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## **Vipac Engineers & Scientists**

### **Hydro Aluminium Kurri Kurri**

## **Land Rezoning Development Masterplan**

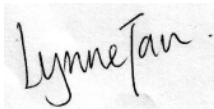
## **Noise Impact Assessment**



29N-14-0030-TRP-822335-2

27 March 2015



| Report Title: Noise Impact Assessment<br>Job Title: Land Rezoning Development Masterplan                                                                                                                                                          |                                                                                                                                                                       |                                                                                                                                                                                                              |
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## EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hydro Aluminium Kurri Kurri to conduct a noise impact assessment for the proposed Development Masterplan for Rezoning Proposals for the Hydro Aluminium lands at Kurri Kurri.

The overall land holding of the Hydro Aluminium site extends to approximately 2,000 hectares, with the former Hydro Aluminium production facility occupying approximately 60 hectares of the site and the remaining lands comprising of a mix of conservation habitat lands, agricultural lands, the Black Waterholes and surrounding floodplains. The site is also crossed by the South Maitland Railway line passing from Maitland to Kurri and on to Cessnock, although it is Vipac's understanding that the train line is currently only used on occasion by coal export trains servicing one mine in the region.

The Preliminary Masterplan for the site had identified approximately 300 hectares of land that is proposed to be rezoned for employment use, and had identified sufficient land to be rezoned that would be suitable for 1,290 residential lots for residential development. The Rezoning Masterplan was revised to reduce the employment development to 200 hectares and to increase residential dwellings to 2,088 lots. The revised Rezoning Masterplan has proposed approximately 603 dwellings at the Northern precinct (in the Maitland LGA), 1,182 dwellings at the Central precinct and 303 dwellings at the Southern precinct.

Noise levels associated with the proposed employment development (Heavy Industrial, Light Industrial and Business Park) and potential impacts on nearby noise sensitive receptors (located in the surrounding area and proposed residential properties in the residential land parcels) will be required to comply with Project Specific Noise Levels that have been determined on the basis of a series of baseline noise surveys that were undertaken across the site and at representative noise sensitive receptors located in the vicinity of the site.

There is a potential for rail noise impacts on future residential properties that may be developed in the proposed residential land parcels located in proximity to the existing South Maitland Railway line which crosses the Hydro Aluminium site. However, based on the existing frequency of use of the rail line, it is not anticipated that the potential rail impacts would impede significantly on the proposed Land Rezoning Masterplan.

However, it will be necessary to conduct an acoustic assessment for any future residential dwellings that may be constructed on lots located in close proximity to the rail line. The assessment should be undertaken by a suitably qualified acoustician in order to ensure that the properties are designed and constructed in accordance with *NSW DoP document- "Development near Rail Corridors and Busy Roads" – Interim Guideline* to achieve acceptable internal noise amenity, with regard to the external rail traffic noise exposure levels.

The predicted existing and cumulative future traffic noise levels associated with traffic volumes representative of the full development of the Land Rezoning proposals, at existing receivers along Hart Road (south of the Hunter Expressway) and in proximity to the Hunter Expressway (West of Hart Road) comply with the daytime and night-time noise criteria. However the predicted existing road traffic noise levels at receivers along Main Street and McLeod Road/Heddon Street are raised above the daytime and night-time noise criteria. As stated in Section 3.4 of the Road Noise Policy, with regard to existing residences and other sensitive land uses affected by additional traffic on existing roads, generated by land use development, any increase in total traffic noise level should be limited to 2dB above that of the corresponding existing noise level at any residential property.

The traffic noise levels that would be generated in association with the Land Rezoning Masterplan proposed development will be expected to be within +2dB of the existing road traffic noise levels at all of the noise sensitive receivers during day and night-time periods provided the traffic generated by the proposed development is within the traffic volumes outlined in this assessment. The predicted noise impact associated with the Hydro Aluminium Land Rezoning Masterplan development would comply with the Road Noise Policy criteria.

It is predicted that the potential traffic noise exposure that may arise in the event of the overall development of the Land Rezoning Masterplan, associated with the Residential Land Parcels and the 200Ha Employment Land areas, would be raised above the applicable noise criteria by approximately 5dB at a number of residential lots, taking into consideration a 2.0m noise bund/barrier. Notwithstanding the indicative external noise limits, future residential dwellings that may be constructed on the affected lots could comply with applicable internal noise criteria and will need to be designed and constructed in accordance with *NSW DoP document- "Development Near Rail Corridors and Busy Roads" – Interim Guideline* to achieve acceptable internal noise amenity, with regard to the external road traffic noise exposure levels.

The internal noise levels on existing and proposed noise sensitive receptors associated with the potential traffic movements that may be generated in the area, in the event that the Land Rezoning Proposals are developed in full, are predicted to be below the maximum internal noise levels, which is unlikely to cause awakening reaction to the occupants and would be unlikely to cause sleep disturbance impacts.

The proposed Land Rezoning Masterplan for the Hydro Aluminium lands at Kurri Kurri is therefore not considered likely to generate any significant noise impact on existing noise sensitive receptors located in the surrounding area. The findings of the noise impact assessment of the proposed Land Rezoning Masterplan also indicate that potential future noise sensitive receptors (i.e. future residential properties that may be developed on the proposed Residential Parcels of the Land Rezoning Masterplan) are not considered likely to experience any significant noise impacts. However, based on the results of the noise impact assessment, it is anticipated that a 2.0m noise bund/barrier is likely to be required in proximity to a number of potentially affected proposed future residential lots facing Main Street (Northern Precinct Residential Land Parcels) and proposed future residential lots facing the Hunter Expressway (Southern Precinct Residential Land Parcels).

Any development proposals for residential properties on the affected lots will be subject to a separate Development Application and Approvals process that should include an acoustic review by a suitably qualified acoustician of detailed designs for properties that may be developed in due course. This review will be required in order to ensure that satisfactory internal noise amenity criteria can be achieved within the properties.

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## 1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Hydro Aluminium Kurri Kurri to conduct a noise impact assessment for the proposed Development Masterplan for Rezoning Proposals for the Hydro Aluminium lands at Kurri Kurri.

This report presents the findings of the following

- The traffic noise impact from Hunter Expressway, Hart Road, McLeod Road and Main Road on the proposed residential and mixed-use development area.
- The additional traffic impact generated by the proposed development on existing sensitive receptors located in the vicinity of the Hydro Aluminium lands.
- To establish project specific noise criteria for the proposed residential, commercial and industrial areas within the proposed development/rezoned lands.
- To establish project specific noise criteria for the existing and proposed residential receivers with regard to potential future noise impacts from the proposed industrial development land parcels.

## 2 GLOSSARY OF TERMS

A list of commonly used acoustical terms (and their definition) used in this report is provided below in **Table 1**, as an aid to readers of the report.

**Table 1: Definition of Acoustical Terms**

| Term            | Definition                                                                                                                                                                                                                                                                                                     |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $L_{eq,1hr}$    | Equivalent Continuous Noise Level - which, lasting for as long as a given noise event, has the same amount of acoustic energy as the given event for the period of one hour.                                                                                                                                   |
| $L_{A10,1 hr}$  | The noise level, which is equalled or exceeded for 10% of the measurement period of one hour.                                                                                                                                                                                                                  |
| $L_{A90,T}$     | The noise level, which is equalled or exceeded for 90% of a given measurement period, T. $L_{A90,T}$ is used in Australia as the descriptor for background noise.                                                                                                                                              |
| $L_{Aeq,T}$     | The equivalent continuous A-weighted sound pressure level that has the same mean square pressure level as a sound that varies over time, for a given time period. It can be considered as the average sound pressure level over the measurement period and is commonly used as a descriptor for ambient noise. |
| $L_n$           | The Sound Pressure levels that is equalled or exceeded for n% of the interval time period. Commonly used noise intervals are $L_1$ , $L_{10}$ , $L_{90}$ and $L_{99\%}$                                                                                                                                        |
| $L_{A10,18hrs}$ | The $L_{10}$ noise level for the time period extending from 6am to midnight.                                                                                                                                                                                                                                   |

### 3 PROJECT DESCRIPTION

#### 3.1 Site Location

The overall land holding of the Hydro Aluminium site extends to approximately 2,000 hectares, with the former Hydro Aluminium production facility occupying approximately 60 hectares of the site and the remaining lands comprising of a mix of conservation habitat lands, agricultural lands, the Black Waterholes and surrounding floodplains. The site is also crossed by the South Maitland Railway line passing from Maitland to Kurri and on to Cessnock, although it is Vipac's understanding that the train line is currently only used on occasion by coal export trains servicing one mine in the region.

#### 3.2 Rezoning Masterplan

The Preliminary Masterplan for the site had identified approximately 300 hectares of land that is proposed to be rezoned for employment use, and had identified sufficient land to be rezoned that would be suitable for 1,290 residential lots for residential development.

The Rezoning Masterplan was revised to reduce the employment development to 200 hectares and to increase residential dwellings to 2,088 lots. The revised Rezoning Masterplan has proposed approximately 603 dwellings at the Northern precinct (in the Maitland LGA), 1,182 dwellings at the Central precinct and 303 dwellings at the Southern precinct.

**Figure 1** below shows the Rezoning Masterplan for the proposed Hydro Aluminium Land Rezoning Application and the noise monitoring points used in this assessment.

#### 3.3 Noise Sensitive Receivers

The sensitive receptors listed in **Table 2** are considered to be representative of the nearest noise sensitive receptors located in the vicinity of the lands proposed in the Land Rezoning Masterplan to be developed as the Industrial Area. The locations of the sensitive receptors are illustrated in **Figure 2** and **Figure 3**.

**Table 2: Noise Sensitive Receptors**

| Reference | Address                                                               | Type of receivers    |
|-----------|-----------------------------------------------------------------------|----------------------|
| R1        | 103 Bishop Bridge Road, Sawyers Gully                                 | Suburban Residential |
| R2        | 132 Sawyers Gully Road                                                | Suburban Residential |
| R3        | 532 Main Street, Clifftleigh                                          | Suburban Residential |
| R4        | Hydro Buffer Lands near Lot 11, 464 Cessnock Road, Gillieston Heights | Rural Residential    |
| R5        | 6 Dawes Avenue                                                        | Suburban Residential |
| RE1       | Kurri Kurri Speedway                                                  | Recreational         |
| RE2       | Kurri Kurri Junior Motorcycle Club                                    | Recreational         |
| S1        | Hunter TAFE, Kurri Kurri Campus                                       | School/College       |

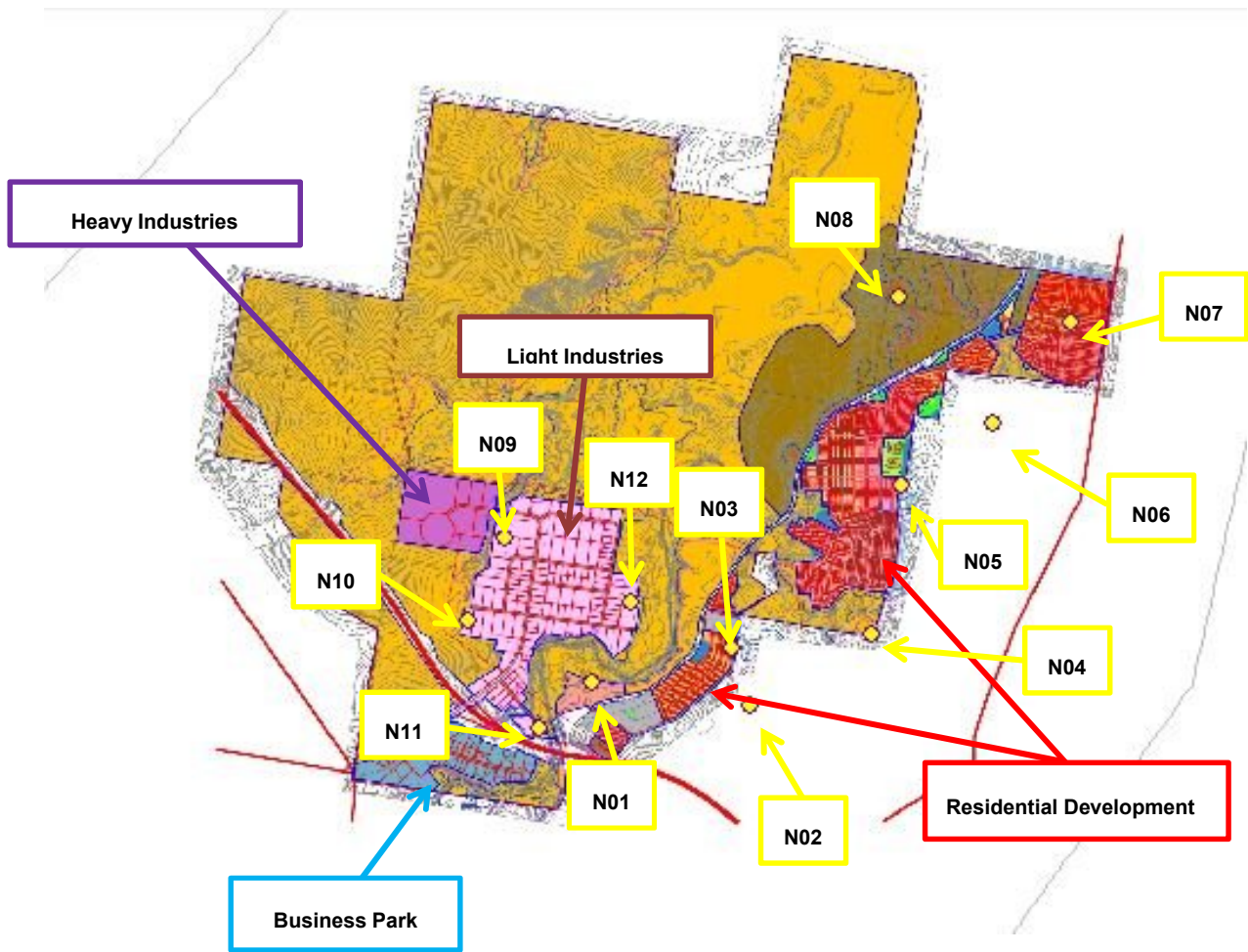


Figure 1: Revised Masterplan

## 4 EXISTING NOISE ENVIRONMENT

### 4.1 Unattended Noise Measurements

A series of baseline noise surveys were undertaken on the Hydro Aluminium lands and at noise sensitive receptors located in the vicinity of the site in order to determine Project Specific Noise levels of the potentially affected areas across the site and at representative sensitive receptors located in the surrounding areas.

The purpose of the noise surveys is to determine the existing ambient noise levels in the area, which will be taken into account in the Noise Assessment for the project. This will enable an assessment of the potential noise impacts on the receiving environment.

Vipac installed noise logging equipment at twelve locations to measure baseline environmental noise levels at representative noise sensitive receptor locations in the vicinity of the proposed development site. The location of the monitoring points are listed in **Table 3**, and shown in **Figure 2** and **Figure 3**.

**Table 3: Monitoring Locations**

| Loc. | Noise Survey Dates      | Location / Address                                                    | Instrument | Serial No. |
|------|-------------------------|-----------------------------------------------------------------------|------------|------------|
| N1   | 25/06/2014 – 04/07/2014 | 6 Dawes Avenue, Loxford                                               | LD870      | 1461       |
| N2   | 02/09/2014 – 08/09/2014 | Hunter TAFE, Kurri Kurri Campus                                       | LD870      | 1464       |
| N3   | 22/07/2014 – 29/07/2014 | 18 Bowditch Avenue, Loxford                                           | LD870      | 1461       |
| N4   | 22/07/2014 – 29/07/2014 | Hydro Buffer Lands near 10 Howe Street, Clifftleigh                   | LD824      | 2595       |
| N5   | 22/07/2014 – 29/07/2014 | Hydro Buffer Lands near Glen Ayre Avenue, Clifftleigh                 | LD870      | 1459       |
| N6   | 22/07/2014 – 29/07/2014 | Hydro Buffer Lands near 532 Main Road, Clifftleigh                    | LD870      | 1464       |
| N7   | 22/07/2014 – 29/07/2014 | Hydro Buffer Lands near Lot 54, 464 Cessnock Road, Gillieston Heights | LD870      | 1457       |
| N8   | 22/07/2014 – 29/07/2014 | Hydro Buffer Lands near Lot 11, 464 Cessnock Road, Gillieston Heights | LD870      | 1466       |
| N9   | 25/06/2014 – 04/07/2014 | Hydro Aluminium Site, near substation                                 | LD870      | 1466       |
| N10  | 25/06/2014 – 04/07/2014 | Hydro Aluminium Site, near Hunter Expressway                          | LD870      | 1464       |
| N11  | 02/09/2014 – 08/09/2014 | 14 Horton Road, Loxford                                               | LD870      | 1466       |
| N12  | 25/06/2014 – 04/07/2014 | Kurri Kurri Speedway Track, 73 Dickson Road, Loxford                  | Duo dB1    | 10304      |

The instruments were programmed to accumulate noise data continuously over sampling periods of 15-minutes for the entire monitoring period. Internal software then calculates and stores the Ln percentile noise levels for each sampling period, which can later be retrieved for detailed analysis. Meteorological data during the noise logging survey period was obtained from the Bureau of Meteorology (BoM) Weather Station at Cessnock Airport NSW (061260). Where adverse meteorological conditions such as wind exceeding 5m/s and/or rain were observed in any 15-minutes period, these data were excluded.

The instruments were calibrated using a Rion NC-73 calibrator immediately before and after monitoring and showed a maximum error of 0.5 dB.



**Figure 2: Noise Monitoring Locations and Noise Sensitive Receptors**

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**Figure 3: Noise Monitoring Locations and Noise Sensitive Receptors**

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A summary of the current ambient noise levels at the monitoring locations as determined from the baseline noise logging surveys is presented in **Table 4**. The results of the noise logging surveys are presented graphically in **Appendix A**.

**Table 4: Summary of current ambient noise levels (dB(A))**

| Loc. | Period  | L <sub>Aeq</sub> | L <sub>A90</sub> | RBL <sup>1</sup> |
|------|---------|------------------|------------------|------------------|
| N01  | Day     | 49               | 44               | 43               |
|      | Evening | 48               | 43               | 42               |
|      | Night   | 47               | 43               | 40               |
| N02  | Day     | 52               | 44               | 44               |
|      | Evening | 46               | 43               | 43               |
|      | Night   | 46               | 41               | 41               |
| N03  | Day     | 48               | 39               | 38               |
|      | Evening | 46               | 35               | 35               |
|      | Night   | 42               | 37               | 34               |
| N04  | Day     | 51               | 38               | 36               |
|      | Evening | 45               | 35               | 35               |
|      | Night   | 49               | 35               | 32               |
| N05  | Day     | 46               | 39               | 38               |
|      | Evening | 46               | 33               | 33               |
|      | Night   | 40               | 35               | 31               |
| N06  | Day     | 49               | 42               | 41               |
|      | Evening | 46               | 35               | 34               |
|      | Night   | 42               | 36               | 33               |
| N07  | Day     | 59               | 45               | 44               |
|      | Evening | 54               | 45               | 44               |
|      | Night   | 49               | 51               | 36               |
| N08  | Day     | 58               | 36               | 35               |
|      | Evening | 47               | 33               | 33               |
|      | Night   | 40               | 34               | 32               |
| N09  | Day     | 45               | 39               | 38               |
|      | Evening | 43               | 37               | 37               |
|      | Night   | 44               | 39               | 36               |
| N10  | Day     | 50               | 45               | 44               |
|      | Evening | 51               | 45               | 44               |
|      | Night   | 50               | 43               | 38               |
| N11  | Day     | 55               | 50               | 50               |
|      | Evening | 52               | 47               | 47               |
|      | Night   | 51               | 45               | 42               |
| N12  | Day     | 46               | 43               | 41               |
|      | Evening | 46               | 38               | 38               |
|      | Night   | 43               | 39               | 36               |

<sup>1</sup> RBL is the median of the overall assessment background noise level calculated using OEH Industrial Noise Policy methodology as defined in the glossary of acoustic terms

## 4.2 Attended Noise Measurements

In addition to the unattended noise logging surveys, Vipac also conducted short period 15-minute attended noise measurements at the baseline monitoring locations (N1 to N12) to quantify the dominant and contributory noise sources associated with the overall ambient noise levels in the area. The results of the attended noise surveys at each monitoring location are presented in **Table 5**.

**Table 5: Attended Noise Survey results**

| Loc. | Date & Time         | L <sub>Aeq</sub> | L <sub>A90</sub> | Description                                                                                                                                                                                                                                                                                                                               |
|------|---------------------|------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| N01  | 04/07/2014<br>16:31 | 44.8             | 41.9             | Traffic Noise and machinery noise from Loxford Fabrications dominated the environment. Noise from birds was significant and dominant at times. No insects were noted during the survey.                                                                                                                                                   |
| N02  | 08/09/2014<br>13:48 | 52.3             | 42.1             | Dominant noise source initially was truck reversing and maneuvering near the monitoring point. Subsequently the noise environment was dominated by the birds. Air conditioning system on Block G (canteen) was noted throughout the survey. Excavator and truck reversing were dominating the environment towards the end of the survey.  |
| N03  | 22/07/2014<br>15:30 | 49.0             | 37.6             | Bird noise in the area dominated the overall noise environment. Traffic noise towards Main Road also influenced the noise levels in this area. Distant reversing beacon, air plane and cattle grazing were influential at times.                                                                                                          |
| N04  | 22/07/2014<br>13:53 | 42.7             | 39.1             | Dominant source was construction noise from new housing land near Clifleigh/Kelman Drive. Noise from birds in this area was significant. Occasionally, dog barking was faintly audible.                                                                                                                                                   |
| N05  | 22/07/2014<br>14:39 | 50.0             | 45.6             | Dominant source was construction noise (bulldozer activities) from new housing land near Clifleigh/Kelman Drive. Noise from Jet passing was significant briefly during the survey.                                                                                                                                                        |
| N06  | 22/07/2014<br>12:45 | 41.4             | 36.5             | Construction noise from new housing land near Clifleigh/Kelman Drive dominated the overall noise environment. Construction activities were from earthworks, graders, dozers, excavators and trucks. Noise from rustling foliage was also noted at times.                                                                                  |
| N07  | 22/07/2014<br>11:03 | 45.5             | 39.0             | Dominant noise source was bird noise and traffic noise from Main Road. Occasionally, noise from airplane overhead was influential.                                                                                                                                                                                                        |
| N08  | 22/07/2014<br>11:53 | 43.1             | 35.9             | Bird noise in the area dominated at this monitoring location. Construction activities in the vicinity to the monitoring position were significant. No traffic noise was audible at this location.                                                                                                                                         |
| N09  | 04/07/2014<br>15:02 | 42.6             | 40.0             | Dominant noise source was from distant traffic noise. Occasionally, noise from rattling of metal panels and birds chirping were audible in this area. Airplane noise influential briefly but the overall noise environment was dominated by the distant traffic noise. Noise generated by the substation was inaudible during the survey. |
| N10  | 04/07/2014<br>14:33 | 54.1             | 49.8             | Traffic noise from Hunter Expressway dominated the overall noise environment. Birds chirping and steel storage yard activities were audible occasionally. Light airplane flying overhead the monitoring was significant source briefly. No noise sources were audible from Hydro site.                                                    |
| N11  | 08/09/2014<br>13:09 | 50.4             | 46.0             | Dominant source was traffic on Hunter Expressway especially truck pass-by. Noise from birds in the area was also significant in this area. Occasionally noise from metal cutting/grinding was noted.                                                                                                                                      |
| N12  | 04/07/2014<br>15:45 | 39.4             | 37.4             | Frogs/Insects noise and distant traffic noise from Hunter Expressway dominated the overall noise environment. Occasionally bird noise was audible in this area. Sound of breeze blowing in trees and reeds was also influential but not significant.                                                                                      |

It is noteworthy that although the Hydro Lands are crossed by the South Maitland Railway line, train noise emissions were not recorded or were not noted as a contributory noise sources during any of the attended baseline noise monitoring surveys, as there were no passing trains on the rail line during the attended noise monitoring surveys.

Seven of the twelve attended baseline noise monitoring locations are situated within reasonable proximity to the rail line as the route crosses the site. These include the monitoring positions N01 (04/07/14), N03 (22/07/14), N05 (22/07/14), N06 (22/07/14), N07 (22/07/14), N08 (22/07/14) and N11 (08/09/14), where noise monitoring surveys were undertaken on two separate dates in July and also on one date in September 2014.

However, Vipac have conducted noise monitoring surveys in proximity to rail lines in the Newcastle, Warnervale and Hunter Valley areas for a number of separate projects and have recorded noise levels ranging from 64 – 79 dB  $L_{Amax}$  at distances of approximately 60m from rail lines for passing coal trains and freight trains. Noise levels associated with passenger trains tend to be much lower.

It is reasonable to assume that noise levels in the order of 64 – 79  $L_{Amax}$  at distances of 60m may also be apparent when coal trains use the section of the South Maitland Railway line that crosses the Hydro Aluminium site.

## 5 CRITERIA

### 5.1 NSW EPA Industrial Noise Policy

The NSW EPA Industrial Noise Policy (INP) sets limits on the noise that may be generated by activities associated with the varying forms of development, and is applicable to the proposed land uses associated with the Hydro Aluminium Land Rezoning Masterplan. These limits are dependent upon the existing noise levels at the site and noise sensitive receptors located in the surrounding area and are implemented to ensure changes to the existing noise environment are minimised and deal with the intrusiveness of the noise and the amenity of the environment. The most stringent of the limits is taken as the limiting criterion for the noise source.

The intrusiveness noise criterion requires that the  $L_{Aeq,15minutes}$  for a given noise source, measured at the most sensitive receiver under worst-case conditions, should not exceed the Rated Background Level (RBL) by more than 5dB, represented as follows:

- $L_{Aeq,15minutes} < RBL + 5dB$

Noise levels associated with the proposed Land Rezoning and Development Uses and potential impacts on nearby noise sensitive receptors (located in the surrounding area and proposed residential) will be required to comply with the Project Specific Noise Levels detailed in **Table 6**, which have been determined on the basis of the results of the baseline noise surveys.

**Table 6: Project Specific Noise Levels at Noise Sensitive Receptors dB(A)**

| Location                                           | Period      | L <sub>Aeq</sub> | RBL | Recommended <sup>1</sup><br>Acceptable L <sub>Aeq</sub> | Intrusiveness<br>Criteria Level | Project<br>Specific<br>Noise Level |
|----------------------------------------------------|-------------|------------------|-----|---------------------------------------------------------|---------------------------------|------------------------------------|
| N01 (R5)                                           | Day         | 49               | 43  | 55                                                      | 48                              | 48                                 |
|                                                    | Evening     | 48               | 42  | 45                                                      | 47                              | 45                                 |
|                                                    | Night       | 47               | 40  | 40                                                      | 45                              | 40                                 |
| N02<br>Proposed Residential<br>(South Precinct)    | Day         | 52               | 44  | 55                                                      | 49                              | 49                                 |
|                                                    | Evening     | 46               | 43  | 45                                                      | 48                              | 45                                 |
|                                                    | Night       | 46               | 41  | 40                                                      | 46                              | 40                                 |
| N03<br>Proposed Residential<br>(South Precinct)    | Day         | 48               | 38  | 55                                                      | 43                              | 43                                 |
|                                                    | Evening     | 46               | 35  | 45                                                      | 40                              | 40                                 |
|                                                    | Night       | 42               | 34  | 40                                                      | 39                              | 39                                 |
| N04<br>Proposed Residential<br>(Central Precinct)  | Day         | 51               | 36  | 55                                                      | 41                              | 41                                 |
|                                                    | Evening     | 45               | 35  | 45                                                      | 40                              | 40                                 |
|                                                    | Night       | 49               | 32  | 40                                                      | 37                              | 37                                 |
| N05<br>Proposed Residential<br>(Central Precinct)  | Day         | 46               | 38  | 55                                                      | 43                              | 43                                 |
|                                                    | Evening     | 46               | 33  | 45                                                      | 38                              | 38                                 |
|                                                    | Night       | 40               | 31  | 40                                                      | 36                              | 36                                 |
| N06 (R3)                                           | Day         | 49               | 41  | 50                                                      | 46                              | 46                                 |
|                                                    | Evening     | 46               | 34  | 45                                                      | 39                              | 39                                 |
|                                                    | Night       | 42               | 33  | 40                                                      | 38                              | 38                                 |
| N07<br>Proposed residential<br>(Northern Precinct) | Day         | 59               | 44  | 55                                                      | 49                              | 49                                 |
|                                                    | Evening     | 54               | 44  | 45                                                      | 49                              | 45                                 |
|                                                    | Night       | 49               | 36  | 40                                                      | 40                              | 40                                 |
| N08 (R4)                                           | Day         | 58               | 35  | 50                                                      | 40                              | 40                                 |
|                                                    | Evening     | 47               | 33  | 45                                                      | 38                              | 38                                 |
|                                                    | Night       | 40               | 32  | 40                                                      | 37                              | 37                                 |
| N09                                                | Day         | 45               | 38  | 55                                                      | 43                              | 43                                 |
|                                                    | Evening     | 43               | 37  | 45                                                      | 42                              | 42                                 |
|                                                    | Night       | 44               | 36  | 40                                                      | 41                              | 40                                 |
| N10 (R1, R2)                                       | Day         | 50               | 44  | 55                                                      | 49                              | 49                                 |
|                                                    | Evening     | 51               | 44  | 45                                                      | 49                              | 45                                 |
|                                                    | Night       | 50               | 38  | 40                                                      | 43                              | 40                                 |
| N11 (R4)                                           | Day         | 55               | 50  | 55                                                      | 55                              | 55                                 |
|                                                    | Evening     | 52               | 47  | 45                                                      | 42                              | 42                                 |
|                                                    | Night       | 51               | 42  | 40                                                      | 47                              | 40                                 |
| N12                                                | Day         | 46               | 41  | 55                                                      | 46                              | 46                                 |
|                                                    | Evening     | 46               | 38  | 45                                                      | 43                              | 43                                 |
|                                                    | Night       | 43               | 36  | 40                                                      | 41                              | 40                                 |
| Commercial                                         | When in use | -                | -   | 65                                                      | -                               | 65                                 |
| Industrial                                         | When in use | -                | -   | 70                                                      | -                               | 70                                 |
| Active recreation area<br>(RE1 and RE2)            | When in use | -                | -   | 55                                                      | -                               | 55                                 |
| School Class Room                                  | When in use | -                | -   | 35<br>(Internal)                                        | -                               | 35<br>(Internal)                   |

<sup>1</sup> Recommended Acceptable L<sub>Aeq</sub> noise level for residence in Rural and Suburban area from Table 2.1 in OEH Industrial Noise Policy.  
27 Mar 2015

## 5.2 Sleep Disturbance Approach

Guidance indicating the potential for sleep disturbance is set out in the NSW Environmental Criteria for Road and Traffic Noise (EPA 1999), and is summarised as follows:

*“OEH reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*

*From the research, OEH recognised that current sleep disturbance criterion of an  $L_{A1, (1 \text{ minute})}$  not exceeding the  $L_{A90, (15 \text{ minute})}$  by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, OEH will continue to use it as a guide to identify the likelihood of sleep disturbance.*

*This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*

*The detailed analysis should cover the maximum noise level or  $L_{A1, (1 \text{ minute})}$ , that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:*

- *How often high noise events will occur*
- *Time of day (normally between 10pm and 7am)*
- *Whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).*

*The  $L_{A1, (1 \text{ minute})}$  descriptor is meant to represent a maximum noise level measured under ‘fast’ time response. DECCW will accept analysis based on either  $L_{A1, (1 \text{ minute})}$  or  $L_{A(Max)}$ .*

It should be noted that the OEH refers to the Office of Environment and Heritage, and DECCW refers to the Department of Environment, Climate Change and Water.

**Table 7** details the criteria for sleep disturbance for each of the individual noise receiver locations.

**Table 7: Sleep Disturbance Noise Criteria at Noise Sensitive Receptors dB(A) - Residential**

| Location                                        | $L_{A90}$ | Criteria - $L_{90+15}$ |
|-------------------------------------------------|-----------|------------------------|
| N01 (R5)                                        | 43        | 58                     |
| N02<br>Proposed Residential (South Precinct)    | 41        | 56                     |
| N03<br>Proposed Residential (South Precinct)    | 37        | 52                     |
| N04<br>Proposed Residential (Central Precinct)  | 35        | 50                     |
| N05<br>Proposed Residential (Central Precinct)  | 35        | 50                     |
| N06 (R3)                                        | 36        | 51                     |
| N07<br>Proposed residential (Northern Precinct) | 51        | 66                     |
| N08 (R4)                                        | 34        | 49                     |
| N10 (R1, R2)                                    | 43        | 58                     |
| N11 (R4)                                        | 45        | 60                     |

### 5.3 NSW Road Noise Policy (RNP)

#### 5.3.1 Operational Phase

The requirements of the NSW Road Noise Policy (RNP) published by the Department of Environment, Climate Change and Water (DECCW) are also applicable to this assessment. The proposed Land Rezoning Application and associated development plans has the potential to generate additional traffic on the arterial/local roads that will provide access to the different land parcels, and can potentially impact on the existing nearby noise sensitive receivers, in addition to the proposed future residential properties that may be developed on the lands subject to the rezoning proposals. **Table 8** summarises the applicable road categories to establish the noise assessment criteria based on the type of road and the proposed land use developments.

**Table 8: Road Traffic Noise Assessment Criteria for Residential Land Uses**

| Road Category                                                                     | Type of project / land use                                                                                                                 | Assessment Criteria/<br>Target Noise Level, dB(A) |                                              |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------|
|                                                                                   |                                                                                                                                            | Day<br>(7am-10pm)                                 | Night<br>(10pm-7am)                          |
| Freeway/arterial/sub-arterial Road<br>(Hunter Expressway, Hart Road, Main Street) | 3. Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments. | L <sub>Aeq</sub> , (15hour).<br>60 (external)     | L <sub>Aeq</sub> , (9 hour)<br>55 (external) |
| Local Road<br>(McLeod Road, Heddon Street)                                        | 6. Existing residences affected by additional traffic on existing local roads generated by land use developments                           | L <sub>Aeq</sub> , (1hour).<br>55 (external)      | L <sub>Aeq</sub> , (1 hour)<br>50 (external) |

Note: These criteria are for assessment against façade- corrected noise levels when measured in front of a building façade. Hence, a correction factor of 2.5 dB is added to the predicted noise levels

As stated in Section 3.4 of the Road Noise Policy, with regard to existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use development, any increase in total traffic noise level should be limited to 2dB above that of the corresponding 'no build option'.

Currently Hart Road is a local road with the main purpose to provide access to/from the existing Hydro Aluminum Facility. The classification of the Hart Road would be subject to change to a "sub-arterial road" when the proposed land parcels of the Hydro Aluminium Land Rezoning Masterplan is developed, particularly the proposed Heavy Industries, Light Industries and Business Park areas. The change of classification in the road category would be primarily associated with the proposed Heavy Industries, Light Industries and Business Park areas, which would be accessed via Hart Road as the road connecting the Hunter Expressway and Local Roads in the area. In this regard, Hart Road would be servicing the major traffic generators from the proposed Heavy Industries, Light Industries and Business Park areas of the overall site.

#### 5.3.2 Practice Note 3 (Traffic Sleep Disturbance)

A substantial portion of the DECC NSW Road Noise Policy (RNP) discusses a review of international research on the subject of sleep disturbance associated with noise. The guidance outlined with regard to road traffic noise and potential impacts on sleep disturbance expands on previous guidance set out in the RTA Environmental Noise Management Manual (ENMM) and earlier guidance set out in the Environmental Protection Authority Environmental Criteria for Road Traffic Noise (ECRTN).

The most recent guidance set out in the RNP states that "*there appears to be insufficient evidence to set new indicators for potential sleep disturbance due to road traffic noise*". The RNP refers to the RTA Practice Note 3 protocol as the method for assessing and reporting on maximum noise levels that may cause sleep disturbance. The guidelines indicate that:

- Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions, and
- One or two noise events per night with maximum internal noise levels of 65-70 dB(A) are not likely to significantly affect health and well-being.

#### 5.4 NSW DoP Development near Rail Corridors and Busy Road – Interim Guideline

This Guideline is based on the State Environmental Planning Policy (Infrastructure) 2007 (the “infrastructure SEPP”). This guideline sets out the internal noise levels for developments with the potential to be impacted by traffic noise.

The infrastructure SEPP sets out the following criteria for internal noise levels from airborne traffic noise:

For Clause 102 (Road Corridors):

If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following  $L_{eq}$  levels are not exceeded:

- In any bedroom in the building :35dB(A) at any time 10pm to 7am,
- Anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.

## 6 NOISE MODELLING

Noise modelling has been undertaken using the SoundPLAN<sup>®</sup> computational noise modelling software package. The use of the SoundPLAN<sup>®</sup> software and referenced modelling methodology is accepted for use in the state of NSW by the EPA (OEH) for environmental noise modelling purposes. Vipac have undertaken numerous noise modelling and impact assessments previously for a range of projects, including infrastructure development and industrial projects using SoundPLAN<sup>®</sup>.

### 6.1 Geographical Data

ESS Australia supplied topographical details of the area to Vipac for noise modelling purposes. **Table 9** below lists the drawings received and used in the noise model.

**Table 9: Drawings used**

| Drawing Ref                     | Description             | Date       |
|---------------------------------|-------------------------|------------|
| Hydro base Data 20140701.DWG    | Ground Terrain          | 18/12/2014 |
| 13119 Base Plan 03-Dec 2014.DWG | Hydro Masterplan layout | 18/12/2014 |

### 6.2 Noise Impact from Generated Traffic

The Calculation of Road Traffic Noise (CoRTN) method of traffic noise prediction was used, which is a method approved by the EPA (OEH). The traffic data presented in the “Hydro Redevelopment at Kurri Kurri- Traffic and Transport Study” (by Hyder Consulting, dated February 2015) and traffic count data from February 2015 were used to calculate the traffic noise generation.

Additional data was also referenced from the Hunter Expressway Noise Assessment entitled “F3 Freeway to Branxton Link” (by Atkins Acoustics, dated March 2007). Details regarding traffic volumes on the Hunter Expressway between Allandale Road and Lang Street, were sourced from the Atkins Acoustics report.

Further data regarding the diurnal profile of traffic movements in the area was referenced from previous work undertaken by Vipac for a proposed development in the Hunter Economic Zone, near Kurri Kurri. Data from an auto-tube traffic survey undertaken in December 2014 on Railway Street and Stanford Street in Kurri Kurri was utilised for this purpose.

### 6.2.1 Background Traffic Growth

The noise model assumed 2031 as the ultimate year with the following background traffic growth:

- 2% per annum on Cessnock Road,
- 2% per annum on Hart Road,
- 1% per annum on McLeod Road and Heddon Street,
- 4% per annum on the Hunter Expressway between Allandale Road and Hart Road,
- 3% per annum on the Hunter Expressway between Hart Road and Lang Street.

### 6.2.2 Traffic Generated by Proposed Development

The traffic generated from the proposed residential land parcels and each stage of employment associated development land parcels associated with the Heavy Industries, Light Industries and Business Park areas is detailed in **Table 10**.

**Table 10: Development Thresholds and Generated Trips**

| Description                               | Development                           | Peak Hour Traffic |
|-------------------------------------------|---------------------------------------|-------------------|
| Residential Development<br>2088 dwellings | Northern and Central Precinct         | 1,205             |
|                                           | Southern Precinct                     | 273               |
| Employment Development<br>(75 Ha)         | General Industrial (Light Industries) | 955               |
|                                           | Heavy Industrial (Heavy Industries)   | 262               |
|                                           | Employment Park (Business Park)       | 291               |
| Employment Development<br>(120 Ha)        | General Industrial (Light Industries) | 1,529             |
|                                           | Heavy Industrial (Heavy Industries)   | 419               |
|                                           | Employment Park (Business Park)       | 465               |
| Employment Development<br>(200 Ha)        | General Industrial (Light Industries) | 2,548             |
|                                           | Heavy Industrial (Heavy Industries)   | 698               |
|                                           | Employment Park (Business Park)       | 775               |

The anticipated traffic distribution of the additional trips generated by the proposed Hydro Aluminium Land Rezoning Masterplan and associated development was a key factor in determining its impact on Hart Road and Cessnock Road.

The residential development suggests the following trip patterns and assumes one access on Cessnock Road for the Northern and Central precincts:

- Approximately 50% of trips towards the north to Maitland via Cessnock Road.
- Approximately 20% of trips towards the east to Newcastle, Lake Macquarie, M1 Pacific Motorway via Cessnock Road and the Hunter Expressway.
- Approximately 15% of trips towards the south to Kurri Kurri and Cessnock via Cessnock Road.
- Approximately 15% of trips towards the west to Braxton and Upper Hunter via Cessnock Road and the Hunter Expressway.

The employment land development suggests the following trip distribution patterns and assumes one access on Hart Road:

- Approximately 15% of trips towards the north to Maitland via the Hunter Expressway and Cessnock Road.

- Approximately 40% of trips towards the east to Newcastle, Lake Macquarie, M1 Pacific Motorway via Hunter Expressway.
- Approximately 15% of trips towards the south to Kurri Kurri via Hart Road.
- Approximately 30% of trips towards the west to Branxton and Upper Hunter via Hart Road and the Hunter Expressway.

It is expected that the Southern Residential Precinct area of the Rezoning Masterplan will be accessed from McLeod Road via Heddon Street.

**Table 11** shows the additional traffic generated on Main Street, Hart Road, McLeod Road, Heddon Street and the Hunter Expressway based on the trip distribution and potential traffic generated by the Hydro Aluminium Land Rezoning Masterplan and associated development.

**Table 11: Traffic Generated on roads**

| Road                                          | Residential +<br>70Ha Employment Land | Residential +<br>120Ha Employment Land | Residential +<br>200Ha Employment Land |
|-----------------------------------------------|---------------------------------------|----------------------------------------|----------------------------------------|
| Main Street                                   | 829                                   | 965                                    | 1,206                                  |
| Hart Road<br>(North of the Hunter Expressway) | 1,217                                 | 1,948                                  | 3,246                                  |
| Hart Road<br>(South of the Hunter Expressway) | 291                                   | 465                                    | 775                                    |
| McLeod Road                                   | 273                                   | 273                                    | 273                                    |
| Heddon Street                                 | 174                                   | 174                                    | 174                                    |
| Hunter Expressway<br>(North of Hart Road)     | 452                                   | 724                                    | 1,206                                  |
| Hunter Expressway<br>(South of Hart Road)     | 1,010                                 | 1,508                                  | 2,393                                  |

### 6.2.3 Summary of Traffic Data

In the absence of annual average daily traffic count data (AADT) for Hart Road and Main Street, Vipac has assumed that the AADT traffic flows is approximately equivalent to 10 times the peak hour traffic; a factor of 90% was used to convert AADT's to 15-hour traffic flow during the daytime (07:00 – 22:00) and a factor of 10% was used to convert AADT to 9-hour traffic flow during the night-time (22:00 – 07:00). The traffic distribution during the daytime and night-time periods were assumed based on the RMS traffic counter data for the nearest station to the Hydro Aluminium site, which is located on Cessnock Road in Abermain/Neath (Station ID 05194 Cessnock Road, Neath – North of Railway Crossing).

As McLeod Road and Heddon Street are local roads, the noise levels must be assessed in the context of the LAeq,1hour noise descriptor, and therefore, one hour traffic data for the day period (07:00 to 22:00) and night-time periods (22:00 to 07:00) are required. In the absence of the hourly data over a 24-hour diurnal period, Vipac used peak hour data to calculate the potential traffic noise impact during the day period. For the night period, a factor of 40% was used to convert night period traffic volumes to the night-time peak hour traffic. The traffic distribution during night-time was assumed based on data obtained from an auto-tube traffic survey conducted in December 2014 on Railway Street and Stanford Street in Kurri Kurri, in conjunction with a separate project undertaken by Vipac for a proposed development in the Hunter Economic Zone, located near Kurri Kurri.

**Table 12** to **Table 14** summaries the base traffic data and potential traffic that may be generated by the Hydro Aluminium Land Rezoning Masterplan and associated development for each individual road, which was used to predict the potential traffic noise impact on sensitive receivers in the surrounding areas.

**Table 12: Traffic Volume for Residential + 75 Ha Employment Land**

| Traffic Details                            | Main Road    |                                    | Hart Road (North)                  |                                    | Hart Road (South) |                                    | Hunter Expressway (North) |                                    | Hunter Expressway (South) |                                    |
|--------------------------------------------|--------------|------------------------------------|------------------------------------|------------------------------------|-------------------|------------------------------------|---------------------------|------------------------------------|---------------------------|------------------------------------|
|                                            | Base Traffic | Base Traffic + Proposed Operations | Base Traffic                       | Base Traffic + Proposed Operations | Base Traffic      | Base Traffic + Proposed Operations | Base Traffic              | Base Traffic + Proposed Operations | Base Traffic              | Base Traffic + Proposed Operations |
| Average Daily Traffic                      | 22,870       | 31,162                             | 250                                | 12,420                             | 8,280             | 11,190                             | 31,766                    | 36,290                             | 33,374                    | 43,478                             |
| 15 hour traffic flows (Day Period)         | 20,583       | 28,046                             | 225                                | 11,178                             | 7,452             | 10,071                             | 26,452                    | 30,121                             | 27,808                    | 36,087                             |
| % Percentage Heavy Vehicles (15 hours)     | 5.0%         | 5.0%                               | 17.6%                              | 20.0%                              | 4.5%              | 10.0%                              | 15.7%                     | 16.2%                              | 14.1%                     | 14.6%                              |
| 9 hour traffic flows (Night Period)        | 2,287        | 3,116                              | 25                                 | 1,242                              | 828               | 1,119                              | 5,314                     | 6,169                              | 5,566                     | 7,391                              |
| % Percentage Heavy Vehicles (9 hours)      | 3.5%         | 3.5%                               | 17.6                               | 10.0%                              | 4.5%              | 5.0%                               | 25.8%                     | 25.8%                              | 23.2%                     | 23.2%                              |
| Speed Limit (km/h)                         | 60           |                                    | 70                                 |                                    | 70                |                                    | 110                       |                                    | 110                       |                                    |
| Traffic Details                            | McLeod Road  |                                    |                                    |                                    |                   | Heddon Street                      |                           |                                    |                           |                                    |
|                                            | Base Traffic |                                    | Base Traffic + Proposed Operations |                                    |                   | Base Traffic                       |                           | Base Traffic + Proposed Operations |                           |                                    |
| Average Daily Traffic                      | 1,640        |                                    | 4,370                              |                                    |                   | 3,350                              |                           | 5,090                              |                           |                                    |
| 1 hour traffic flows (Day Period)          | 164          |                                    | 437                                |                                    |                   | 335                                |                           | 509                                |                           |                                    |
| % Percentage Heavy Vehicles (Day Period)   | 2.2%         |                                    | 2.2%                               |                                    |                   | 2.2                                |                           | 2.2%                               |                           |                                    |
| 1 hour traffic flows (Night Period)        | 66           |                                    | 175                                |                                    |                   | 134                                |                           | 204                                |                           |                                    |
| % Percentage Heavy Vehicles (Night Period) | 2.2%         |                                    | 2.2%                               |                                    |                   | 2.2%                               |                           | 2.2%                               |                           |                                    |
| Speed Limit (km/h)                         | 60           |                                    |                                    |                                    |                   | 50                                 |                           |                                    |                           |                                    |

**Table 13: Traffic Volume for Residential + 120 Ha Employment Land**

| Traffic Details                               | Main Road    |                                    | Hart Road (North)                  |                                    | Hart Road (South) |                                    | Hunter Expressway (North) |                                    | Hunter Expressway (South) |                                    |
|-----------------------------------------------|--------------|------------------------------------|------------------------------------|------------------------------------|-------------------|------------------------------------|---------------------------|------------------------------------|---------------------------|------------------------------------|
|                                               | Base Traffic | Base Traffic + Proposed Operations | Base Traffic                       | Base Traffic + Proposed Operations | Base Traffic      | Base Traffic + Proposed Operations | Base Traffic              | Base Traffic + Proposed Operations | Base Traffic              | Base Traffic + Proposed Operations |
| Average Daily Traffic                         | 22,870       | 32,520                             | 250                                | 19,730                             | 8,280             | 12,930                             | 31,766                    | 39,005                             | 33,374                    | 48,456                             |
| 15 hour traffic flows<br>(Day Period)         | 20,583       | 29,268                             | 225                                | 17,757                             | 7,452             | 11,637                             | 26,452                    | 32,374                             | 27,808                    | 40,218                             |
| % Percentage Heavy Vehicles<br>(15 hours)     | 5.0%         | 5.0%                               | 17.6%                              | 20.0%                              | 4.5%              | 10.0%                              | 15.7%                     | 16.5%                              | 14.1%                     | 15.2%                              |
| 9 hour traffic flows<br>(Night Period)        | 2,287        | 3,252                              | 25                                 | 1,973                              | 828               | 1,293                              | 5,314                     | 6,631                              | 5,566                     | 8,237                              |
| % Percentage Heavy Vehicles<br>(9 hours)      | 3.5%         | 3.5%                               | 17.6                               | 10.0%                              | 4.5%              | 10.0%                              | 25.8%                     | 25.8%                              | 23.2%                     | 23.2%                              |
| Speed Limit (km/h)                            | 60           |                                    | 70                                 |                                    | 70                |                                    | 110                       |                                    | 110                       |                                    |
| Traffic Details                               | McLeod Road  |                                    |                                    |                                    |                   | Heddon Street                      |                           |                                    |                           |                                    |
|                                               | Base Traffic |                                    | Base Traffic + Proposed Operations |                                    |                   | Base Traffic                       |                           | Base Traffic + Proposed Operations |                           |                                    |
| Average Daily Traffic                         | 1,640        |                                    | 4,370                              |                                    |                   | 3,350                              |                           | 5,090                              |                           |                                    |
| 1 hour traffic flows<br>(Day Period)          | 164          |                                    | 437                                |                                    |                   | 335                                |                           | 509                                |                           |                                    |
| % Percentage Heavy Vehicles<br>(Day Period)   | 2.2%         |                                    | 2.2%                               |                                    |                   | 2.2%                               |                           | 2.2%                               |                           |                                    |
| 1 hour traffic flows<br>(Night Period)        | 66           |                                    | 175                                |                                    |                   | 134                                |                           | 204                                |                           |                                    |
| % Percentage Heavy Vehicles<br>(Night Period) | 2.2%         |                                    | 2.2%                               |                                    |                   | 2.2%                               |                           | 2.2%                               |                           |                                    |
| Speed Limit (km/h)                            | 60           |                                    |                                    |                                    |                   | 50                                 |                           |                                    |                           |                                    |

**Table 14: Traffic Volume for Residential + 200 Ha Employment Land**

| Traffic Details                               | Main Road    |                                    | Hart Road (North)                  |                                    | Hart Road (South) |                                    | Hunter Expressway (North) |                                    | Hunter Expressway (South) |                                    |
|-----------------------------------------------|--------------|------------------------------------|------------------------------------|------------------------------------|-------------------|------------------------------------|---------------------------|------------------------------------|---------------------------|------------------------------------|
|                                               | Base Traffic | Base Traffic + Proposed Operations | Base Traffic                       | Base Traffic + Proposed Operations | Base Traffic      | Base Traffic + Proposed Operations | Base Traffic              | Base Traffic + Proposed Operations | Base Traffic              | Base Traffic + Proposed Operations |
| Average Daily Traffic                         | 22,870       | 34,932                             | 250                                | 32,710                             | 8,280             | 16,030                             | 31,766                    | 43,829                             | 33,374                    | 57,300                             |
| 15 hour traffic flows<br>(Day Period)         | 20,583       | 31,438                             | 225                                | 29,439                             | 7,452             | 14,427                             | 26,452                    | 36,378                             | 27,808                    | 47,559                             |
| % Percentage Heavy Vehicles<br>(15 hours)     | 5.0%         | 5.0%                               | 17.6%                              | 20.0%                              | 4.5%              | 10.0%                              | 15.7%                     | 16.9%                              | 14.1%                     | 15.9%                              |
| 9 hour traffic flows<br>(Night Period)        | 2,287        | 3,493                              | 25                                 | 3,271                              | 828               | 1,603                              | 5,314                     | 7,451                              | 5,566                     | 9,741                              |
| % Percentage Heavy Vehicles<br>(9 hours)      | 3.5%         | 3.5%                               | 17.6                               | 10.0%                              | 4.5%              | 5.0%                               | 25.8%                     | 25.8%                              | 23.2%                     | 23.20%                             |
| Speed Limit (km/h)                            | 60           |                                    | 70                                 |                                    | 70                |                                    | 110                       |                                    | 110                       |                                    |
| Traffic Details                               | McLeod Road  |                                    |                                    |                                    |                   | Heddon Street                      |                           |                                    |                           |                                    |
|                                               | Base Traffic |                                    | Base Traffic + Proposed Operations |                                    |                   | Base Traffic                       |                           | Base Traffic + Proposed Operations |                           |                                    |
| Average Daily Traffic                         | 1,640        |                                    | 4,370                              |                                    |                   | 3,350                              |                           | 5,090                              |                           |                                    |
| 1 hour traffic flows<br>(Day Period)          | 164          |                                    | 437                                |                                    |                   | 335                                |                           | 509                                |                           |                                    |
| % Percentage Heavy Vehicles<br>(Day Period)   | 2.2%         |                                    | 2.2%                               |                                    |                   | 2.2%                               |                           | 2.2%                               |                           |                                    |
| 1 hour traffic flows<br>(Night Period)        | 66           |                                    | 175                                |                                    |                   | 134                                |                           | 204                                |                           |                                    |
| % Percentage Heavy Vehicles<br>(Night Period) | 2.2%         |                                    | 2.2%                               |                                    |                   | 2.2%                               |                           | 2.2%                               |                           |                                    |
| Speed Limit (km/h)                            | 60           |                                    |                                    |                                    |                   | 50                                 |                           |                                    |                           |                                    |

## 7 RESULTS

### 7.1 Potential Rail Noise Impact on Existing and Future Noise Sensitive Receptors

As outlined in Section 4.2, several of the baseline noise monitoring locations were located in reasonable proximity to the South Maitland Railway line, which crosses the Hydro Aluminium lands but no train pass-bys occurred during the attended noise surveys at any of the monitoring points located near the rail line.

It is understood that the section of the rail line that crosses the Hydro Aluminium lands is currently only used on occasion by coal export trains servicing one mine in the region. However, based on the noise levels monitored by Vipac in proximity to other rail lines in the Newcastle, Warnervale and Hunter Valley areas on a number of projects, it is reasonable to assume that noise levels of up to 64 – 79  $L_{Amax}$  at distances of 60m may be apparent when coal trains use the section of the South Maitland Railway line that crosses the Hydro Aluminium site.

Based on the existing frequency of use of the rail line, it is unlikely to contribute to significant impacts on existing sensitive receptors located in the area. Any contribution to the existing ambient noise levels in the area associated with the occasional coal trains that use the rail line as it traverses the Hydro Aluminium Lands will have been recorded by the noise loggers during the unattended noise logging surveys which have been used to determine the Project Specific Noise Levels at the respective monitoring locations.

A number of the proposed residential plots shown on the Land Rezoning Masterplan are located in close proximity to the rail line and in this regard there is a potential for rail noise impacts on future sensitive receptors in the proposed residential land parcels that are located near the rail line.

However, it is also noteworthy that sections of the rail line are in cut where it crosses the site although much of the rail line is exposed at grade, i.e. is at a similar level to the surrounding land as the rail line crosses the site. This would give rise to variations in the apparent noise levels in different areas of the site associated with train pass-bys on the rail line.

Any future residential dwellings proposed to be constructed on lots located in close proximity to the rail line will need to be assessed by a suitably qualified acoustician to ensure that the properties are designed and constructed in accordance with *NSW DoP document- "Development near Rail Corridors and Busy Roads" – Interim Guideline* to achieve acceptable internal noise amenity.

### 7.2 Traffic Noise Impact on Existing Noise Sensitive Receptors

Noise modelling has been undertaken to assess the potential noise impacts on existing noise sensitive receptors, associated with vehicle movements along Hart Road, Main Street (North of the Hunter Expressway), McLeod Road/Heddon Street and the Hunter Expressway (between Allandale Road and Lang Street). The noise model has taken into account all the sources associated with traffic that may be generated in due course in association with the proposed Hydro Aluminium Land Rezoning Masterplan, to determine the cumulative noise levels in the area.

The CoRTN method predicts the  $L_{A10}$  statistics. In order to convert the noise descriptor data from  $L_{A10}$  noise levels to  $L_{Aeq}$  noise levels, Vipac has used a 3dB constant to determine the  $L_{Aeq}$  levels. The results of the noise predictions associated with the Hydro Aluminium Land Rezoning Masterplan are presented in **Table 15** and **Table 16**.

**Table 15: Cumulative Traffic Noise Impact (dBA) – Day Period**

| Location                                                                       | Day Period                  |                                                         |                                                          |                                                          | Criteria (Day Period)     |
|--------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|---------------------------|
|                                                                                | Base Traffic Flow           | Base Traffic Flow + Proposed development traffic (75Ha) | Base Traffic Flow + Proposed development traffic (120Ha) | Base Traffic Flow + Proposed development traffic (200Ha) |                           |
| Main Street (11 Young Street, Heddon Greta)                                    | L <sub>eq,15hour</sub> 69.8 | L <sub>eq,15hour</sub> 71.1                             | L <sub>eq,15hour</sub> 71.3                              | L <sub>eq,15hour</sub> 71.6                              | L <sub>eq,15hour</sub> 60 |
| Hart Road (South of Hunter Expressway) (7 Currangwong Close, Weston)           | L <sub>eq,15hour</sub> 55.0 | L <sub>eq,15hour</sub> 57.0                             | L <sub>eq,15hour</sub> 58.5                              | L <sub>eq,15hour</sub> 58.5                              | L <sub>eq,15hour</sub> 60 |
| Heddon Street (7 Heddon Street)                                                | L <sub>eq,1hour</sub> 63.0  | L <sub>eq,1hour</sub> 64.9                              | L <sub>eq,1hour</sub> 64.9                               | L <sub>eq,1hour</sub> 64.9                               | L <sub>eq,1hour</sub> 55  |
| Hunter Expressway (West of Hart Road) (103 Bishops Bridge Road, Sawyers Gully) | L <sub>eq,15hour</sub> 55.6 | L <sub>eq,15hour</sub> 57.8                             | L <sub>eq,15hour</sub> 58.2                              | L <sub>eq,15hour</sub> 58.8                              | L <sub>eq,15hour</sub> 60 |

**Table 16: Cumulative Traffic Noise Impact (dBA) – Night Period**

| Location                                                                       | Day Period                 |                                                         |                                                          |                                                          | Criteria (Night Period)   |
|--------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|---------------------------|
|                                                                                | Base Traffic Flow          | Base Traffic Flow + Proposed development traffic (75Ha) | Base Traffic Flow + Proposed development traffic (120Ha) | Base Traffic Flow + Proposed development traffic (200Ha) |                           |
| Main Street (11 Young Street, Heddon Greta)                                    | L <sub>eq,9hour</sub> 59.5 | L <sub>eq,9hour</sub> 61.1                              | L <sub>eq,9hour</sub> 61.3                               | L <sub>eq,9hour</sub> 61.7                               | L <sub>eq,15hour</sub> 55 |
| Hart Road (South of Hunter Expressway) (7 Currangwong Close, Weston)           | L <sub>eq,9hour</sub> 46.2 | L <sub>eq,9hour</sub> 48.8                              | L <sub>eq,9hour</sub> 48.8                               | L <sub>eq,9hour</sub> 48.8                               | L <sub>eq,15hour</sub> 55 |
| Heddon Street (7 Heddon Street)                                                | L <sub>eq,1hour</sub> 59.3 | L <sub>eq,1hour</sub> 61.3                              | L <sub>eq,1hour</sub> 61.3                               | L <sub>eq,1hour</sub> 61.3                               | L <sub>eq,1hour</sub> 50  |
| Hunter Expressway (West of Hart Road) (103 Bishops Bridge Road, Sawyers Gully) | L <sub>eq,9hour</sub> 51.2 | L <sub>eq,9hour</sub> 50.3                              | L <sub>eq,9hour</sub> 52.2                               | L <sub>eq,9hour</sub> 52.7                               | L <sub>eq,15hour</sub> 55 |

The predicted existing and future traffic noise levels associated with all the potential development scenarios associated with the Land Rezoning Masterplan, at receivers along Hart Road (South of the Hunter Expressway) and the Hunter Expressway (West of Hart Road) comply with the daytime and night-time noise criteria. However the predicted existing road traffic noise levels at receivers along Main Street, McLeod Road/Heddon Street are raised above the daytime and night-time noise criteria. As stated in Section 3.4 of the Road Noise Policy, with regard to existing residences and other sensitive land uses affected by additional traffic on existing roads, generated by land use development, any increase in total traffic noise level should be limited to 2dB above that of the corresponding existing noise level at any residential property.

**Table 17** shows the noise level difference between the existing and future traffic noise level associated with each of the proposed development stages associated with the Hydro Aluminium Land Rezoning Masterplan.

**Table 17: Difference between Existing and Future Traffic Noise Levels**

| Location                                       | Day Period                                              |                                                          |                                                          | Night Period                                            |                                                          |                                                          |
|------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
|                                                | Base Traffic Flow + Proposed development traffic (75Ha) | Base Traffic Flow + Proposed development traffic (120Ha) | Base Traffic Flow + Proposed development traffic (200Ha) | Base Traffic Flow + Proposed development traffic (75Ha) | Base Traffic Flow + Proposed development traffic (120Ha) | Base Traffic Flow + Proposed development traffic (200Ha) |
| Main Street<br>(11 Young Street, Heddon Greta) | 1.3                                                     | 1.5                                                      | 1.8                                                      | 1.6                                                     | 1.8                                                      | 2.2                                                      |
| Heddon Street<br>(7 Heddon Street)             | 1.9                                                     | 1.9                                                      | 1.9                                                      | 2.0                                                     | 2.0                                                      | 2.0                                                      |

As shown in **Table 17**, the traffic noise levels that would be generated in association with the Land Rezoning Masterplan proposed development will be expected to be within +2dB of the existing road traffic noise levels at all of the noise sensitive receivers during day and night-time periods provided the traffic generated by the proposed development is within the traffic volumes outlined in **Table 12** to **Table 14**.

The predicted noise impact associated with the Hydro Aluminium Land Rezoning Masterplan development would comply with the Road Noise Policy criteria. It should be noted that the difference between the existing and future noise levels should be rounded up to the nearest whole number, then compared with the noise criteria.

### 7.3 Traffic Noise Impact on Proposed Residential Development

Noise modelling has also been undertaken to assess the potential noise impacts on future noise sensitive receptors, associated with vehicle movements on Hart Road, Main Street (North of the Hunter Expressway), McLeod Road, Heddon Street and the Hunter Expressway (between Allandale Road and Lang Street) on the proposed Northern, Central and Southern Precinct Residential areas. The noise model has taken into account all the sources associated with traffic that may be generated in due course in association with the proposed Hydro Aluminium Land Rezoning Masterplan, to determine the cumulative noise levels in the area.

In the absence external noise criteria for new development near existing roads, Vipac has used the most relevant criteria detailed in NSW Road Noise Policy (RNP) as indicative noise limits to determine external noise exposure to the residences. The indicative noise criteria are outlined in **Table 8** of this report.

The potential traffic noise impact on the future residential areas was modelled to assess the potential worst-case scenario, which is representative of the potential cumulative volume of traffic in the area, that may arise in the event that the proposed Land Rezoning Application proposals are developed in future years, comprising of proposed residential precincts and the 200ha employment land development.

Based on the noise contour maps presented in **Appendix B**, the predicted noise levels are expected to exceed the applicable criteria on the proposed future residential lots facing Main Street (Northern Precinct Residential Land Parcels in the Land Rezoning Masterplan) and the proposed future residential lots facing the Hunter Expressway (Southern Precinct Residential Land Parcels in the Land Rezoning Masterplan) by approximately 2-8dB during the day and night period. The affected lots facing Main Street (Northern Precinct area) and the Hunter Expressway (Southern Precinct area) are indicated in **Figure 4**.



**Figure 4: Lots exceeding noise criteria**

In order to reduce the noise levels to comply with the noise criteria, noise mitigation in the form of a noise bund or barrier along the lot boundaries and façade treatment on each of the affected individual lots will be required.

Vipac has undertaken additional noise prediction modelling to assess a mitigated scenario, taking into consideration the impacts associated with a noise bund/barrier of 2.0m in height along the lot property boundary. The results of the noise model for the mitigated scenario shows a reduction of 4-6dB with a 2.0-metre noise bund/barrier, as shown in **Appendix C**. Nevertheless with the installation of a noise bund/barrier, the predicted noise level is still expected to exceed the criteria by approximately 5dB. An excursion of +5dB in noise levels would be considered as clearly noticeable, whereas an increase of +3dB would only be just perceptible to the human ear. However, this would not render the proposed residential lots in the affected areas as unsuitable for residential development. It is common practice for noise exposure levels to be assessed and taken into account in residential development proposals and an excursion of +5dB with regard to external noise criteria can readily be attenuated by careful consideration of the design and layout for any future residential dwellings that may be constructed on the proposed residential lots.

Any future residential dwellings proposed to be constructed on the affected lots where the road traffic noise criteria are exceeded, will need to be designed and constructed in accordance with *NSW DoP document- "Development near Rail Corridors and Busy Roads" – Interim Guideline* to achieve acceptable internal noise amenity.

The extent of façade treatment may vary depending on the glazing area/floor area ratio in each room of any dwellings that may be developed in due course. However, individual property acoustic assessments are not applicable at this stage. It should be noted that the proposal at this point is limited to a Land Rezoning Application for the Hydro Aluminium Lands.

However, given the traffic noise levels outlined in this report and the proposed Land Rezoning Masterplan, it is Vipac's opinion that any façade treatment that may be required for properties that may ultimately be developed on the affected lots would be reasonably feasible and achievable and would not be unduly cost prohibitive.

In light of the above, an acoustic report should accompany Development Applications for residential dwellings in the proposed subdivision, including assessment and recommendation of acoustic measures incorporated into the respective designs and layout.

#### 7.4 Traffic Noise Impact - Sleep Disturbance

The CoRTN method predicts the  $L_{A10}$  statistics. To determine  $L_{Amax}$  parameter, Vipac used the constant between  $L_{Aeq}$  and  $L_{Amax}$  from sound power measurement of trucks to determine the  $L_{Amax}$  (+12dB). In order to convert the noise parameter of  $L_{A10}$  to  $L_{Aeq}$ , Vipac has used a 3dB constant to determine  $L_{Aeq}$ .

**Table 18** presents the predicted external noise level at the nearest receiver at Main Street, Hart Road, the Hunter Expressway and Heddon Street.

**Table 18: Predicted Noise Levels, External dB(A)**

| Location                                                                       | Day Period          |                                                         |                                                          |                                                          | Criteria (Night Period) |
|--------------------------------------------------------------------------------|---------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|-------------------------|
|                                                                                | Base Traffic Flow   | Base Traffic Flow + Proposed development traffic (75Ha) | Base Traffic Flow + Proposed development traffic (120Ha) | Base Traffic Flow + Proposed development traffic (200Ha) |                         |
| Main Street (11 Young Street, Heddon Greta)                                    | $L_{Amax,9hour}$ 72 | $L_{Amax,9hour}$ 73                                     | $L_{Amax,9hour}$ 73                                      | $L_{Amax,9hour}$ 74                                      | $L_{eq,15hour}$ 55      |
| Hart Road (South of Hunter Expressway) (7 Currangwong Close, Weston)           | $L_{Amax,9hour}$ 58 | $L_{Amax,9hour}$ 58                                     | $L_{Amax,9hour}$ 61                                      | $L_{Amax,9hour}$ 61                                      | $L_{eq,15hour}$ 55      |
| Heddon Street (7 Heddon Street)                                                | $L_{Amax,1hour}$ 71 | $L_{Amax,1hour}$ 73                                     | $L_{Amax,1hour}$ 73                                      | $L_{Amax,1hour}$ 73                                      | $L_{eq,1hour}$ 50       |
| Hunter Expressway (West of Hart Road) (103 Bishops Bridge Road, Sawyers Gully) | $L_{Amax,9hour}$ 63 | $L_{Amax,9hour}$ 62                                     | $L_{Amax,9hour}$ 64                                      | $L_{Amax,9hour}$ 65                                      | $L_{eq,15hour}$ 55      |

Typically building façades exposed to a road are generally closed structures (including doors and windows) which provide a degree of attenuation (in the order of 20dB) to the inside amenity of the building. The corresponding internal noise levels that would be expected for a property that may be developed on any of the affected lots illustrated in **Figure 4**, are presented in **Table 19**, taking into account the expected level of noise reduction for external to internal areas of a property.

**Table 19: Predicted Noise Levels, Internal dB(A)**

| Location                                                                             | Night Period               |                                                        |                                                         |                                                         | Criteria<br>(Night Period) |
|--------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|----------------------------|
|                                                                                      | Base Traffic Flow          | Base Traffic Flow +Proposed development traffic (75Ha) | Base Traffic Flow +Proposed development traffic (120Ha) | Base Traffic Flow +Proposed development traffic (200Ha) |                            |
| Main Street<br>(11 Young Street, Heddon Greta)                                       | L <sub>Amax,9hour</sub> 52 | L <sub>Amax,9hour</sub> 53                             | L <sub>Amax,9hour</sub> 53                              | L <sub>Amax,9hour</sub> 54                              | L <sub>eq,15hour</sub> 55  |
| Hart Road (South of Hunter Expressway)<br>(7 Currangwong Close, Weston)              | L <sub>Amax,9hour</sub> 38 | L <sub>Amax,9hour</sub> 38                             | L <sub>Amax,9hour</sub> 41                              | L <sub>Amax,9hour</sub> 41                              | L <sub>eq,15hour</sub> 55  |
| Heddon Street<br>(7 Heddon Street)                                                   | L <sub>Amax,1hour</sub> 51 | L <sub>Amax,1hour</sub> 53                             | L <sub>Amax,1hour</sub> 53                              | L <sub>Amax,1hour</sub> 53                              | L <sub>eq,1hour</sub> 50   |
| Hunter Expressway<br>(West of Hart Road)<br>(103 Bishops Bridge Road, Sawyers Gully) | L <sub>Amax,9hour</sub> 43 | L <sub>Amax,9hour</sub> 42                             | L <sub>Amax,9hour</sub> 44                              | L <sub>Amax,9hour</sub> 45                              | L <sub>eq,15hour</sub> 55  |

The internal noise levels on existing noise sensitive receptors are predicted to be below the maximum internal noise levels, which is unlikely to cause awakening reaction to the occupants.

The predicted noise level is approximately L<sub>eq,9hour</sub> 60 dB(A) at the property boundaries for the proposed future residential lots that may be impacted by traffic noise (i.e. the potentially affected lots facing Main Street [Northern Precinct area] and the Hunter Expressway [Southern Precinct area], illustrated in **Figure 4**). This would correlate with an expected noise level of L<sub>Amax</sub> 52 dB internally. Therefore, the internal noise levels that are likely to be apparent within properties in the proposed residential areas, would be unlikely to cause sleep disturbance impacts.

## 8 CONCLUSION

Vipac Engineers and Scientists Ltd (Vipac) has completed a noise impact assessment for the proposed Land Rezoning Masterplan for the Hydro Aluminium lands at Kurri Kurri. Noise levels associated with the proposed employment development (Heavy Industrial, Light Industrial and Business Park) and potential impacts on nearby noise sensitive receptors (located in the surrounding area and proposed residential properties in the residential land parcels) will be required to comply with the Project Specific Noise Levels detailed in **Table 6** and sleep disturbance criteria detailed in **Table 7**, determined on the basis of the baseline noise surveys.

There is a potential for rail noise impacts on future residential properties that may be developed in the proposed residential land parcels located in proximity to the existing South Maitland Railway line which crosses the Hydro Aluminium site. However, based on the existing frequency of use of the rail line, it is not anticipated that the potential rail impacts would impede significantly on the proposed Land Rezoning Masterplan.

However, it will be necessary to conduct an acoustic assessment for any future residential dwellings that may be constructed on lots located in close proximity to the rail line. The assessment should be undertaken by a suitably qualified acoustician in order to ensure that the properties are designed and constructed in accordance with *NSW DoP document- "Development near Rail Corridors and Busy Roads" – Interim Guideline* to achieve acceptable internal noise amenity, with regard to the external rail traffic noise exposure levels.

The predicted existing and cumulative future traffic noise levels associated with traffic volumes representative of the full development of the Land Rezoning proposals, at existing receivers along Hart Road (south of the Hunter Expressway) and in proximity to the Hunter Expressway (West of Hart Road) comply with the daytime and night-time noise criteria. However the predicted existing road traffic noise levels at receivers along Main Street and McLeod Road/Heddon Street are raised above the daytime and night-time noise criteria. As stated in Section 3.4 of the Road Noise Policy, with regard to existing residences and other sensitive land uses affected by additional traffic on existing roads, generated by land use development, any increase in total traffic noise level should be limited to 2dB above that of the corresponding existing noise level at any residential property.

As shown in **Table 17**, the traffic noise levels that would be generated in association with the Land Rezoning Masterplan proposed development will be expected to be within +2dB of the existing road traffic noise levels at all of the noise sensitive receivers during day and night-time periods provided the traffic generated by the proposed development is within the traffic volumes outlined in **Table 12** to **Table 14**. The predicted noise impact associated with the Hydro Aluminium Land Rezoning Masterplan development would comply with the Road Noise Policy criteria.

It is predicted that the potential traffic noise exposure that may arise in the event of the overall development of the Land Rezoning Masterplan, associated with the Residential Land Parcels and the 200Ha Employment Land areas, would be raised above the applicable noise criteria by approximately 5dB at a number of residential lots, taking into consideration a 2.0m noise bund/barrier. Notwithstanding the indicative external noise limits, future residential dwellings that may be constructed on the affected lots could comply with applicable internal noise criteria and will need to be designed and constructed in accordance with *NSW DoP document- "Development Near Rail Corridors and Busy Roads" – Interim Guideline* to achieve acceptable internal noise amenity, with regard to the external road traffic noise exposure levels.

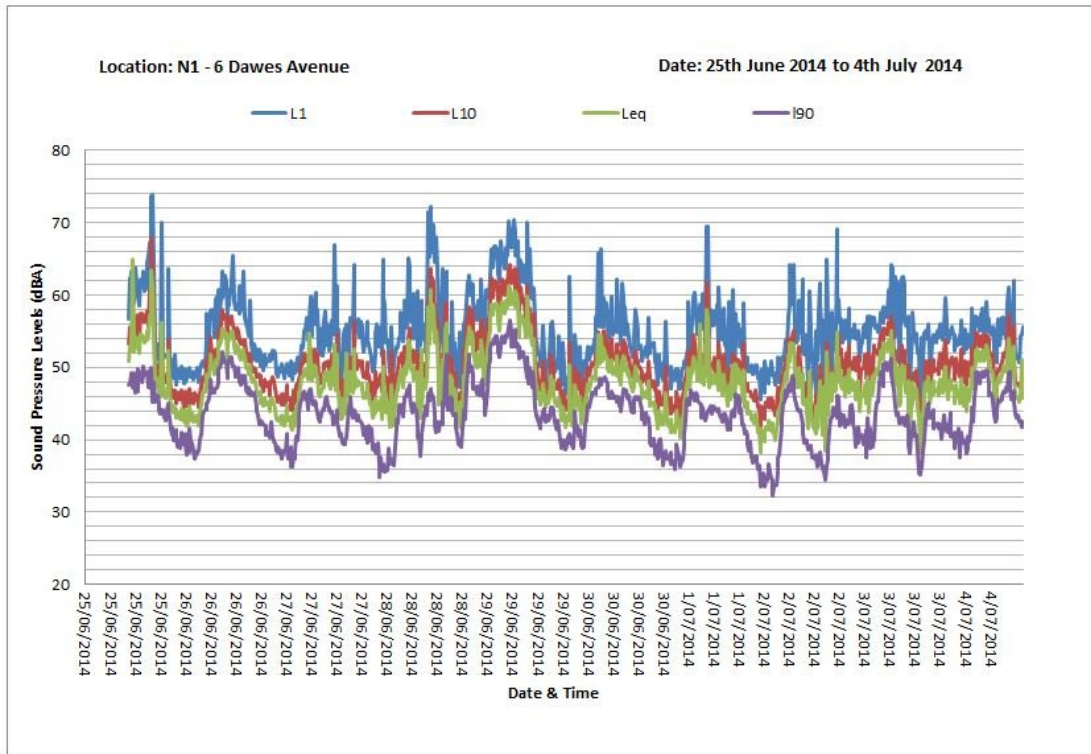
The internal noise levels on existing and proposed noise sensitive receptors associated with the potential traffic movements that may be generated in the area, in the event that the Land Rezoning Proposals are developed in full, are predicted to be below the maximum internal noise levels, which is unlikely to cause awakening reaction to the occupants and would be unlikely to cause sleep disturbance impacts.



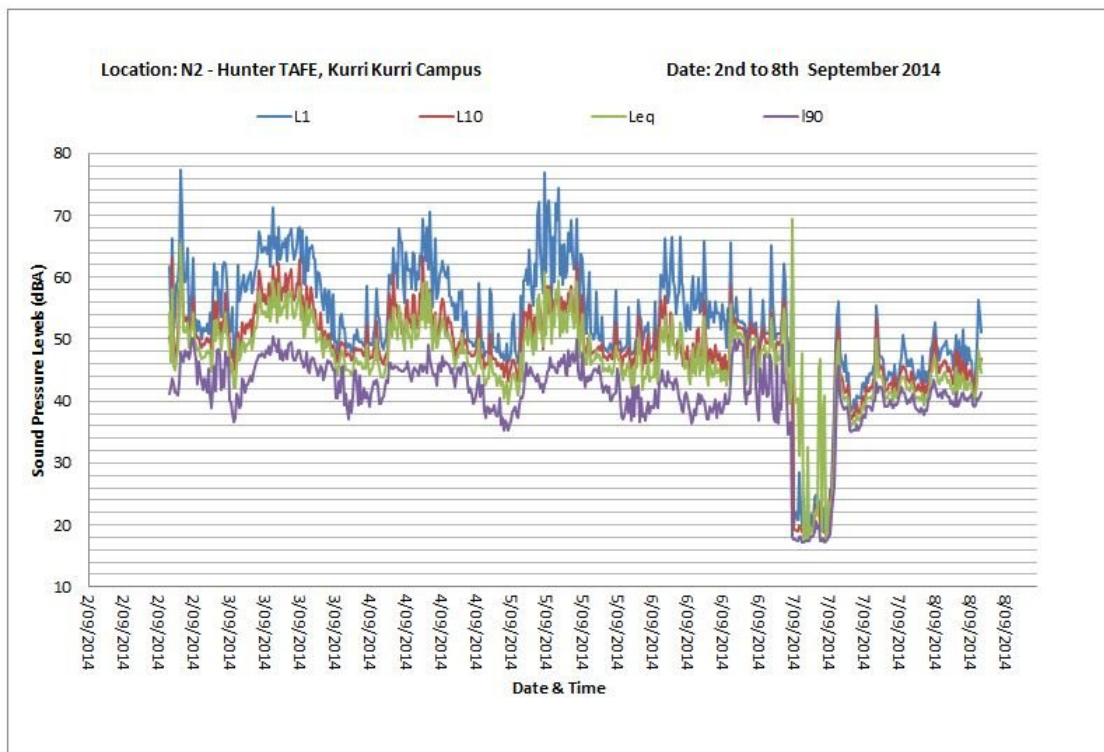
The proposed Land Rezoning Masterplan for the Hydro Aluminium lands at Kurri Kurri is therefore not considered likely to generate any significant noise impact on existing noise sensitive receptors located in the surrounding area. The findings of the noise impact assessment of the proposed Land Rezoning Masterplan also indicate that potential future noise sensitive receptors (i.e. future residential properties that may be developed on the proposed Residential Parcels of the Land Rezoning Masterplan) are not considered likely to experience any significant noise impacts. However, based on the results of the noise impact assessment, it is anticipated that a 2.0m noise bund/barrier is likely to be required in proximity to a number of potentially affected proposed future residential lots facing Main Street (Northern Precinct Residential Land Parcels) and proposed future residential lots facing the Hunter Expressway (Southern Precinct Residential Land Parcels).

Any development proposals for residential properties on the affected lots will be subject to a separate Development Application and Approvals process that should include an acoustic review by a suitably qualified acoustician of detailed designs for properties that may be developed in due course. This review will be required in order to ensure that satisfactory internal noise amenity criteria can be achieved within the properties.

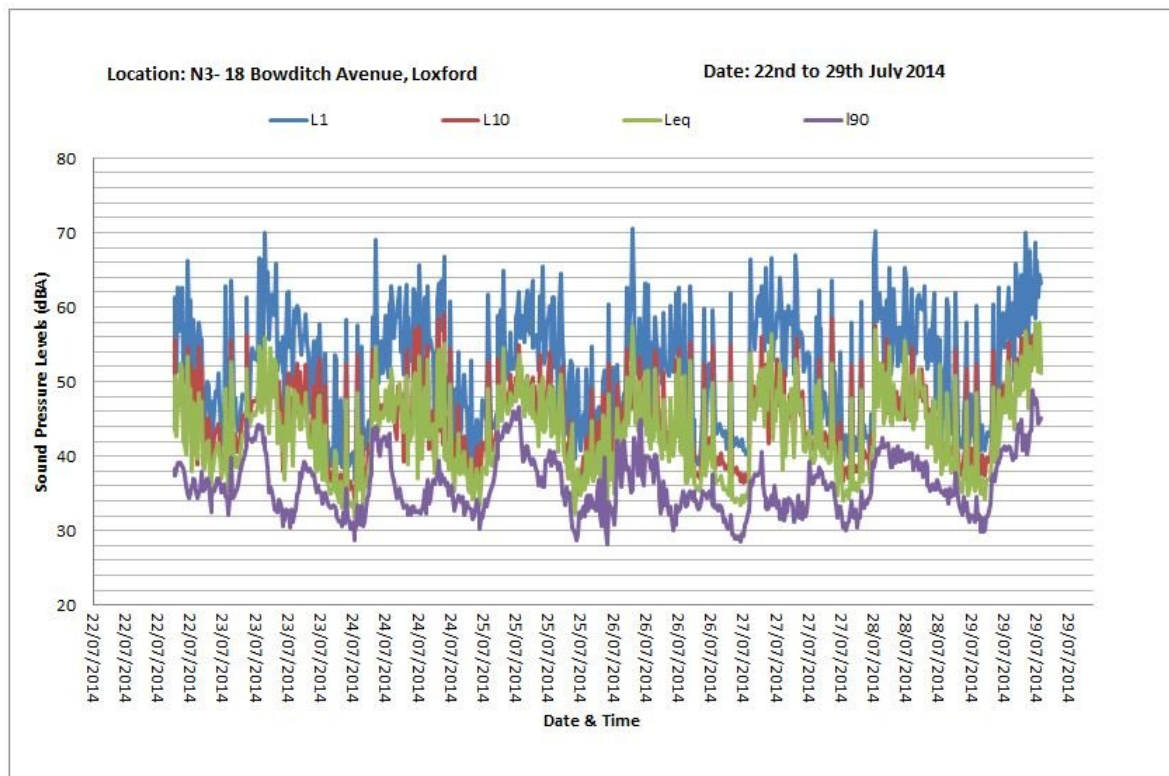
## Appendix A: NOISE LOGGING SURVEY- MEASUREMENT RESULTS



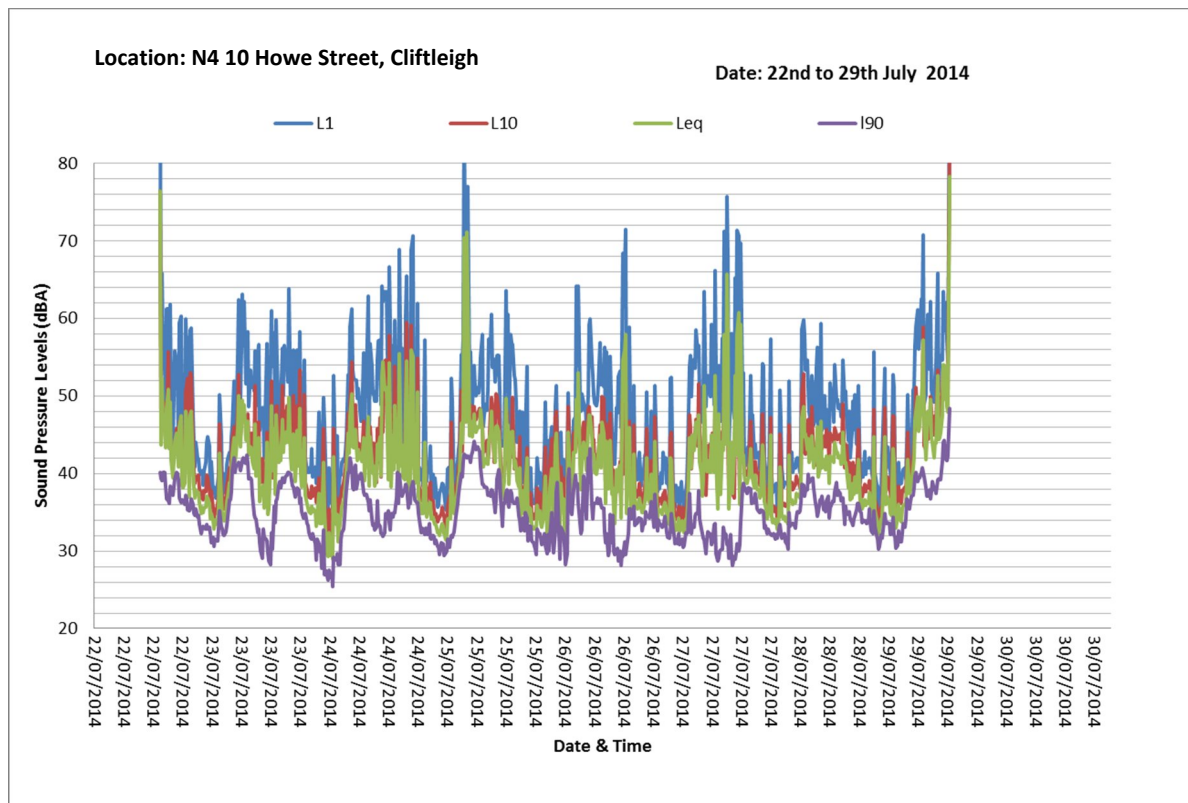
**Figure 5: Noise Logging Results – N1**



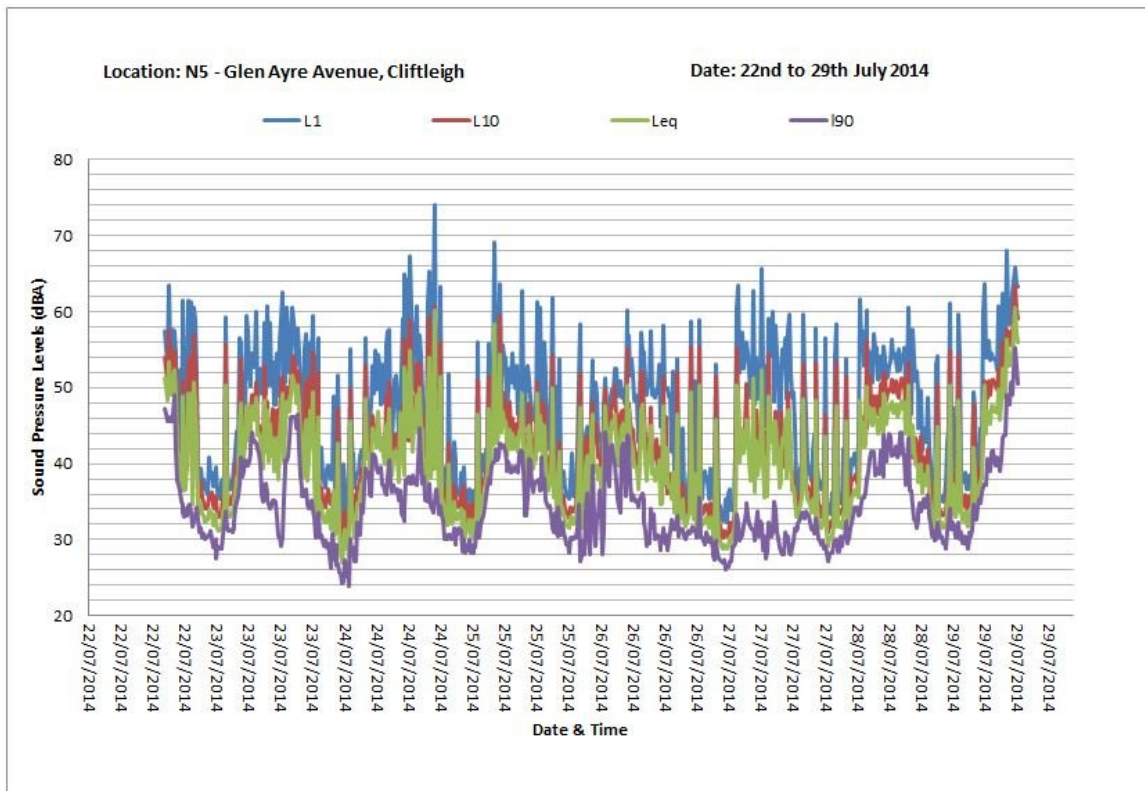
**Figure 6: Noise Logging Results – N2**



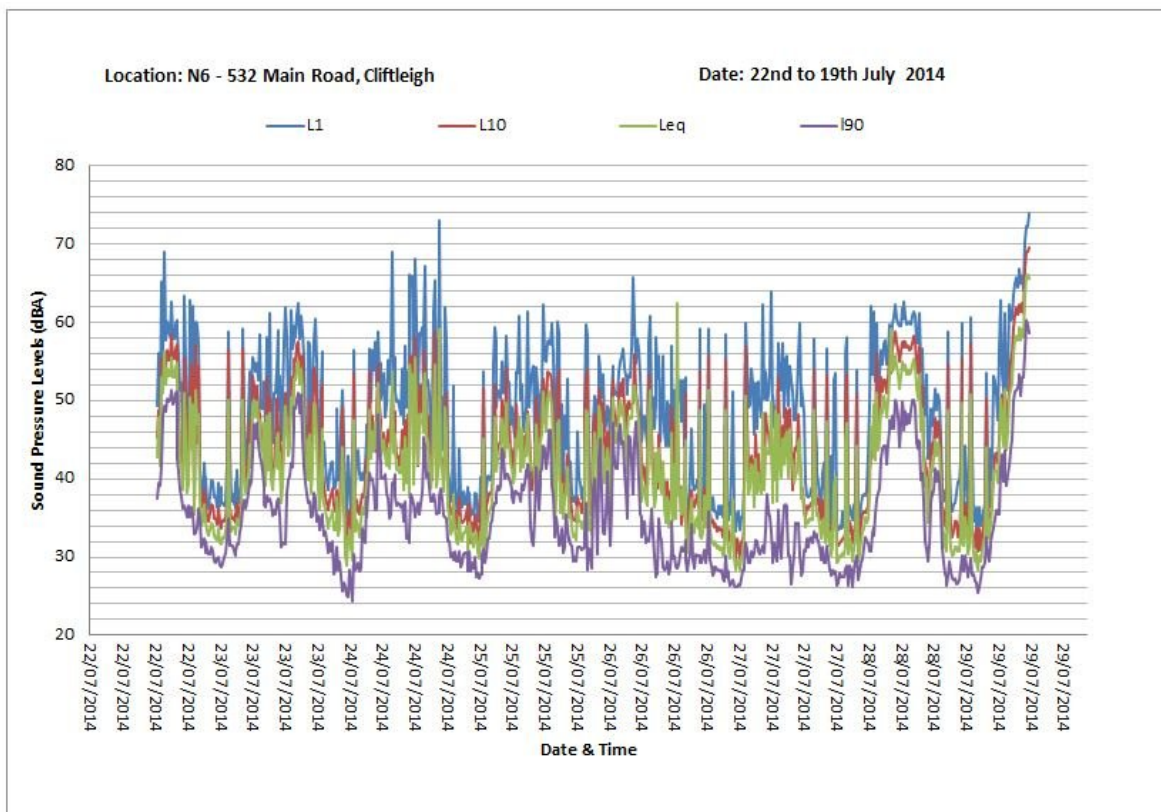
**Figure 7: Noise Logging Results – N3**



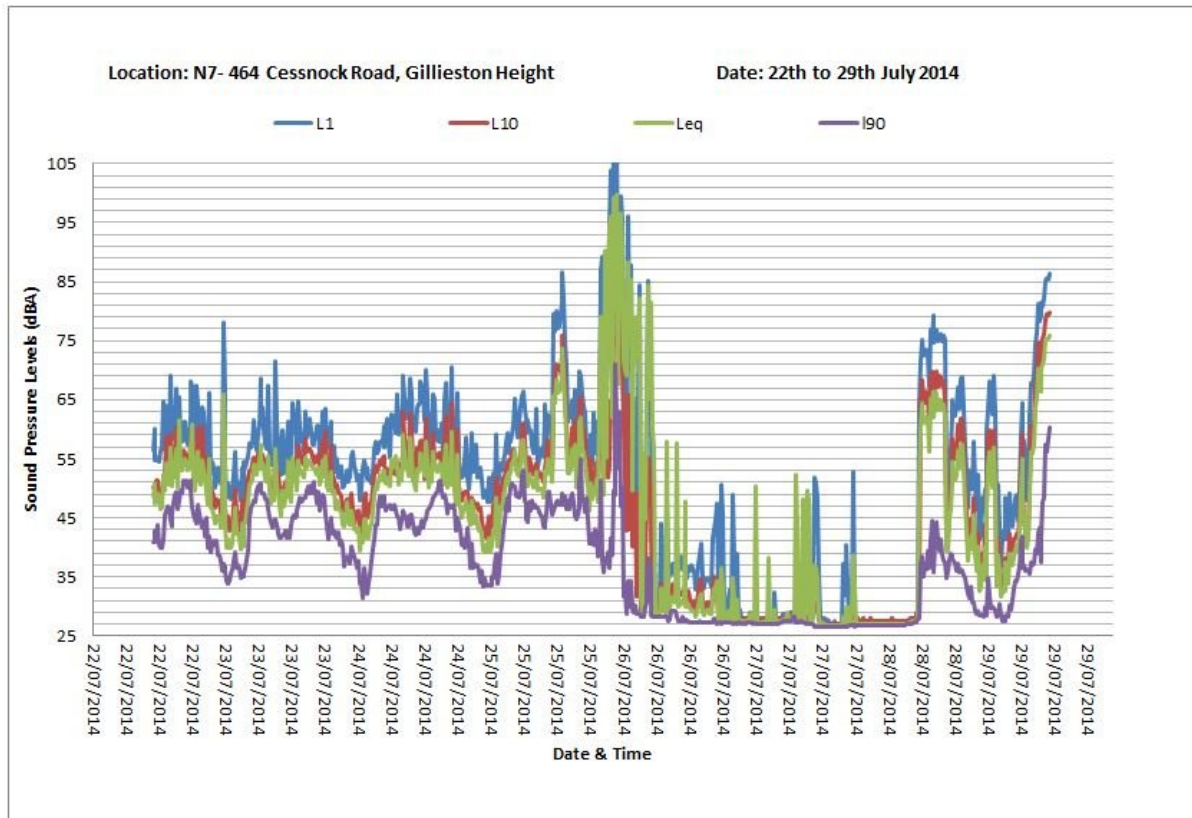
**Figure 8: Noise Logging Results – N4**



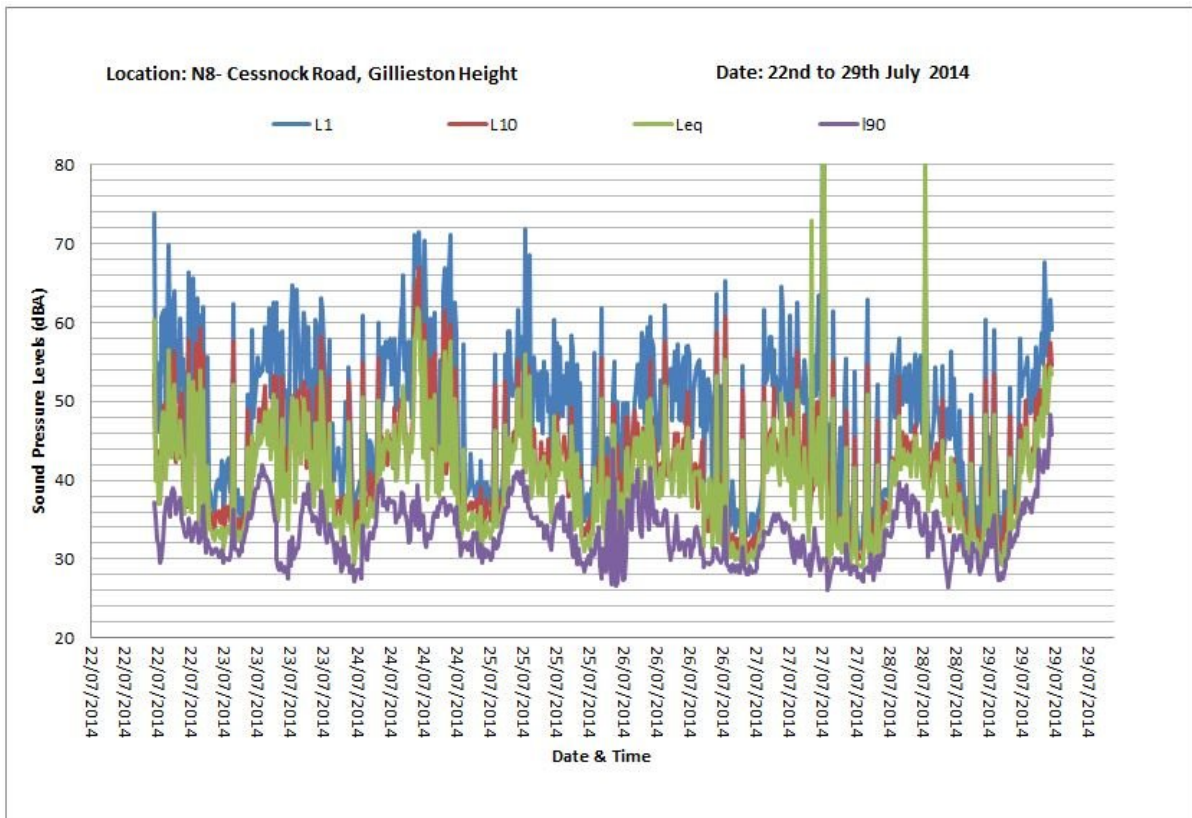
**Figure 9: Noise Logging Results – N5**



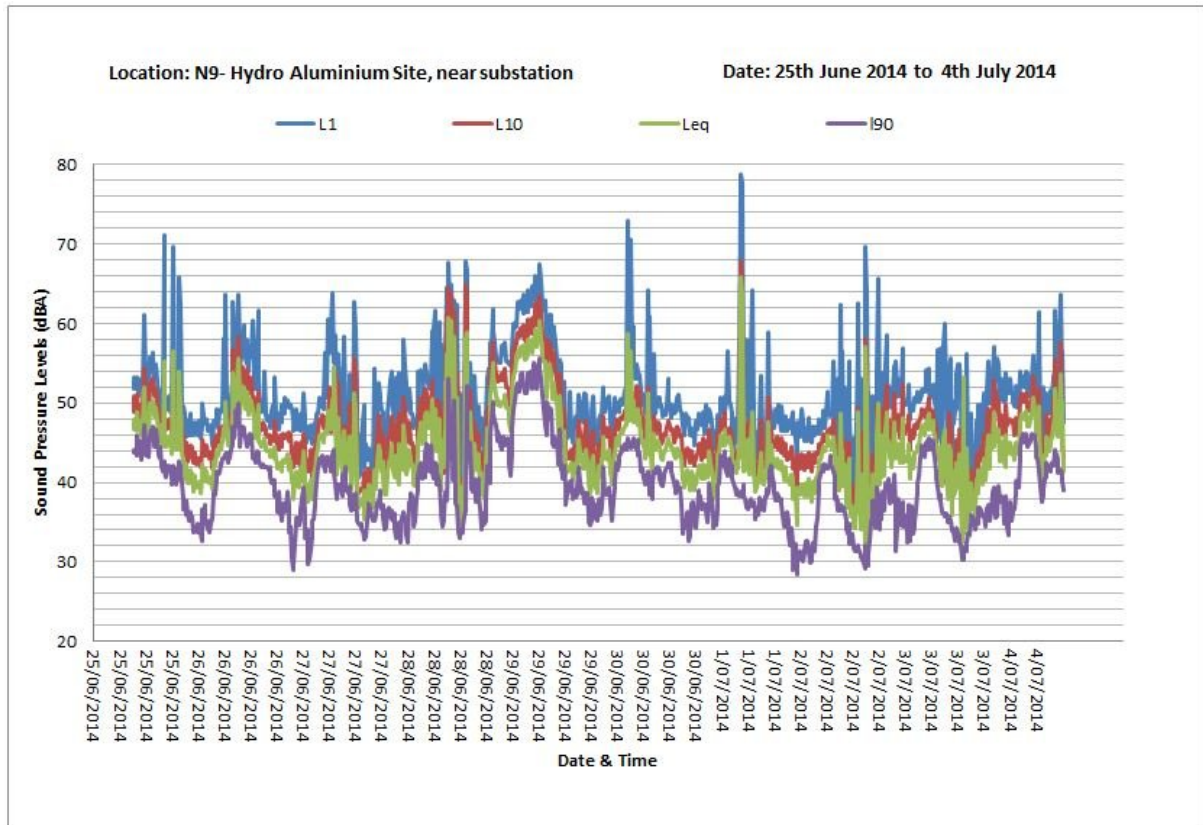
**Figure 10: Noise Logging Results – N6**



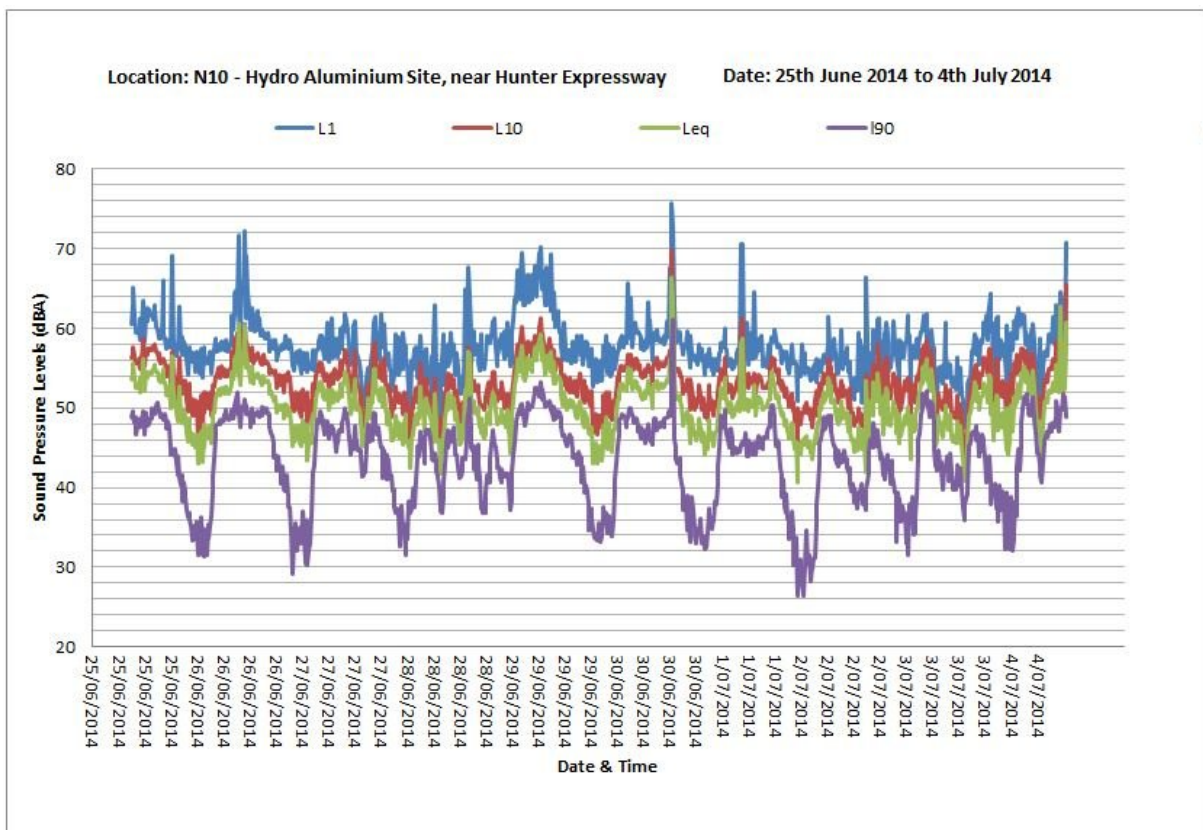
**Figure 11: Noise Logging Results – N7**



**Figure 12: Noise Logging Results – N8**

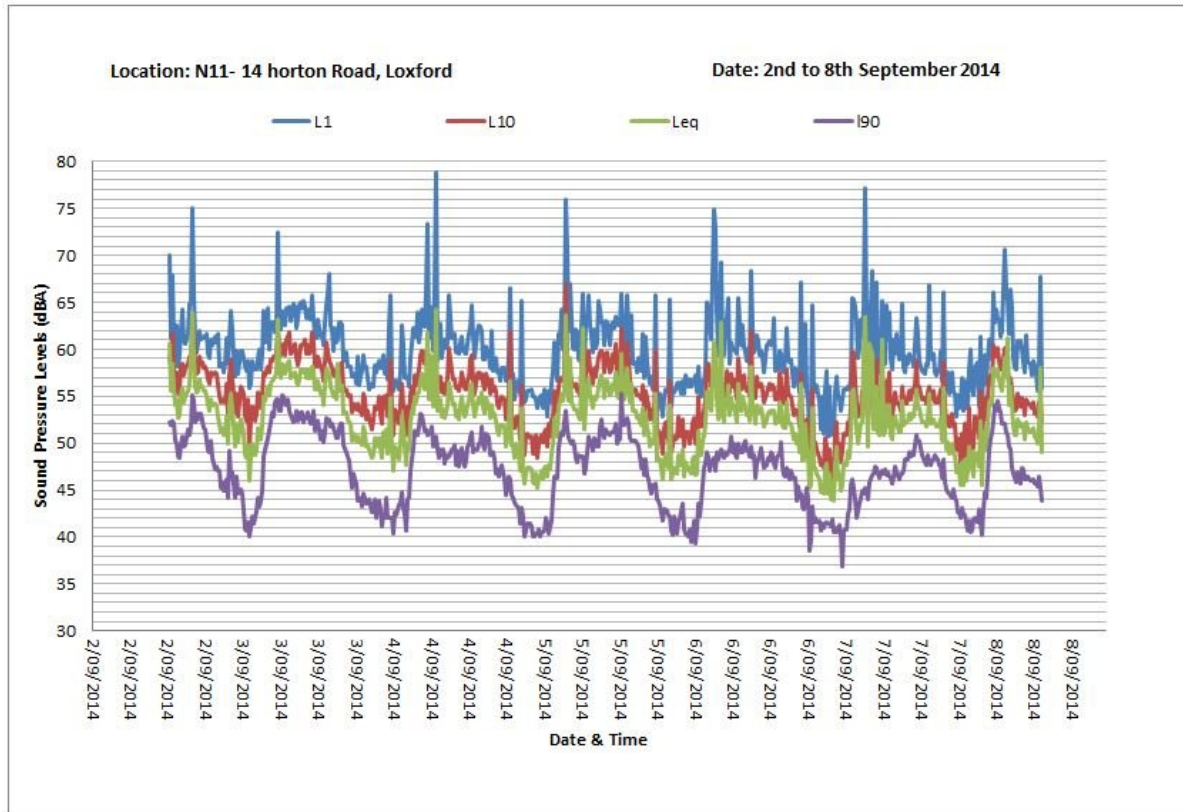


**Figure 13: Noise Logging Results – N9**

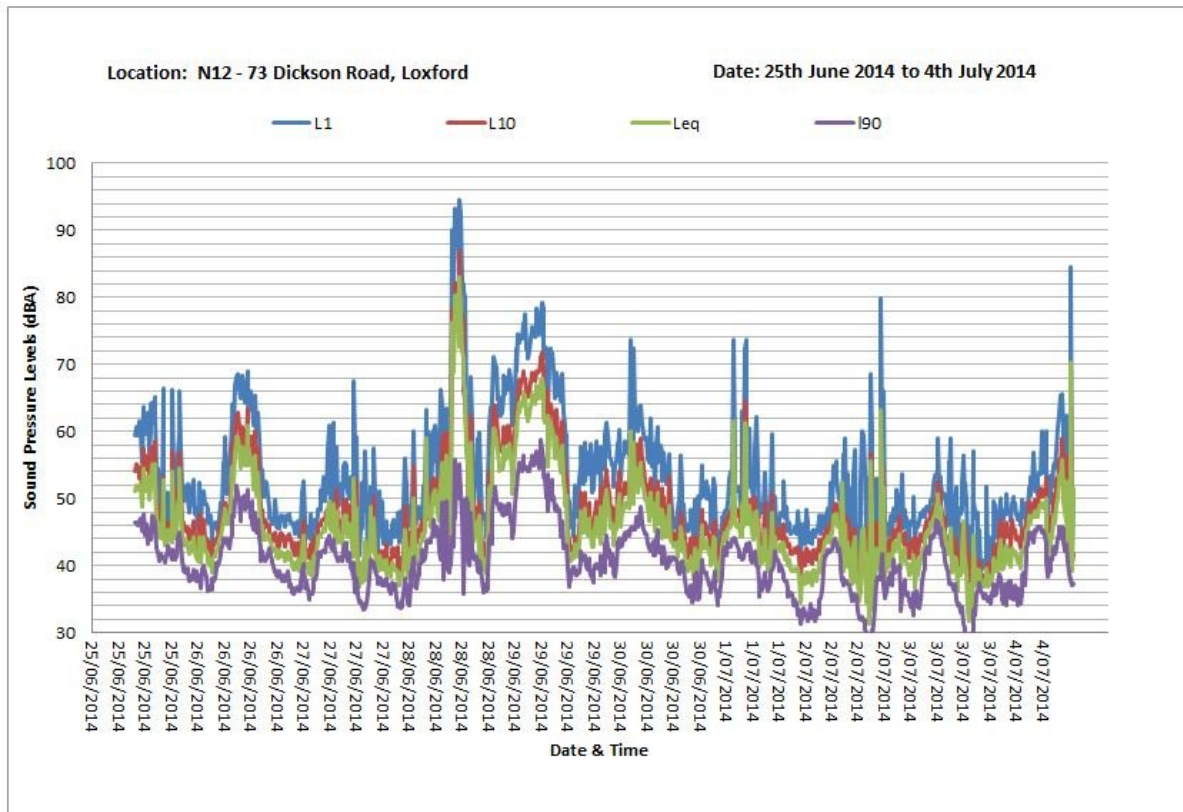


**Figure 14: Noise Logging Results – N10**

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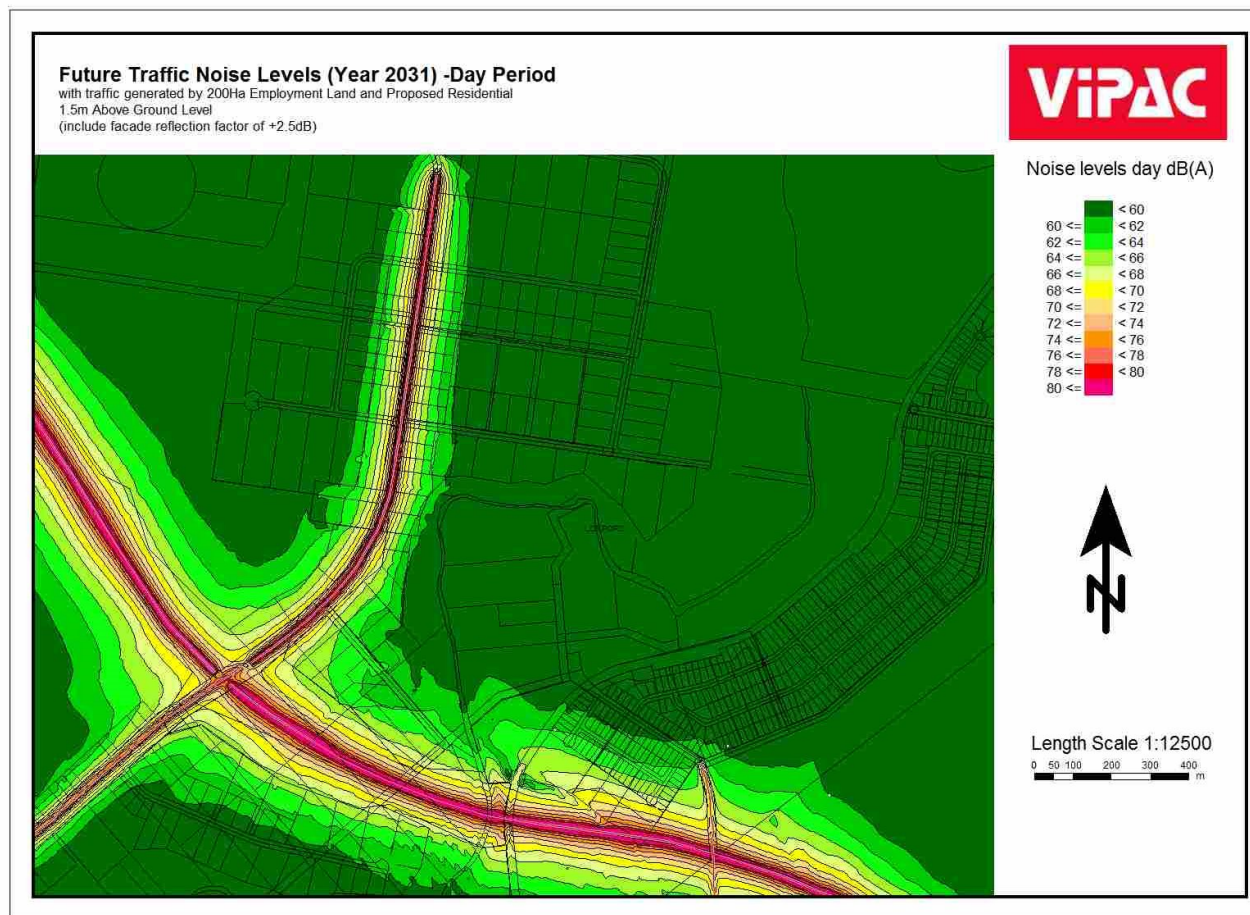


**Figure 15: Noise Logging Results – N11**



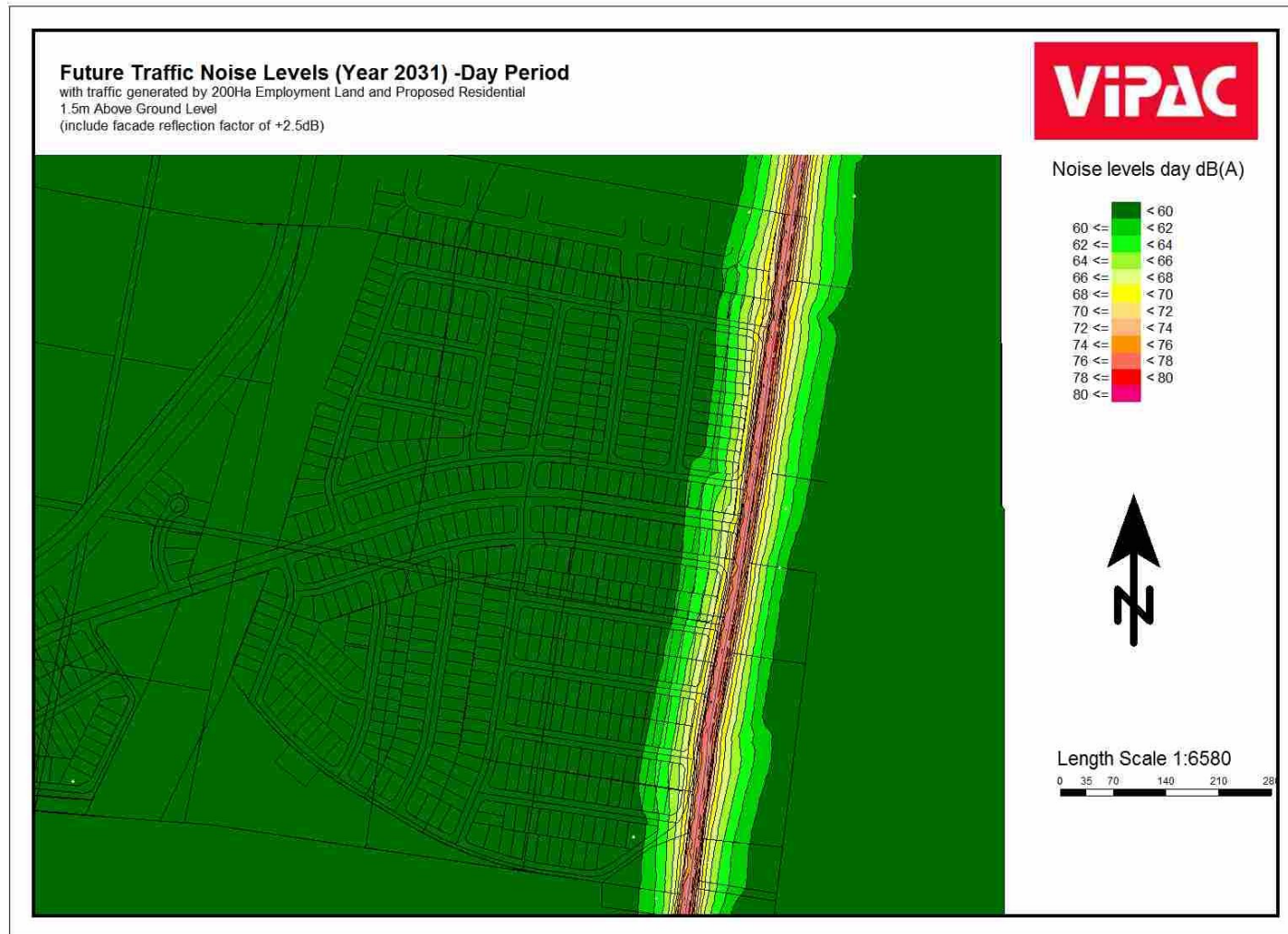
**Figure 16: Noise Logging Results – N12**

## Appendix B: NOISE CONTOUR MAPS (200HA EMPLOYMENT LAND + RESIDENTIAL)-YEAR 2031



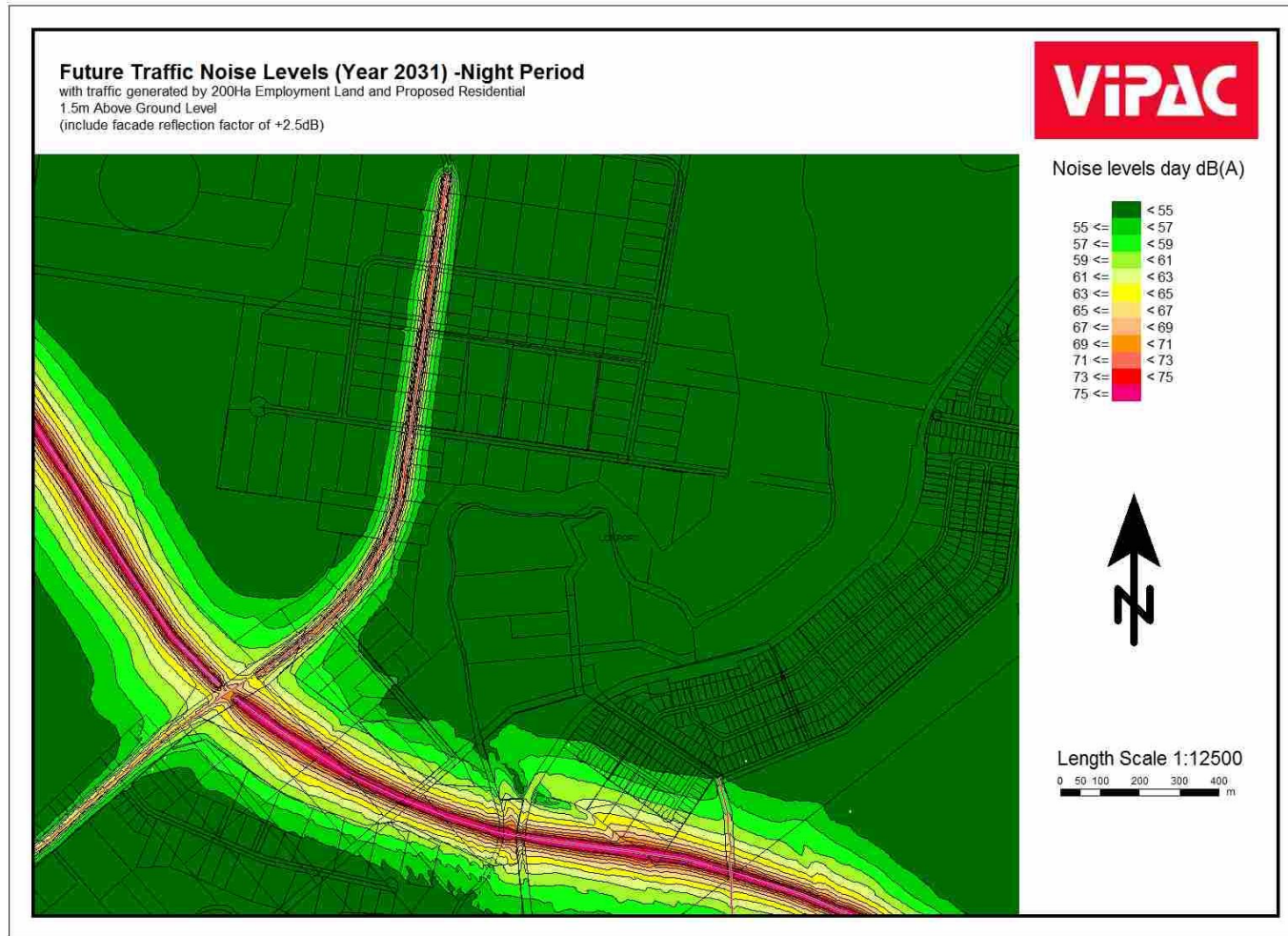
**Figure 17: Employment Land + Southern Residential Precinct (Day Period)**

27 Mar 2015



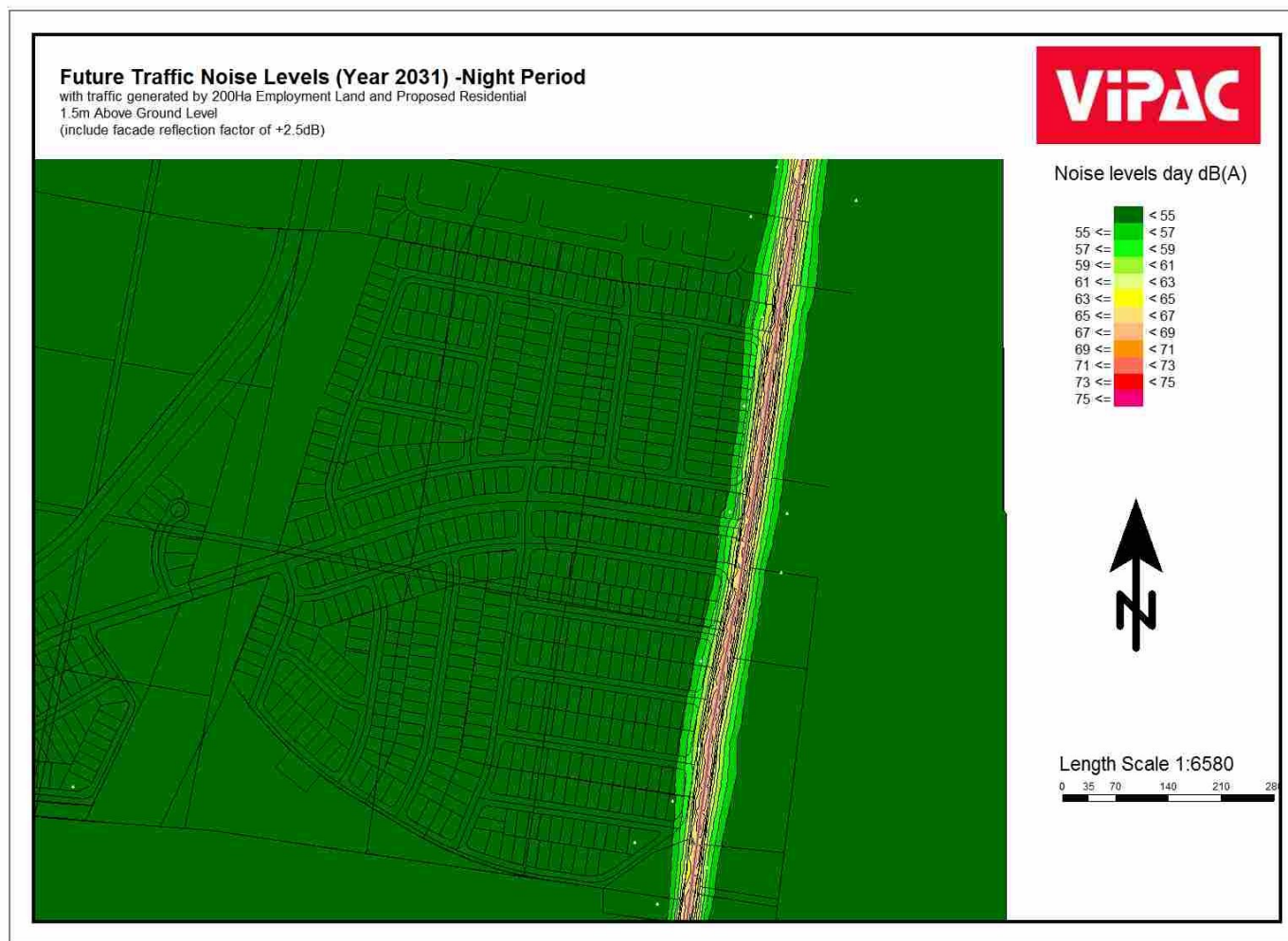
**Figure 18: Northern Residential Precinct (Day Period)**

27 Mar 2015



**Figure 19: Employment Land + Southern Residential Precinct (Night Period)**

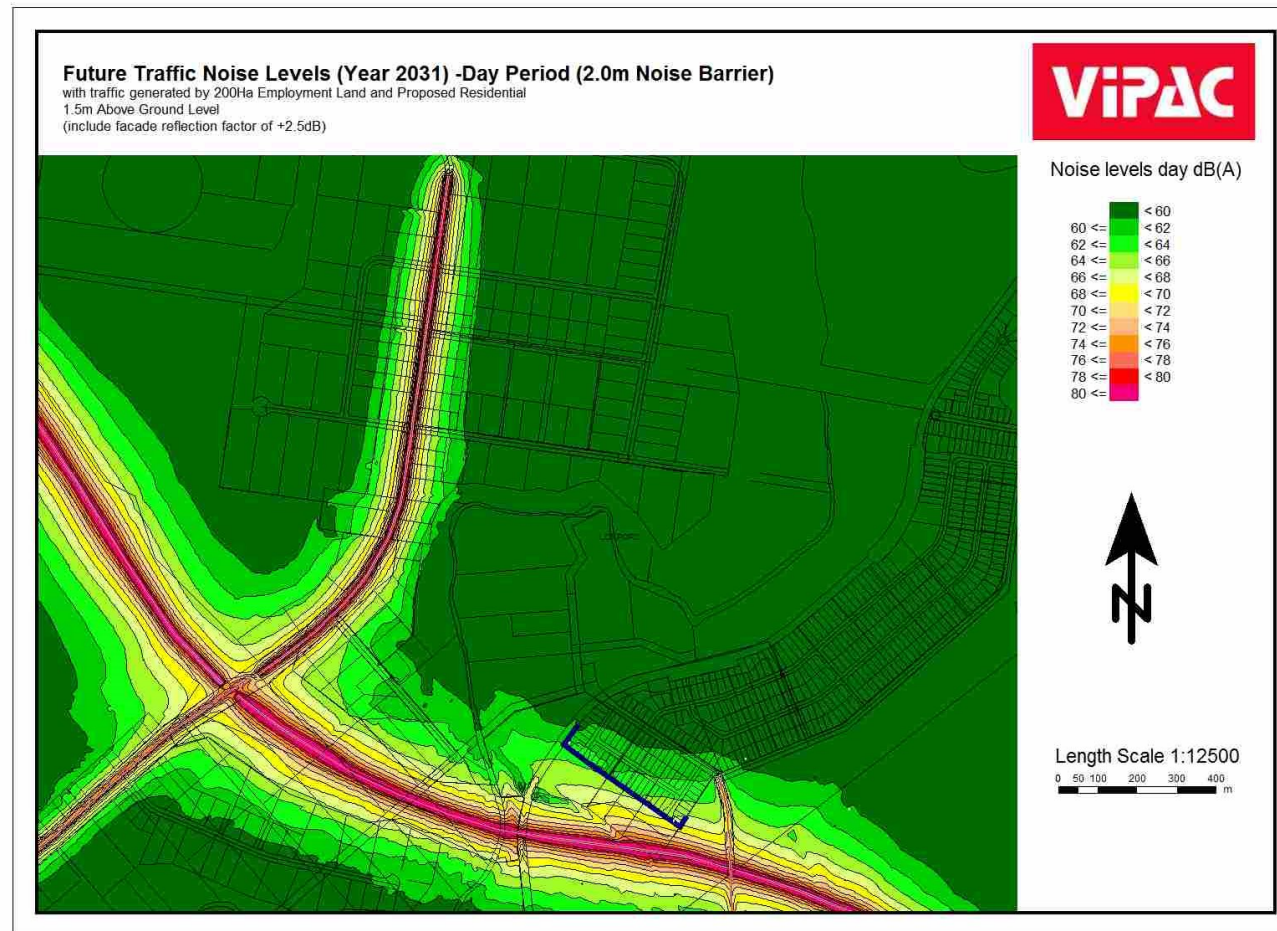
27 Mar 2015



**Figure 20: Northern Residential Precinct (Night Period)**

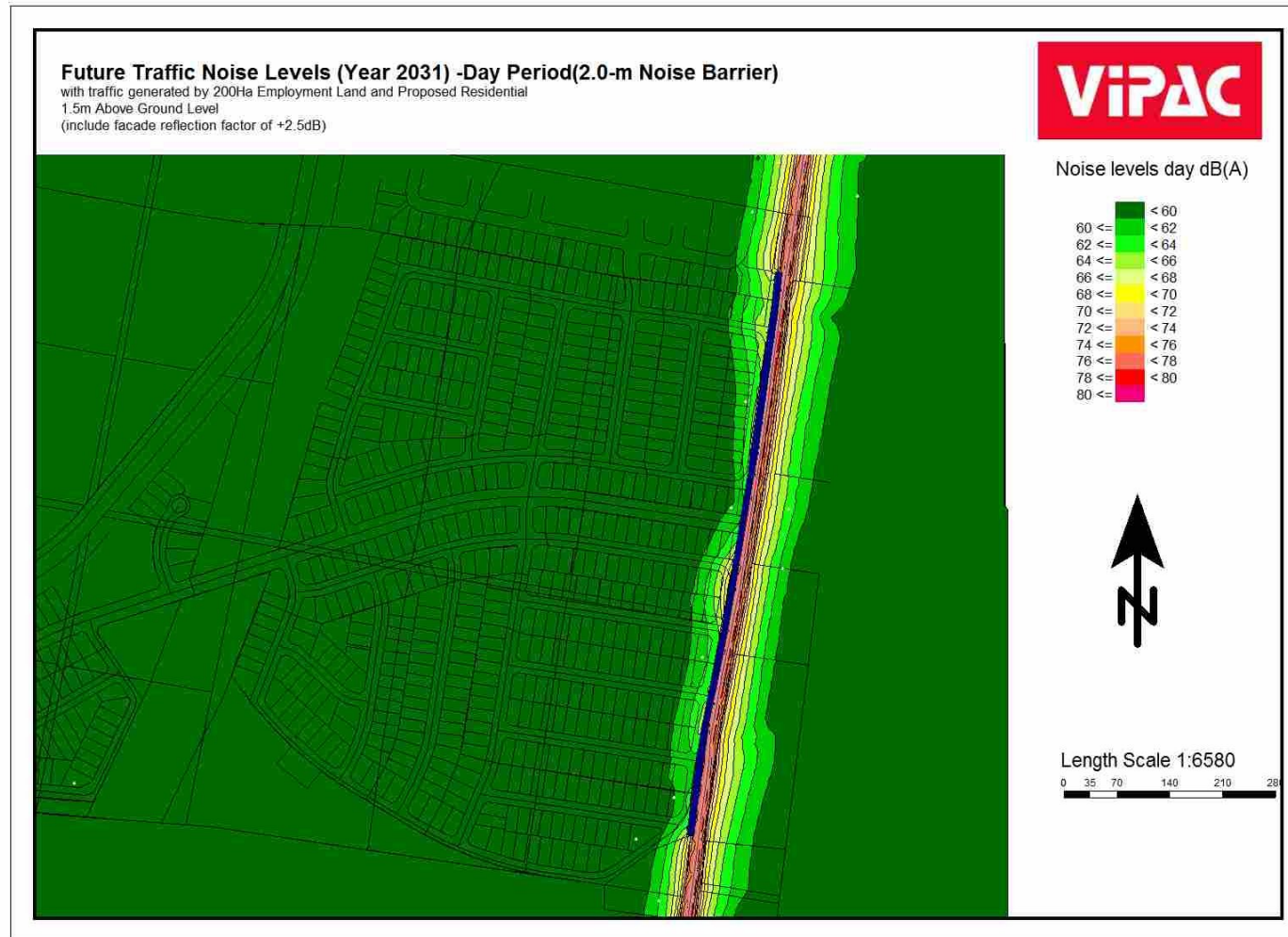
27 Mar 2015

## Appendix C: NOISE CONTOUR MAPS (200HA EMPLOYMENT LAND + RESIDENTIAL)-YEAR 2031 (WITH 2.0 NOISE BUND/BARRIER)



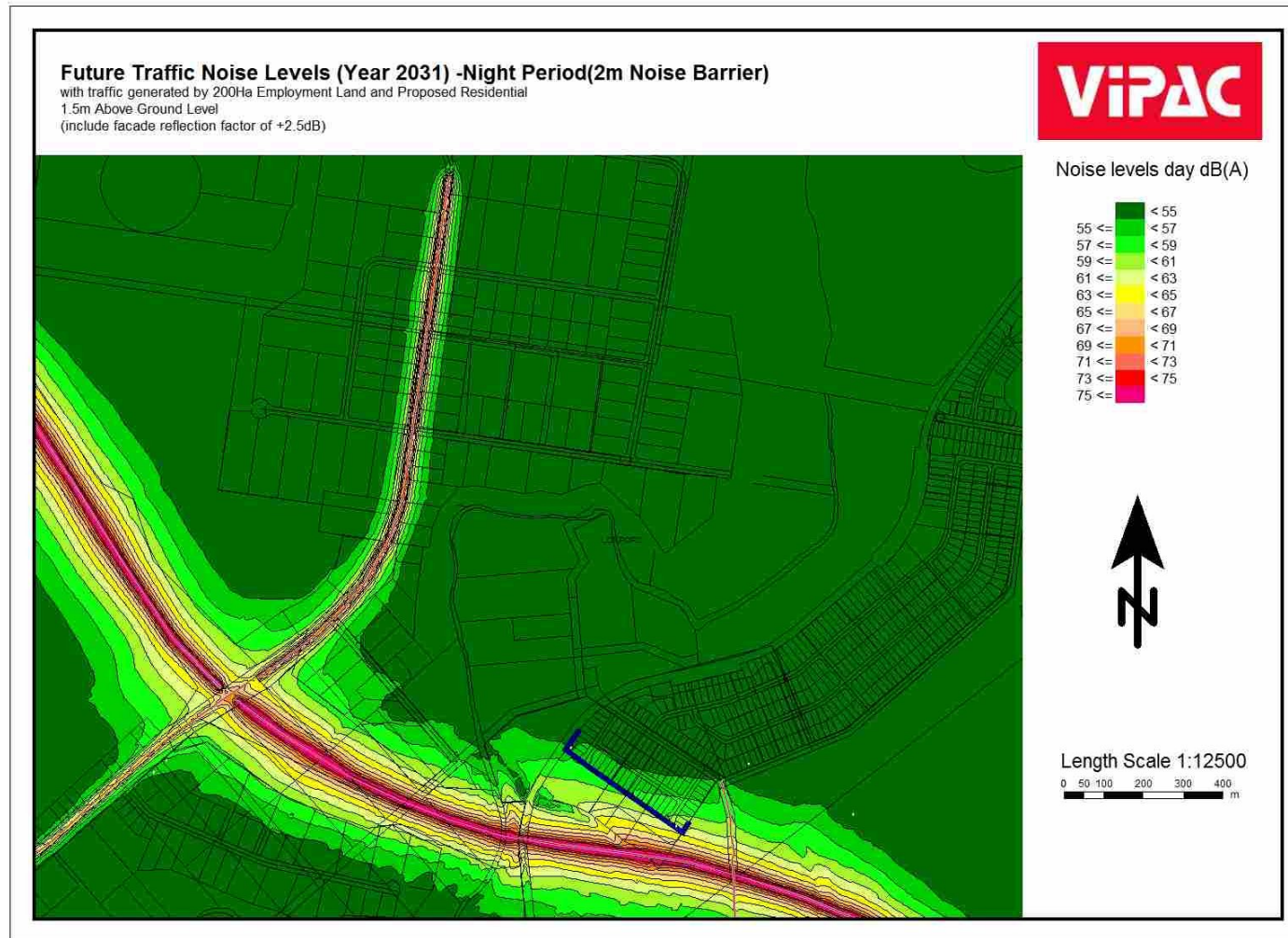
**Figure 21: Employment Land + Southern Residential Precinct (Day Period) - 2.0m Noise Bund/Barrier**

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**Figure 22: Northern Residential Precinct (Day Period) - 2.0m Noise Bund/Barrier**

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**Figure 23: Employment Land + Southern Residential Precinct (Night Period) - 2.0m Noise Bund/Barrier**

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**Figure 24: Northern Residential Precinct (Night Period) - 2.0m Noise Bund/Barrier**

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