongoing communications with the complainant or any other potentially affected parties in relation to the complaint and investigation.

In the event that routine monitoring or complaint investigations indicate that operational noise levels exceed environmental authority criteria, there are a range of management measures that can be implemented. These may include:

- Selection of quieter equipment or maintenance and modification of equipment to reduce noise emissions when operating in proximity to noise sensitive receptors
- Grading haul roads to remove potholes and bumps
- Use of broadband reversing alarms (audible movement alarms) rather than standard tonal reversing alarms
- Partial or full enclosure of noisy stationary plant items
- Use of earth mounds to block noise

3.3.3 Low Frequency Noise

3.3.3.1 Potential Noise Impact

LFN due to operation of the Project (Mine), in particular the coal handling and processing CHPP, has the potential to adversely impact on noise sensitive places through annoyance and discomfort to humans located in dwellings. The predicted operational LFN levels at the nearest surrounding sensitive receptors are shown in Table 3-8. Noise model results indicate the predicted LFN levels are expected to be under the LFN criteria of 50 dB(linear) at all assessed surrounding sensitive receptors.

Table 3-8 Predicted Operational Low Frequency Noise Level at Receptors – Adverse Conditions

Receptor	LFN criteria dB(linear)	Predicted operational LFN level, dB(linear)			
		Adverse meteorology (F Class inversion + 2 m/s easterly wind)			
		Year 2016	Year 2037	Year 2067	Year 2103
1 Commercial/Industrial precinct	50	14	34	41	34
2 Workers accommodation village		19	35	40	34
3 Bygana Homestead		19	35	40	34
4 Lignum_Homestead		14	35	42	35
5 Mellaluka Homestead		<10	27	35	27
6 Doongmabulla Homestead		33	36	36	29
7 Carmichael Homestead		<10	24	22	<10

3.3.3.2 Management Measures

Noise model results indicate the predicted LFN levels are expected to be under the LFN criteria of 50 dB(linear) at all assessed surrounding sensitive receptors and mitigation measures are not required.

3.3.4 Operational Traffic

3.3.4.1 Potential Operational Traffic Impact

Operational traffic generation due to vehicles travelling to the mine site has the potential to adversely impact on noise sensitive places in close proximity to travel routes.

Vehicle movements will comprise of the following:

- Operations equipment – Delivery of equipment required for the operations at the site.
- Operations workforce – Light vehicle movements due to local travel of operations workforce.
- Consumable for workforce – Consumables such as food and miscellaneous items required to sustain the workforce.

Vehicle movements associated with operation of the Mine have been estimated based on vehicle movements provided in the Logistics Study for the Mine.

It has been assumed that all vehicle movements would occur along the Gregory Developmental Road, Elign Moray Road and Moray Carmichael Road. The following assumptions were made:

- Operations vehicle movements were assumed to occur 365 days per year.
- Peak hour vehicle movements were assumed to be 20% of daily movements.

Table 3-9 provides the estimated worst-case daily vehicle movements during Mine operations that have been generated in the Logistics Study.

Table 3-9 Estimated Operational Vehicle Movements (Worst-case Scenario)

Access Roads	Maximum movements per year	Vehicles per day	Estimated Peak Hour movements
Gregory Developmental Road, Elign Moray Road, Moray Carmichael Road	52,158	143	29

It should be noted that the figures provided in Table 3-9 represent trips to and from site and are estimated on the basis of two vehicle movements per delivery.

The nearest identified sensitive receptor relative to the haulage route is the Moray Downs Homestead which is located approximately 130 m from the Elgin Moray Road which joins into Gregory Developmental Road. Noise levels due to operational vehicle movements at this receptor have been predicted based on the Intermittent Traffic Noise calculation method shown in Section 1.4.4.2. Table 3-10 provides the estimated traffic noise level with having consideration to the DTMR noise criteria. Based on the results, the estimated operational noise level at the nearest potentially affected receptor due to heavy vehicle movements along Elgin Moray Road is expected to be well under the DTMR 68 dB(A)$L_{10,18hr}$ criterion. Furthermore, calculations show that based on the above traffic volumes, the buffer distance required to meet the 68 dB(A)$L_{10,18hr}$ is approximately 45 m from the edge of the road.

Table 3-10 Estimated Operational Traffic Noise Levels at Potentially Most Affected Sensitive Receptor (Moray Downs Homestead)

Noise Source	Criterion dB(A)$L_{10,18hr}$	Estimated Peak-Hour Traffic Noise Level dB(A)$L_{10,18hr}$
Operational vehicle movements on local roads	68	59

* Includes 2.5 dB(A) façade reflection.

3.3.5 Blasting

3.3.5.1 Potential Blasting Impact

Potential adverse impacts to sensitive receptors associated with blasting may include:

- Disturbance of native fauna and livestock (see Section 3.4)
- Annoyance and discomfort to sensitive receptors as a result of airblast overpressure and ground vibration
- Damage to property and infrastructure as a result of ground vibration

Ground vibration and airblast overpressure estimations have been undertaken with consideration to AS2187-2006 and have been based on available information. Typical site constants have been used in the blasting assessment to reflect geological conditions, however ground conditions, including rock structure and strata type, can vary significantly within and surrounding a mine site and this can affect the propagation of vibration and airblast overpressure.

Calculations are based on the distance from the nearest open cut or underground mining boundary, to the sensitive receptors.

Table 3-11 identifies predicted ground vibration and airblast overpressure levels at sensitive receptors based on expected lower and upper site constants. Based on the predicted blast impacts, the predicted airblast overpressure and ground vibration levels at the surrounding sensitive receptors are expected to be below the blasting criteria under all assessed conditions.

Table 3-11 Predicted Blast Impacts

Receptor	Distance from nearest open cut or underground mining boundary (m)	Estimated Airblast Overpressure, dB(Linear) Peak		Estimated Ground Vibration, PPV (mm/s)	
		$k_a = 10$	$k_a = 100$	$K_g = 800$	$K_g = 1600$
1 Commercial/ Industrial precinct	7,700	90.3	110.3	0.1	0.2
2 Workers accommodation village	14,100	82.7	102.7	<0.1	0.1
3 Bygana Homestead	9,900	87.1	107.1	0.1	0.2
4 Lignum_Homestead	6,900	91.7	111.7	0.1	0.3

Receptor	Distance from nearest open cut or underground mining boundary (m)	Estimated Airblast Overpressure, dB(Linear) Peak		Estimated Ground Vibration, PPV (mm/s)	
		k_a = 10	k_a = 100	K_g = 800	K_g = 1600
5 Mellaluka Homestead	12,300	84.4	104.4	0.1	0.1
6 Doongmabulla Homestead	6,300	92.8	112.8	0.2	0.3
7 Carmichael Homestead	13,500	83.2	103.2	<0.1	0.1
Acceptable limits		**115 dB(L)**		**5 mm/s PPV**	

3.3.5.2 Management Measures

Although predicted airblast overpressure and ground vibration levels are expected to be under the criteria, overpressure levels at sensitive receptors 4 (Lignum) and 6 (Doongmabulla) are predicted to be within 2 to 3 dB of the 115 dB(L) criteria.

It should be noted that the calculations are based on typical site constants which should be verified with the blasting contractor prior to blasting. If predictions indicate that the acceptable limit of 115 dB(L) is likely to be approached or exceeded, and this cannot be confidently addressed by changing blasting parameters, receptors will be notified and consideration will be given to whether receptors at potentially affected homesteads should be relocated away from the blast location during the blasting activity. As this is only likely to affect a small number of individuals at the potentially affected homesteads, this should not cause unnecessary disruption. Engagement with potentially affected landholders and workers on adjacent properties will occur through the stakeholder engagement program and details of engagement will be recorded in the Consultation Manager database.

If airblast levels are likely to exceed the acceptable limits, monitoring will also be undertaken to check the accuracy of predictions and indicate whether further optimisation of the blast parameters is required.

Where monitoring or complaints indicate airblast overpressure or ground vibration levels exceed the environmental protection objectives, modification to blast parameters will be considered. Blast parameters that may be altered to address excessive airblast overpressure include:

- Maximum instantaneous charge
- Stemming height
- Reducing the maximum instantaneous charge 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
- Ensuring stemming depth and type is adequate
- Restricting blasts to favourable weather conditions

It is not proposed to introduce time restrictions to blasting activities given the small number of potentially affected receptors, and that these receptors will be notified ahead of time of proposed blasting activities. Blasting is not expected to take place at night except in extraordinary circumstances.

3.4 Noise Impacts on Native Fauna and Livestock

3.4.1 Overview

Current research indicates that there are no government policies or widely accepted guidelines with regard to noise criteria for animals. However, information is provided in technical literature and has been reviewed for the Project (Mine). Refer to Volume 4, Appendix N1 Mine Terrestrial Ecology Report for further detail regarding noise impacts on native fauna.

3.4.2 Livestock

The noise goals provided in this report are based on human response and annoyance factors and, as such, are not applicable to livestock or other non-human receptors. However, it is recognised that sudden noise has the potential to startle or upset domestic livestock and pets.

Heggies Pty Ltd (now SLR Pty Ltd) conducted a literature review as part of their assessment of blasting noise impacts on livestock for the proposed Caval Ridge Coal Mine Project (Heggies 2009). Heggies cites results from a study on the response of farm animals to sonic booms, which indicated that reactions of sheep, horses and cattle to sonic booms (125 dB to 136 dB) were considered slight to mild. The study indicated that analysis of data from 42 herds did not show any evidence that flyovers or proximity to the ends of the active runways had an effect on the milk production of the herds. Animal installations were selected for observations on animal behaviour under sonic boom conditions. Numbers of animals observed in this study were about 10,000 commercial feedlot beef cattle, 100 horses, 150 sheep and 320 lactating dairy cattle. Booms during the test period were scheduled at varying intervals during the morning hours Monday to Friday of each week.

Results of the study showed that the reactions of the sheep and horses to sonic booms were slight. Dairy cattle were little affected by sonic booms (125 dB to 136 dB). Only 19 of 104 booms produced even a mild reaction, as evidenced by a temporary cessation of eating, rising of heads, or slight startle effects in a few of those being milked. Milk production was not affected during the test period, as evidenced by total and individual milk yield.

Given these conclusions, it is unlikely that the Project (Mine) would have an adverse effect on livestock.

3.4.3 Native Fauna

The effect of noise on wildlife can be similar to the effects observed in humans. Noise can adversely affect wildlife by interfering with communication, masking the sounds of predators and prey, causing stress or avoidance reactions and (in the extreme) resulting in temporary or permanent hearing damage. Experiments have shown that exposure to noise impulses throughout the night-time sleep period resulted in poorer daytime task performance by animals (see Fletcher and Busnel, 1978).

The learning ability of many animal species, in regard to familiarisation, is discussed by Busnel (1971). The animal's initial reaction to a new noise source is fright and avoidance but if other sensory systems are not stimulated (for instance optical or olfactory), the animal learns quite quickly to ignore the noise source, particularly when it exists in the presence of man.

Migratory birds have the potential to be influenced by noise from the Project (Mine). Studies of birds (Larkin, 1996) have shown that they will habituate to loud noises that are not biologically meaningful for them. For example if the noise is associated with possible harm such as thunder on a cloudy day, birds will avoid it, but routine noises such as traffic will not disturb them. Examples are provided of sea-birds that voluntarily co-exist with relatively loud noise environments, such as around airports, and birds roosting on light-posts above busy motorways.

Attempts at using noise to deliberately scare birds away from an area, for example to protect farming crops, have been shown to grow less effective over time as birds habituate to the noise. Larkin suggests that keeping the noise as consistent as possible both in the sound produced and the frequency with which it occurs may also help mitigate its effects on birds. Poole (1982) and Algers *et. al.* (1978) shows that birds tend to adapt to steady state noise levels, even of a relatively high level (in the order of 70 dB(A)). Given the predicted steady noise levels around the Project (Mine) are expected to be much less than this level, noise impacts on birds surrounding the Project (Mine) is considered negligible.

Refer to Volume 4 Appendix N1 Mine Terrestrial Ecology Report for further detail regarding noise impacts on native fauna.

3.4.4 Summary

Available literature suggests that the impact of noise from the Project (Mine) is unlikely to result in negative impacts to either livestock or native fauna. As such, it is not proposed to provide any specific management measures, other than those proposed in regard to management of impacts to human receptors.

4. Conclusion

4.1 Baseline Monitoring and Noise and Vibration Criteria

Baseline noise monitoring was conducted at two locations in the vicinity of the proposed Project (Mine). Locations selected were considered representative of the acoustic environment for the nearest sensitive receptors located in the vicinity of the mine. Noise levels at monitoring Location A were generally higher due to the influence of birdlife and cattle. Both monitoring locations were dominated by natural noise sources including insects and birds and noise levels were consistent with a quiet rural location.

Based on the background noise monitoring results, construction and operational noise criteria have been determined and are given in Section 1.3.2 and 1.3.3. Human comfort, vibration and structural vibration criteria are also discussed in Section 1.3.9 and 1.3.10. Blasting vibration and overpressure criteria are given in Section 1.3.8.

4.2 Construction Noise

Noise predictions indicate that construction noise is not expected to cause adverse impacts at noise sensitive receptors.

Predicted results indicate the estimated construction noise level at the nearest potentially affected receptor due to vehicle movements along Elgin Moray Road is expected to be well under the DTMR 68 dB(A)$L_{10,18hr}$ criteria.

Results indicate that predicted construction noise levels outside of normal hours are expected to be well under the 55 dB(A) WHO criteria at all sensitive receptors.

4.3 Operational Noise and Vibration

Operational noise modelling results indicate that predicted noised levels for year 2016, 2037 and 2103 are expected to be compliant with the most stringent night-time noise criteria at all assessed surrounding sensitive receptors under neutral and adverse weather conditions, except for Receptor 4. At receptor 4, the predicted noise level is expected to be 29 dB(A) during year 2067, causing a marginal exceedance of the most stringent night-time criteria of 28dB(A). It is noted that this exceedance is based on worst-case Project (Mine) operations.

Noise from the proposed offsite infrastructure has been conservatively assessed and included in the operational noise models. Noise impacts associated with the proposed industrial precinct, rail siding and water pumping stations are not expected to cause adverse noise impacts at sensitive receptors.

Although Project (Mine) operations are generally not expected to cause adverse noise impacts, mitigation measures have been identified in the event that exceedance of the noise criteria occurs , or a complaint is received and validated.

Noise model results indicate the predicted LFN levels are expected to be under the LFN criteria of 50 dB(linear) at all assessed surrounding sensitive receptors and mitigation measures are not required.

Given the relatively low volume of project related traffic volumes projected on the Moray Carmichael Road and the large distances involved from the road to sensitive receptors, traffic noise levels during Mine operations are expected to be well under the DTMR 68 dB(A)$L_{10,18hr}$ criteria.

Based on typical site constants, predicted airblast overpressure and ground vibration levels are expected to be under the criteria. However, overpressure levels at sensitive receptors 4 (Lignum) and 6 (Doongmabulla) are predicted to be within 2 to 3 dB of the 115 dB(L) criteria.

Once site constants are verified with the blasting contractor, it is recommended that airblast overpressure be recalculated prior to blasting and mitigation measures identified if required. Monitoring should also be conducted during the initial blasts to assist with the optimisation of the blast parameters and confirmation of predictions. Maximum instantaneous charge and stemming height together with other blast parameters should be designed to ensure the airblast criterion is not exceeded.

Potential noise impacts on livestock and native fauna are discussed in Section 3.4 and further detail is provided in Volume 4, Appendix N1 Mine Terrestrial Ecology Report. Based on available literature it is concluded that it is unlikely that any adverse noise impacts would be associated with the Project (Mine) relating to livestock and native fauna and that therefore management measures are not anticipated to be required in this regard.

5. References

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Queensland Environmental Protection Regulation, 2008 QLD Government.

Queensland Rail Code of Practice for Railway Noise Management.

Runge Ltd, 2011, Carmichael Macro-conceptual Mining Study, Report No. ADV-BR-10370a for Adani Mining Pty Ltd.

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Appendix A

Terms of Reference Cross-reference

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Terms of Reference Requirement/Section Number	Section of this report
Section 3.7.1 Description of environmental values	
Describe the existing noise and vibration environment that may be affected by the project in the context of environmental values as defined by the *Environmental Protection (Noise) Policy 2008* (EPP (Noise)). DERM's *Noise Measurement Manual*[2] should be considered and references should be made to the EPA's *Guideline: Noise and Vibration from Blasting.*[3]	Section 2
Identify sensitive noise receptors adjacent to all project components and estimate typical background noise and vibration levels based on surveys at representative sites. Include proposed accommodation camps as sensitive noise receptors. Discuss the potential sensitivity of such receptors and nominate performance indicators and standards. The locations of any noise sensitive receptors, as listed in Schedule 1 of EPP (Noise), should be identified on a map at a suitable scale.	Section 2.1 and 1.3
Where a railway is also proposed to be constructed and operated, conduct an assessment of the acoustic impacts of the rail in the context of: ◗ the QR Code of Practice for Railway Noise Management[4] for external design level noise criteria ◗ meeting indoor design level noise criteria to achieve average maximum sound level between 10:00pm and 6:00am of 45 decibels (dB).	Not applicable to this report. Refer to Volume 4 Appendix AF.
Section 3.7.2 Potential impacts and mitigation measures	
Describe the impacts of noise and vibration generated during the construction and operational phases of the project. Noise and vibration impact analysis should include: ◗ the levels of noise and vibration generated, including noise contours, assessed against current typical background levels, using modelling where appropriate ◗ impact of noise, including low frequency noise (noise with components below 200 Hz) and vibration at all potentially sensitive receptors compared with the performance indicators and standards nominated above ◗ impact on terrestrial and aquatic fauna proposals to minimise or eliminate these effects, including details of any screening, lining, enclosing or bunding of facilities, or timing schedules for construction and operations that would minimise environmental harm	Section 3.2, 0 and 3.4 of this report.

[2] Department of Environment and Resource Management, *Noise Measurement Manual*, 3rd edn, Department of Environment and Resource Management, Brisbane, 2000, viewed 20 December 2010 www.derm.qld.gov.au/register/p00367aa.pdf

[3] Environment Protection Agency, *Guideline: Noise and vibration from blasting*, Environment Protection Agency, Brisbane, 2006, viewed 20 December 2010, www.derm.qld.gov.au/register/p01382aa.pdf

[4]QR National, *QR Code of Practice for Railway Noise Management* , 2007, viewed 18 January 2011, www.qrnational.com.au/Corporate/OurCommitment/Environment/Documents/Noise_Code_Practice_2007.pdf

and environmental nuisance from noise and vibration.	
Any impact on human health at sensitive receptors (including accommodation camps) must be appropriately mitigated to achieve a satisfactory internal noise level for the preservation of health and well-being identified within the *Environmental Protection (Noise) Policy 2008*. Provide management options at sensitive receptors when noise attenuation at the source does not adequately reduce noise generation.	Section 3

Appendix B

Noise Monitoring Data – Location A

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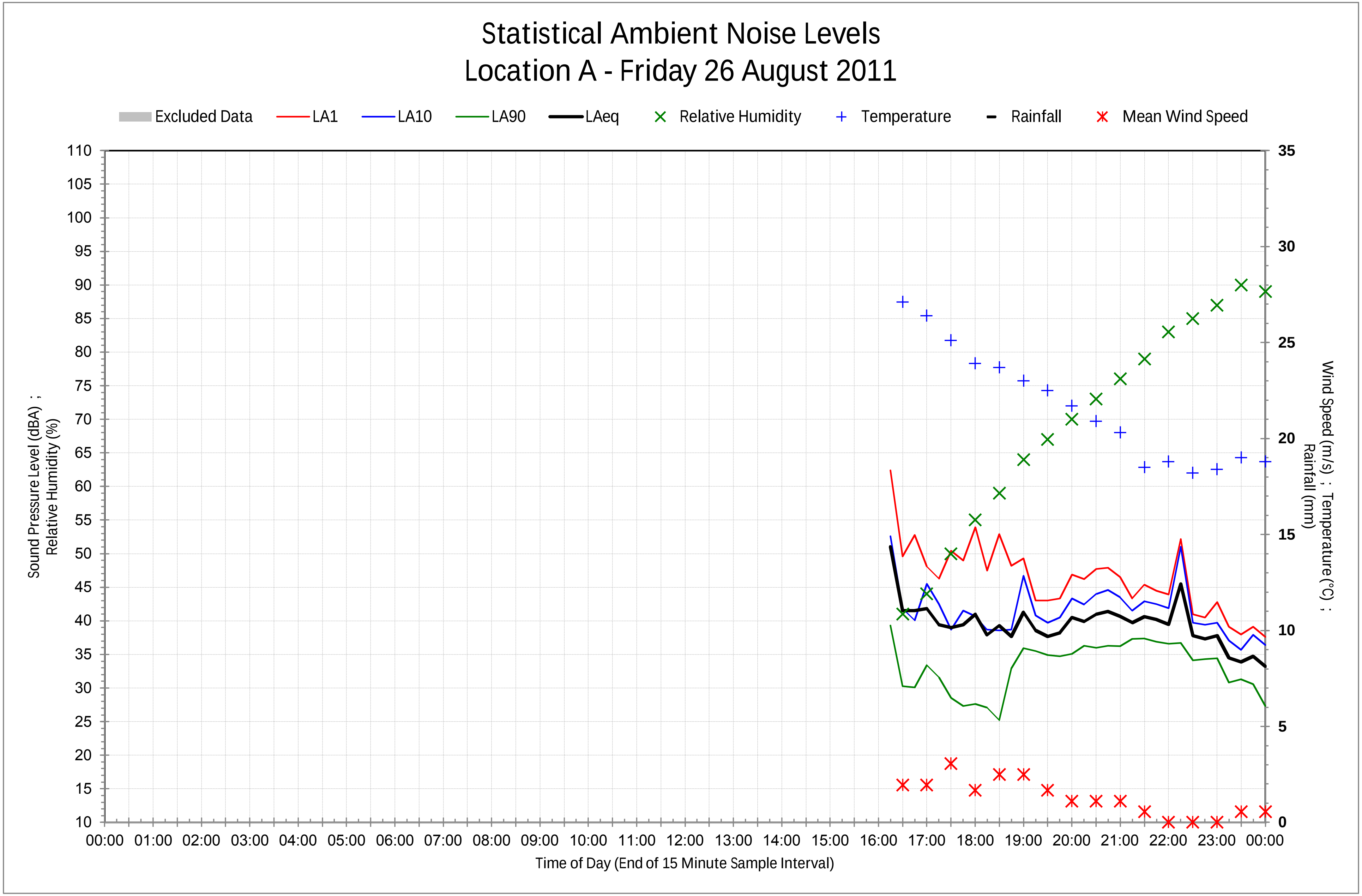
Statistical Ambient Noise Levels
Location A - Friday 26 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
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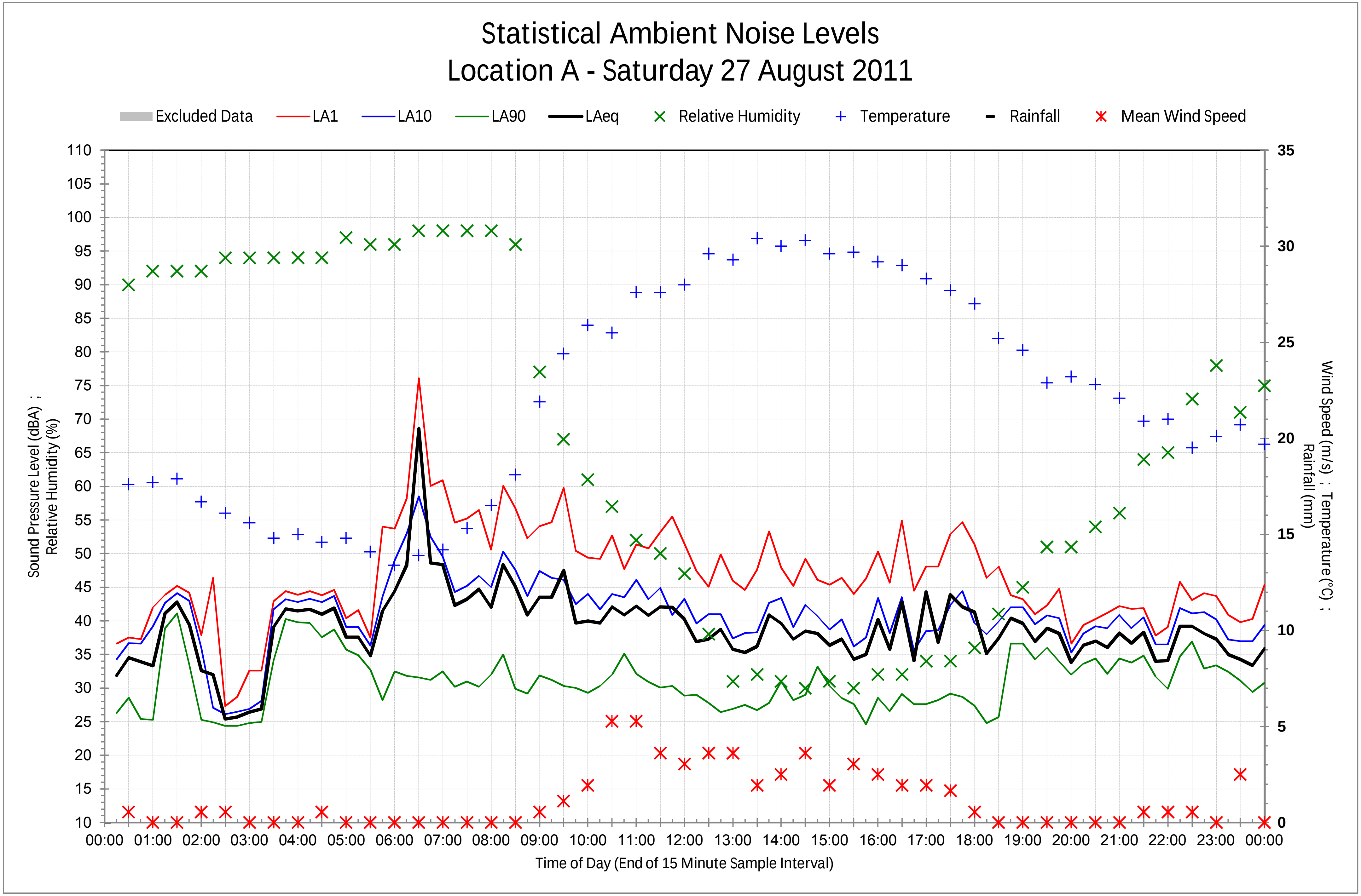
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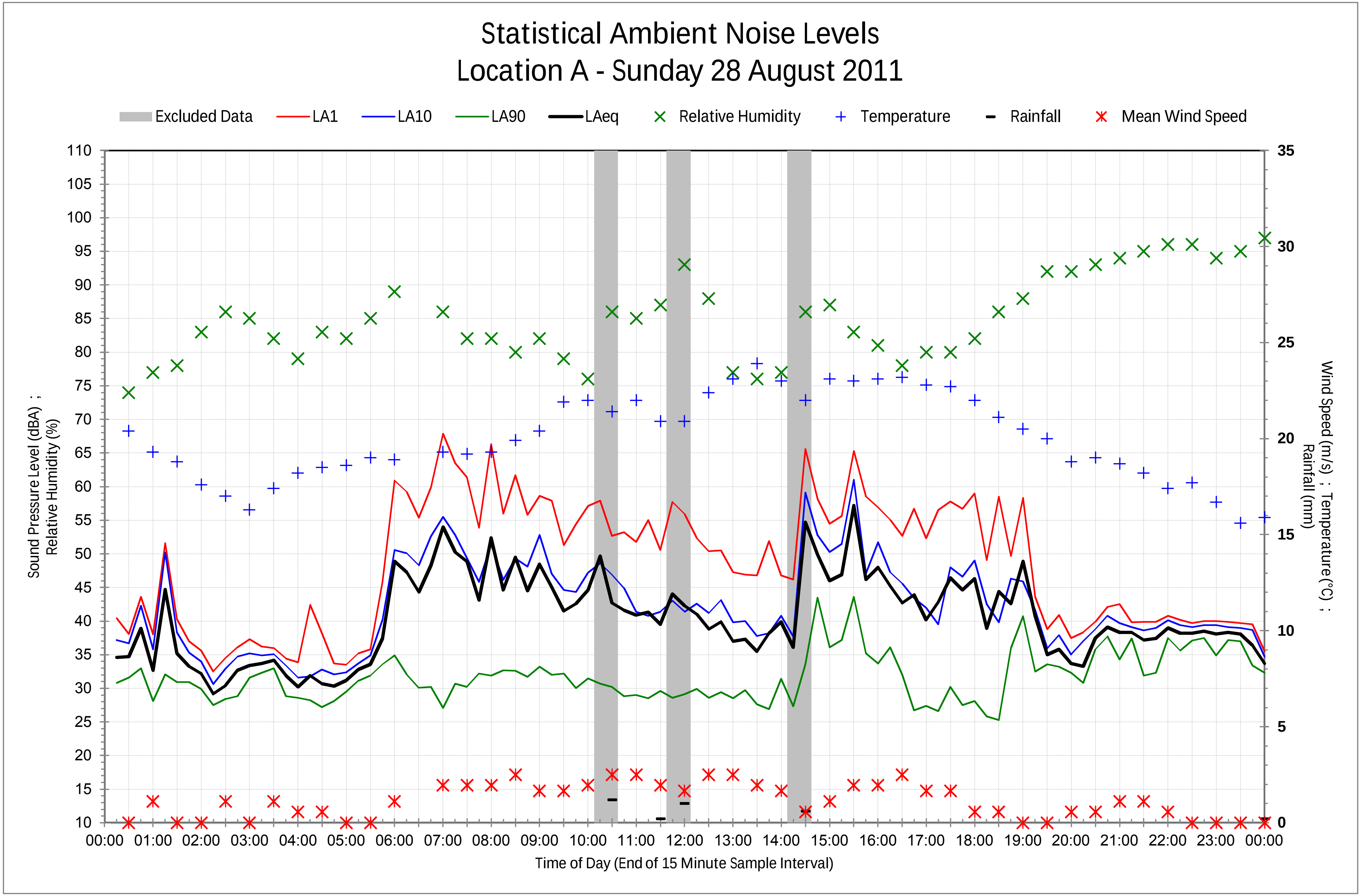
Location A - Saturday 27 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)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Location A - Sunday 28 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
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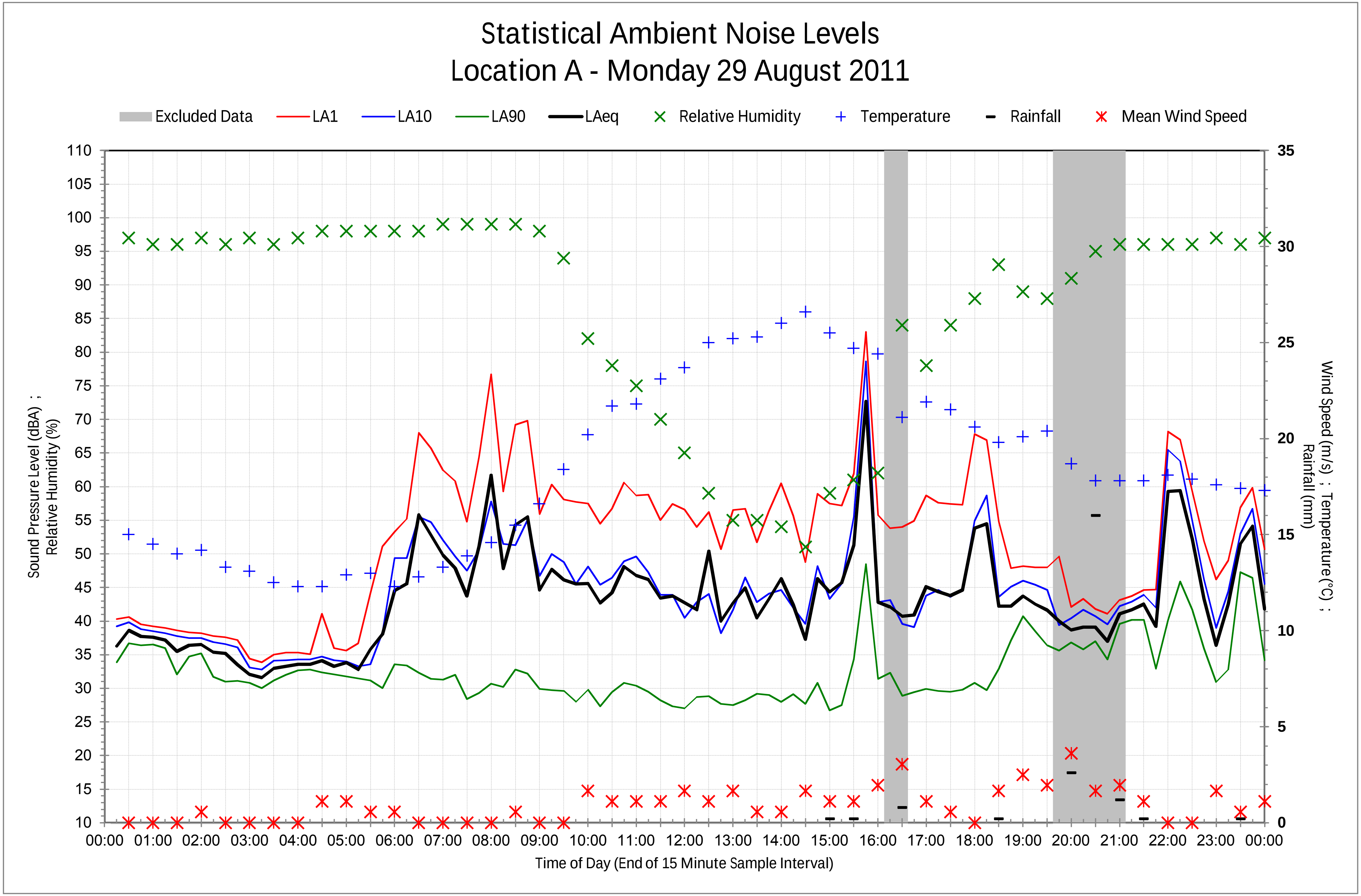

Statistical Ambient Noise Levels
Location A - Monday 29 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
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95
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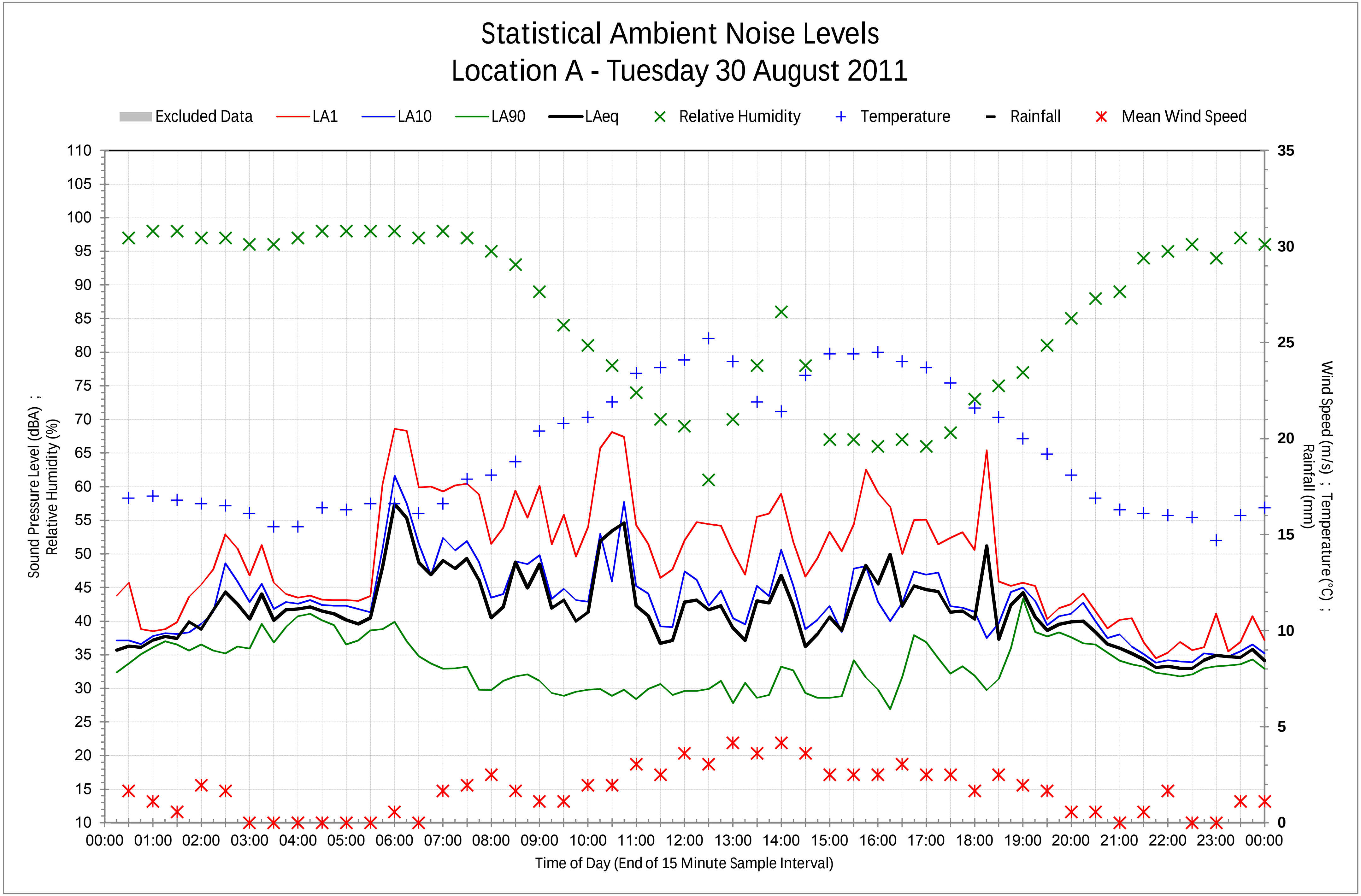

Statistical Ambient Noise Levels
Location A - Tuesday 30 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
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95
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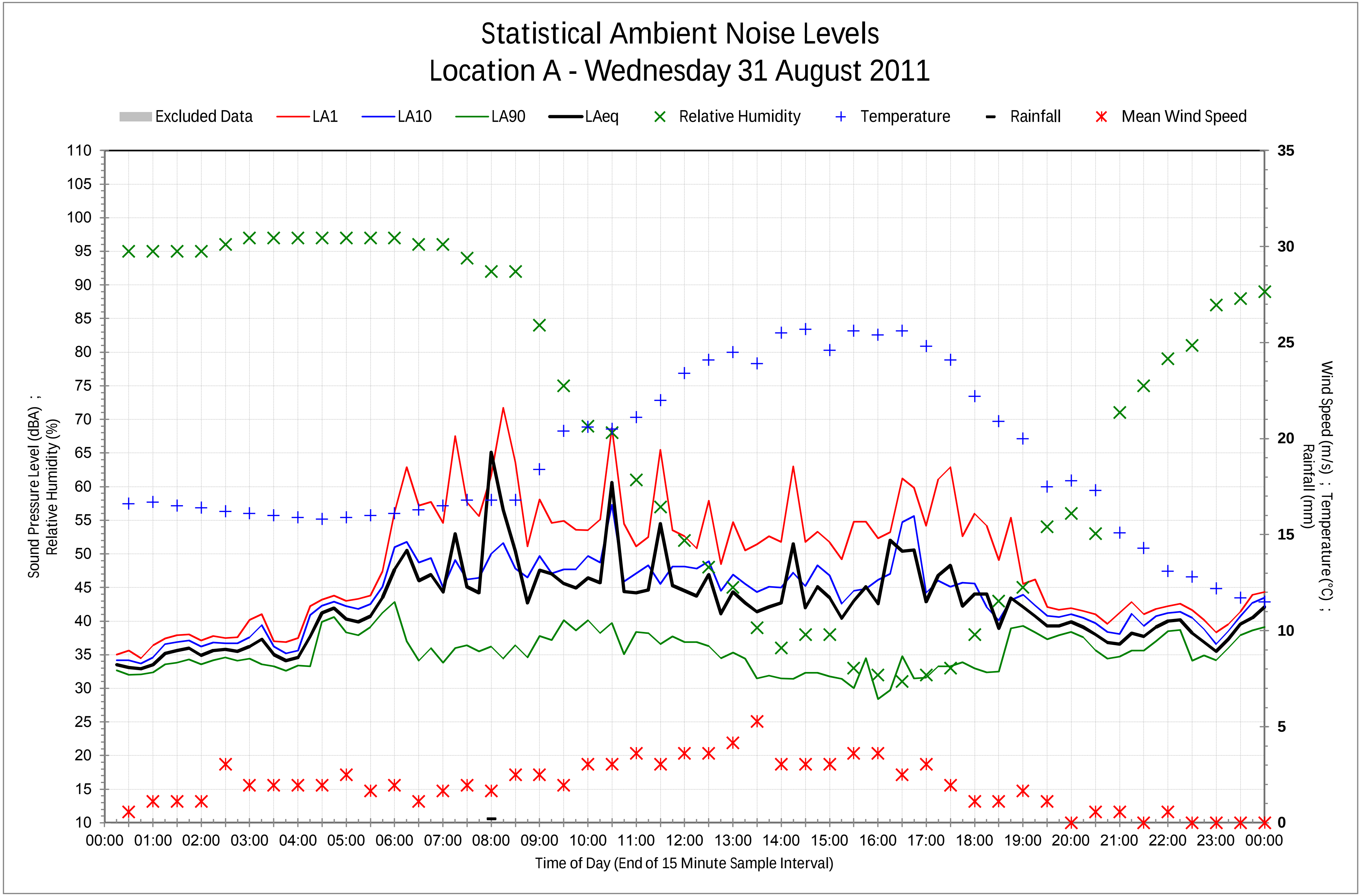

Statistical Ambient Noise Levels
Location A - Wednesday 31 August 2011
Excluded Data
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LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
35
30
25
20
15
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
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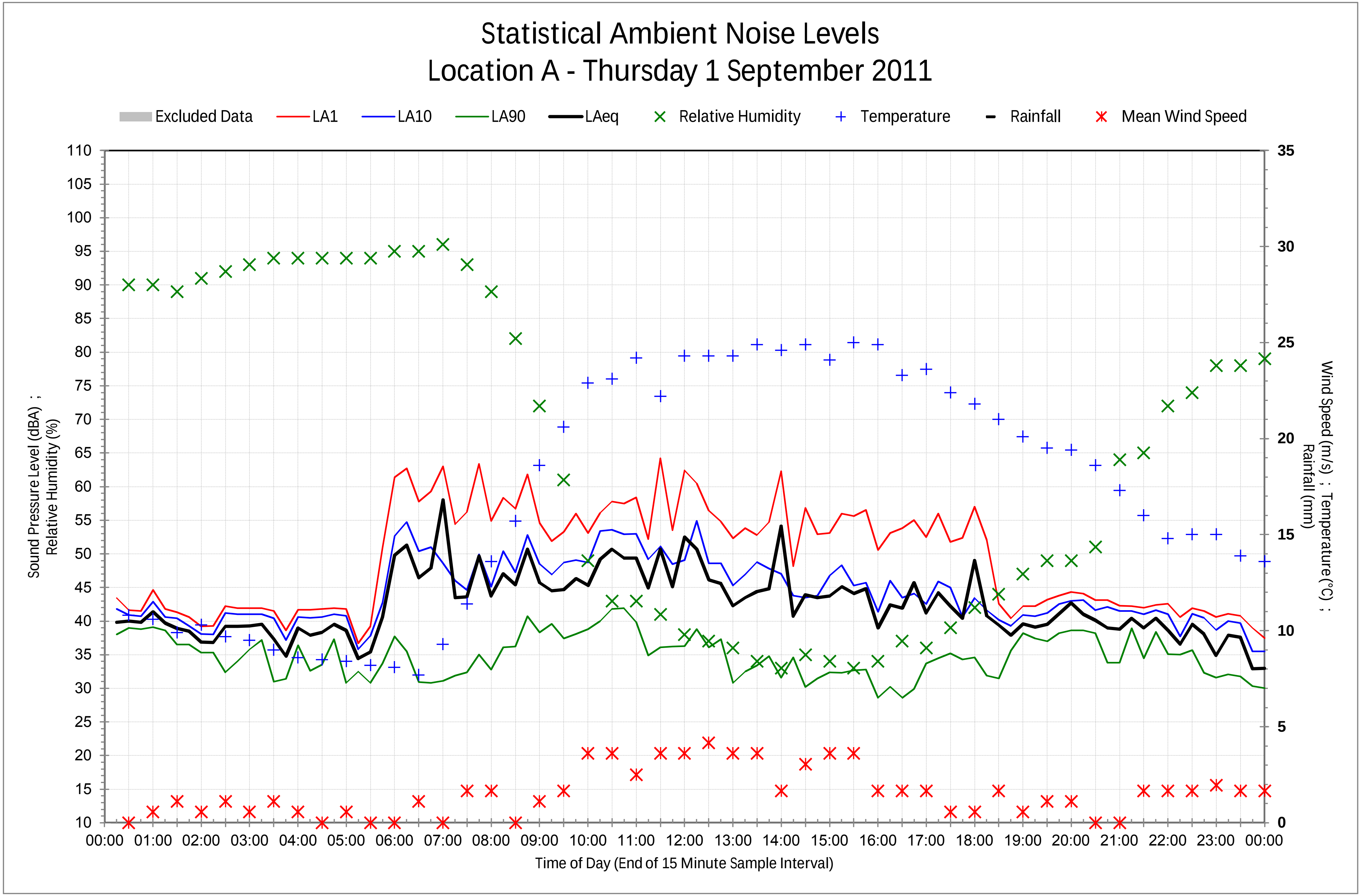
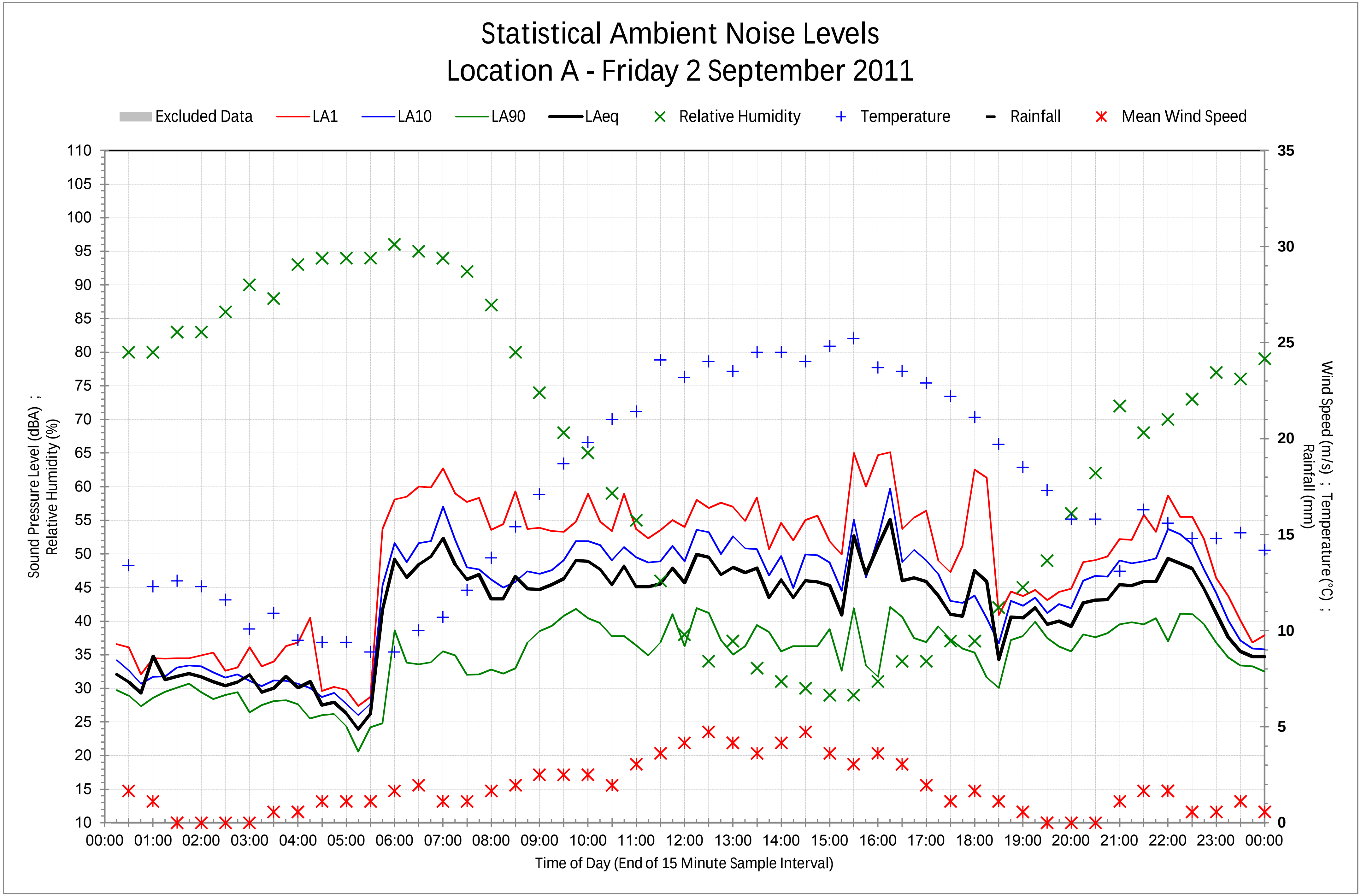
19:00
20:00
21:00
22:00
23:00
00:00



Statistical Ambient Noise Levels
Location A - Thursday 1 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)



Statistical Ambient Noise Levels
Location A - Friday 2 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
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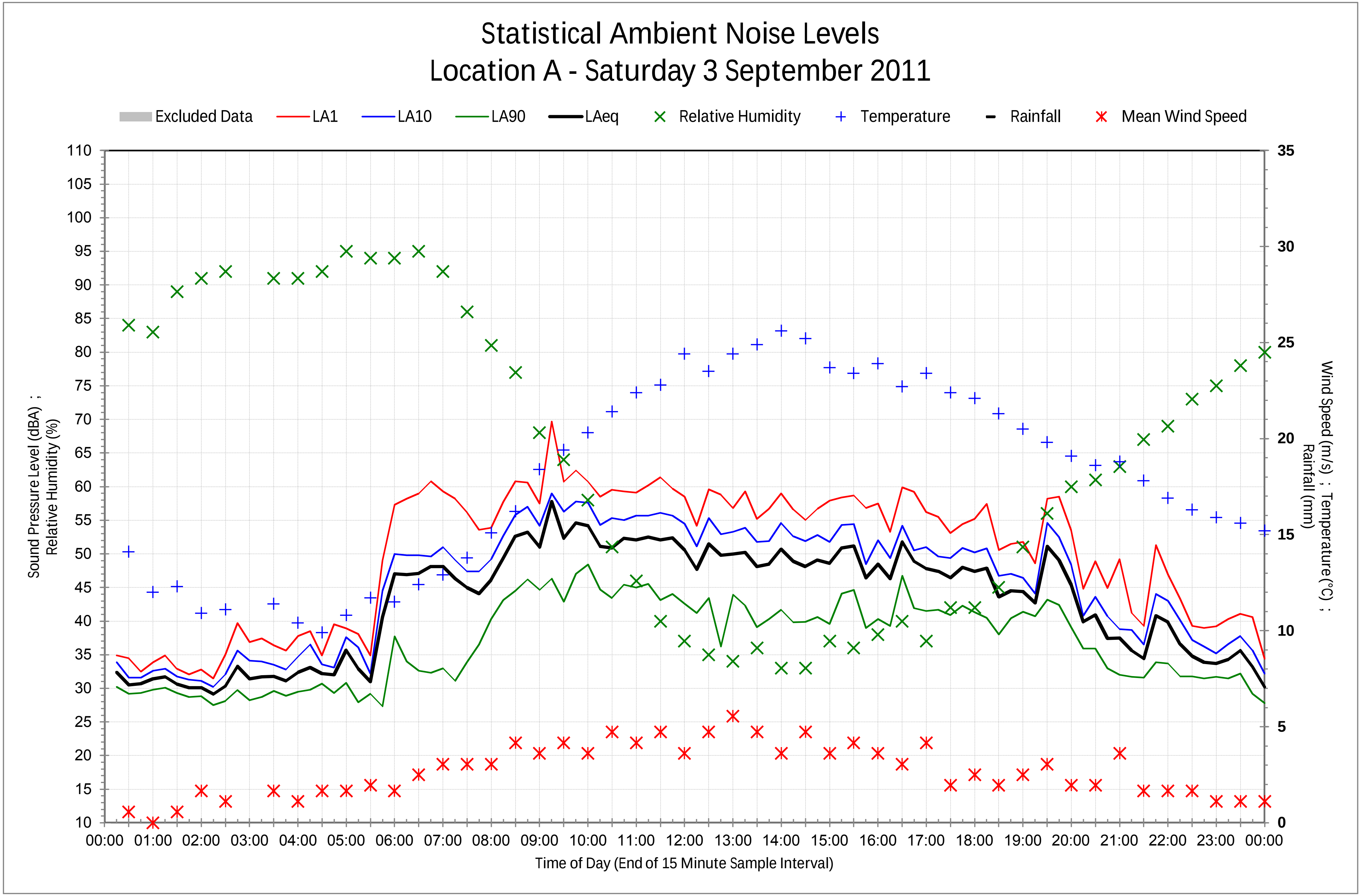
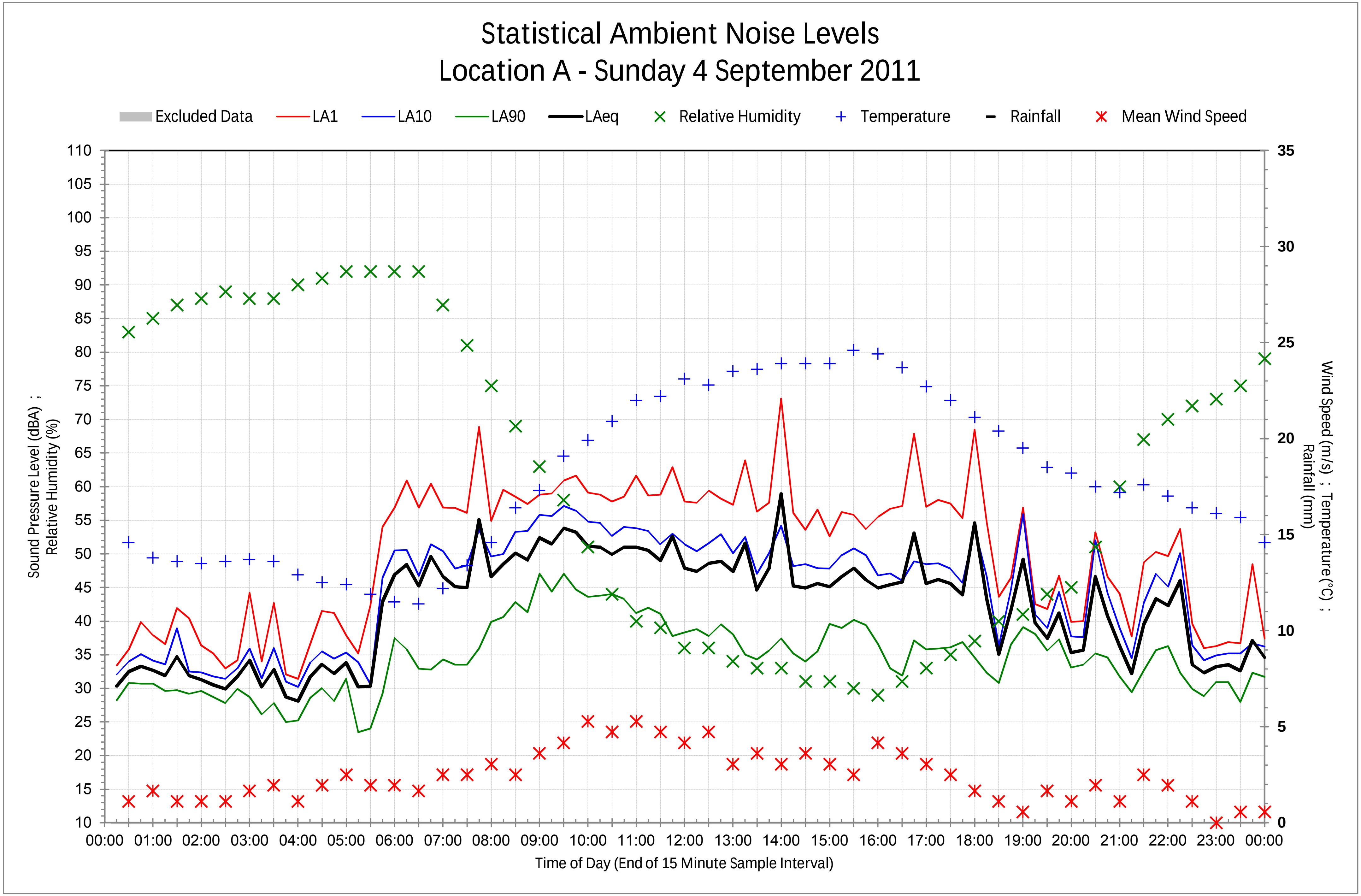
22:00
23:00
00:00



Statistical Ambient Noise Levels
Location A - Saturday 3 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Location A - Sunday 4 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
35
30
25
20
15
10
5
0
00:00
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02:00
03:00
04:00
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10:00
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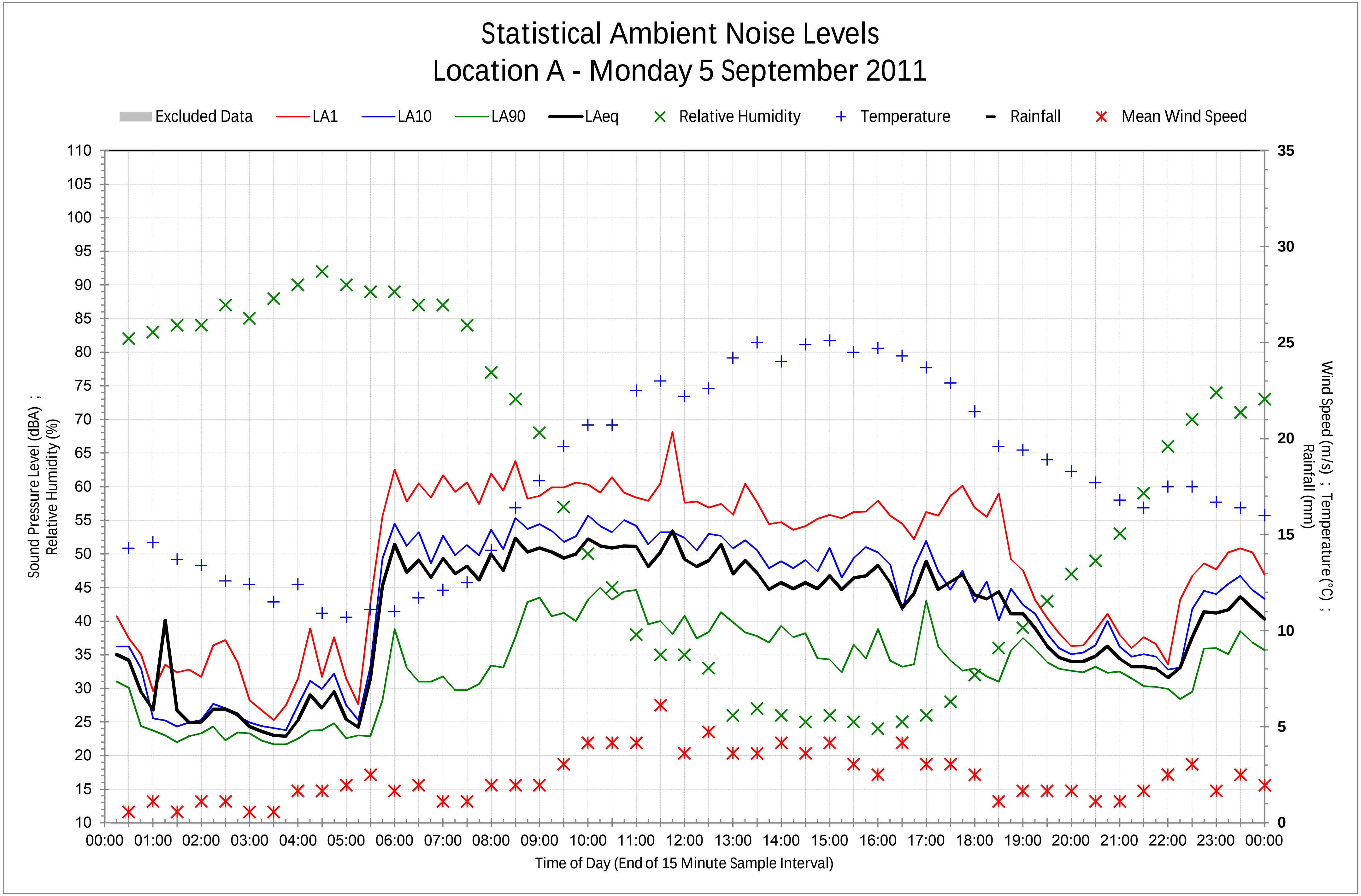
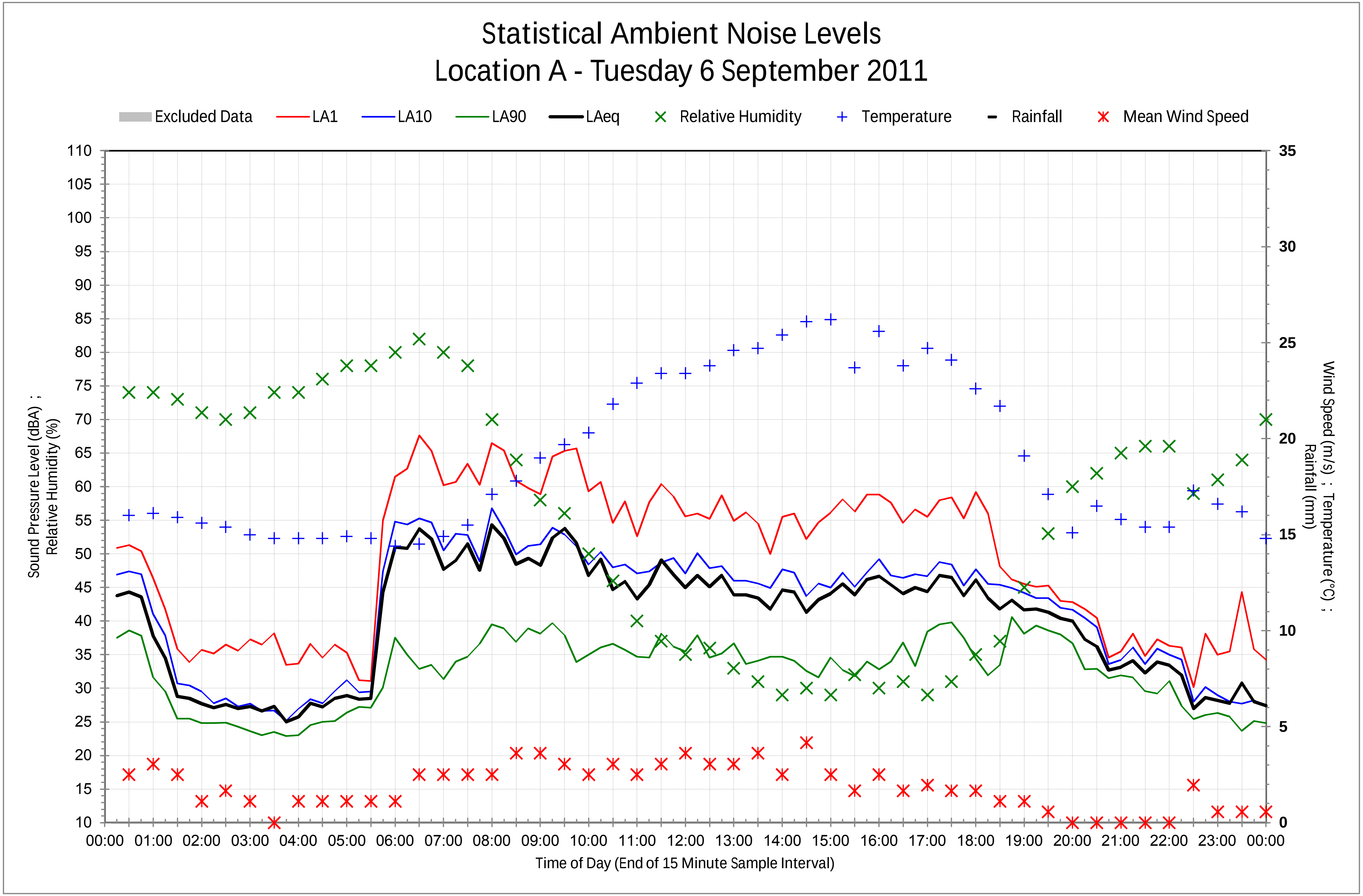
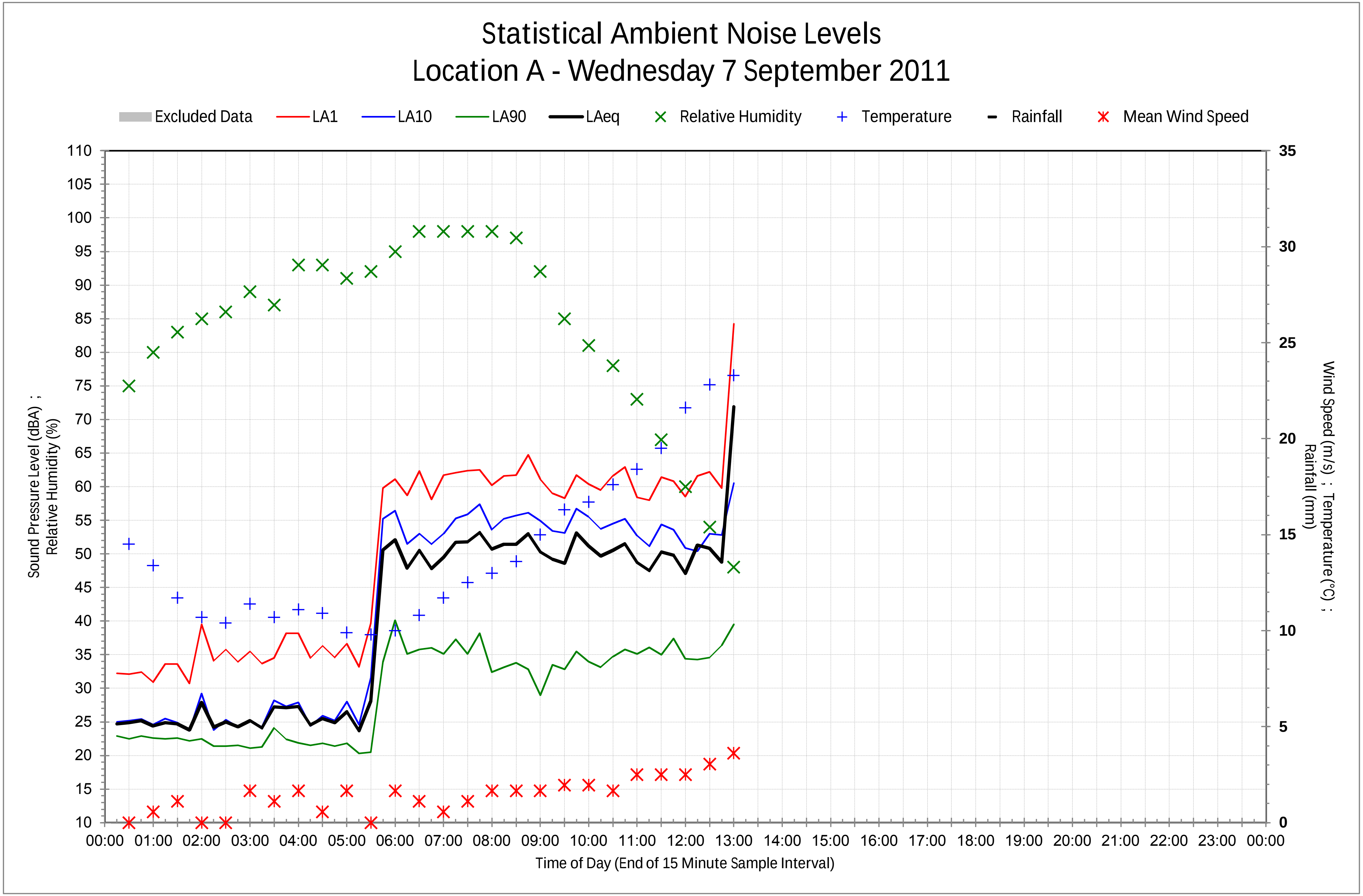

Statistical Ambient Noise Levels
Location A - Monday 5 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Location A - Tuesday 6 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
35
30
25
20
15
10
5
0
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00


Statistical Ambient Noise Levels
Location A - Wednesday 7 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
35
30
25
20
15
10
5
0
00:00
01:00
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03:00
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10:00
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13:00
14:00
15:00
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Appendix C

Noise Monitoring Data – Location B

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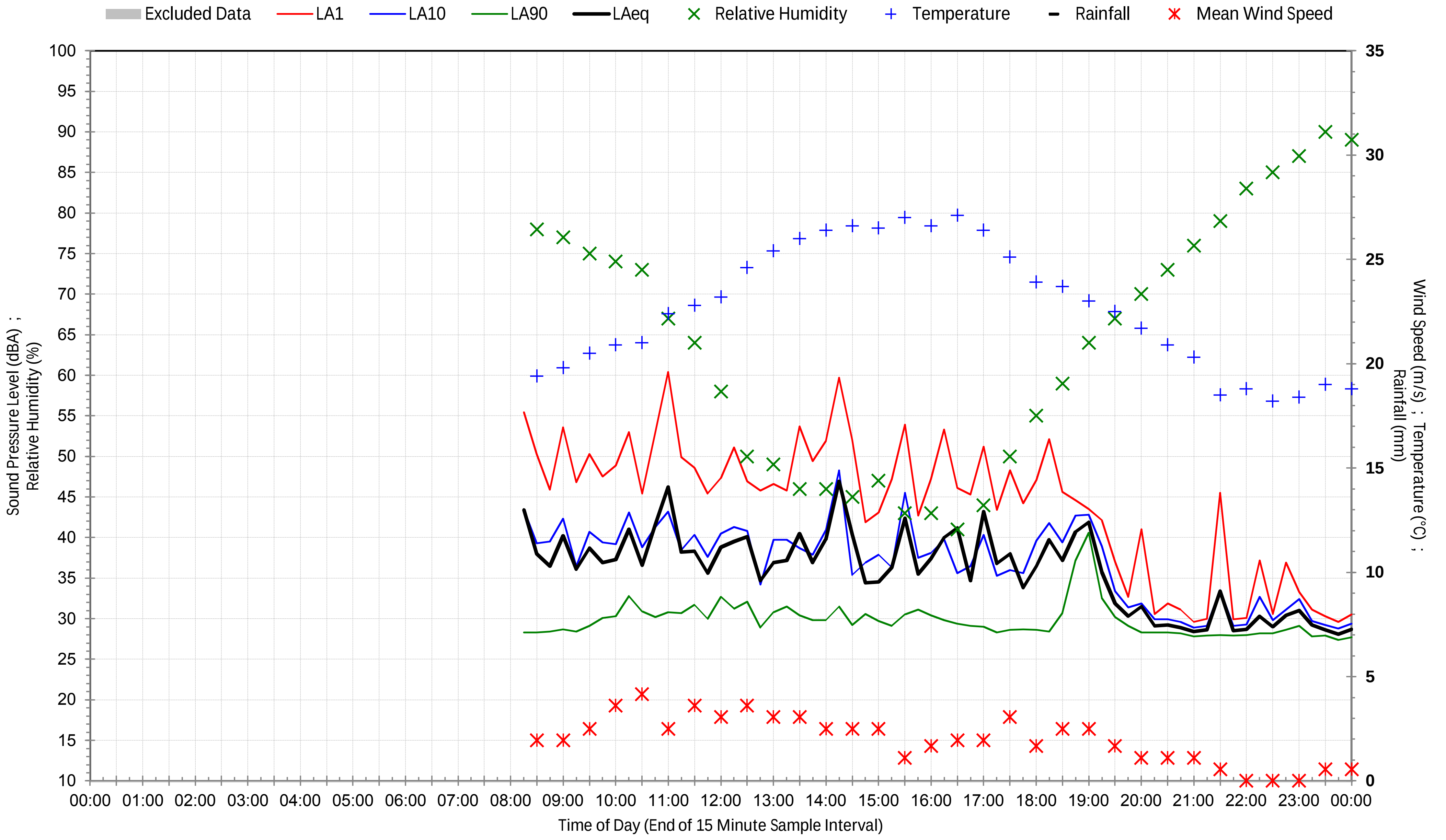
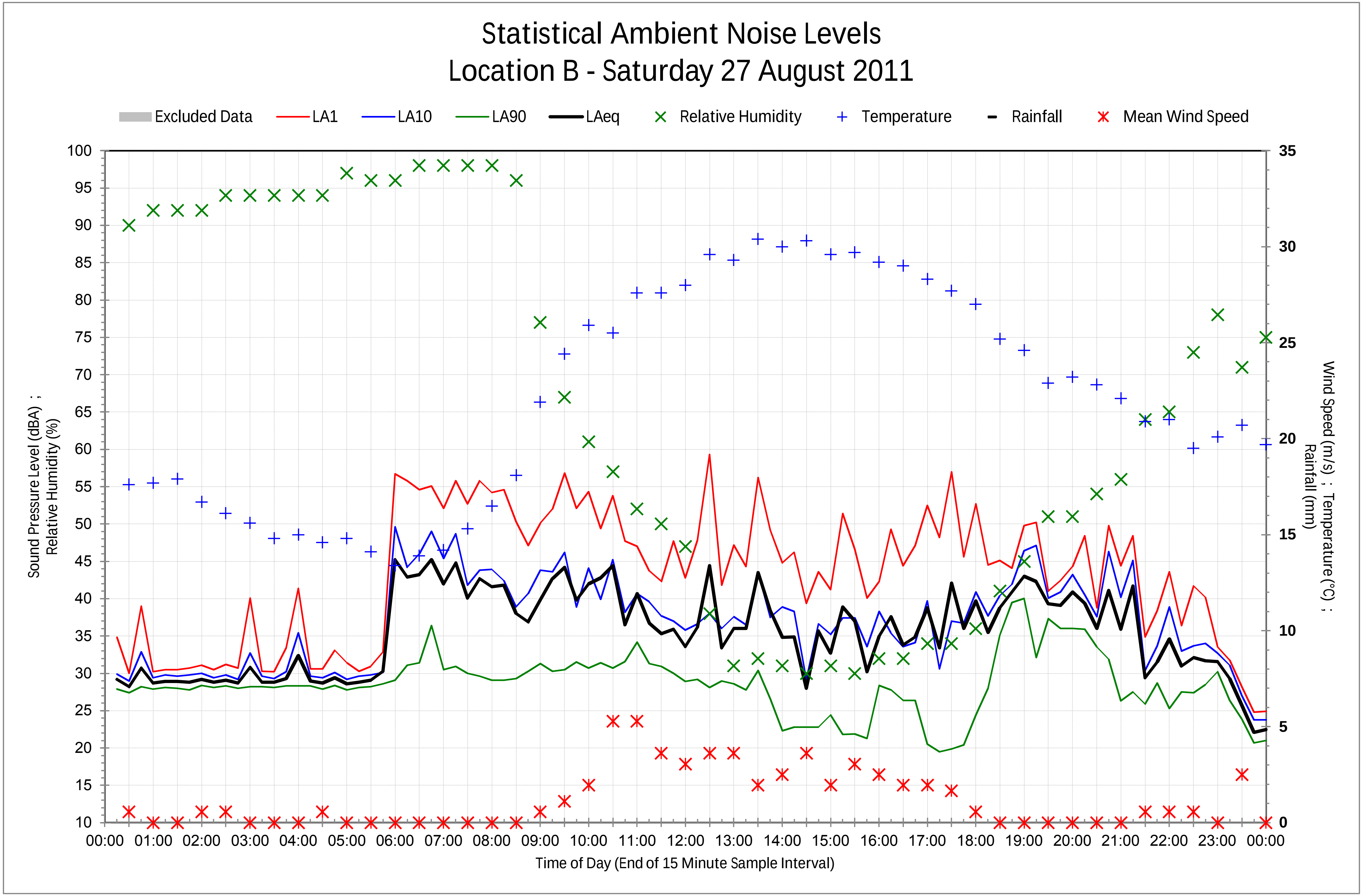
Statistical Ambient Noise Levels
Location B - Friday 26 August 2011





Statistical Ambient Noise Levels
Location B - Saturday 27 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
35
30
25
20
15
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16:00
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18:00
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20:00
21:00
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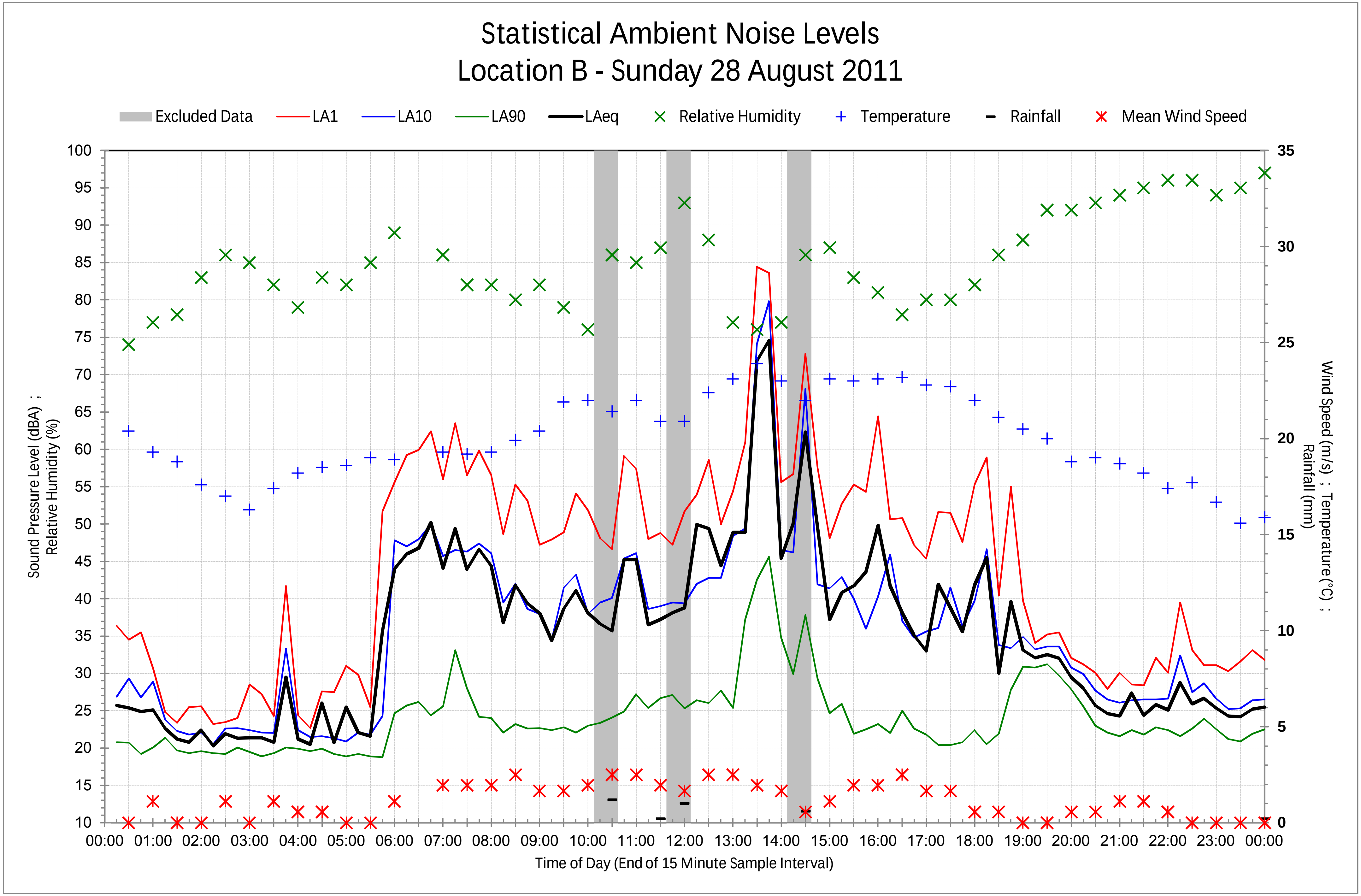
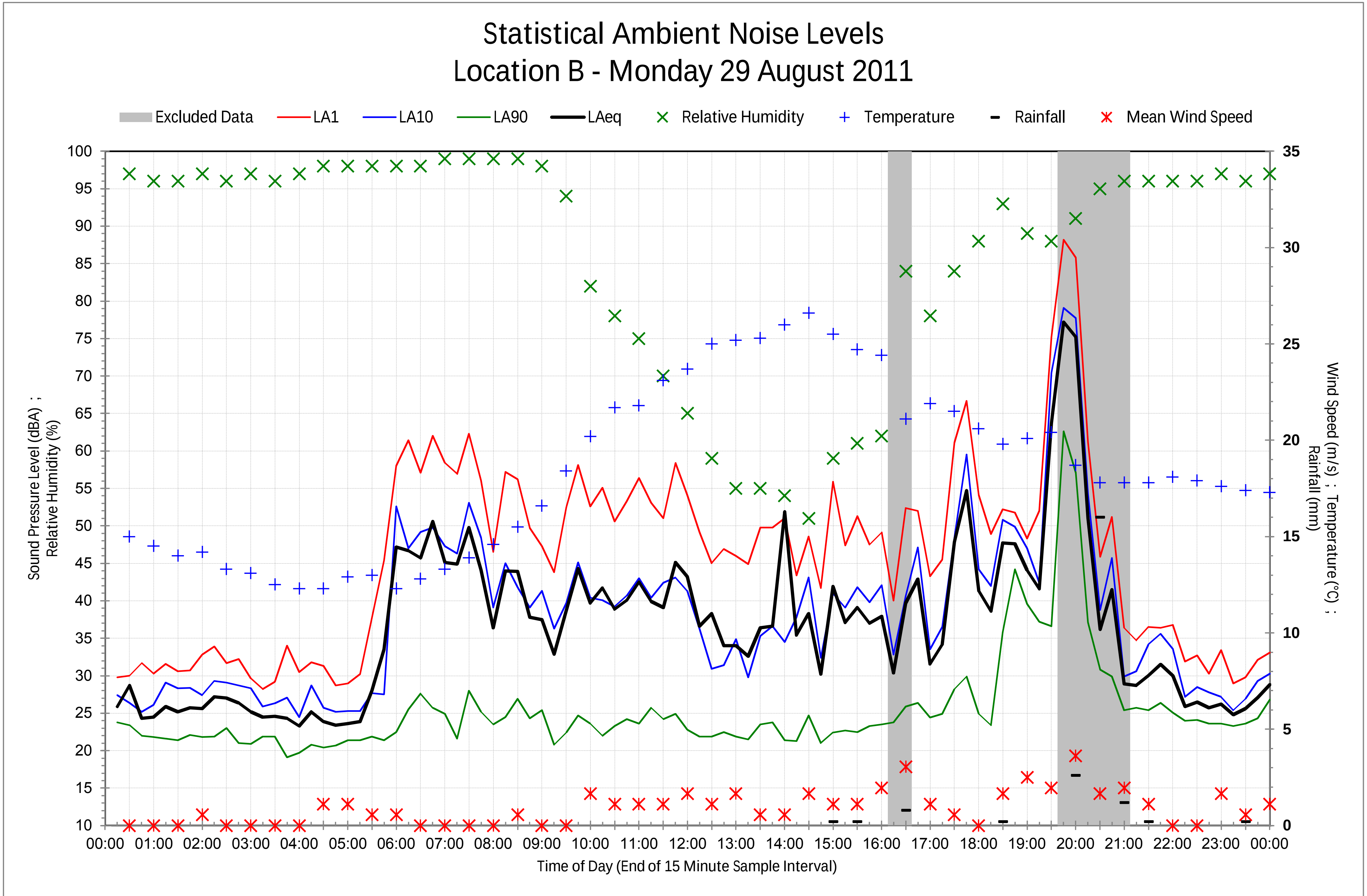


Statistical Ambient Noise Levels
Location B - Sunday 28 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)



Statistical Ambient Noise Levels
Location B - Monday 29 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
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20
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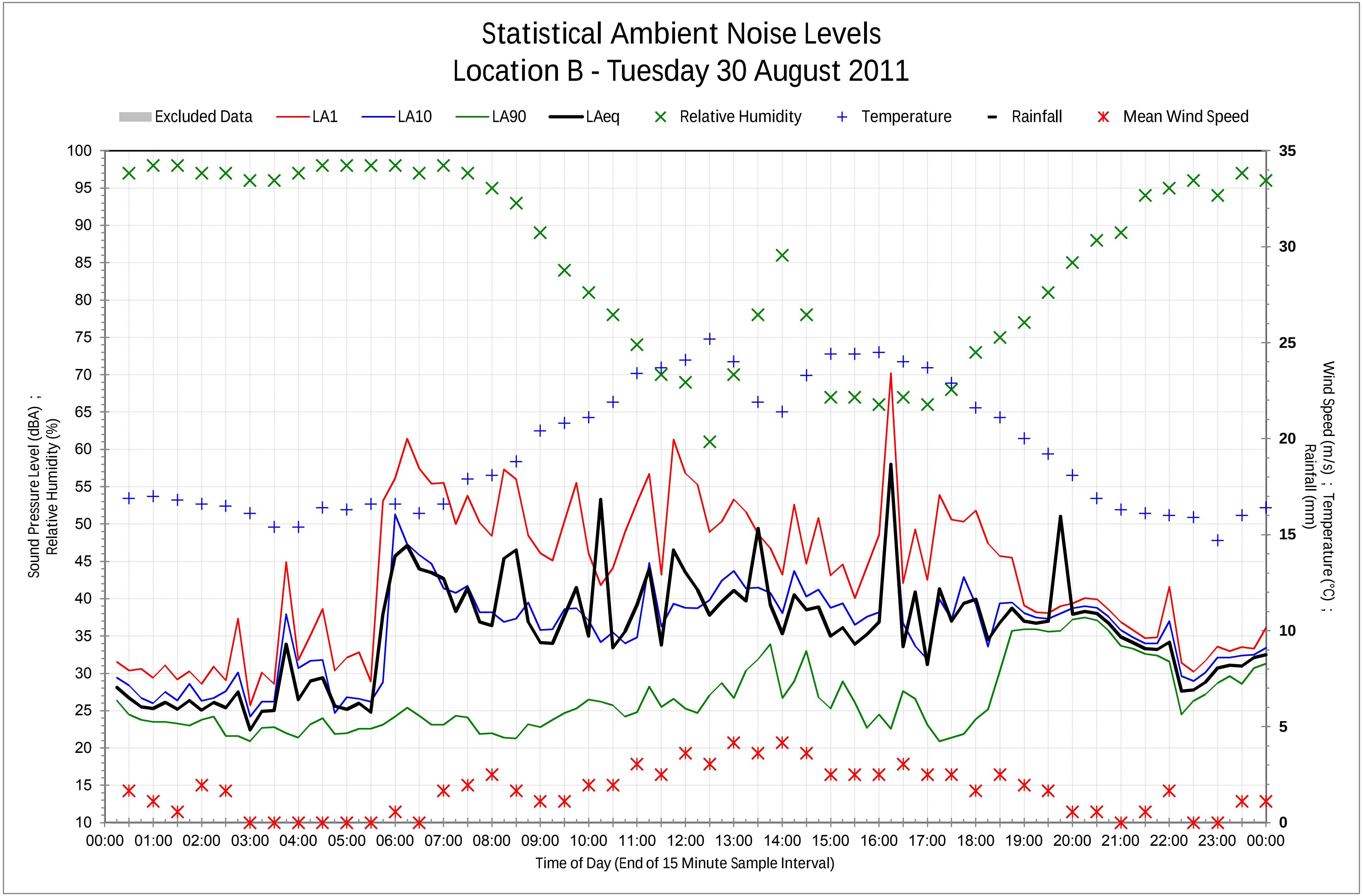
Statistical Ambient Noise Levels
Location B - Tuesday 30 August 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
00:00
01:00
02:00
03:00
04:00
05:00
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07:00
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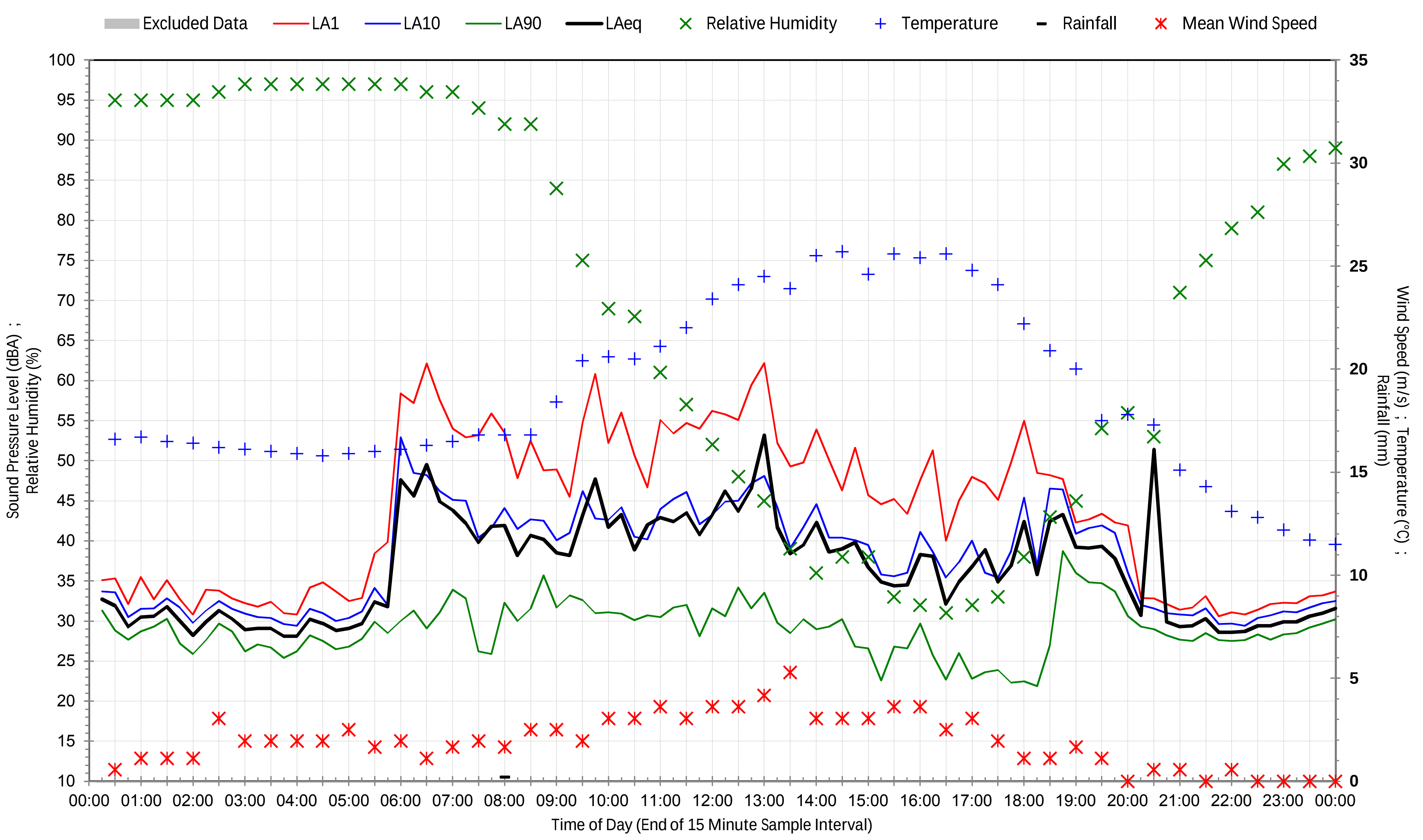
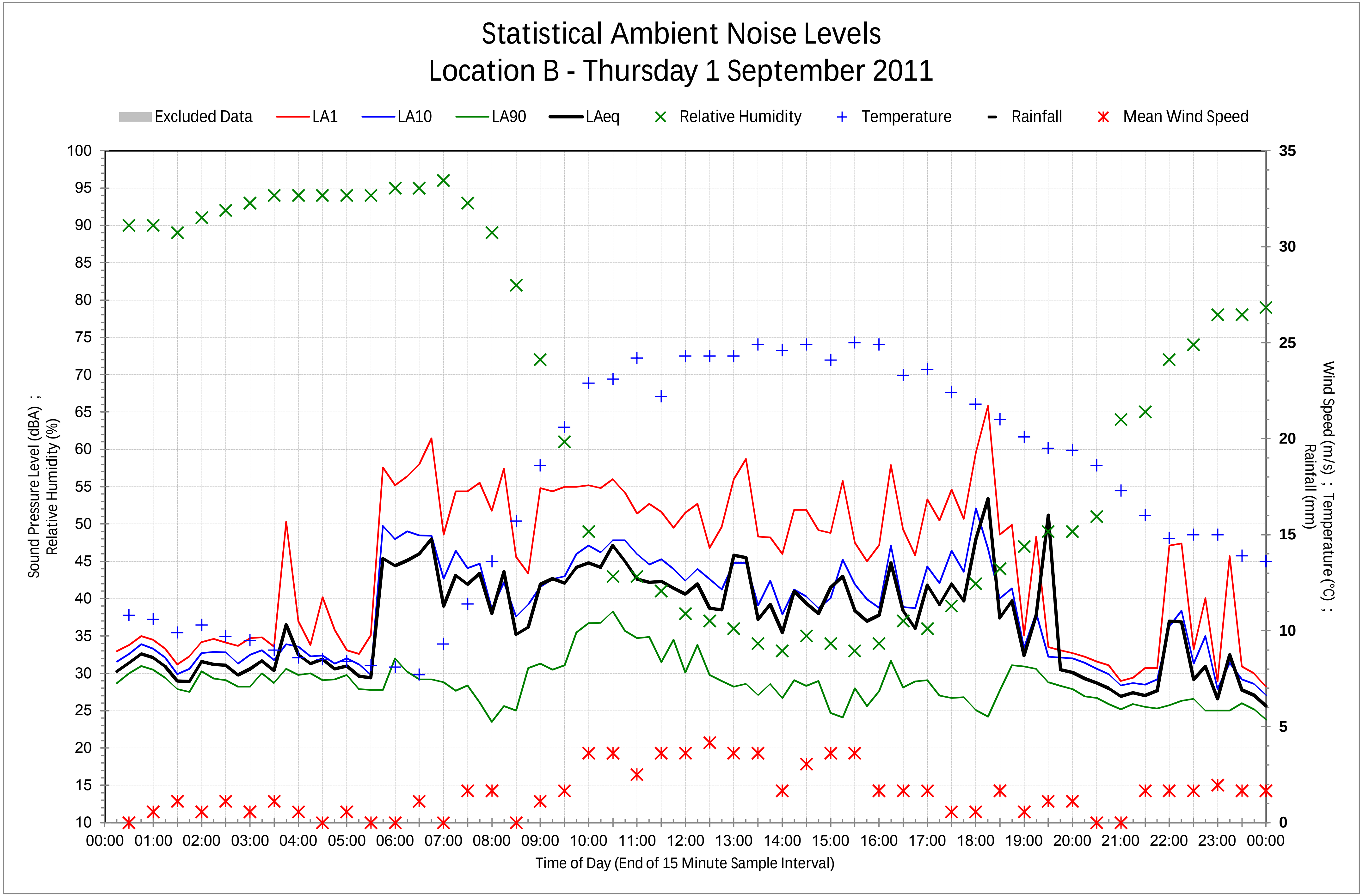
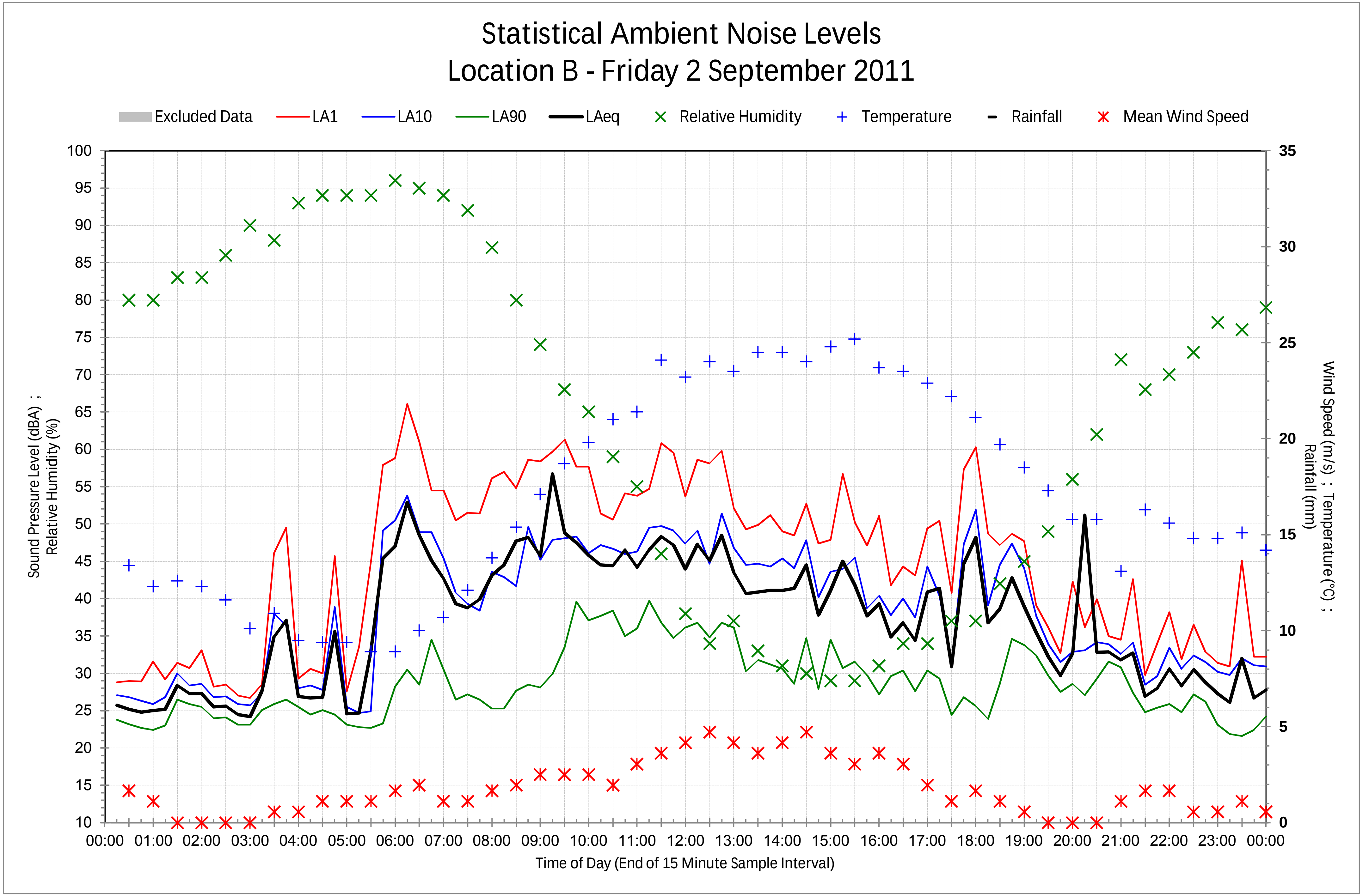
Statistical Ambient Noise Levels
Location B - Wednesday 31 August 2011




Statistical Ambient Noise Levels
Location B - Thursday 1 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00
100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
35 30 25 20 15 10 5 0



Statistical Ambient Noise Levels
Location B - Friday 2 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
100
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75
70
65
60
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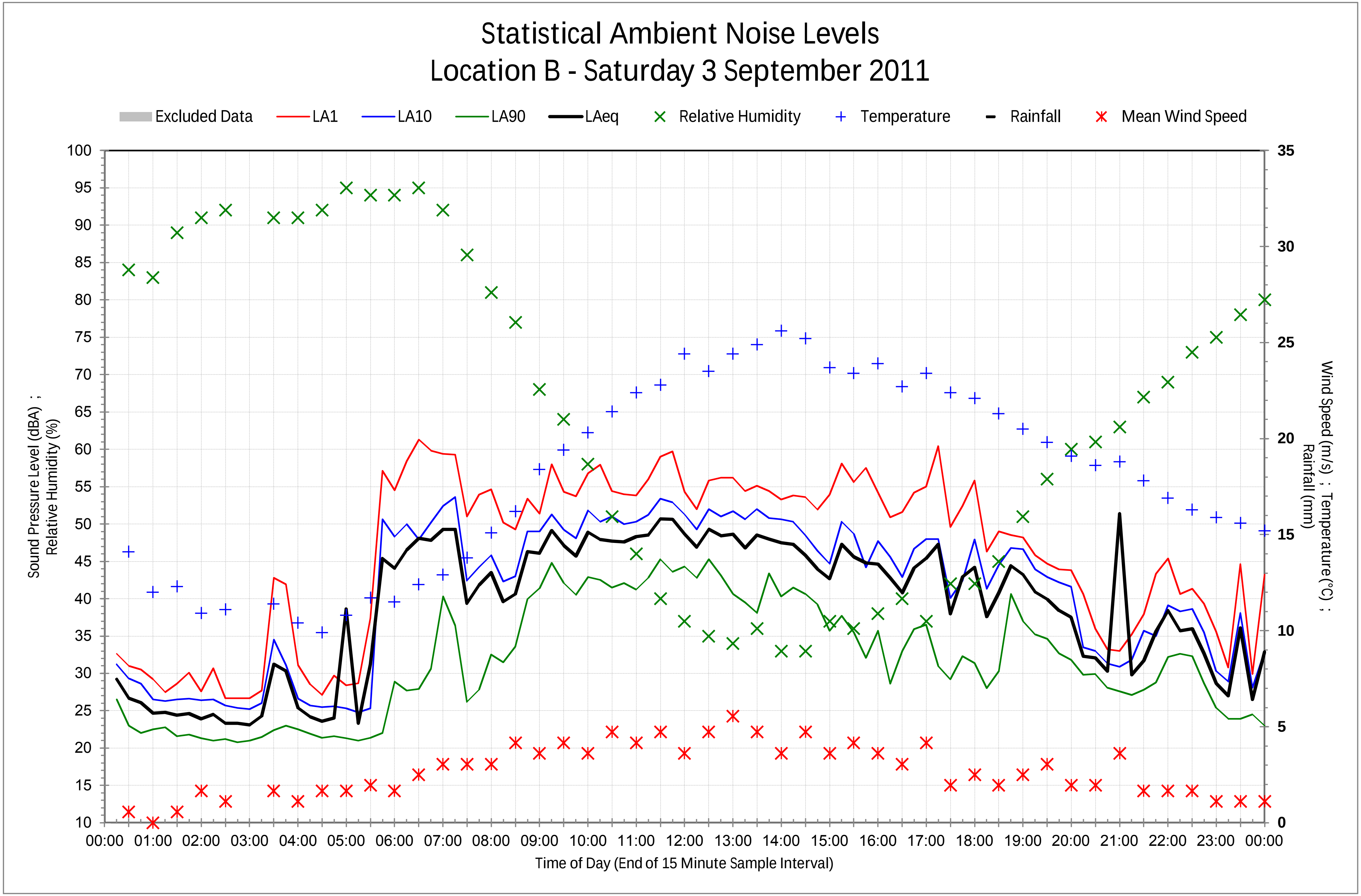

Statistical Ambient Noise Levels
Location B - Saturday 3 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
100
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21:00
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23:00
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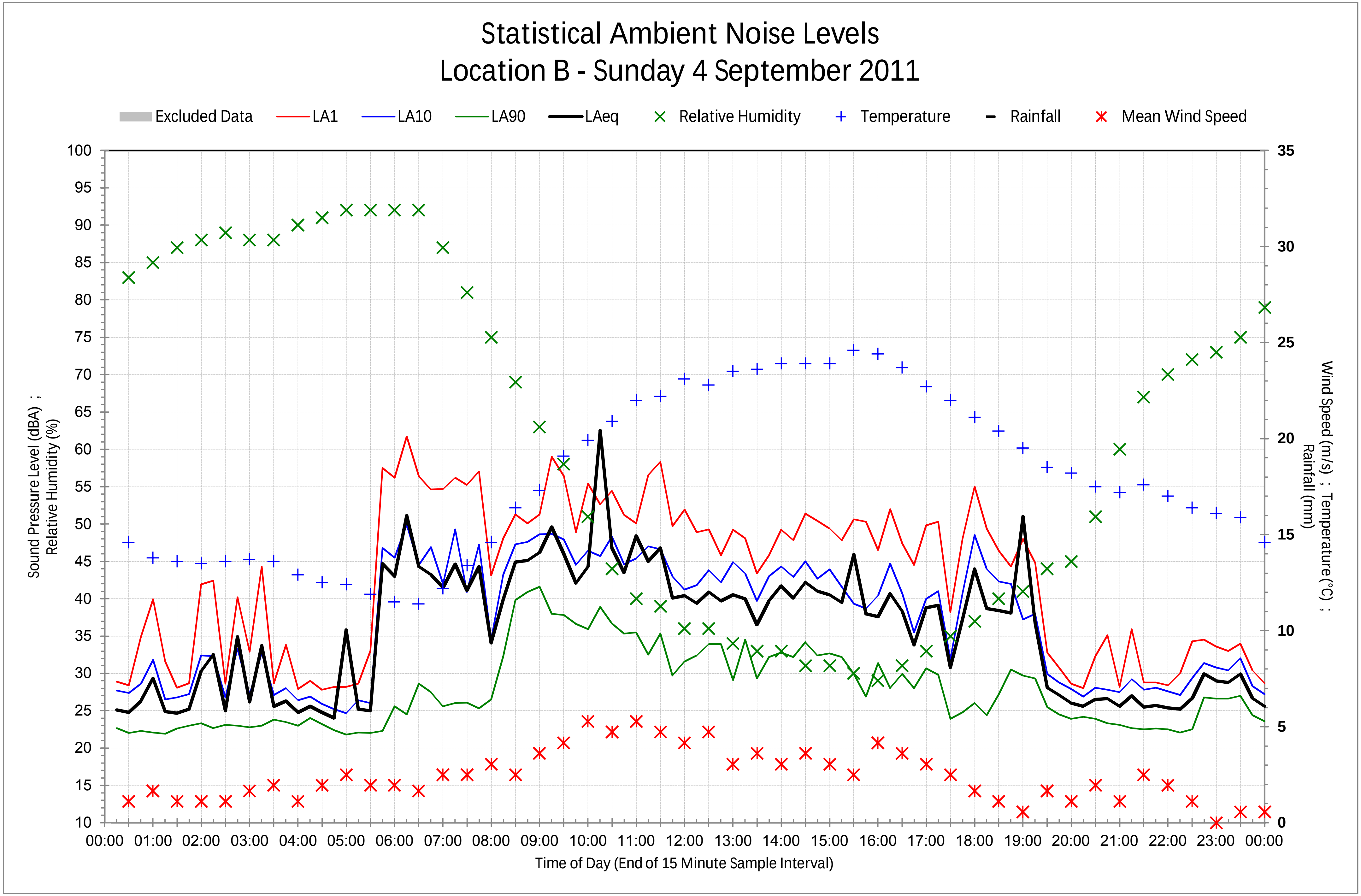
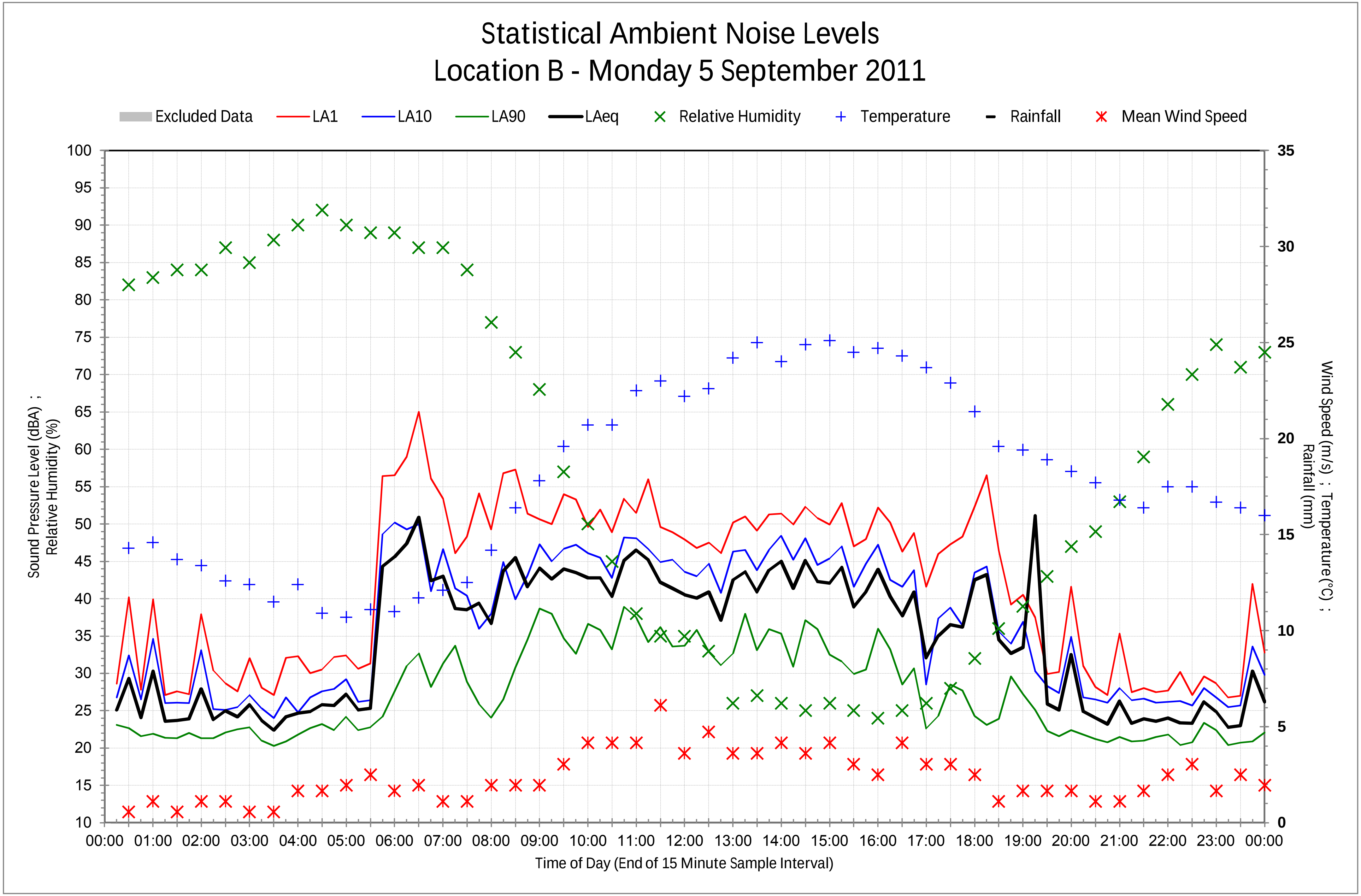


Statistical Ambient Noise Levels
Location B - Sunday 4 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)



Statistical Ambient Noise Levels
Location B - Monday 5 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)
100
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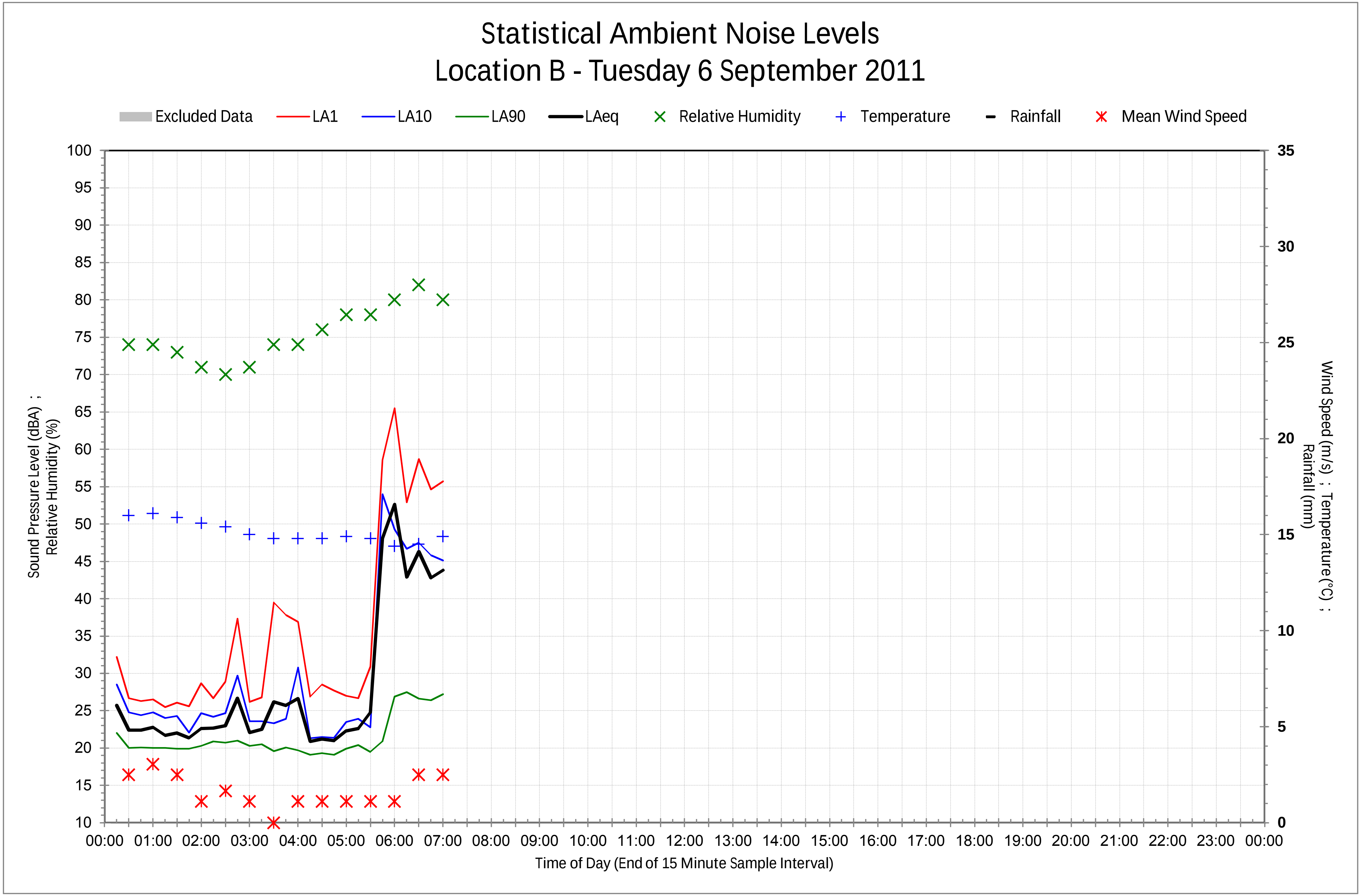

Statistical Ambient Noise Levels
Location B - Tuesday 6 September 2011
Excluded Data
LA1
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

Appendix D

Meteorological Data

Wind Roses

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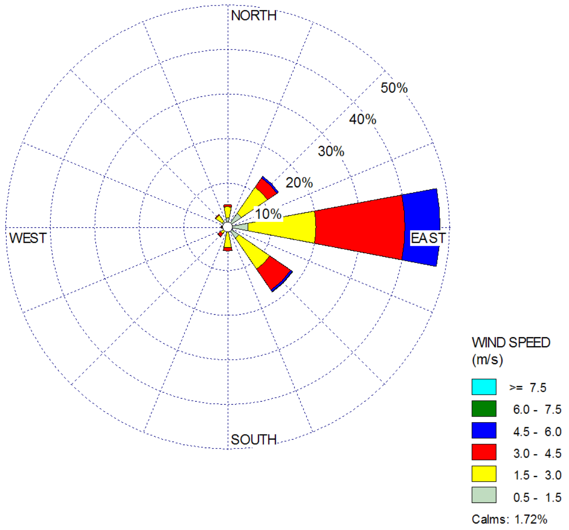
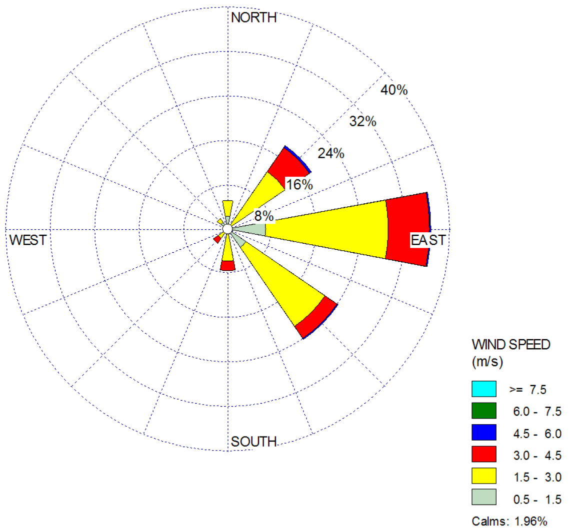
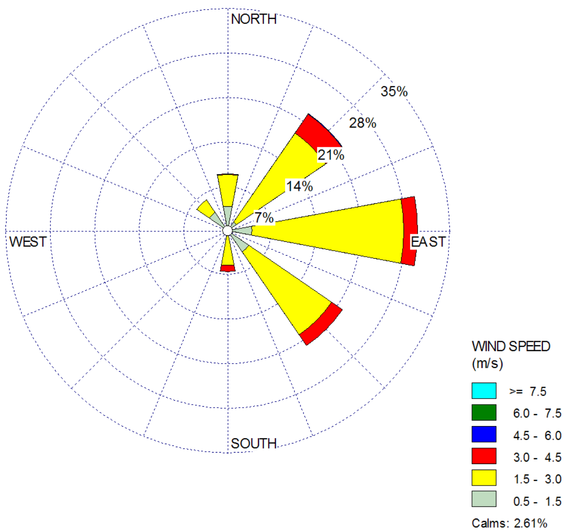
AUTUMN



0700 – 1800 hrs

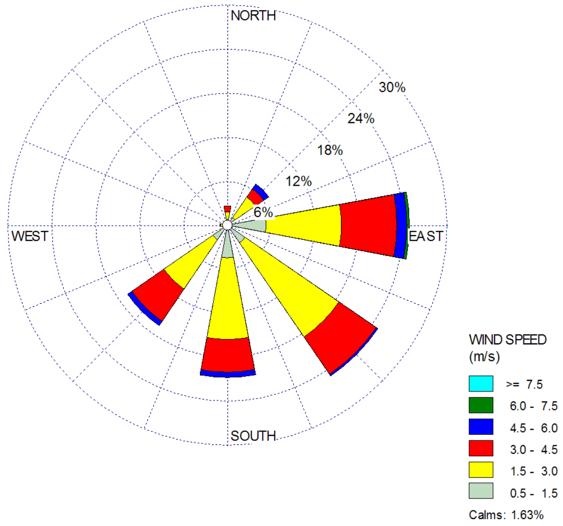


1800 – 2200 hrs

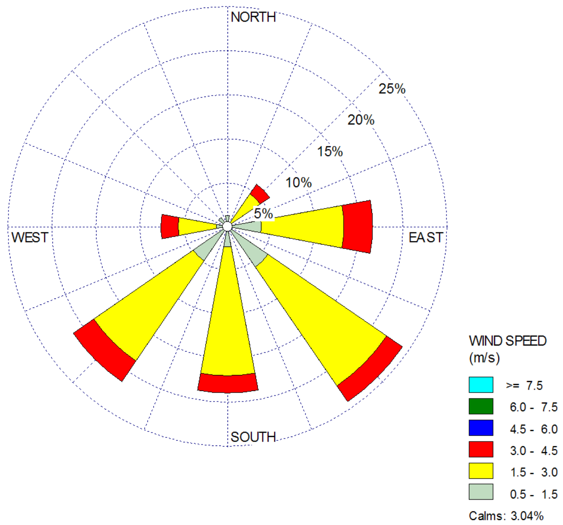


2200 – 0700 hrs

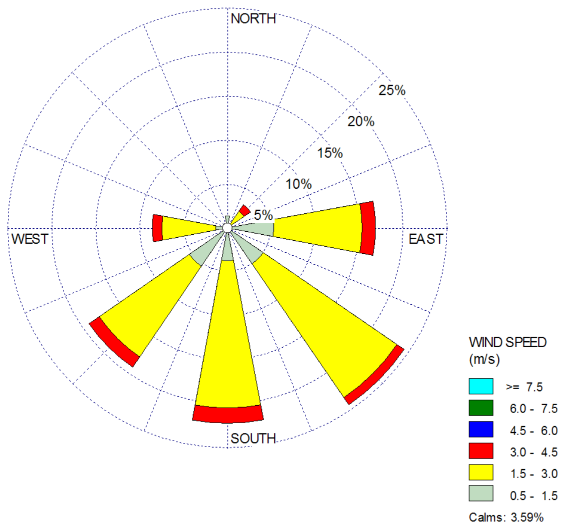
WINTER



0700 – 1800 hrs

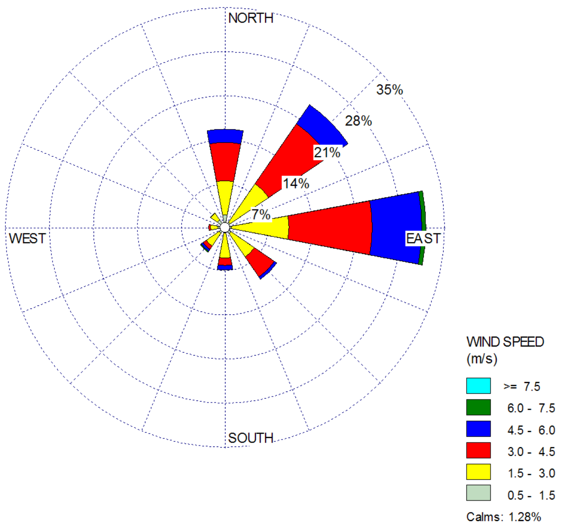


1800 – 2200 hrs

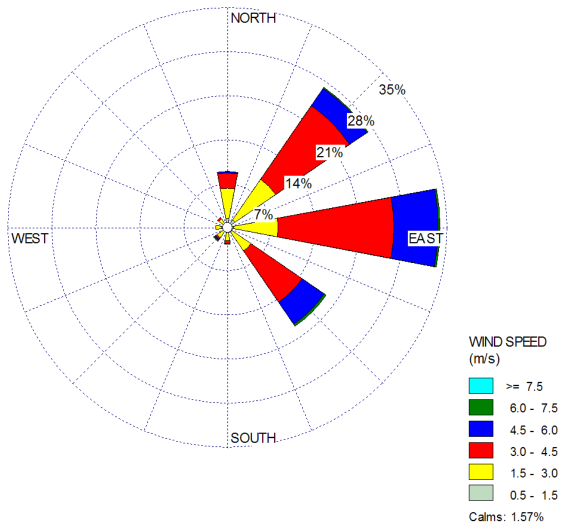


2200 – 0700 hrs

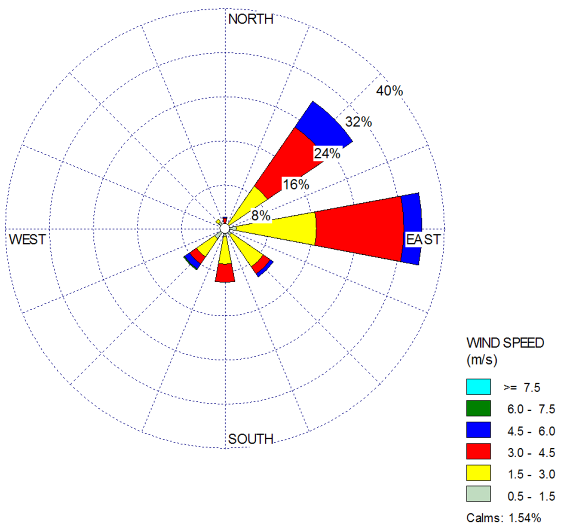
SPRING	SUMMER



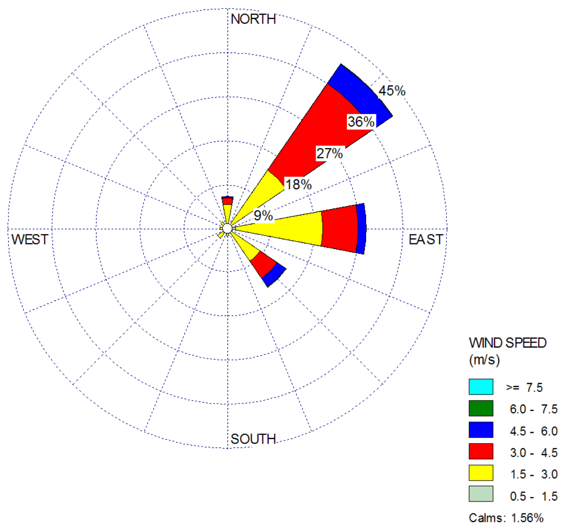
SPRING 0700 – 1800 hrs



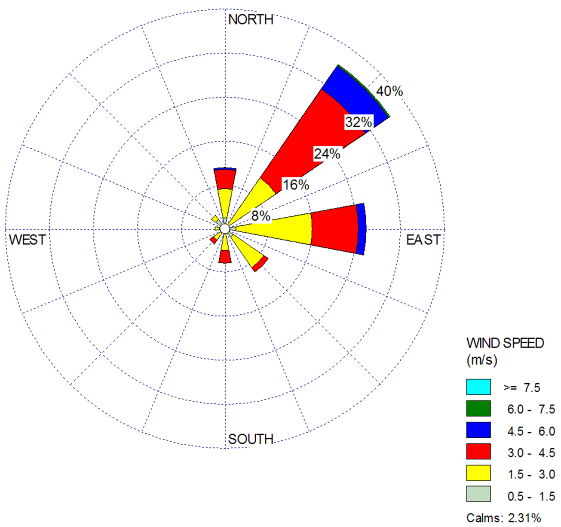
SUMMER 0700 – 1800 hrs



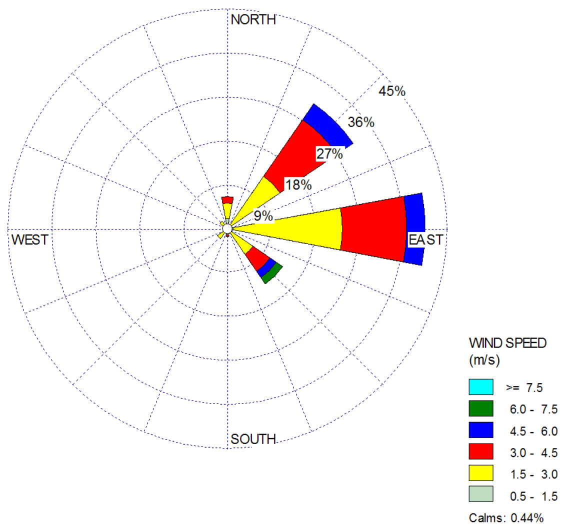
SPRING 1800 – 2200 hrs



SUMMER 1800 – 2200 hrs



SPRING 2200 – 0700 hrs



SUMMER 2200 – 0700 hrs

Appendix E

Mine Operational Stage Plans

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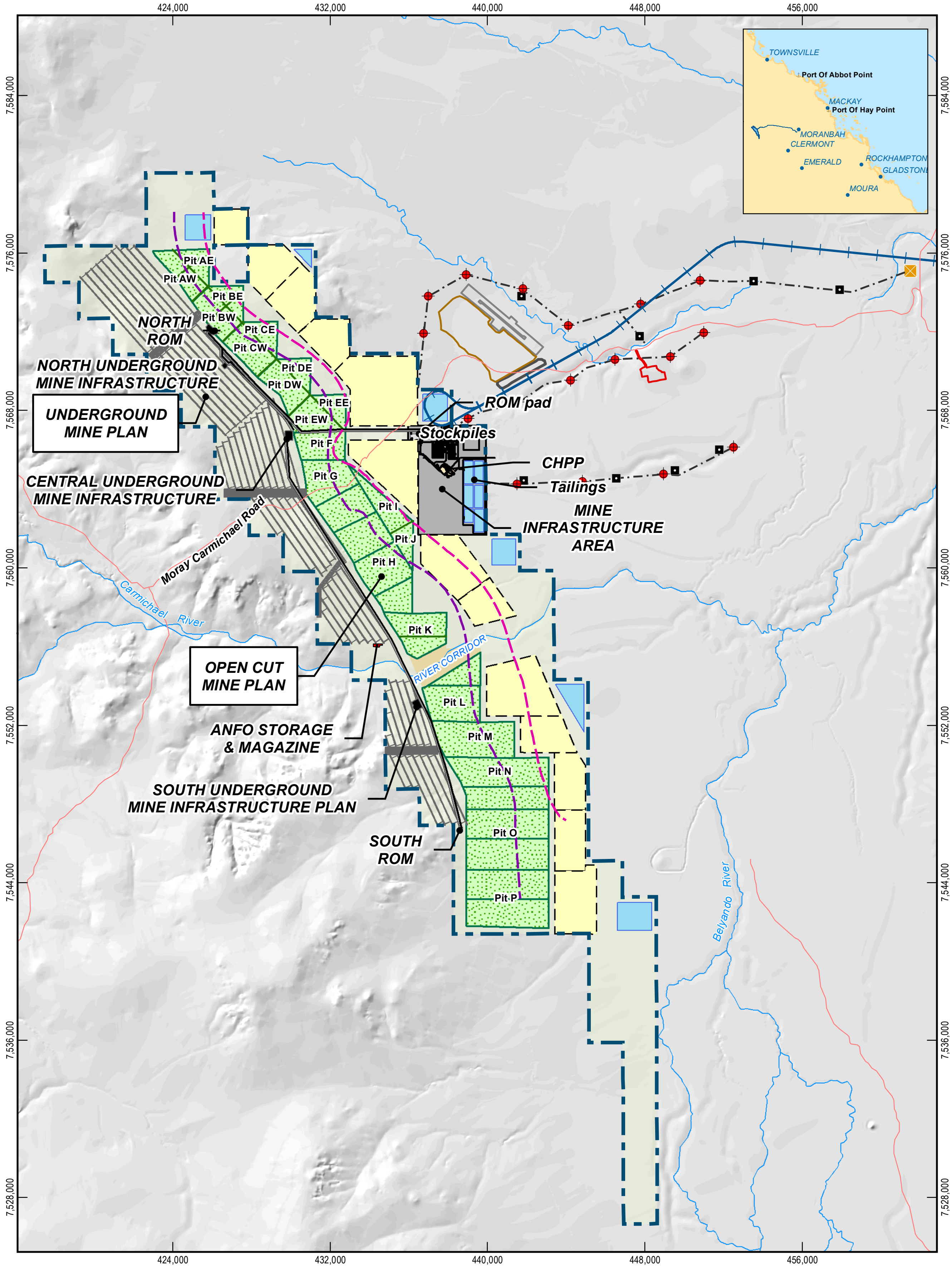


LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

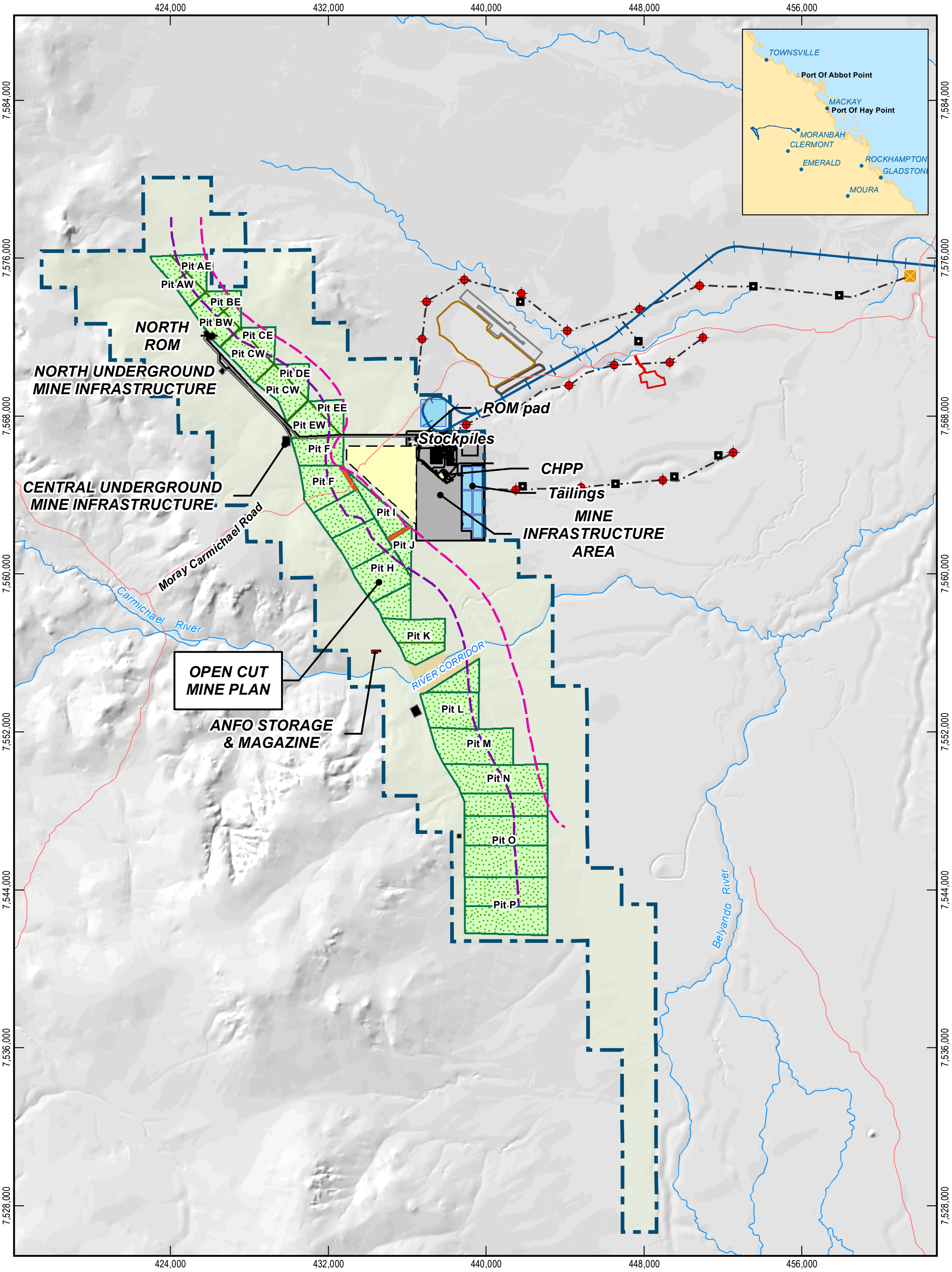
Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision C
Date 30-08-2012

General Mine Layout

Figure E-1

Data Source: GA: Road, River / Watercourse (2007); DME:EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure, Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Active Mining Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	C
Date	30-08-2012

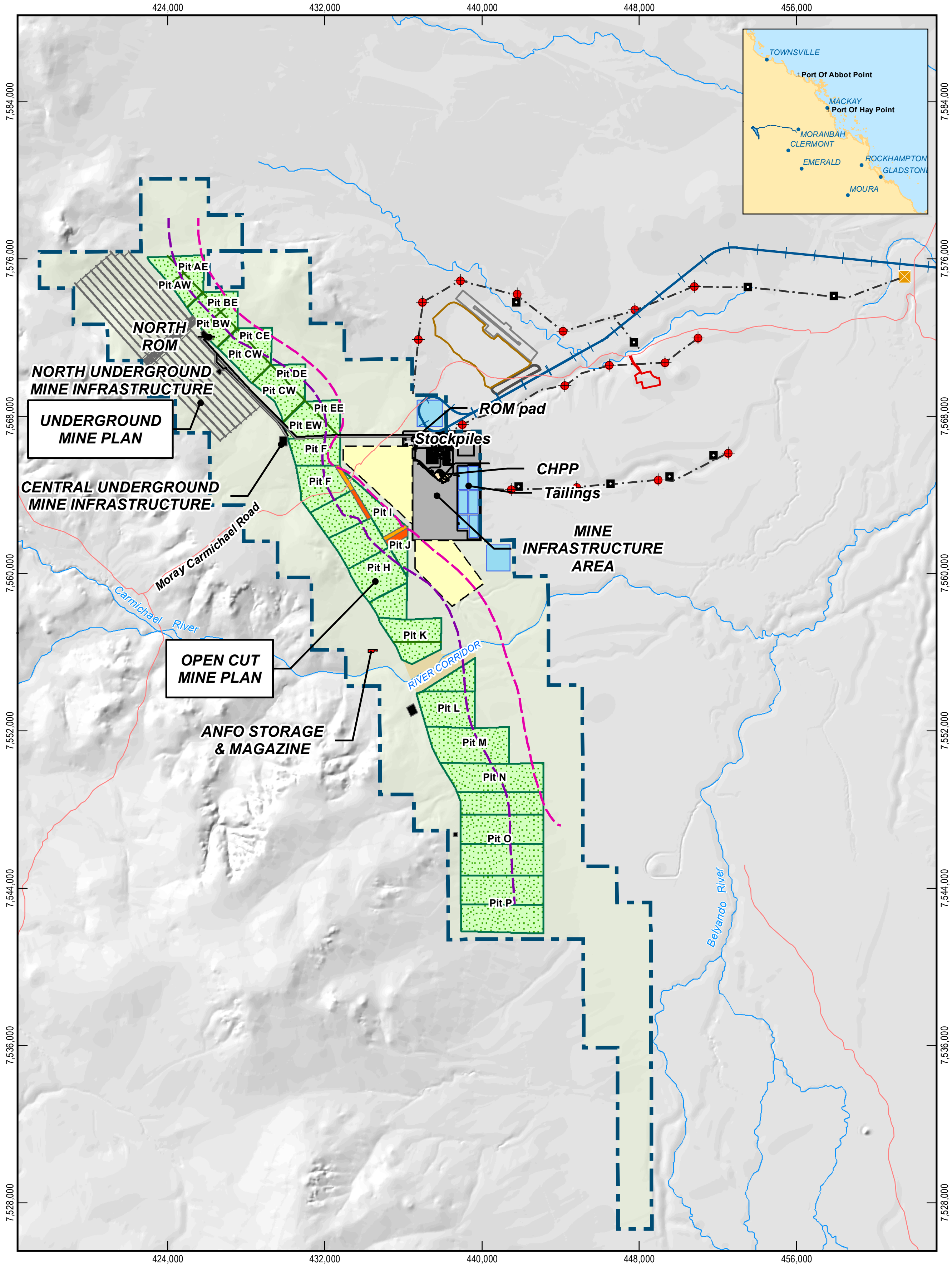
Mine Layout Progress Plot - Year 2013

Figure E-2

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_171_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Active Mining Area
- Disturbed Mining Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number | 41-25215
Revision | C
Date | 05-09-2012

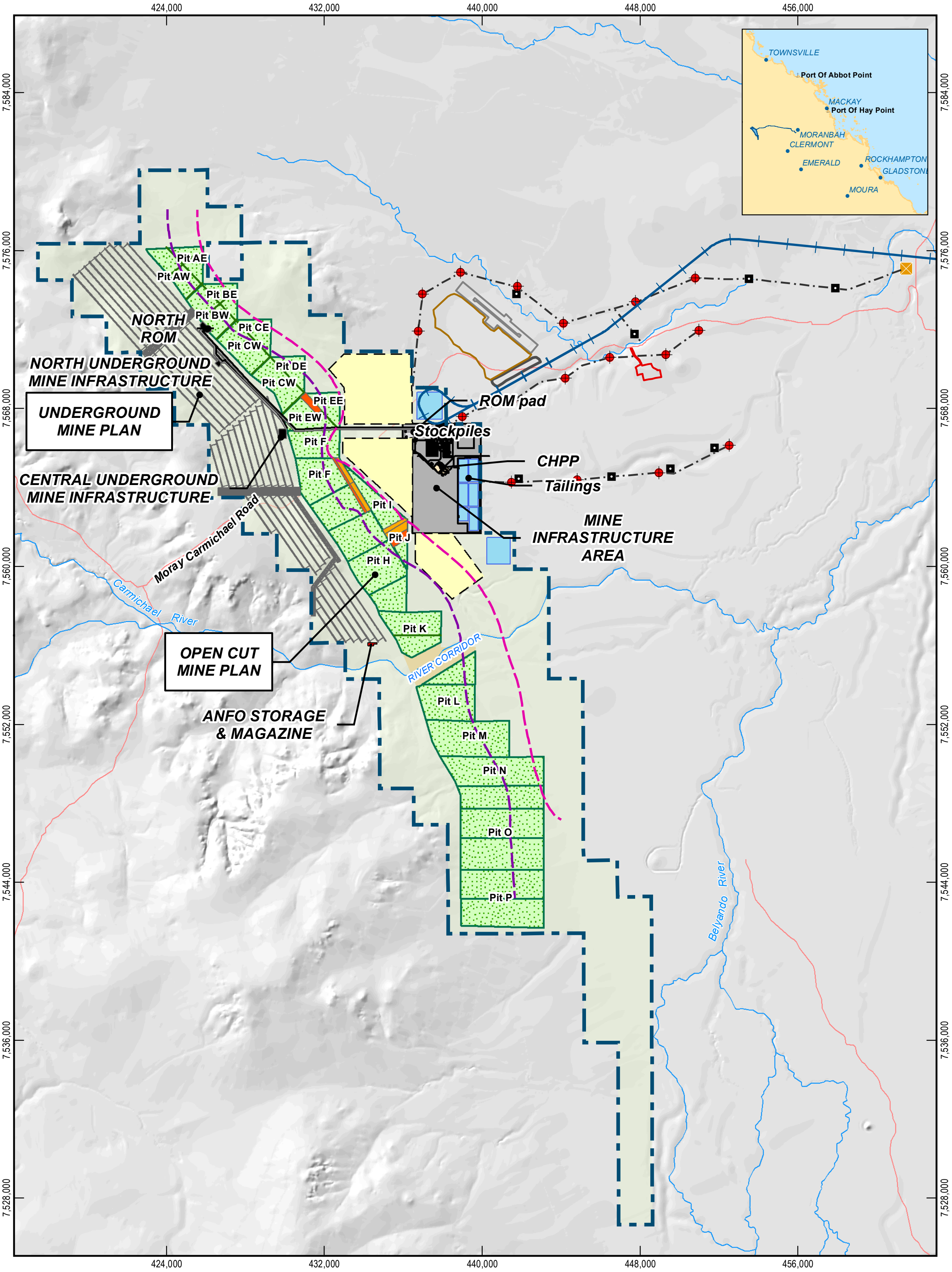
Mine Layout Progress Plot - Year 2014

Figure E-3

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_172_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Active Mining Area
- Disturbed Mining Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

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1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision C
Date 30-08-2012

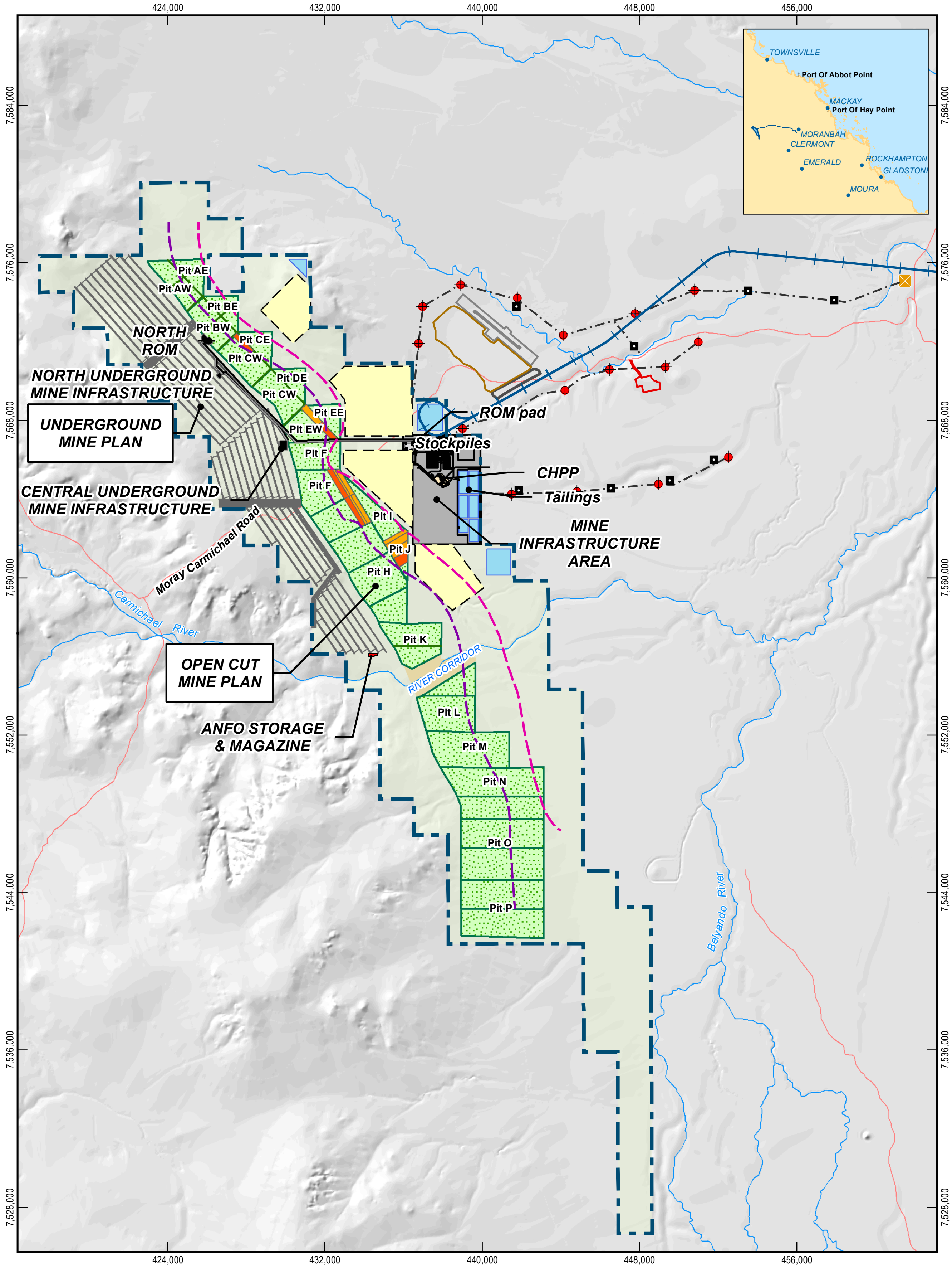
Mine Layout Progress Plot - Year 2015

Figure E-4

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_173_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Active Mining Area
- Disturbed Mining Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision C
Date 30-08-2012

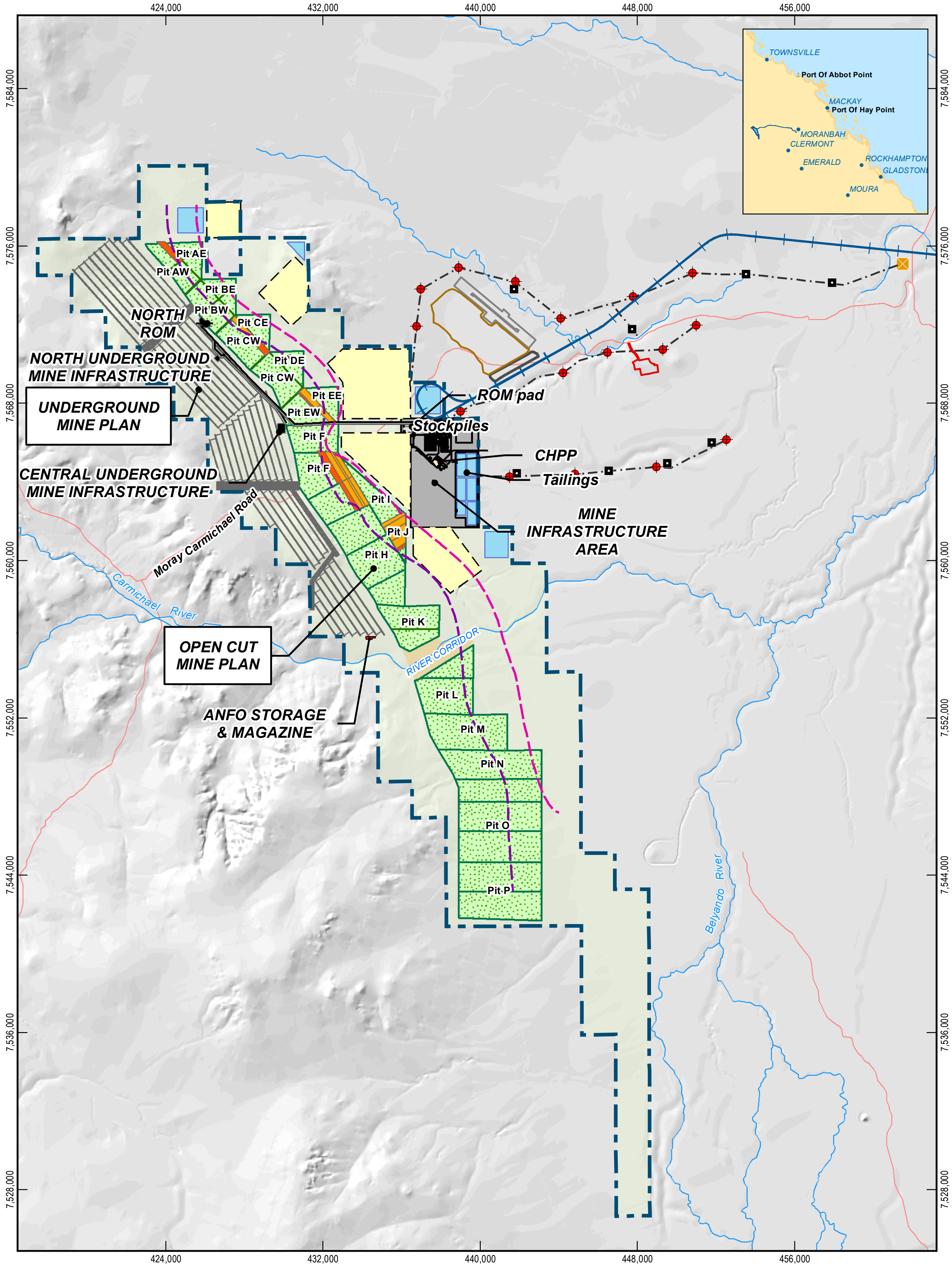
Mine Layout Progress Plot - Year 2016

Figure E-5

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_174_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Active Mining Area
- Disturbed Mining Area
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	C
Date	30-08-2012

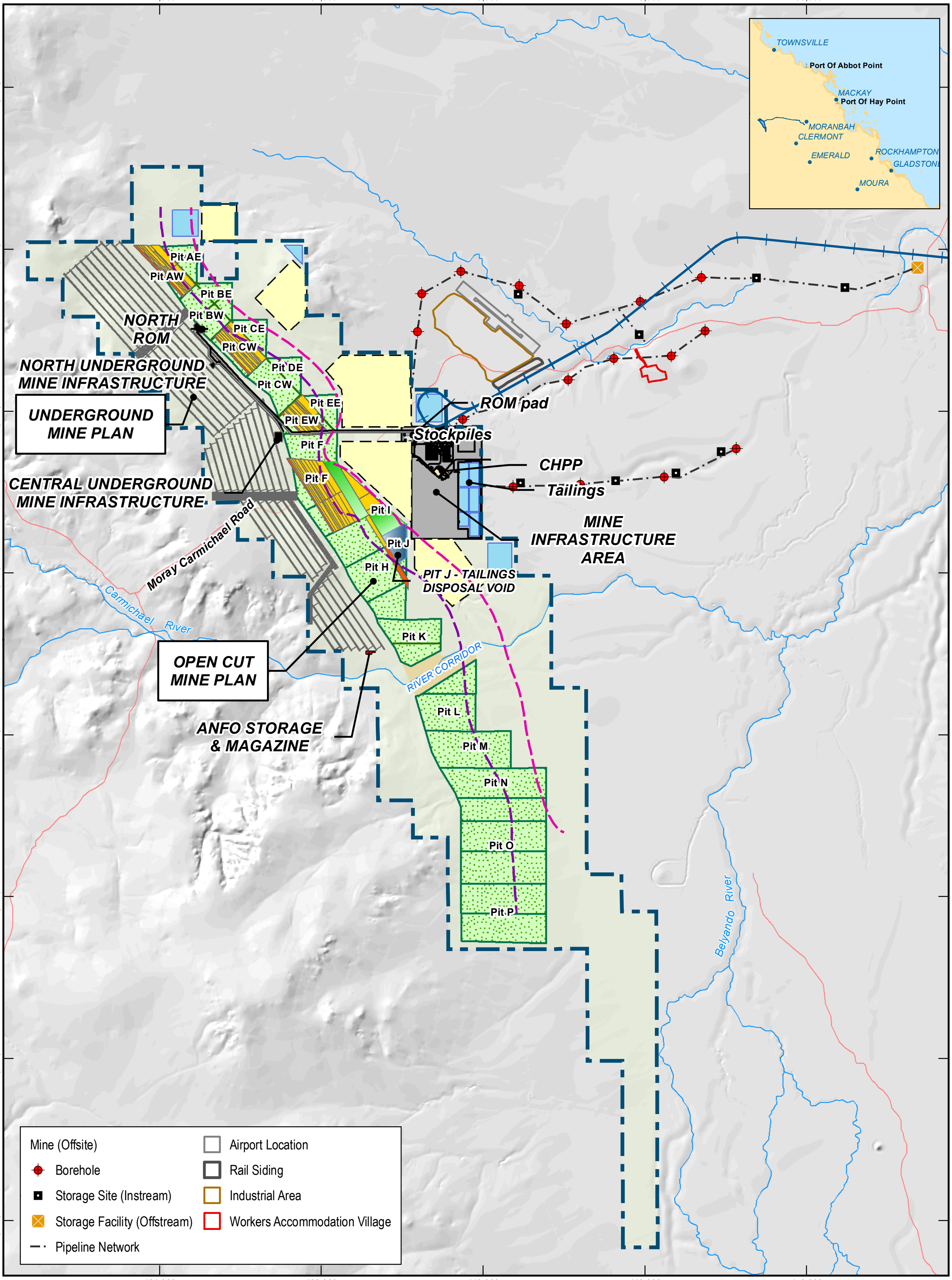
Mine Layout Progress Plot - Year 2017

Figure E-6

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_175_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Area Under Rehabilitation
- Active Mining Area
- Disturbed Mining Area

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

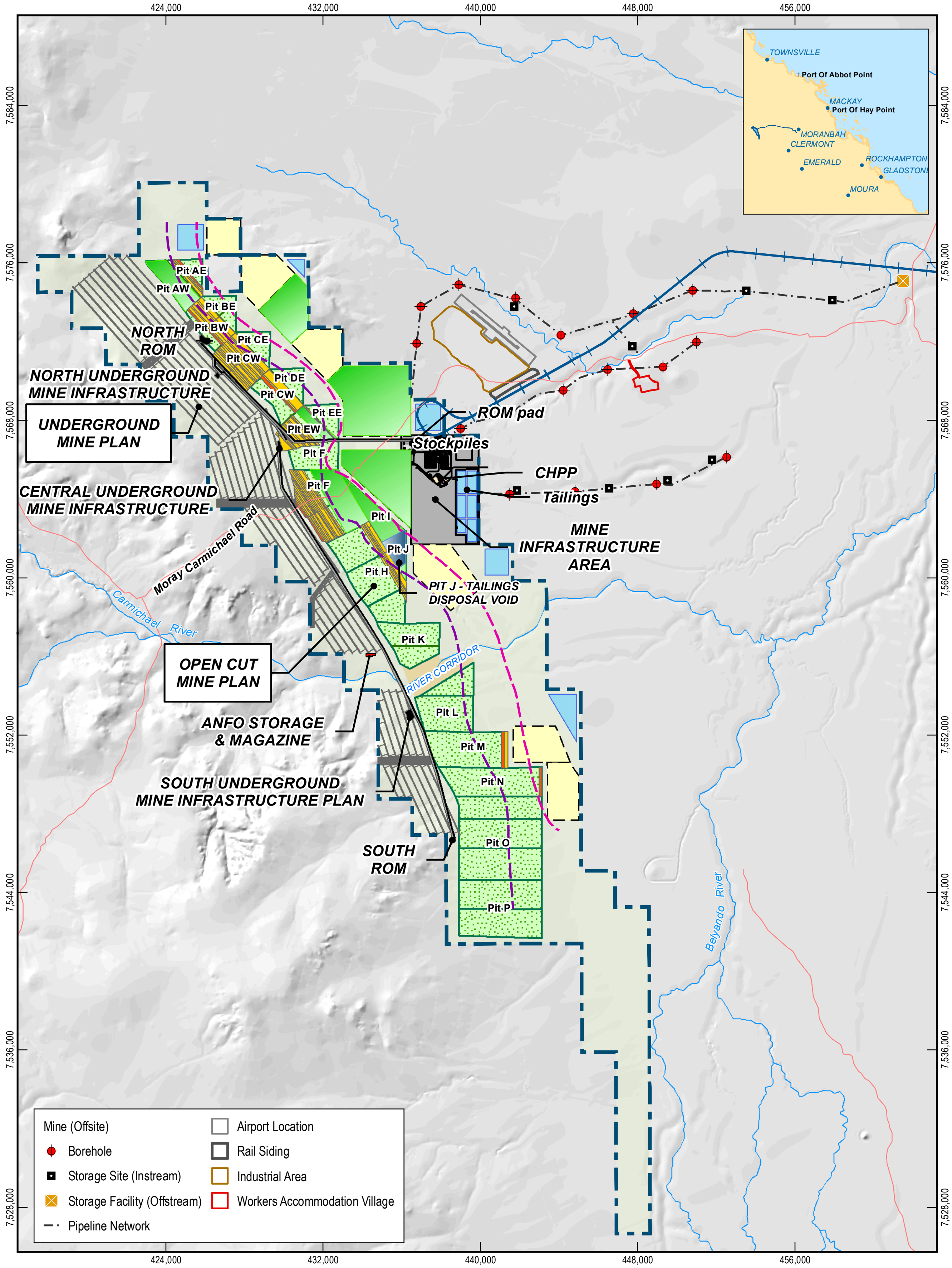
Job Number	41-25215
Revision	C
Date	05-09-2012

Mine Layout Progress Plot - Year 2027 — Figure E-7

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_176_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

Local Road	Rail (West)	Open Cut Blocks	Area Under Rehabilitation
River / Watercourse	Mine (Onsite)	Out of Pit Waste Dumps	Active Mining Area
AB1 Cropline		Water Management Dams	Disturbed Mining Area
D1 Cropline			
Overland Conveyors			

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision C
Date 05-09-2012

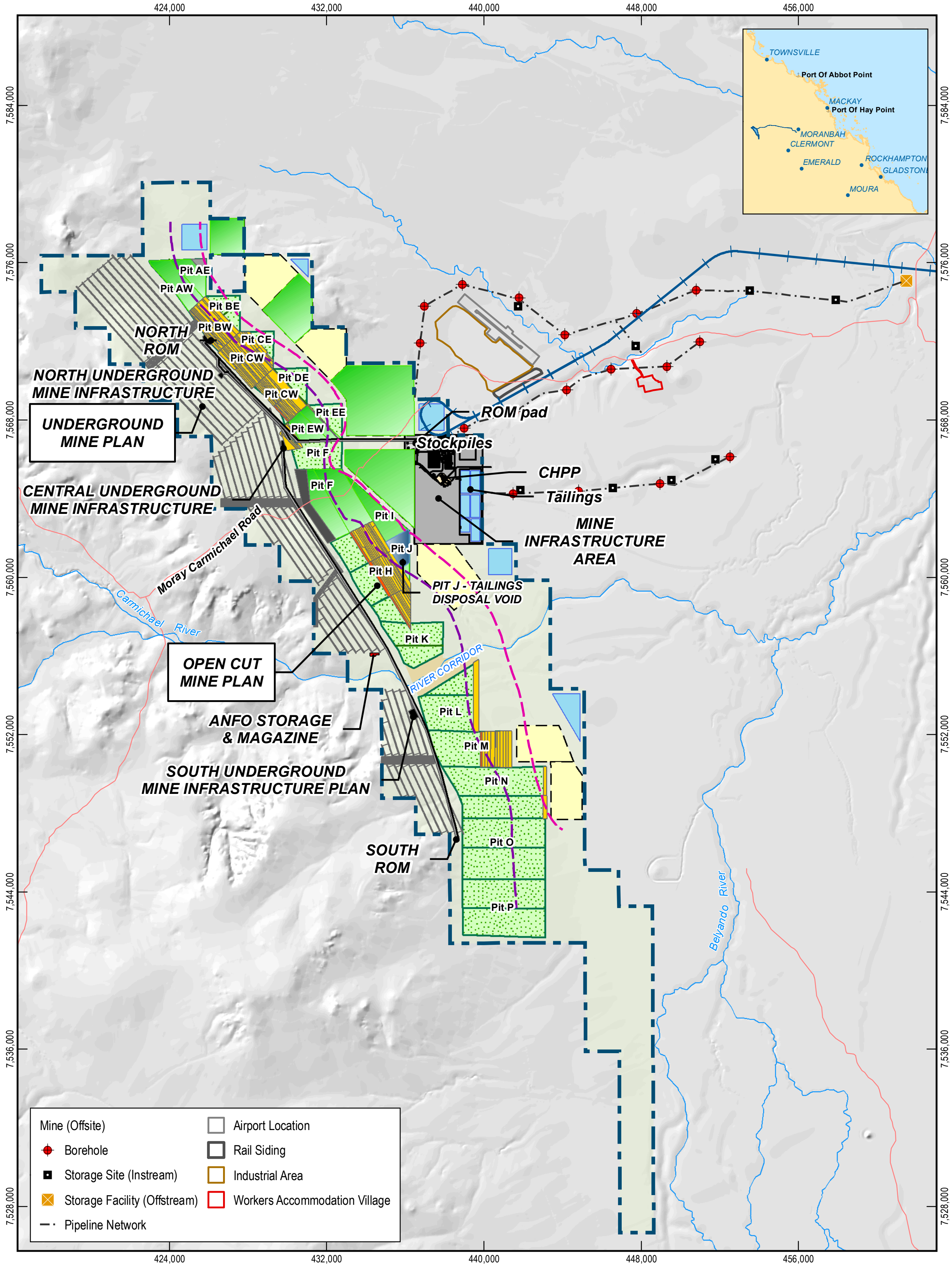
Mine Layout Progress Plot - Year 2037

Figure E-8

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_177_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

River / Watercourse
Local Road
AB1 Cropline
D1 Cropline
Overland Conveyors
Rail (West)
Mine (Onsite)
Open Cut Blocks
Out of Pit Waste Dumps
Water Management Dams
Area Under Rehabilitation
Active Mining Area
Disturbed Mining Area
Void
Remediated Void

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number 41-25215
Revision C
Date 05-09-2012

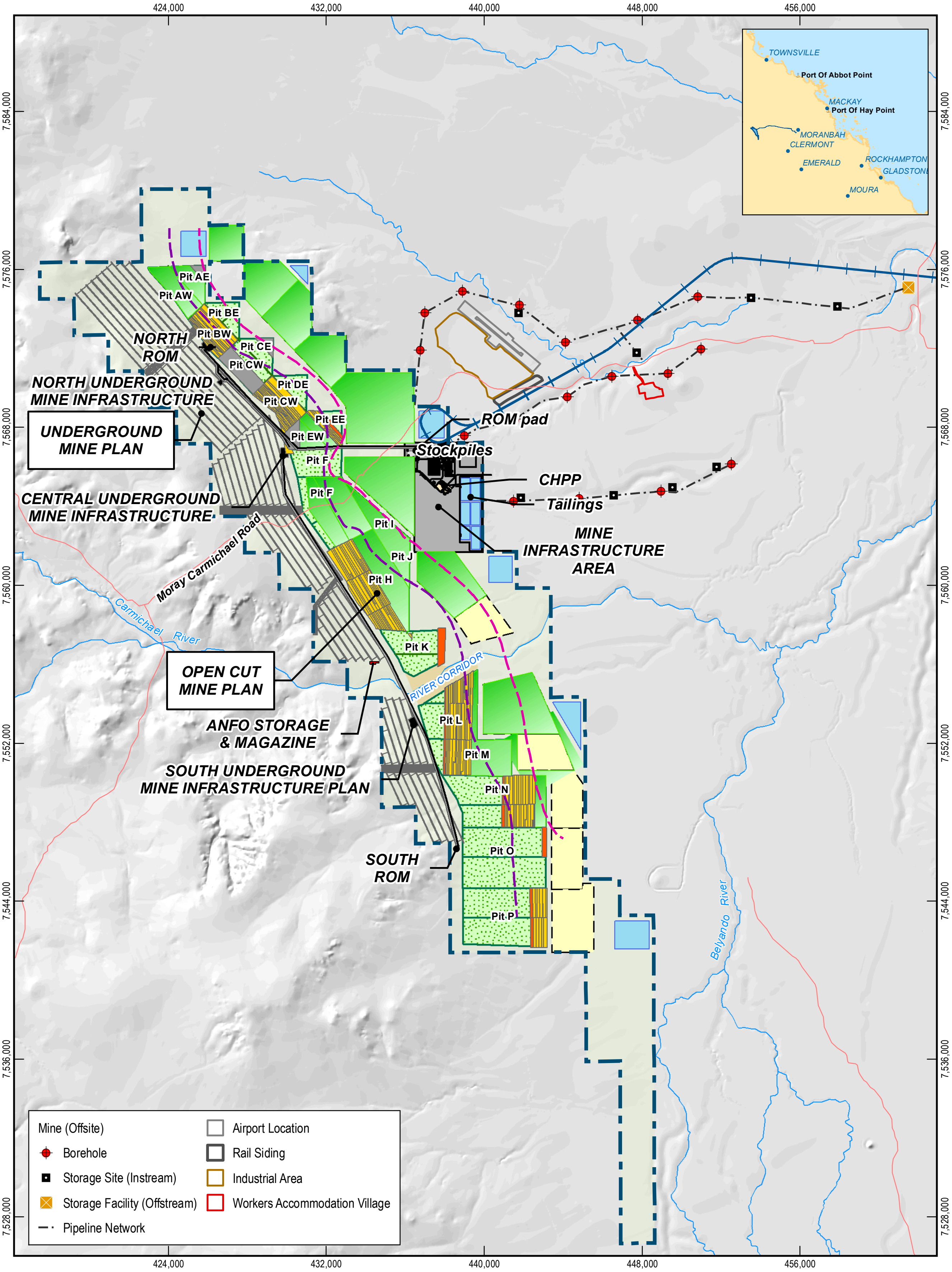
Mine Layout Progress Plot - Year 2047

Figure E-9

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_178_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Area Under Rehabilitation
- Active Mining Area
- Disturbed Mining Area
- Void
- Remediated Void

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	C
Date	30-08-2012

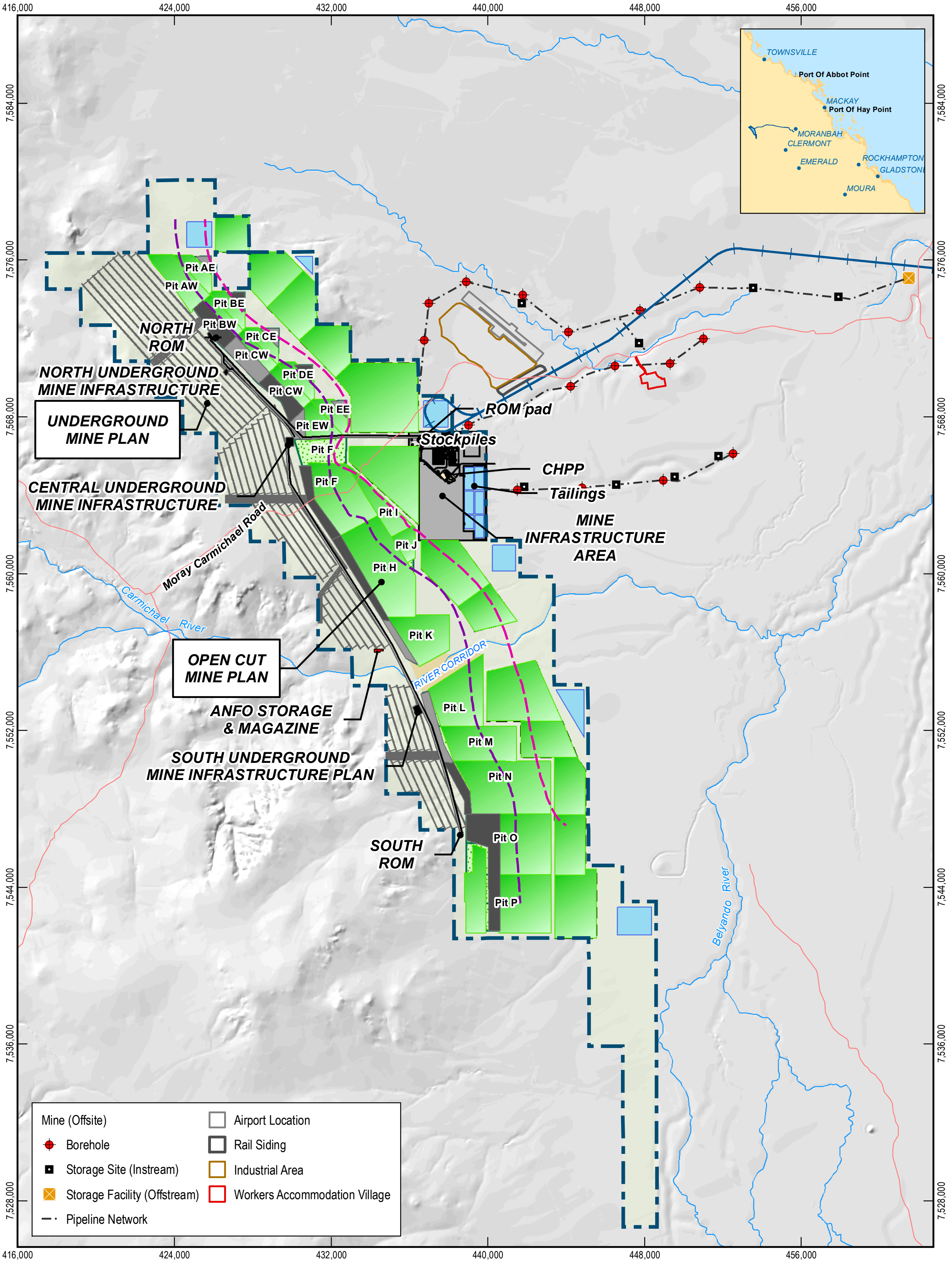
Mine Layout Progress Plot - Year 2067

Figure E-10

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_179_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC



LEGEND

- Local Road
- River / Watercourse
- AB1 Cropline
- D1 Cropline
- Overland Conveyors
- Rail (West)
- Mine (Onsite)
- Open Cut Blocks
- Out of Pit Waste Dumps
- Water Management Dams
- Area Under Rehabilitation
- Active Mining Area
- Disturbed Mining Area
- Void
- Remediated Void

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:275,000 (at A4)

0 2 4 6 8

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project

Job Number	41-25215
Revision	C
Date	30-08-2012

Mine Layout Progress Plot - Year 2103

Figure E-11

G:\41\25215\GIS\Maps\MXD\100_Planning\41-25215_180_rev_c.mxd Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GA: Road, River / Watercourse (2007); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Layout / Infrastructure (2012), Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012). Created by: JVC

Appendix F

Mine Operational Noise Contours

Year 2016, 2037, 2067 and 2103

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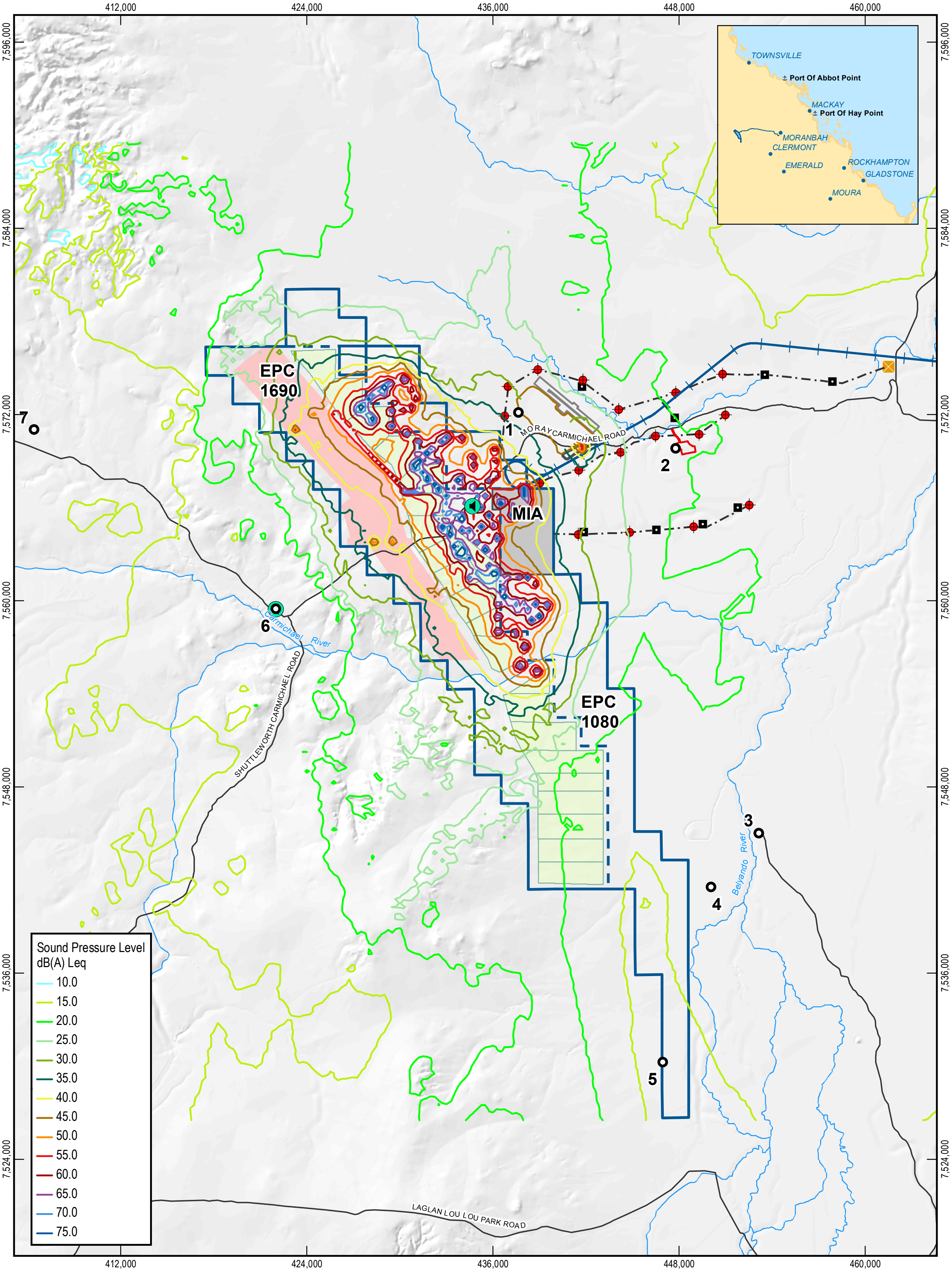

LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine Site
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
  - Borehole
  - Storage Site (Instream)
  - Storage Facility (Offstream)
  - Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

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1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

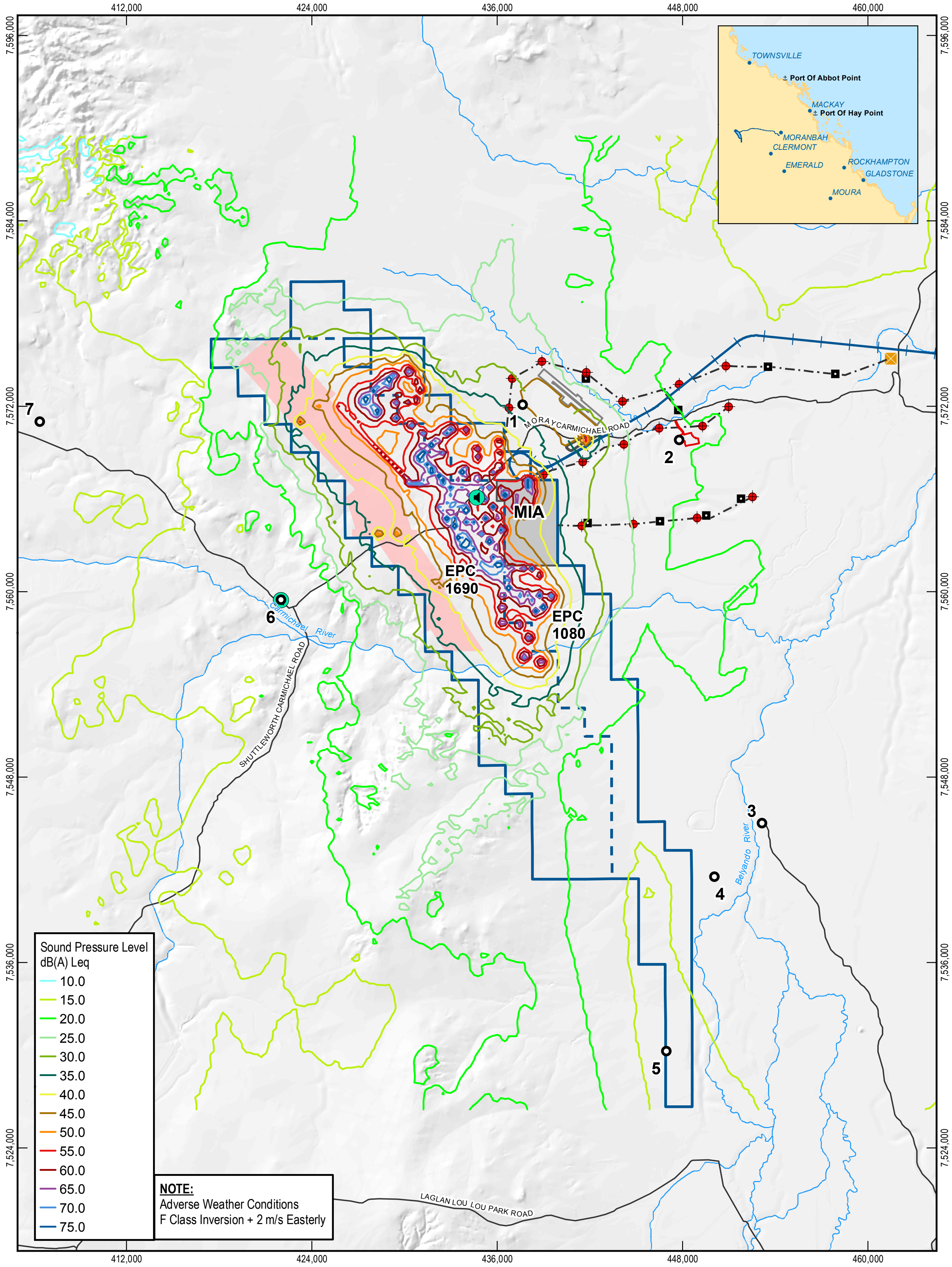
Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2016
Neutral Weather Conditions

Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-1

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_715_rev_c.mxd Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Adani: Mine Layout, Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Sensitive Receptor (2012), Noise Contours (2012). Created by: JVC



LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2016
Adverse Weather Conditions

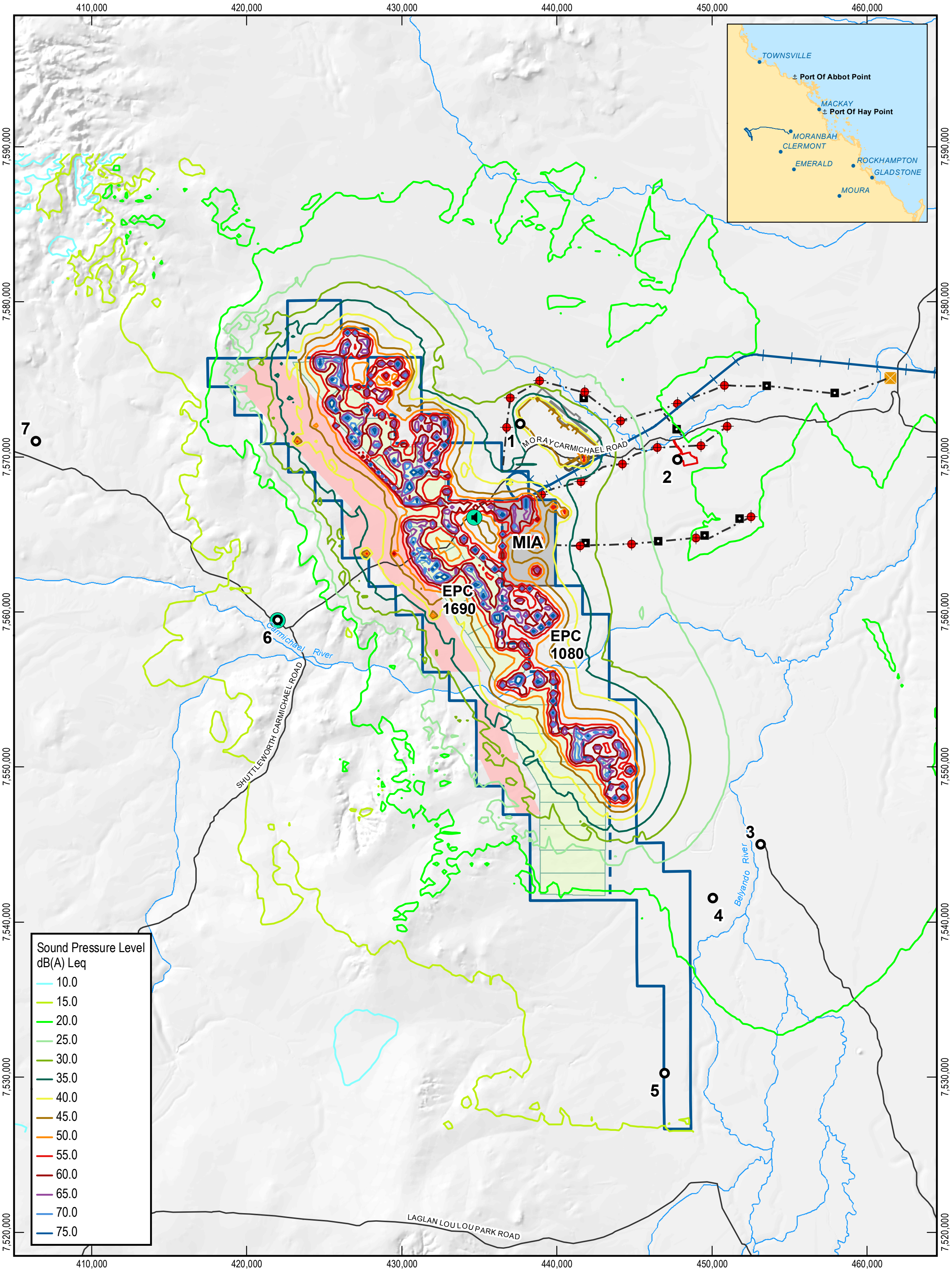
Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-2

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_716_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Adani: Mine Layout, Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Sensitive Receptor (2012), Noise Contours (2012). Created by: JVC



LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
  - Borehole
  - Storage Site (Instream)
  - Storage Facility (Offstream)
  - Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2037
Neutral Weather Conditions

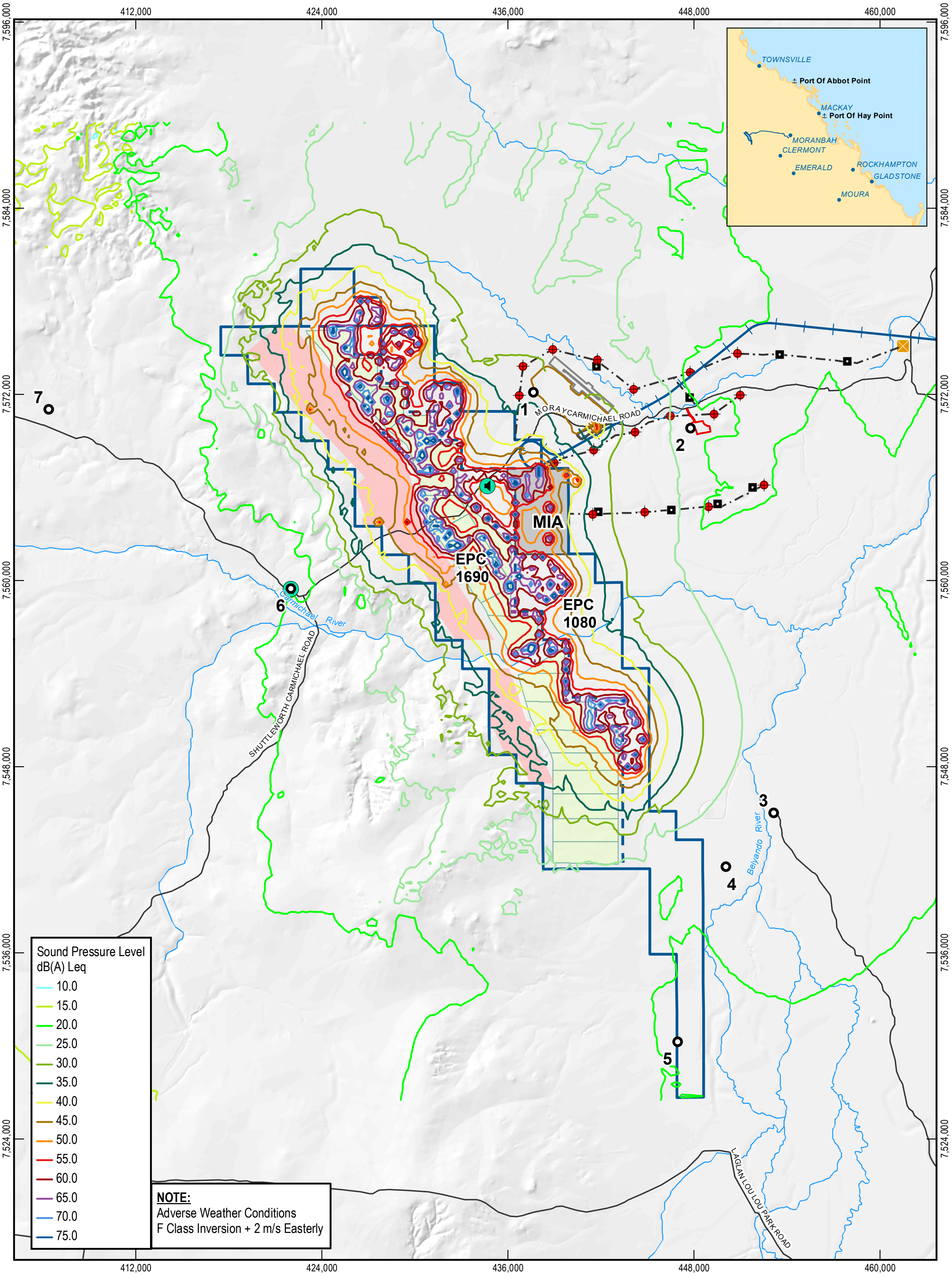
Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-3

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_717_rev_c.mxd

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Adani: Mine Layout, Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Sensitive Receptor (2012), Noise Contours (2012). Created by: JVC



LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
  - Borehole
  - Storage Site (Instream)
  - Storage Facility (Offstream)
  - Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

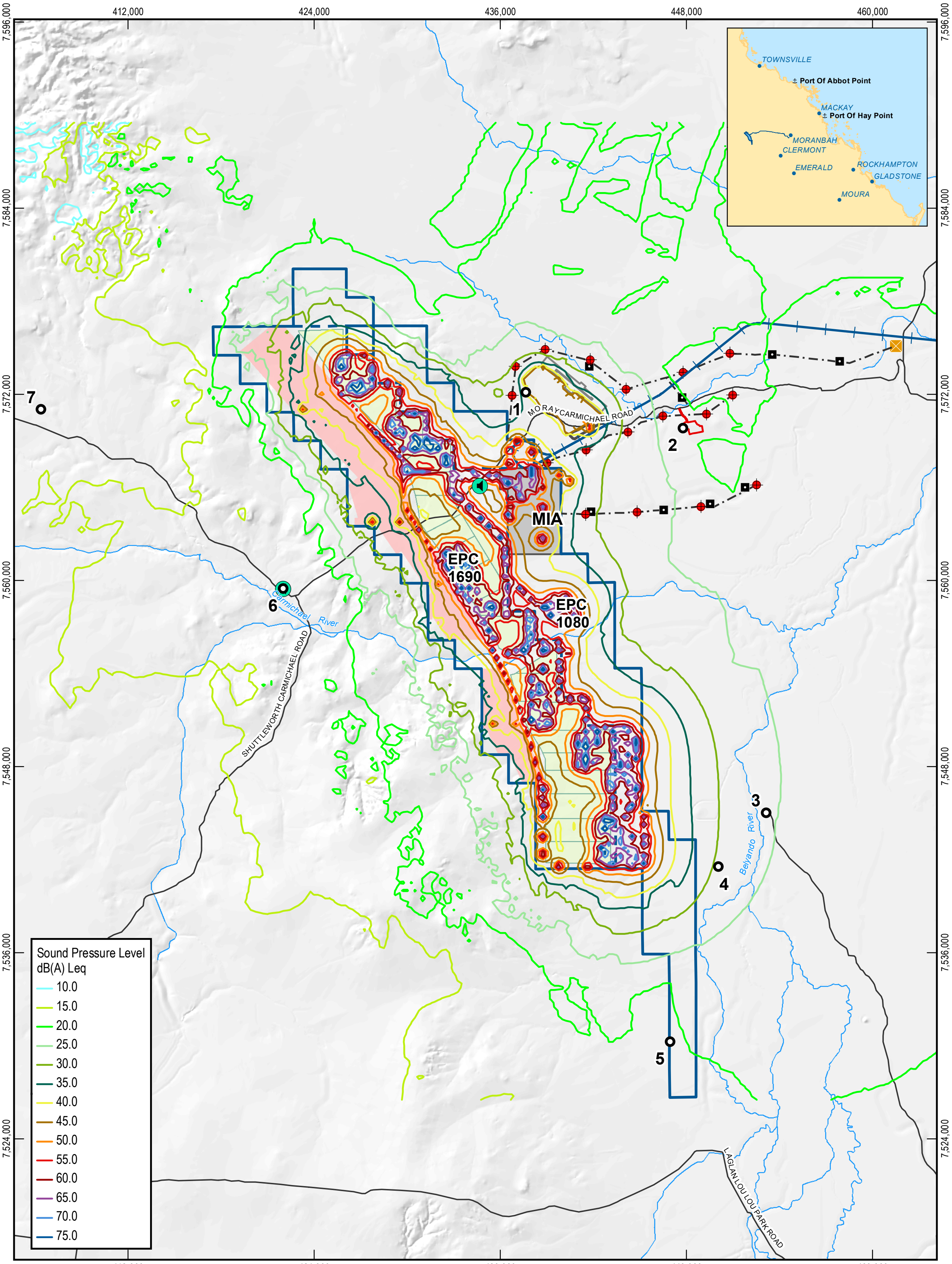
Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2037
Adverse Weather Conditions

Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-4

Level 4, 201 Charlotte St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road, Watercourse (2007); Adani: Adani: Mine Layout, Alignment Opt9 Rev3 (2012); Gassman/Hyder: Mine (Offsite) (2012); GHD: Sensitive Receptor (2011), Noise Contours (2012). Created by: JVC



LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2067
Neutral Weather Conditions

Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-5

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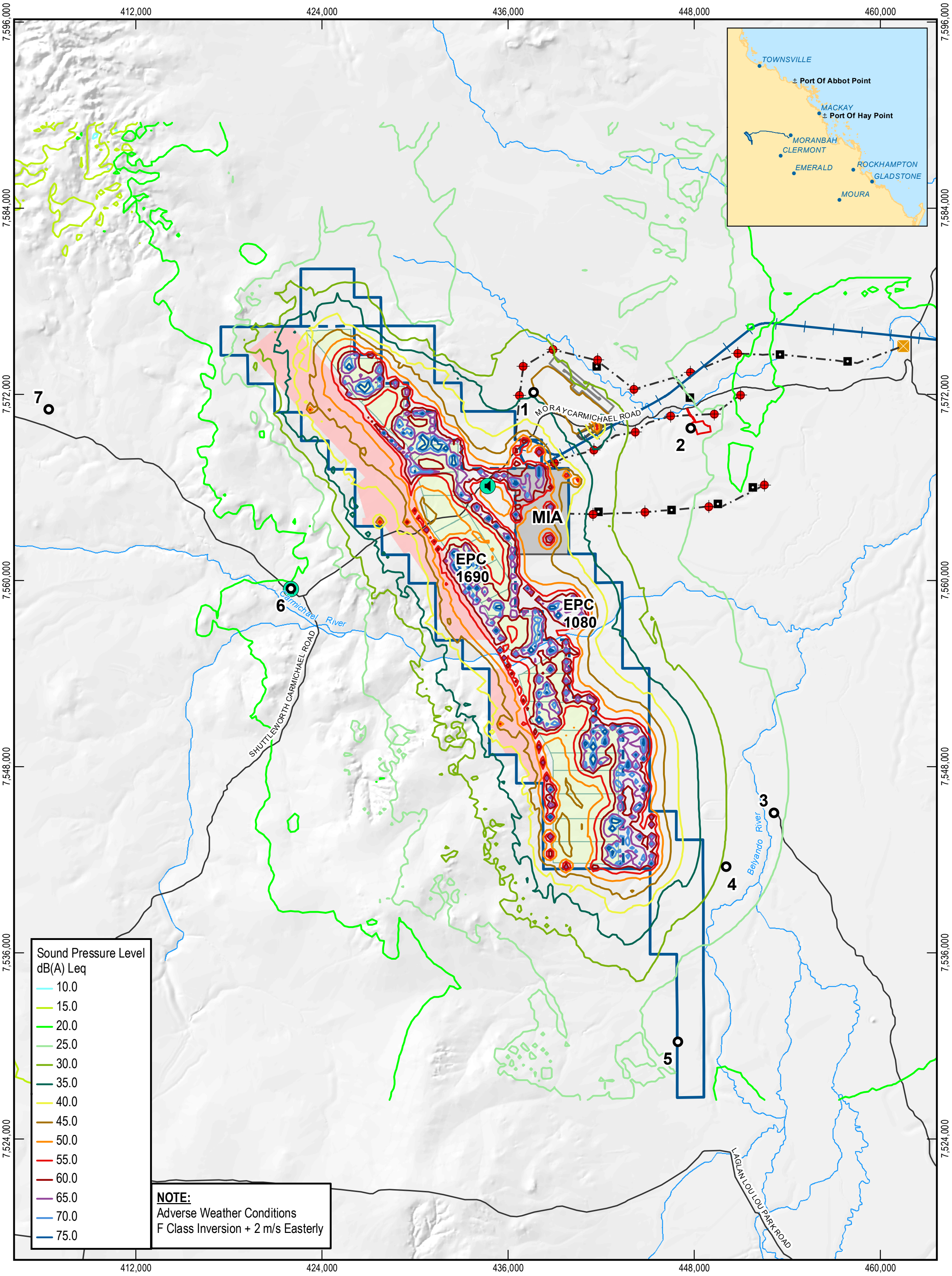

LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2067
Adverse Weather Conditions

Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-6

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_720_rev_c.mxd

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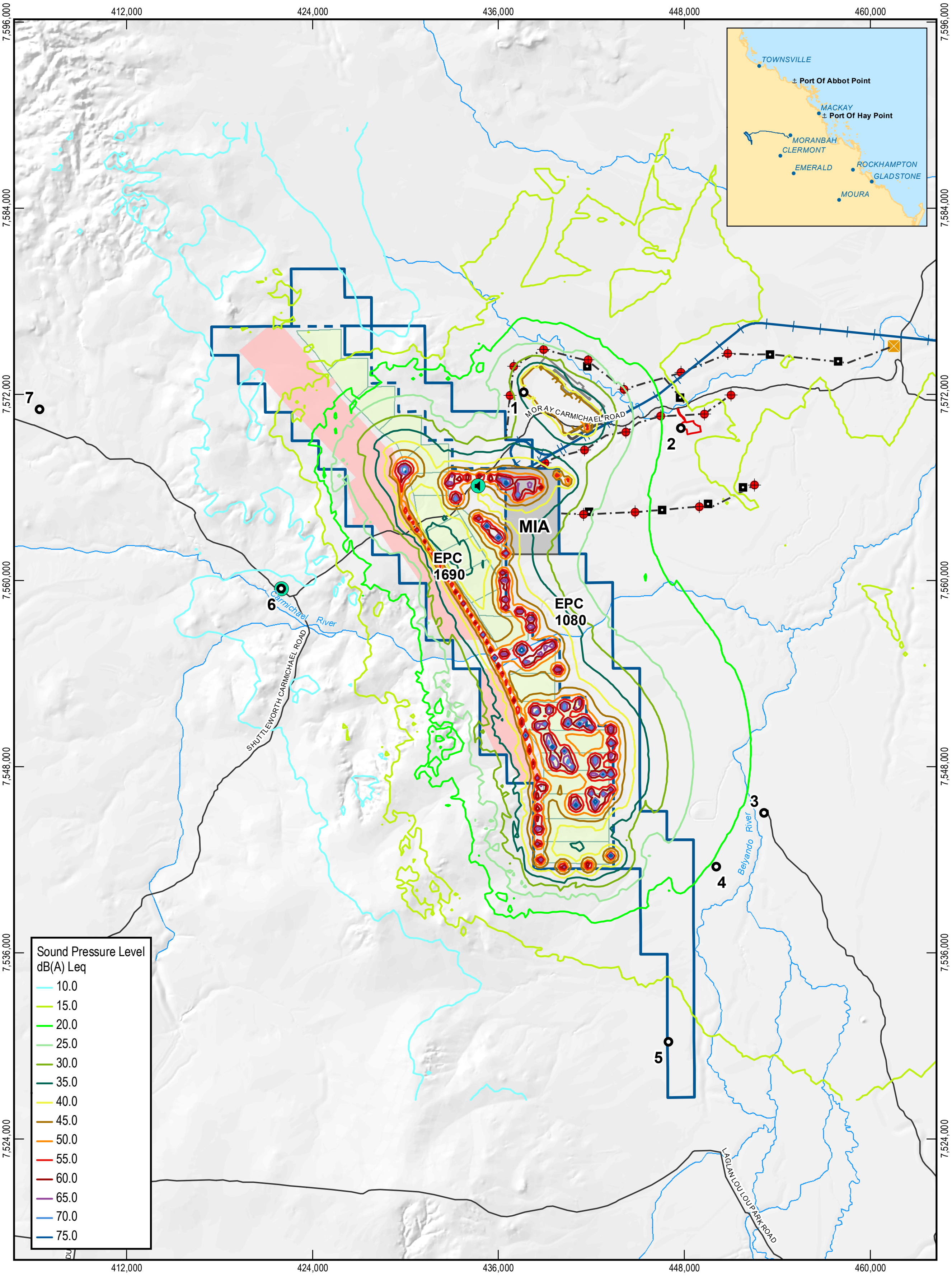

LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan
- Mine (Offsite)
  - Borehole
  - Storage Site (Instream)
  - Storage Facility (Offstream)
  - Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project
Mine Operational Noise Contours
Mine Year 2103
Neutral Weather Conditions

Job Number	41-25215
Revision	C
Date	05-09-2012

Figure F-7

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_721_rev_c.mxd

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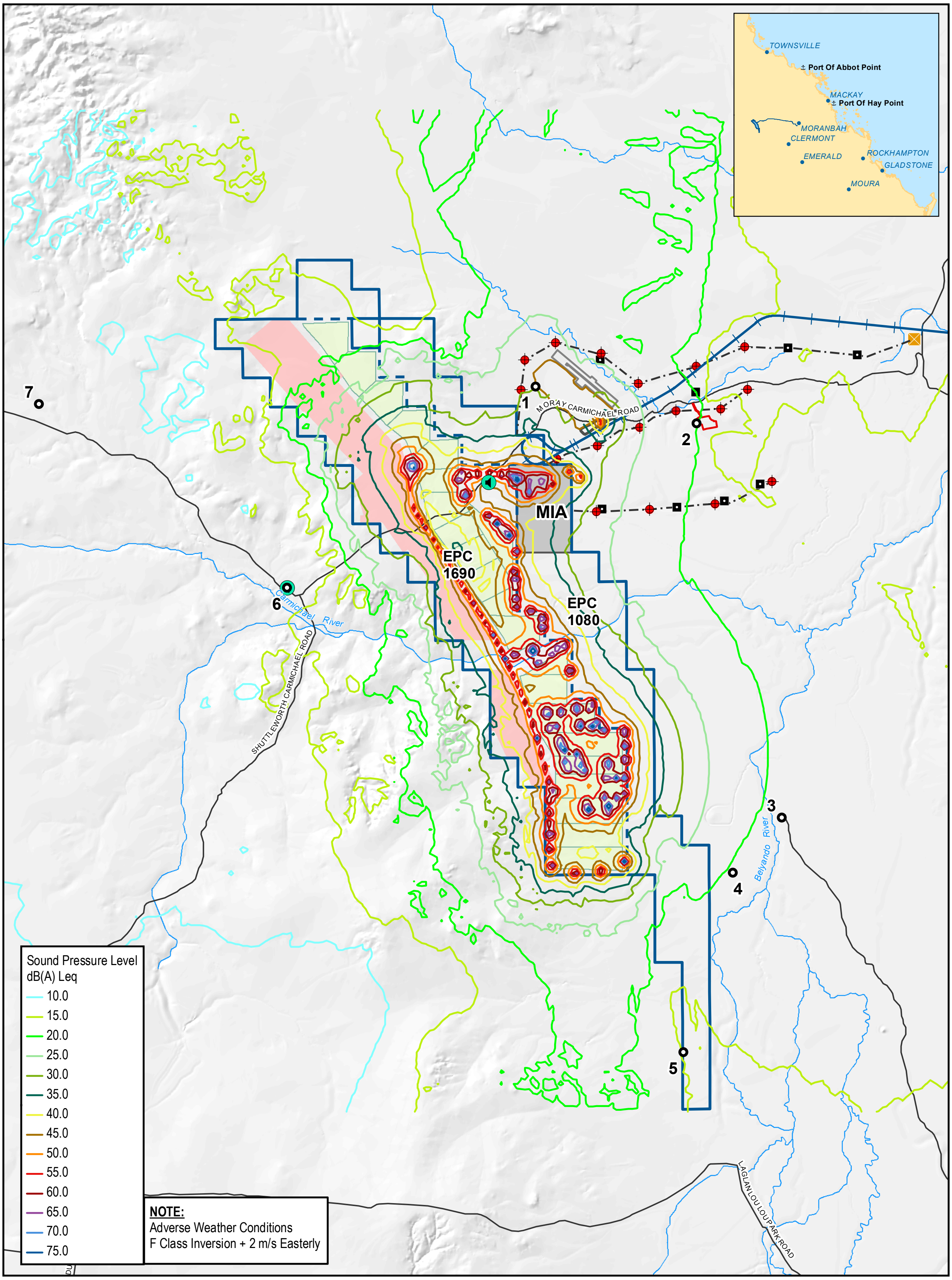

LEGEND

- Sensitive Receptor
- Noise Logger
- Watercourse
- Local Road
- Rail (West)
- Mine (Onsite)
- Mine Infrastructure Area
- Open Cut Blocks
- Underground Mine Plan

Mine (Offsite)

- Borehole
- Storage Site (Instream)
- Storage Facility (Offstream)
- Pipeline Network
- Airport Location
- Rail Siding
- Industrial Area
- Workers Accommodation Village

1:350,000 (at A4)

0 2 4 6 8 10 12

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project

Mine Operational Noise Contours

Mine Year 2103

Adverse Weather Conditions

Job Number 41-25215
Revision C
Date 05-09-2012

Figure F-8

G:\41\25215\GIS\Maps\MXD\700_Environment\41-25215_722_rev_c.mxd

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	C Evenden	V Chavand	On file	DRAFT	Draft	12/01/2012
0	C Evenden	J Keane	On file	J Scott	On file	24/01/2012
1	C Evenden	J Keane	On file	J Scott	On file	28/02/2012
2	C Evenden	J Keane		J Keane		28/09/2012
3	C Evenden	J Keane		J Keane		12/10/2012