RENZO TONIN RON RUMBLE
inspired to achieve

Consultants in Acoustics, Vibration & Structural Dynamics
email: Brisbane@renzotonin.com.au
website: www.renzotonin.com.au

RESIDENTIAL SUBDIVISION, TEVIOT DOWN ESTATE, PUB LANE, GREENBANK

NOISE IMPACT ASSESSMENT

Q8999-02F01 (REV1) FINAL ACOUSTIC REPORT.DOC

19 DECEMBER 2012

Prepared for:

Teviot Downs Estate Pty Ltd
c/-
RPS
743 Ann Street
Fortitude Valley Qld 4006

Attention: Julian Kemp

30 1982-2012 ACOUSTIC ENGINEERING EXCELLENCE

aaac Association of Australian Acoustical Consultants

Brisbane
Renzo Tonin Ron Rumble
A Division of Renzo Tonin & Associates (QLD) Pty Ltd
ABN 16 123 509 884
96 Petrie Terrace
PO Box 820 SPRING HILL, QLD 4004
Ph (07) 3367 3131 Fax (07) 3367 3121

Sydney (Head Office)
Melbourne
Gold Coast
Kuwait

DOCUMENT CONTROL

Date	Revision History	Non-Issued Revision	Issued Revision	Prepared By (initials)	Reviewed By (initials)	Authorised by (initials)
16/12/2012	Draft	-	0	DR	PJ	PJ
19/12/2012	Final	-	1	DR	PJ	PJ

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation noted by the initials printed in the last two columns above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for our Client's particular requirements which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

EXECUTIVE SUMMARY

Teviot Downs Estate Pty Ltd proposes to develop a residential subdivision on land situated at Pub Lane at Greenbank. The real property description is Lot 9968 on SP163061. The local authority is the Urban Land Development Authority (ULDA). The subject site was part of the former Beaudesert Shire Council but was transferred to Logan City Council (LCC) in March 2008.

The purpose of this report is to present an update of the previous December 2009 road and rail noise report to include the new development scheme and also to respond to an Information Request from the ULDA (Ref: DEV2012/284).

Based upon the analysis presented in this report, the following conclusions have been drawn:

- The site is exposed to road traffic noise from Pub Lane and from rail noise from the Brisbane to Sydney railway corridor, requiring noise attenuation to be incorporated into the subdivision design;

Road Traffic Noise

- Given that the ULDA did not specify any specific criteria for traffic noise intrusion, the requirements of LCC's Logan Planning Scheme Policy 2006 have been adopted. The traffic noise requirements of the Logan Planning Scheme are consistent with those of the Beaudesert Planning Scheme.
- In accordance with discussions between the applicant and Logan City Council, it is understood that a reduction in the posted speed limit down to 60km/hr to reflect the change from a rural environment to an urban environment is being investigated by Council. Accordingly, the noise assessment has assumed has assumed a speed reduction from 80km/hr to 60km/hr for Pub Lane adjacent to Stages 1, 20 and 21 of the subdivision.
- To control road traffic noise, it is proposed to construct 2.5m high acoustic barriers as presented in Figure 8. The barriers will be designed and constructed to achieve a minimum superficial density of 12 kg/m^2 and a leakage of less than 1% of area;
- With the noise barrier in place, the resultant noise levels would comply with the 63dBA at all lots at lowset receivers;
- The noise levels are exceeded at highset receivers for Lots 5 to 15 and 8000 to 8002 inclusive;
- It is recommended that advice be sought from a suitably qualified acoustical consultant for the design of future highset dwellings on Lots 5 to 15 and 8000 to 8002 inclusive to control road traffic noise intrusion;

Rail Noise

Option 1: No noise barriers

- The noise level contours for each rail QDC noise category band has determined. With no noise barriers implemented, lowset dwellings on Lots 119, 120, 148 to 153, 761, 763 to 769, 790, 930 to 942, 948 to 983 and 9919 inclusive would be located within Category 1 zone, while Lots 984 to 996, 8002 and

8003 inclusive would be within Category 2 zone. The provisions of the QDC can be used for the design of future lowset dwellings within Category 1 and 2 or advice can be sought from a suitably qualified acoustical consultant.

- The noise levels at highset dwellings are expected to be higher and it is recommended that advice be sought from a suitably qualified acoustical consultant for the construction of such dwellings.

Option 2: Construction of 3.5m high noise barriers

- To reduce the noise category for Lots 984 to 996 for lowset houses from Category 2 to Category 1 would require the construction of 3.5m high acoustic barriers at the locations shown in Figure 14. The barriers should be designed and constructed to achieve a minimum superficial density of 12 kg/m^2 and a leakage of less than 1% of area. In this instance, lowset dwellings on Lots 984 to 996 will be located within Category 1 zone. The provisions of the QDC can be used for the design of future lowset dwellings within Category 1 or advice can be sought from a suitably qualified acoustical consultant. Further 3.5m high noise barriers would also be required to protect Lots 8002 and 8003.

- The noise levels at highset dwellings are expected to be higher and it is recommended that advice be sought from a suitably qualified acoustical consultant for the construction of such dwellings.

Electrical Transmission Line

- It is recommended to advise future buyers that Corona noise from the transmission line may potentially affect the amenity of future dwellings with windows open and at outdoor areas for the closest dwellings. If Corona noise does occur, it is expected to drop-off with distance separation to the nearest dwellings.

CONTENTS

List of Figures

1 INTRODUCTION

Teviot Downs Estate Pty Ltd proposes to develop a residential subdivision on land situated at Pub Lane at Greenbank. The location of the subject site is shown in Figure 1. The real property description is Lot 9968 on SP163061. The local authority is the Urban Land Development Authority (ULDA) The subject site was part of the former Beaudesert Shire Council but was transferred to Logan City Council (LCC) in March 2008.

A noise impact assessment for a previous development scheme at the same site was prepared in December 2009 (Our Ref: 7585_Rev0). The report addressed road traffic noise and railway noise impacts onto the subdivision. The report was submitted to the Logan City Council and the Department of Transport and Main Roads (DTMR). It is understood that the application was approved by Logan City Council in October 2010.

In 2012, a new development scheme was submitted to the ULDA and in response an Information Request (IR) related to noise amenity was issued (ULDA Ref: DEV2012/284). The IR states:

> *Provide further information on how the visual and noise impacts of adjoining transmission line and rail corridors are to be addressed for Lots 996 to 1007.*

The purpose of this report is to present an update of the previous December 2009 road and rail noise report to include the new development scheme and also to respond to the ULDA's IR.

Given that the ULDA did not specify any not include specific criteria for traffic noise intrusion, the requirements of LCC's Logan Planning Scheme Policy 2006 have been adopted. The traffic noise requirements of the Logan Planning Scheme are consistent with those of the Beaudesert Planning Scheme.

Rail noise has been assessed in accordance with the requirements of the Department of Infrastructure and Planning (DIP) *Transit Oriented Development: Guide for Development in a Railway Environment* and the Queensland Development Code MP4.4 *Buildings in a Transport Noise Corridor*.

2 SITE AND SURROUNDING AREA

The site and the surrounding area can be seen in the aerial photograph in Figure 2. The site currently contains a lowset building to the south which is currently used as a sales office for the subdivision. The remainder of the site is covered with grass and trees.

To the west of the site are residential properties. The site adjoins Pub Lane to the south and the Brisbane to Sydney railway corridor to the east.

Pub Lane is a single carriageway with one lane in each direction. The road currently carries approximately 7,300 vehicles per day. The posted speed is 80km/hr.

3 PROPOSED DEVELOPMENT

It is proposed to subdivide the site into 1017 allotments as shown in Figure 3. Access to the residential allotments will be provided via a new road located between Lots 5 and 8000, between Lots 8001 and 8002 and via an existing road (Sentinel Drive) off Pub Lane to the south.

4 CONTROL OF ROAD TRAFFIC NOISE

4.1 Road Traffic Noise Criteria

The requirements of Logan City Council are presented in the document *Logan Planning Scheme 2006 Chapter 4 – Assessment Provisions for Overlays, Districts, and Sub-Districts Part 12 – Noise Affected Area*. Part 12 applies to development located within a noise affected area as shown on OL Map 11.

Overlay Map 11 does not indicate that the site is affected by traffic noise from Pub Lane. It is however likely that the site would be included on this map (or similar) once a new Planning Scheme is prepared for the new Logan City.

Section 4.12.3 of Part 12 states that for a road transport activity, the specified noise criteria is the sound level measured at a height of 1.2m to 1.5m above the ground level or a reflecting surface (façade-corrected) should not exceed:

- 63dBA $L_{A10\ 18hr}$; and
- 55dBA $L_{Aeq\ 9hr}$[1].

Based upon information supplied by Council, these criteria are not used to determine whether a development is noise-affected or not, but rather to determine whether a formal outdoor recreational area requires attenuation to maintain acoustic amenity[2]. It is understood that compliance with these limits is to be achieved assuming the projected traffic volumes 10 years after the date of the development application apply.

The specific outcomes of the noise-affected area code are presented in Table 4.12.9 and are presented in terms of:

(i) Protection and enhancement of personal health and safety and property; and

(ii) Protection and enhancement of amenity and character.

---

[1] $L_{Aeq\ 9hr}$ refers to the equivalent or energy averaged noise level measured over the nine hour period between 10pm and 7am.

[2] Stated in an email sent to Renzo Tonin Ron Rumble by Anthony Wallis on the 29th July 2008.

The specific outcomes and associated probable solutions are presented in Appendix A. The noise criteria presented in S1.1 of Table 4.12.9 are applicable to railway noise only and are not applicable to road traffic noise[3]. Specific Outcome S1.2 provides guidance regarding the appropriate probable solution in this instance. As the intruding noise is due to road traffic, the relevant codes are:

- AS3671-1989 Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction; and
- AS/NZS2107: 2000 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors.

Of these two Codes, only AS/NZS2107 nominates specific noise criteria. For a house near a major road, Table 1 of AS/NZS2107 specifies the design noise levels to be between 35dBA and 45dBA for living areas and between 30dBA and 40dBA for sleeping areas. There is no specific requirement in the Planning Scheme which nominates the exact design level for road traffic noise intrusion. It simply requires compliance with AS/NZS2107, which would be satisfied by an outcome anywhere between 35dBA and 45dBA for living areas and between 30dBA and 40dBA for sleeping areas.

It is noted that Section 1.1 of *Schedule 3 (Standards) Part 1: Emission Standards* contains noise emission and immission standards. Clause 2(a) of the Schedule lists eight different Australian Standards which are to be applied to noise emissions. AS3671 and AS/NZS2107 are included and are the only standards on this list directly applicable to traffic noise. In the instance where the intruding noise is not covered by any one of the eight standards, Clause 2(b) states that the noise criteria specified in Table 1.1 of Schedule 3 should be applied. In this instance, as the intruding road traffic noise is already addressed by reference to AS3671 and AS/NZS2107, the noise criteria specified in this table do not apply.

In this instance, the noise criteria adopted for internal areas of the proposed development are presented in Table 1.

Table 1: Internal criteria based upon the LCC Planning Scheme 2006

Internal Noise Criteria
Design limit in bedrooms = 35dBA ($L_{Aeq\ night}$)
Design limit in living areas = 40dBA ($L_{Aeq\ day}$)

The adoption of the limits presented in Table 1 ensures that an outcome is achieved for future residences consistent with the requirements of DTMR[4]. In achieving these limits, it is understood that where it cannot be demonstrated that windows can be open to achieve these internal limits,

[3] The limits presented in S1.1 are identical to those specified in the draft Australian Standard *Acoustics – Railway Noise Intrusion – Building Siting and Construction*.

[4] These design limits are also consistent with a large number of local authorities such as the Brisbane City Council, Redland Shire Council, Moreton Bay Regional Council and the Ipswich City Council.

mechanical ventilation and/or air-conditioning must be incorporated into the development to allow the windows to be closed whilst preserving the amenity of the occupants[5].

4.2 Methodology for predicting future road traffic noise exposures

The existing traffic noise levels from the Pub Lane were measured at a representative location in accordance with Australian Standard AS2702-1984 - *Acoustics - Methods for the Measurement of Road Traffic Noise*.

Traffic data and composition for existing conditions and estimates of the growth rates and future speed limit for Pub Lane adjacent to the site have been obtained from TTM Consulting (Brisbane Office). These data are contained in Table 2.

Table 2: Traffic data

Pub Lane	Year 2009			Year 2025		
	24hr Count	% CV	Speed	24hr Count	% CV	Speed
Both Directions	7,300	6.5	80km/hr	15,000	7.5%	60km/hr

Physical data across the site have been obtained from drawings provided by RPS, aerial photographs and from site inspection. The road levels and centreline location were extracted from the RPS drawings.

Traffic noise levels have been predicted using the SoundPLAN[6] computer program. This program uses the CoRTN (1988)[7] algorithms endorsed by Council. The model has been verified for this site by comparing the computer prediction from current traffic flows with the results of noise measurements conducted at the site.

Future traffic noise exposures have been predicted in the form of noise level contours for traffic conditions predicted for year 2025.

In accordance with discussions between the applicant and Logan City Council, it is understood that a reduction in the posted speed limit to 60km/hr to reflect the change from a rural environment to an urban environment is being investigated by Council. Accordingly, the noise assessment has assumed a speed reduction from 80km/hr to 60km/hr for Pub Lane adjacent to Stages 1, 20 and 21 of the subdivision.

---

[5] Communicated in an Information Request issued by Council for another development on the 14th October 2008 (Council Ref: 4883359).

[6] SoundPLAN is an integrated software package for noise and air pollution evaluation developed in Germany by Braunstein + Berndt GmbH. It has been configured to predict the extent of (i) road traffic noise intrusion by application of the CRTN '88 algorithms and (ii) industrial noise emission using the CONCAWE algorithms. It is in use in more than 30 countries and has had widespread application throughout Australia. It is endorsed by Department of Main Roads, Brisbane City Council, Queensland EPA and most other State environmental authorities.

[7] CoRTN 1988 – *Calculation of Road Traffic Noise*, UK Department of Transport HMSO, 1988.

4.3 Existing Traffic Noise Levels

Noise logging was conducted over an extended period at the site to obtain representative statistical data of existing traffic noise. The noise logger was however vandalised after approximately 48 hours of beginning the measurement. As a consequence noise data beginning from midnight on Tuesday 29th September 2009 to midnight Thursday 1st October was the only data suitable for use in this assessment. All extraneous data was removed from further analysis.

The test location is identified as *Traffic Noise Logger* in Figure 2 and was approximately 25m from Pub Lane.

Test instrumentation consisted of the following:

1. Environmental Noise Logger, ARL Type-315 (S/N 15-299-455); and
2. Acoustical calibrator, Rion Type NC73 (S/N 10813189).

The test microphone was positioned at a height of 1.5m above the ground level in free-field conditions. The instrumentation was set to record the noise level statistics over consecutive 15-minute intervals throughout the test.

The results from the noise logger are presented graphically in Figure 4 and Figure 5 and are summarised in Table 3.

Table 3: Existing traffic noise levels (free-field)

Parameter	Measured Level (dBA)	Offset from $L_{A10\ 18hr}$ (dBA)
$L_{A10\ 18hr}$	64.3	-
$L_{Aeq\ night}$	61.7	-2.6
$L_{Aeq\ day}$	66.9	+2.6
$L_{Aeq\ 9hr}$	56.8	-7.5

As stated in Section 4.1, the limits for outdoor recreational areas specified by Council are 55dBA $L_{Aeq\ 9hr}$ and 63BA $L_{A10\ 18hr}$ (façade-corrected). Using the offset shown in Table 3, the 55dBA $L_{Aeq\ 9hr}$ translates to 62.5dBA $L_{A10\ 18hr}$ (=55+7.5) or 63dBA (rounded to the nearest whole number).

4.4 Verification of Computer Model

The SoundPLAN computer model has been verified by comparing the predicted noise level for current traffic conditions with the measured results at the test location. This was done by using the traffic numbers from Table 2 in the computer model and comparing the $L_{A10\ 18hr}$ results from the model with the existing traffic noise levels presented in Table 3.

The predicted and measured values are compared in Table 4.

Table 4: Comparison between the calculated and measured $L_{A10\ 18hr}$ values

$L_{A10\ 18hr}$ Parameter	Predicted	Measured	Difference
Pub Lane	63.5dBA	64.3dBA	-0.8

As can be seen in this table, the difference between the predicted and measured values is within the accepted tolerance of +/- 2dBA.

4.5 Future traffic Noise Exposure

Using the SoundPLAN computer model, the future traffic noise exposure across the site has been predicted for both lowset and highset residences. The parameters used in the model for the predictions are presented in Table 5.

Table 5: Parameters used in the SoundPLAN model for future traffic volumes

Parameters	Pub Lane
18 hour count – Year 2025	14,100
Percentage commercial vehicles (%)	7.5
Traffic speed (km/h) (Zone)	60
Receiver height AGL (m)	1.8m Lowset 4.6m Highset
Façade Correction (dBA)	+2.5
Calibration adjustment (dBA)	+0.8

The calculated noise levels were adjusted to their equivalent facade-corrected values by adding 2.5dBA to the results.

The model has been run with no barriers in place, and the noise contours have been predicted at heights of 1.8m above ground representing lowset dwellings and 4.6m representing highset dwellings.

The future noise exposures for lowset and highset dwellings are presented in Figure 6 and Figure 7. It can be seen in these figures that with no noise barriers, the noise limit of 63dBA $L_{A10\ 18hr}$ is exceeded at several lots adjoining Pub Lane at both lowset and highset residences. As a result, noise attenuation measures will be required to protect the lots from traffic noise intrusion.

4.6 Traffic Noise Attenuation Measures

To attenuate traffic noise intrusion from Pub Lane, it will be necessary to construct noise barriers along the southern boundary of the site to protect lowset residences. To achieve the 63dBA $L_{A10\ 18hr}$ across all lots would require the construction of 2.5m high noise barriers.

The noise model has therefore been set up to include the noise barriers described as follows:

- 2.5m high noise barrier return on the western side of Lot 15 (Approximately 32m in length);

- 2.5m high noise barrier from the southwest corner of Lot 15 to the southeast corner of Lot 5 (Approximately 230m in length);
- 2.5m high noise barrier return on the eastern side of Lot 5 (Approximately 20m in length);
- 2.5m high noise barrier return on the western side of Lot 8000 (Approximately 20m in length);
- 2.5m high noise barrier from the southwest corner of Lot 8000 to the southeast corner of Lot 8001 (Approximately 1845m in length);
- 2.5m high noise barrier return on the eastern side of Lot 8001 (Approximately 20m in length);
- 2.5m high noise barrier return on the western side of Lot 8002 (Approximately 20m in length); and
- 2.5m high noise barrier along the southwest boundary of Lot 8002 (Approximately 70m in length).

The locations of the barriers are shown Figure 8. The barriers should be designed and constructed to achieve a minimum superficial density of 12 kg/m^2 and a leakage of less than 1% of area.

The resultant noise level contours for lowset and highset residences with the 2.5m barriers in place are presented in Figure 9 and Figure 10. It can be seen in Figure 9 that the predicted noise level at lowset residences is less than 63dBA at all lots. It can be seen in Figure 10 that the noise levels at highset heights are exceeded at Lots 5 to 15 and 8000 to 8002 with the 2.5m high barriers.

It is recommended that advice be sought from a suitably qualified acoustical consultant for the design of future highset dwellings on Lots 5 to 15 and 8000 to 8002.

5 CONTROL OF RAIL NOISE INTRUSION

The eastern boundary of the site is located 118m from the rail line of the Brisbane to Sydney Corridor. As the Brisbane to Sydney Corridor is under the control of the Department of Transport and Main Roads (DTMR), rail noise intrusion will need to comply with the requirements of Department of Infrastructure and Planning (DIP) *Transit Oriented Development: Guide for Development in a Railway Environment.*

5.1 DIP Rail Noise Criteria

The Department of Infrastructure and Planning criteria in relation to railway noise intrusion is:

Intruding noise inside future houses shall not exceed the following:

- 45dBA measured as the average maximum noise levels over a number of passby events ($_{ave}L_{Amax}$).

External noise levels at the facade of any dwelling shall not exceed:

- 65dBA, assessed as the 24 hour average equivalent continuous A-weighted sound pressure level ($L_{Aeq\ 24hr}$); and
- 87dBA, assessed as a single event maximum sound pressure level ($_{Max}L_A$) when measured 1m from the most exposed part of the noise sensitive place.

5.2 Queensland Development Code MP4.4

For railway noise intrusion, QDC MP4.4 requires that each external façade of a habitable room be assigned a noise category which is dependent upon the single event maximum at the façade. A summary of the noise categories is presented in Table 6.

Table 6: Noise category levels

Noise Category	Single event maximum noise ($_{max}L_A$)
Category 4	≥85dBA
Category 3	80-84dBA
Category 2	75-79dBA
Category 1	70-74dBA
Category 0	≤69dBA

Depending on the assigned noise category, the external facades are selected to achieve a minimum R_W requirement as specified in Schedule 1 of the Code.

5.3 Rail Noise Measurements

Measurements of the existing levels of rail noise exposure at the site have been conducted over a 48 hour period starting from midnight Tuesday 29th September 2009.

The test location is identified as *Railway Noise Logger* in Figure 2 and was approximately 20m from the railway corridor. The test microphone was positioned at a height of 1.5m above the ground level in free-field conditions. The instrumentation was set to record the noise level statistics over consecutive 5-minute intervals throughout the test.

Test instrumentation consisted of the following:

3. Environmental Noise Logger, NL -21 (S/N 00521710); and
4. Acoustical calibrator, Rion Type NC73 (S/N 10813189).

The data recorded on the noise logger is presented graphically in Figure 11 and Figure 12. The rail noise events have been identified by comparing the noise peaks (identified using stars in Figure 11 and Figure 12) with timetable information obtained from Queensland Rail. The test results are summarised in Table 7 and Table 8.

Table 7: Rail noise levels (20m from railway corridor)

Date	Time	$L_{Aeq\ 5min}$ (dBA)	L_{A90} (dBA)	$Max\ L_A$ (dBA)
29/09/2009	5:43	66.0	49.6	84.3
29/09/2009	6:43	64.7	43.4	81.4
29/09/2009	6:48	67.4	45.3	82.6
29/09/2009	8:03	62.3	46.1	80.0
29/09/2009	16:13	73.6	47.8	89.3
29/09/2009	18:33	72.7	45.9	85.5
29/09/2009	19:18	69.8	45.9	84.2
29/09/2009	21:38	73.0	46.7	89.3
30/09/2009	3:48	71.1	33.3	87.5
30/09/2009	6:03	66.2	49.9	85.0
30/09/2009	6:48	73.0	46.4	90.7
30/09/2009	8:08	63.6	43.1	83.2
30/09/2009	17:48	71.7	47.1	85.3
30/09/2009	18:43	71.5	43.2	87.7
30/09/2009	19:58	73.0	40.6	85.9
30/09/2009	20:48	70.8	40.0	87.4
30/09/2009	22:13	68.5	40.6	83.6

Table 8: Rail noise levels summary (20m from railway corridor)

Noise Parameter	Max Recorded Value	Average*
$max\ L_A$	90.7dBA	$L_{A\ max\ (pass\ by)}$ = 85.5dBA
$L_{Aeq\ 5min}$	73.6dBA	$L_{Aeq\ 5min}$ = 70.5dBA

*$L_{A\ max}$ has been determined as an arithmetic average, $L_{Aeq\ 5min}$ has been determined as a log average.

5.4 Rail Noise Methodology

Train pass-by noise levels shown in Figure 11 and Figure 12 have been measured under free-field conditions. The noise levels at the residential façades have been determined from the measurements by extrapolating the test results to the subdivision site using standard acoustical theory.

The 24-hour external equivalent rail noise level ($L_{Aeq\ 24hr}$) has been calculated from the total number of trains utilising the rail corridor in a typical 24 hour period, and the short term L_{Aeq} noise level measured during a number of sample pass-bys. This was compared against the log average of the data over a 24 hour period to determine an accurate result.

5.5 Future Rail Noise Exposures

DTMR has plans to expand the railway corridor adjacent to the site. Further information of the future type and frequency of trains using the future corridor has been requested from DTMR (Gary Swanson). DTMR has provided a report titled *Salisbury to Beaudesert Rail Corridor Study: Review of environmental factors*, dated Winter 2010. The report states the following for rail noise:

> *Establishment of a passenger rail line between Salisbury and Beaudesert would increase the frequency of train movements on the future passenger rail line in the northern and central sections of the study area and introduce rail noise to existing rural and agricultural areas in the section between Kagaru and Beaudesert. Operational rail noise for the future passenger rail line would be managed in accordance with Queensland Rail's Code of Practice for Railway Noise Management. Noise modelling would be undertaken as part of subsequent study phases to identify where mitigation measures would be required to address noise-related impacts as part of the future development of the rail line.*

DTMR (Gary Swanson) has further stated that the project has been put on hold and currently awaiting approval for further funding.

On this basis, the assessment has not taken the railway expansion plans of DTMR into consideration and has been based upon existing noise levels.

Using the test data from Table 8, it is possible to calculate the various noise parameters nominated in the noise criteria in Section 4.1. These are presented in Table 9.

Table 9: Measured noise parameters (at a distance of 20m from the corridor)

Noise Parameter – DIP Noise Limit		Measured Noise Levels at 20m
(i)	$L_{A\ max}$ at façade - 87dBA	93.2dBA
(ii)	$L_{Aeq\ 24hr}$ at façade - 65dBA	59.2dBA
(iii)	$L_{A\ max}$ indoors - 45dBA	88dBA (external)

Rail noise has been predicted at the eastern boundary of the site using the results presented in Table 9. The following assumptions have been used:

(i) L_{Amax} are generated by moving point sources and propagate according to an inverse-square law. Line of sight has been assumed in all instances.

(ii) L_{Aeq} parameters are generated by a combination of line and point sources and propagate according to a 15 log law.

The calculated noise levels are presented in Table 10.

Table 10: Calculated noise parameters (at a distance of 118m from the corridor)

Noise Parameter – DIP Noise Limit		Calculated Noise Levels at 118m (rounded off)
(i)	$_{max}L_A$ at façade - 87dBA	93.2 – 20*log(118/20) = 78dBA
(ii)	$L_{Aeq\ 24hr}$ at façade - 65dBA	59.2 - 15*log(118/20) = 44dBA
(iii)	$L_{A\ max}$ indoors - 45dBA	88 - 20*log(118/20) = 73dBA (external)

5.6 Noise Attenuation Requirements

From Table 10, it can be seen that the outdoor noise criteria as determined by $_{max}L_A$ and $L_{Aeq\ 24hr}$ are achieved along the eastern boundary of the site, at a distance of 118m from the track.

Noise attenuation requirements based on the Queensland Development Code MP4.4 *Buildings in a Transport Noise Corridor* have been determined. Using the measured noise levels in Table 10, the applicable QDC MP4.4 noise categories were determined at various distances from the railway corridor as presented in Table 11.

Table 11: Noise categories from the railway line

Noise Category	Single event maximum noise ($_{max}L_A$)	Distances from the rail line, d
Category 4	≥ 85dBA	d ≤58m
Category 3	80 - 84dBA	58m < d ≤ 103m
Category 2	75 - 79dBA	103m < d ≤ 182m
Category 1	70 - 74dBA	182m < d ≤ 321m
Category 0	≤ 69dBA	321m

The noise level contours for each QDC noise category band has been superimposed on the proposed subdivision layout in Figure 13. It can be seen that Lots 119, 120, 148 to 153, 761, 763 to 769, 790, 930 to 942, 948 to 983 and 9919 are within Category 1 zone, while Lots 984 to 996, 8002 and 8003 are within Category 2 zone.

As an option, to reduce the noise category for Lots 984 to 996 from Category 2 to Category 1 would require the construction of 3.5m high noise barriers at the locations shown in Figure 14. The barriers should be designed and constructed to achieve a minimum superficial density of 12 kg/m^2 and a leakage of less than 1% of area. Further barriers would be required to protect Lots 8002 and 8003.

The QDC Code requires that the external façades of the proposed dwelling achieve a minimum R_W rating for each building component as specified in Schedule 1 of the Code for the relevant noise category. Table 12 is an extract of Schedule 1 contained within the QDC MP4.4.

Table 12: Minimum R_w rating for each relevant noise category

Noise Category	Minimum transport noise reduction required for habitable rooms	Component of building's external envelope	Minimum R_w required
2	30	Glazing	35 (Total area of glazing for a habitable room is greater than 1.8m^2)
			32 (Total area of glazing for a habitable room is less than or equal to 1.8m^2)
		External Walls	41
		Roof	38
		Floors	45
		Entry doors	33
1	25	Glazing	27 (Total area of glazing for a habitable room is greater than 1.8m^2)
			24 (Total area of glazing for a habitable room is less than or equal to 1.8m^2)
		External Walls	35
		Roof	35
		Entry Doors	28
0	No additional acoustic treatment required - Standard building assessment provisions apply		

The minimum R_w rating for each building component can be achieved by:

- Using the materials specified in Schedule 2 of the Code (http://www.hpw.qld.gov.au/SiteCollectionDocuments/mp-4-4-buildings-in-transport-noise-corridors.pdf); or
- Using materials with manufacturer's specifications that, in combination, achieve the minimum R_w rating for the relevant building component and applicable noise category

6 NOISE EMISSION FROM THE ELECTRICAL TRANSMISSION LINE

As stated in Section 1.0, the ULDA has requested that an assessment of noise from the adjoining transmission line be undertaken.

Transmission lines can generate noise; depending on design parameters and atmospheric conditions. Two types of noise can occur; Corona discharge and Aeolian (wind) noise.

Corona discharge is a buzzing noise caused by leakage currents flowing on the surfaces of insulators and through the air in the vicinity of insulators. A number of factors influence corona, including:

- operating voltage
- conductor and insulator shapes, particularly the presence of any sharp edges or points
- insulator surface conditions and contamination
- water vapour or ionisation in the air

Aeolian noise is a humming tone caused by interaction between wind and vibration of the conductors. This noise is controlled by:

- wind speed and direction
- topographical effects which cause wind funnelling
- conductor diameter and spacing

Noise from the transmission line was not audible during our two site inspections.

In this instance, a literature review has been conducted to ascertain expected levels of Corona and Aeolian noise experienced at other sites. A recent Environmental Impact Statement (EIS) downloaded from the Powerlink's website (*Powerlink Queensland, Wandoan South to Wandoan Coal Connection*, dated October 2012, by GHD) states that *Audible noise from Corona is dependent on weather and distance from the conductor and is typically below 55dBA*. It is also often quoted in literature that corona noise typically results in continuous type noise of the order of 40dBA to 50dBA in close proximity to transmission lines. The information reviewed however did not define the measurement setback from the transmission lines, but it has been assumed to conservatively be approximately 50m away.

The separation distance between the closest lots of the development to the transmission line also appears to be around 50m. On this basis, noise levels in the range of 40dBA to 55dBA are expected at closest residential properties to the transmission line towers.

Corona and Aeolian noise are considered quasi-continuous or a continuous type noise. For noise impact assessments onto future residential properties, the noise limits set in AS/NZS2107-2000 *Acoustics - Recommended Design Sound Levels and Reverberation Times in Building Interiors* can be used. The applicable noise limits for a Bedroom would be 35dBA and 40dBA for a living room.

It can be seen that the maximum required noise reduction is around 20dBA for a bedroom (=55dBA – 35dBA). Noise reductions of the order of 20dBA should be achievable using standard building construction methods for windows closed dwellings.

For naturally-ventilated dwelling scenarios (Open Windows), adjustments between 5dBA and 10dBA are suggested by various authorities to account for façade attenuation. This would results in outdoor noise limits ranging from 40dBA to 45dBA for bedrooms. For Corona noise levels of 55dBA, potential exceedences of 10dBA to 15dBA are expected.

Continuous noise levels of 55dBA at outdoor recreational areas of future dwellings can cause annoyance to residents, but there is no noise control treatment available to control intruding noise at open outdoor areas and open windows scenarios.

It is further noted that there is no prediction methodology currently available for transmission line noise assessments. The information provided in this section is based on a literature review of Powerlink's current project and is indicative only.

Many conditions are required to trigger Corona noise and therefore there is no certainty that transmission noise and its frequency of occurrence may cause noise nuisance at the closest residential lots.

It is recommended to advise future buyers that Corona noise from the transmission line may potentially affect the amenity of future dwellings with windows open and at outdoor areas for the closest dwellings. If corona noise does occur, it is expected to drop-off with distance separation to the nearest dwellings.

7 CONCLUSIONS

Based upon the analysis presented in this report, the following conclusions have been drawn:

- The site is exposed to road traffic noise from Pub Lane and from rail noise from the Brisbane to Sydney railway corridor, requiring noise attenuation to be incorporated into the subdivision design.

Road Traffic Noise

- Given that the ULDA did not specify any specific criteria for traffic noise intrusion, the requirements of LCC's Logan Planning Scheme Policy 2006 have been adopted. The traffic noise requirements of the Logan Planning Scheme are consistent with those of the Beaudesert Planning Scheme.

- In accordance with discussions between the applicant and Logan City Council, it is understood that a reduction in the posted speed limit down to 60km/hr to reflect the change from a rural environment to an urban environment is being investigated by Council. Accordingly, the noise assessment has assumed has assumed a speed reduction from 80km/hr to 60km/hr for Pub Lane adjacent to Stages 1, 20 and 21 of the subdivision.

- To control road traffic noise, it is proposed to construct 2.5m high acoustic barriers as presented in Figure 8. The barriers will be designed and constructed to achieve a minimum superficial density of 12 kg/m^2 and a leakage of less than 1% of area;

- With the noise barrier in place, the resultant noise levels would comply with the 63dBA at all lots at lowset receivers;

- The noise levels are exceeded at highset receivers for Lots 5 to 15 and 8000 to 8002 inclusive;

- It is recommended that advice be sought from a suitably qualified acoustical consultant for the design of future highset dwellings on Lots 5 to 15 and 8000 to 8002 inclusive to control road traffic noise intrusion;

Rail Noise

Option 1: No noise barriers

- The noise level contours for each rail QDC noise category band has determined. With no noise barriers implemented, lowset dwellings on Lots 119, 120, 148 to 153, 761, 763 to 769, 790, 930 to 942, 948 to 983 and 9919 inclusive would be located within Category 1 zone, while Lots 984 to 996, 8002 and 8003 inclusive would be within Category 2 zone. The provisions of the QDC can be used for the design of future lowset dwellings within Category 1 and 2 or advice can be sought from a suitably qualified acoustical consultant.

- The noise levels at highset dwellings are expected to be higher and it is recommended that advice be sought from a suitably qualified acoustical consultant for the construction of such dwellings.

Option 2: Construction of 3.5m high noise barriers

- To reduce the noise category for Lots 984 to 996 for lowset houses from Category 2 to Category 1 would require the construction of 3.5m high acoustic barriers at the locations shown in Figure 14. The barriers should be designed and constructed to achieve a minimum superficial density of 12 kg/m^2 and a leakage of less than 1% of area. In this instance, lowset dwellings on Lots 984 to 996 will be located within Category 1 zone. The provisions of the QDC can be used for the design of future lowset dwellings within Category 1 or advice can be sought from a suitably qualified acoustical consultant. Further 3.5m high noise barriers would also be required to protect Lots 8002 and 8003.

- The noise levels at highset dwellings are expected to be higher and it is recommended that advice be sought from a suitably qualified acoustical consultant for the construction of such dwellings.

Electrical Transmission Line

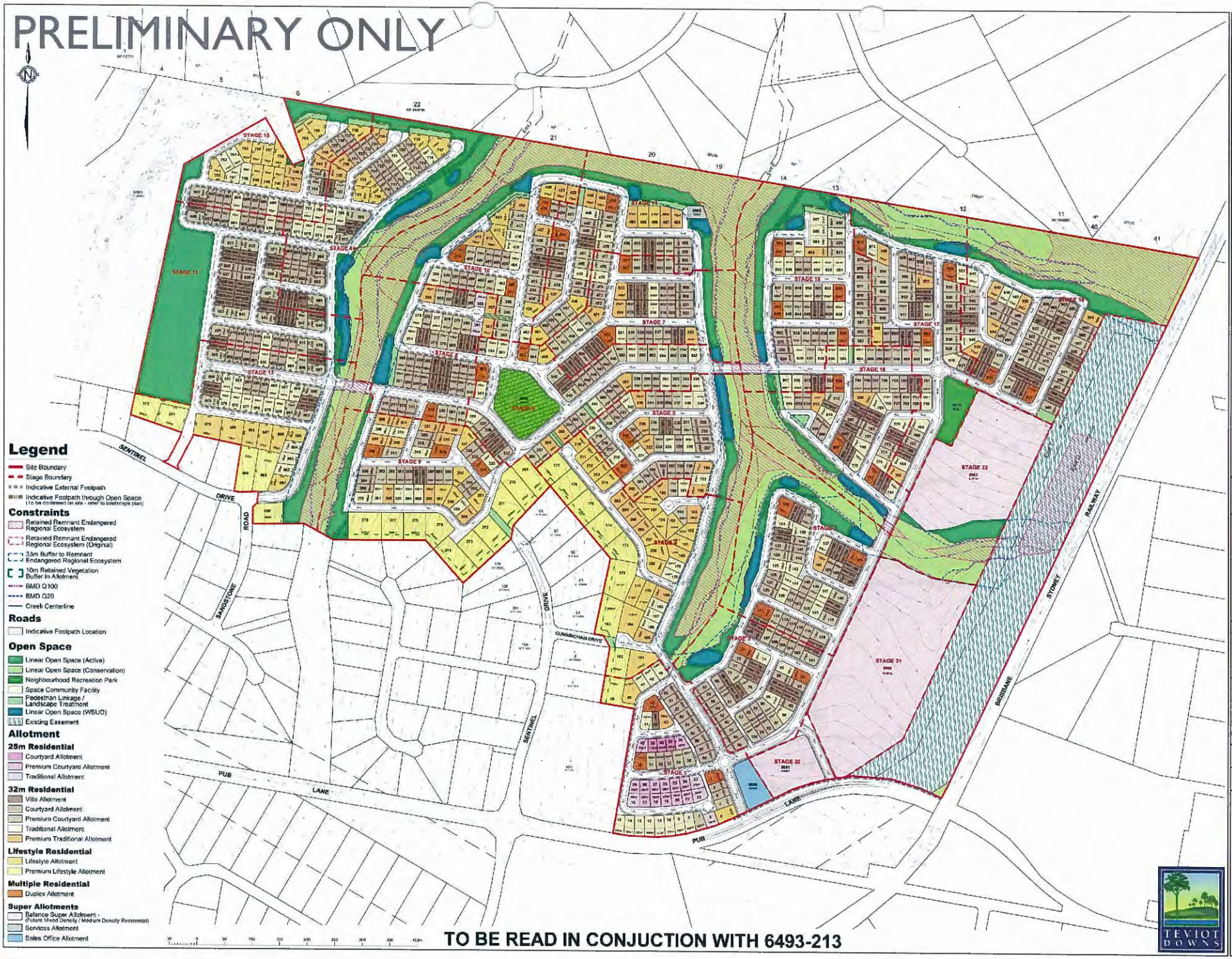
- It is recommended to advise future buyers that Corona noise from the transmission line may potentially affect the amenity of future dwellings with windows open and at outdoor areas for the closest dwellings. If Corona noise does occur, it is expected to drop-off with distance separation to the nearest dwellings.

Figure 1: Site location

Figure 2: Aerial photograph of site and surrounding area

Figure 3: Proposed subdivision development

PRELIMINARY ONLY



Legend

- Site Boundary
- Stage Boundary
- Indicative External Footpath
- Indicative Footpath through Open Space (To be confirmed on site - refer to landscape plan)

Constraints

- Retained Remnant Endangered Regional Ecosystem
- Retained Remnant Endangered Regional Ecosystem (Original)
- 33m Buffer to Remnant Endangered Regional Ecosystem
- 10m Retained Vegetation Buffer in Allotment
- BMD Q100
- BMD Q20
- Creek Centerline

Roads

- Indicative Footpath Location

Open Space

- Linear Open Space (Active)
- Linear Open Space (Conservation)
- Neighbourhood Recreation Park
- Space Community Facility
- Pedestrian Linkage / Landscape Treatment
- Linear Open Space (WSUD)
- Existing Easement

Allotment

25m Residential
- Courtyard Allotment
- Premium Courtyard Allotment
- Traditional Allotment

32m Residential
- Villa Allotment
- Courtyard Allotment
- Premium Courtyard Allotment
- Traditional Allotment
- Premium Traditional Allotment

Lifestyle Residential
- Lifestyle Allotment
- Premium Lifestyle Allotment

Multiple Residential
- Duplex Allotment

Super Allotments
- Balance Super Allotment - (Future Mixed Density / Medium Density Residential)
- Services Allotment
- Sales Office Allotment

TO BE READ IN CONJUCTION WITH 6493-213

REVISION
A: 12/12/12 Amend layout
B: 18/12/12 Amend P3 layout & stage

Notes:
All dimensions and areas are approximate only, and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0.1 metres.

Areas have been rounded down to the nearest 5m².

The boundaries shown on this plan should not be used for final detailed engineers design.

Source Information:
Site boundaries: Land Partners
Adjoining information: DCDB
Contours: Land Partners
Flood: BMD

CLIENT
TEVIOT DOWNS ESTATE PTY LTD

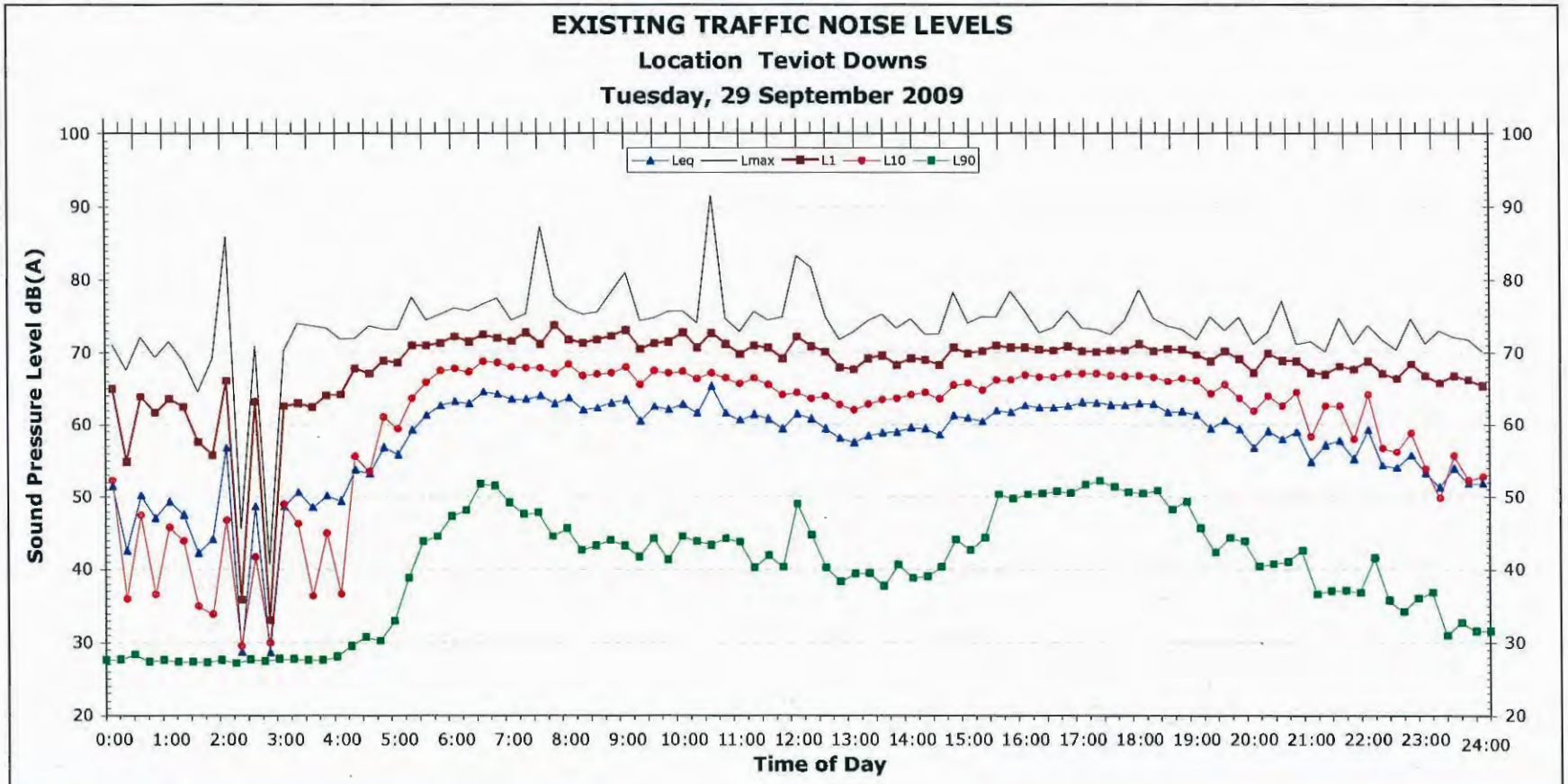
PROJECT
TEVIOT VILLAGE

PLAN OF SUBDIVISION OVERALL ALLOTMENT LAYOUT

Level Datum	
Origin	
Date	18 DEC 2012
Cons By	JLS
DWG Name	6493-204 Proposal Plan
Local Authority	URBAN LAND DEVELOPMENT AUTHORITY
Locality	TEVIOT DOWNS
Job Reference	6493
Scale	1 : 3000
Sheet	A1
Plan Ref	6493 - 204
Rev	B

RPS

TEVIOT DOWNS



Representative Noise Levels					
Descriptor	L_{max}	L_1	L_{10}	L_{90}	L_{eq}
Day	76.0	70.7	65.9	41.3	61.9
Evening	73.1	68.9	63.6	39.0	59.6
Night	71.8	65.0	52.5	29.7	57.4

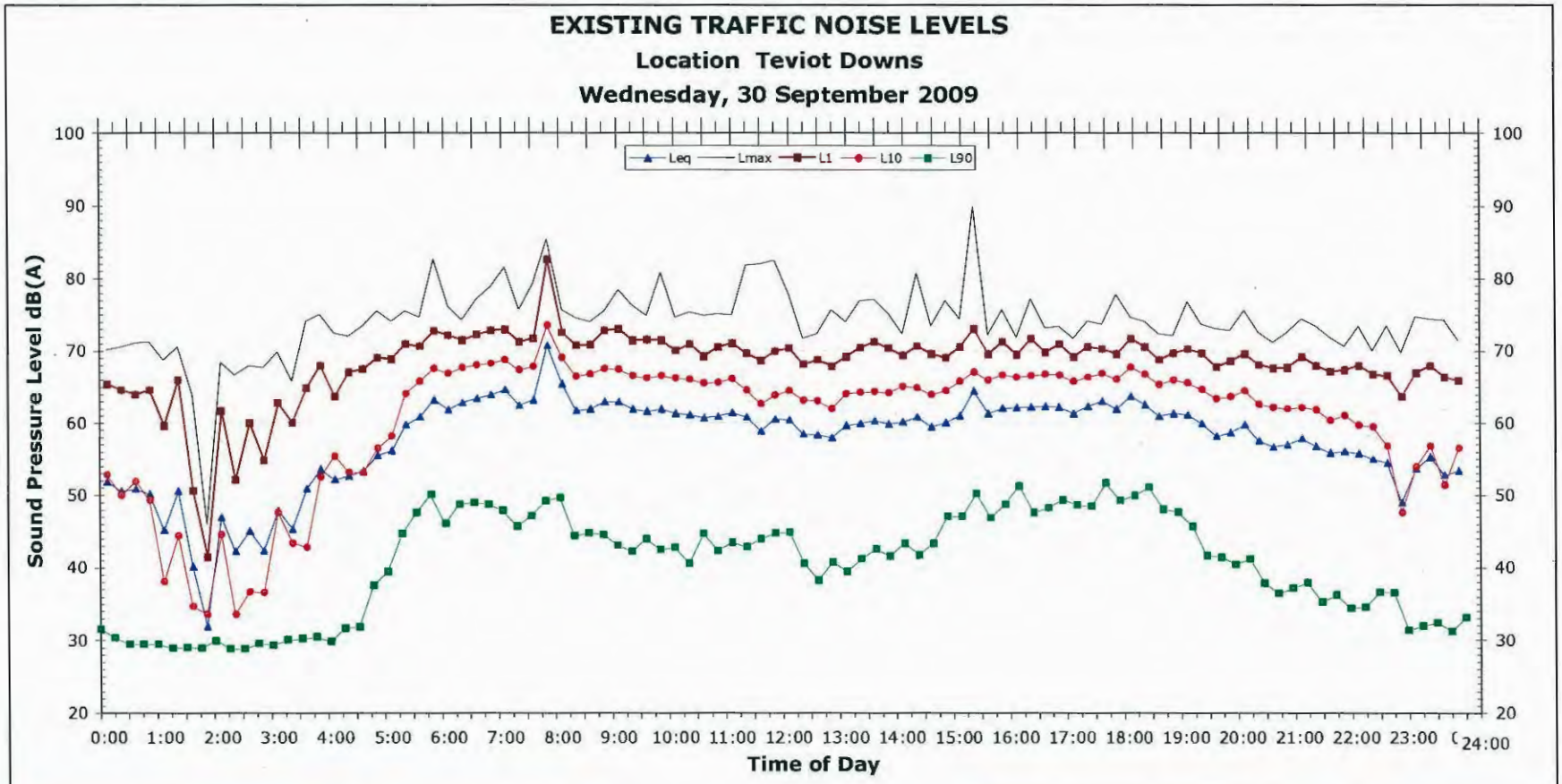
Notes:

1. Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

DMR					
Descriptor	L_{max}	L_{eq}	$L_{eq\ 1hour}$	L_{10}	L_{90}
Day	-	-	64.0	-	-
Night	71.0	-	61.7	-	-
8 Hour	-	-	-	-	33.5
18 Hour	-	-	-	64.3	43.3
24 Hour	-	60.3	-	-	-

Figure 4: Existing traffic noise levels (29/09/09)



Representative Noise Levels					
Descriptor	L_{max}	L_1	L_{10}	L_{90}	L_{eq}
Day	76.4	70.8	65.9	42.3	62.3
Evening	73.2	68.6	63.3	36.3	59.1
Night	72.7	66.3	54.6	31.6	53.8

Notes:

1.Grey areas indicate periods of time that are either affected by rain,wind or other extraneous factors

2. Graphed & tabulated data measured in free-field

DMR					
Descriptor	L_{max}	L_{eq}	$L_{eq\ 1hour}$	L_{10}	L_{90}
Day	-	-	66.9	-	-
Night	72.7	-	55.7	-	-
8 Hour	-	-	-	-	33.4
18 Hour	-	-	-	64.3	43.1
24 Hour	-	61.3	-	-	-

Figure 5: Existing traffic noise levels (30/09/09)

Figure 6: Future noise levels at lowset residences – No noise barrier

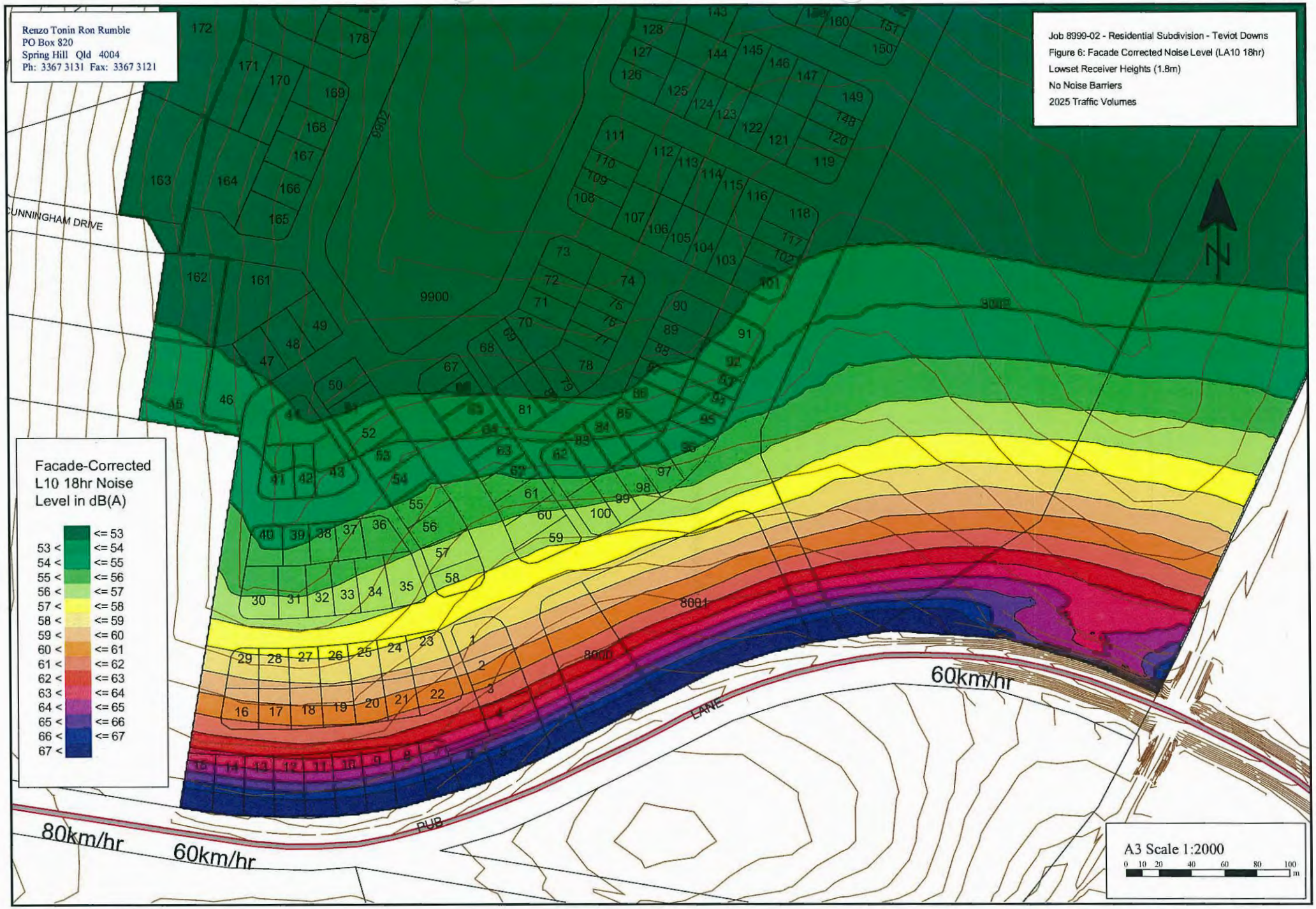

Renzo Tonin Ron Rumble
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121
Job 8999-02 - Residential Subdivision - Teviot Downs
Figure 6: Facade Corrected Noise Level (LA10 18hr)
Lowset Receiver Heights (1.8m)
No Noise Barriers
2025 Traffic Volumes
CUNNINGHAM DRIVE
9900
9901
9902
8000
8001
LANE
PUB
60km/hr
80km/hr
60km/hr
N
Facade-Corrected
L10 18hr Noise
Level in dB(A)
53 < <= 53
54 < <= 54
55 < <= 56
56 < <= 57
57 < <= 58
58 < <= 59
59 < <= 60
60 < <= 61
61 < <= 62
62 < <= 63
63 < <= 64
64 < <= 65
65 < <= 66
66 < <= 67
A3 Scale 1:2000
0 10 20 40 60 80 100
m

Figure 7: Future noise levels at highset residences - No noise barrier

Renzo Tonin Ron Rumble
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121

Job 8999-02 - Residential Subdivision - Teviot Downs
Figure 7: Facade Corrected Noise Level (LA10 18hr)
Highset Receiver Heights (4.6m)
No Noise Barriers
2025 Traffic Volumes

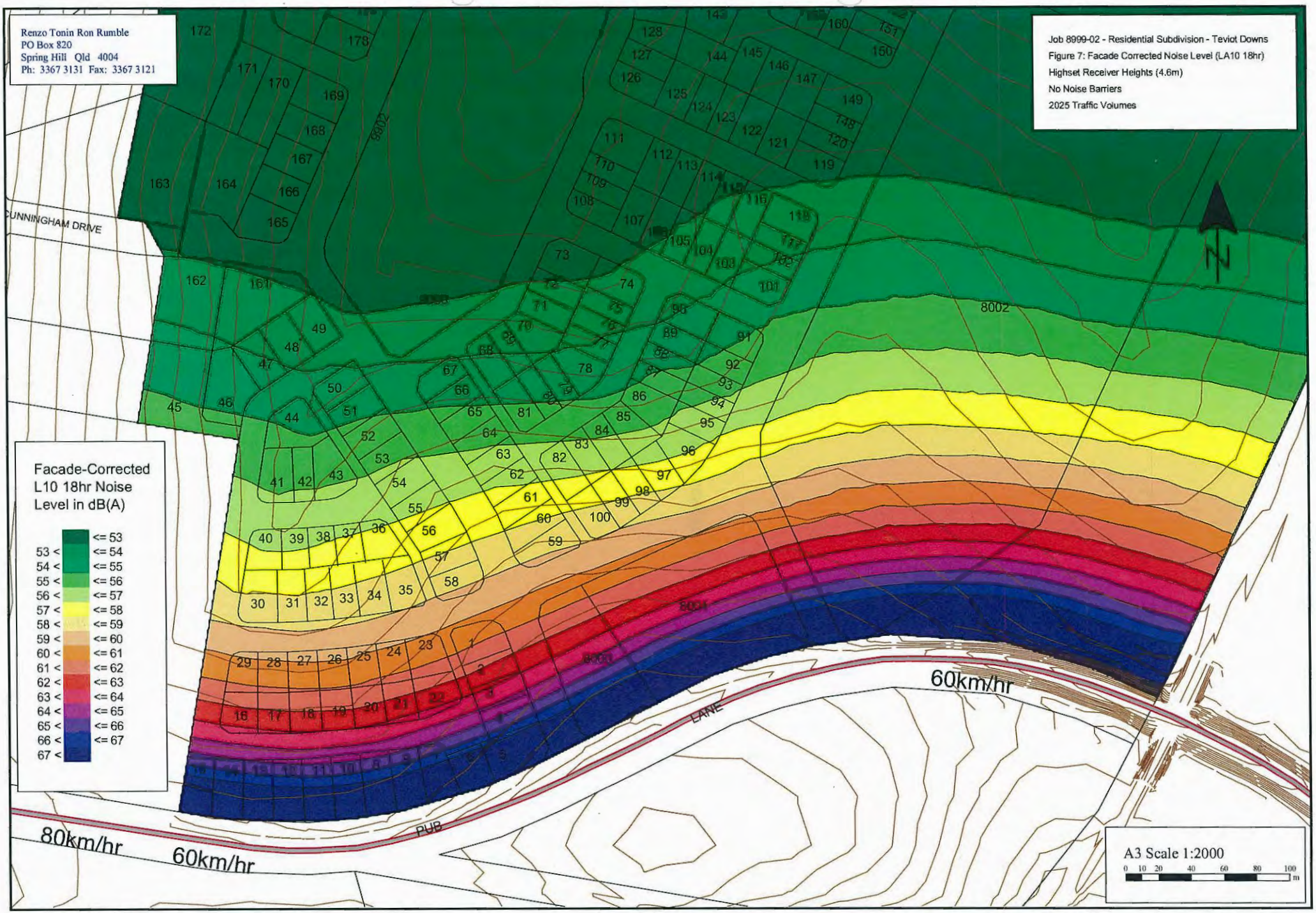


Figure 8: Proposed noise barrier locations – 2.5m high

Renzo Tonin Ron Rumble
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121

Job 8999-02 - Residential Subdivision - Teviot Downs

Figure 8: 2.5m Noise Barrier Location

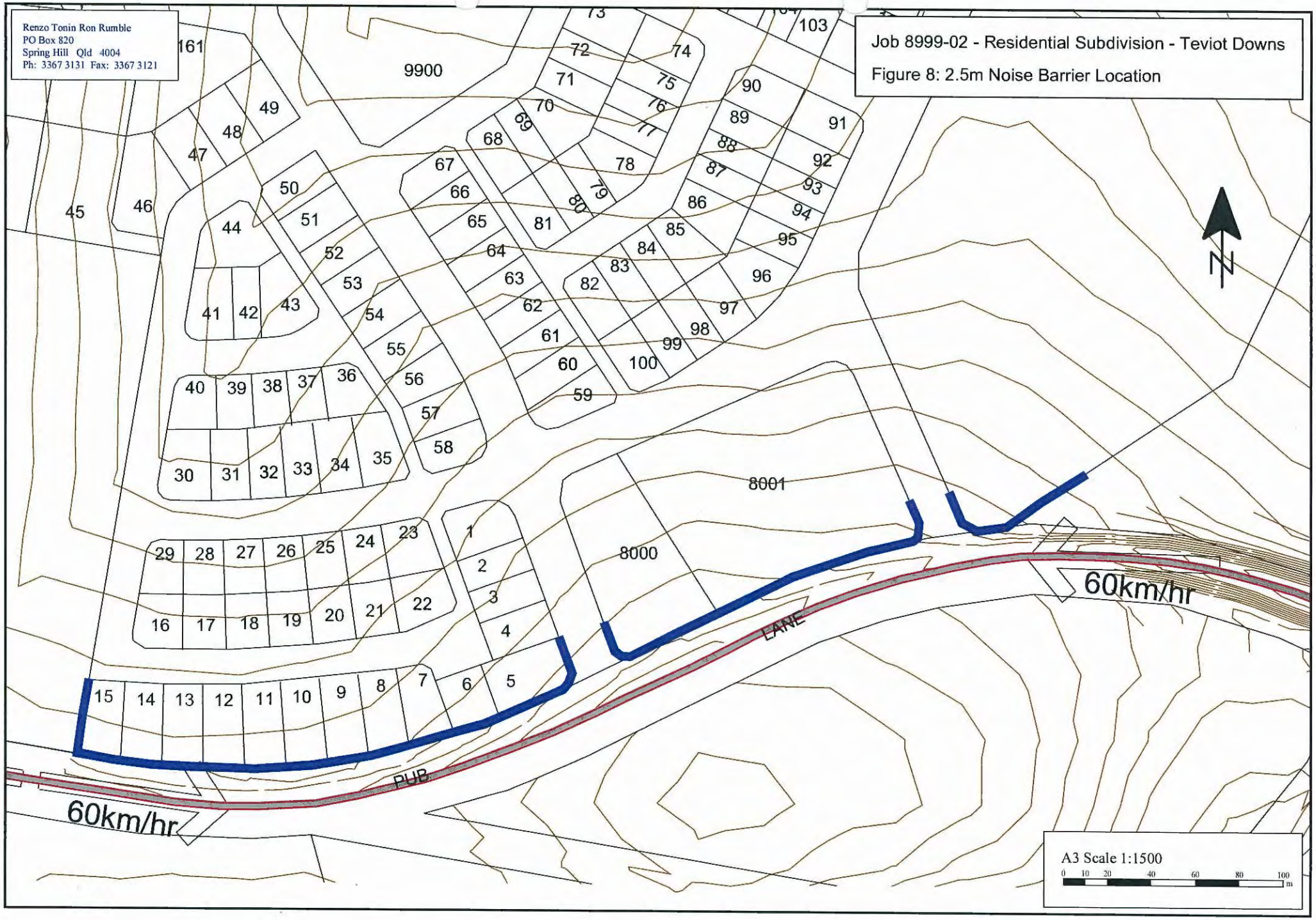


Figure 9: Future noise levels at lowset receiver levels –2.5m high noise barriers

Renzo Tonin Ron Rumble
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121

Job 8999-02 - Residential Subdivision - Teviot Downs
Figure 9: Facade Corrected Noise Level (LA10 18hr)
Lowset Receiver Heights (1.8m)
2.5m Noise Barriers
2025 Traffic Volumes

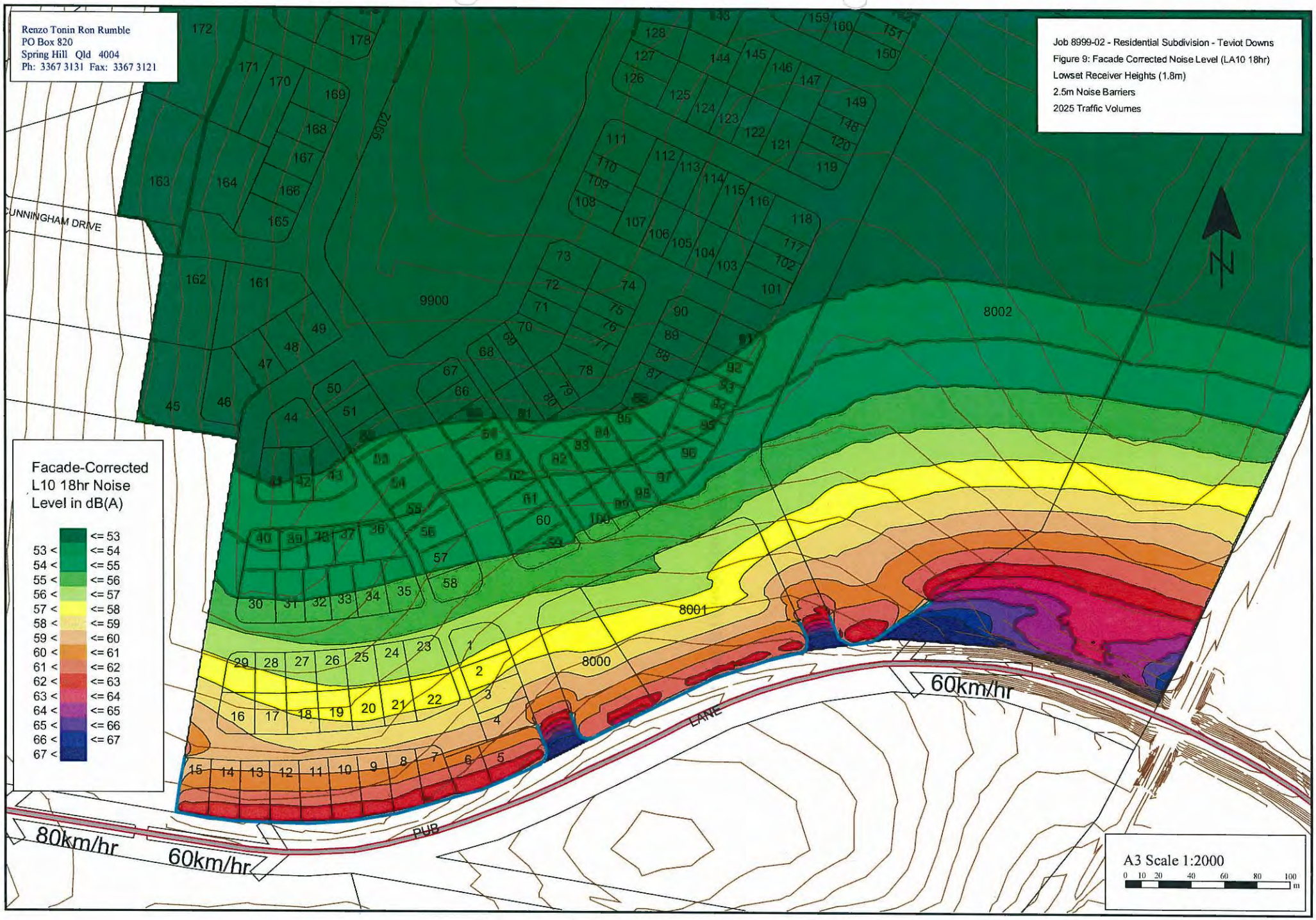
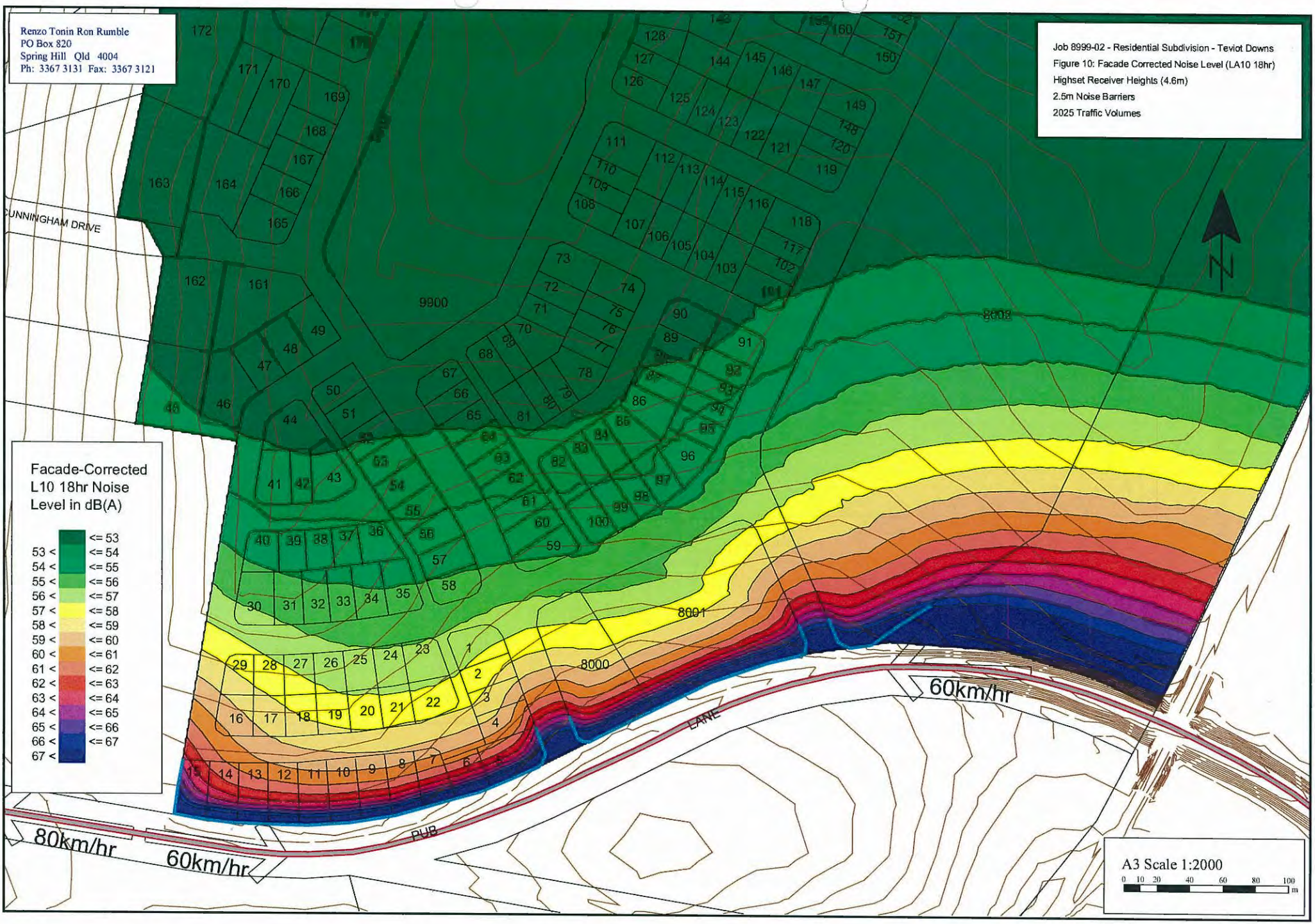


Figure 10: Future noise levels at highset receiver levels – 2.5m high noise barriers

Renzo Tonin Ron Rumble
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121

Job 8999-02 - Residential Subdivision - Teviot Downs
Figure 10: Facade Corrected Noise Level (LA10 18hr)
Highset Receiver Heights (4.6m)
2.5m Noise Barriers
2025 Traffic Volumes



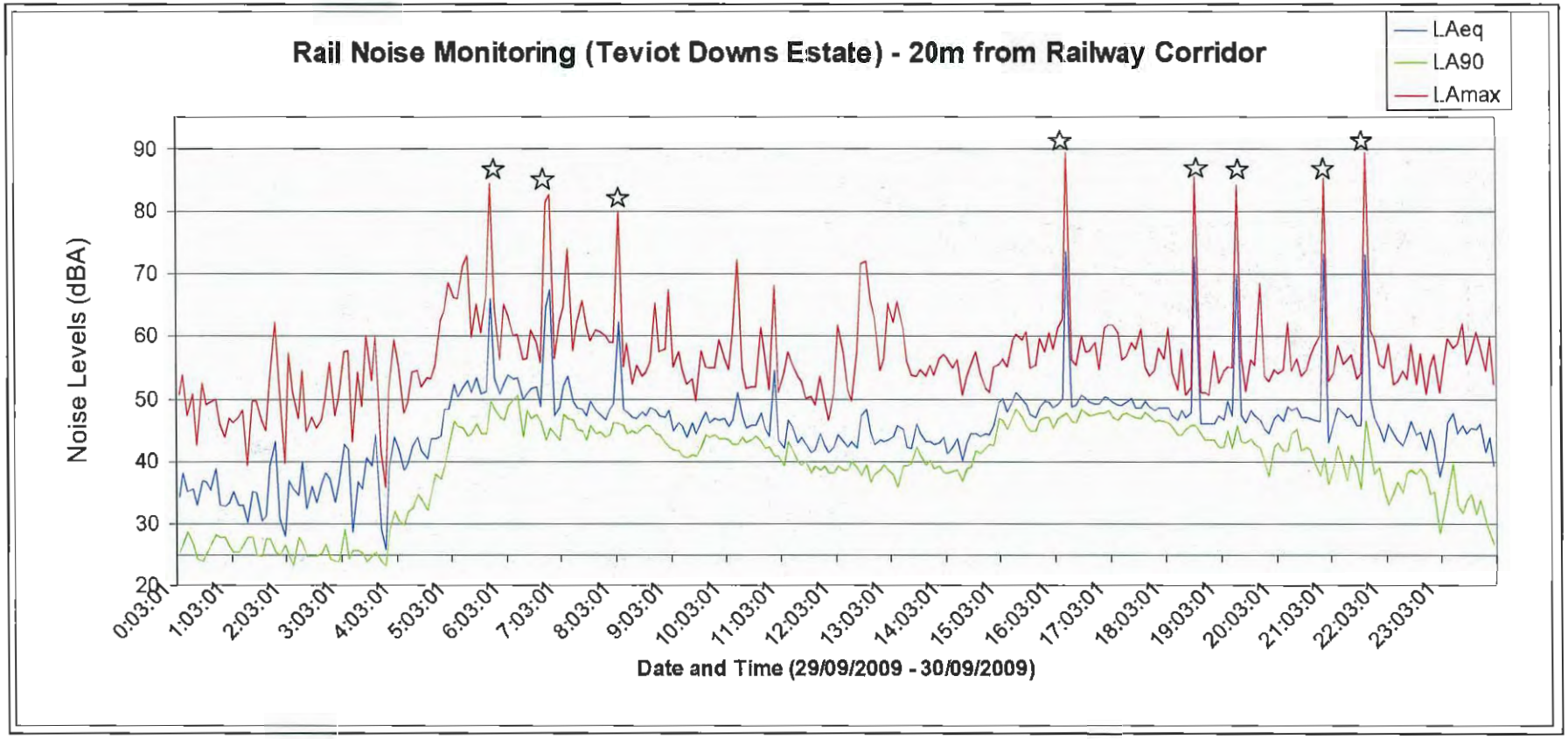


Figure 11: Rail noise measurement results (Tuesday 29th October 2009)

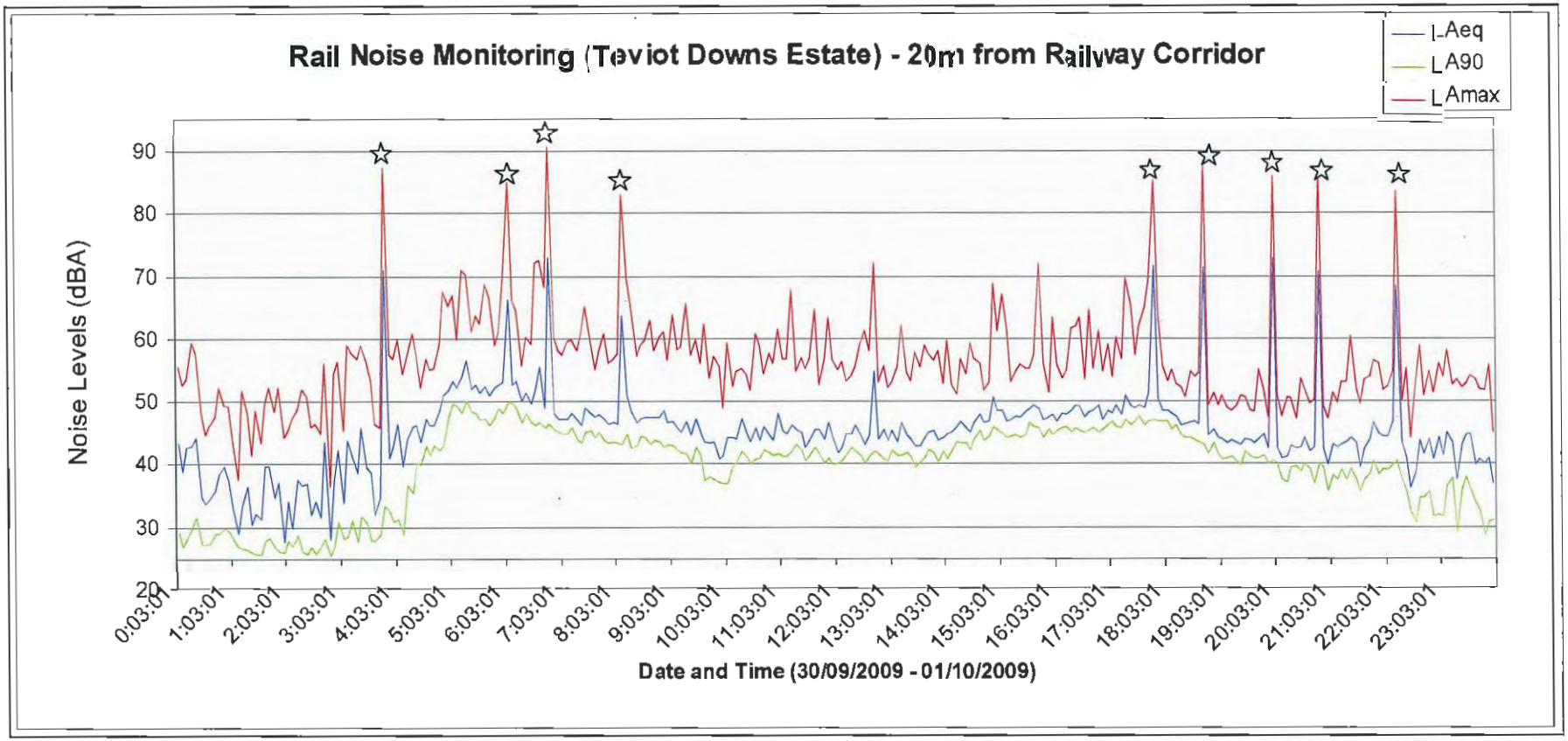


Figure 12: Rail noise measurement results (Wednesday 30th October 2009)

Figure 13: Rail noise level contours - No Barriers

Ron Rumble Renzo Tonin
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121

Job Q8999-02 - Residential Subdivision - Teviot Downs

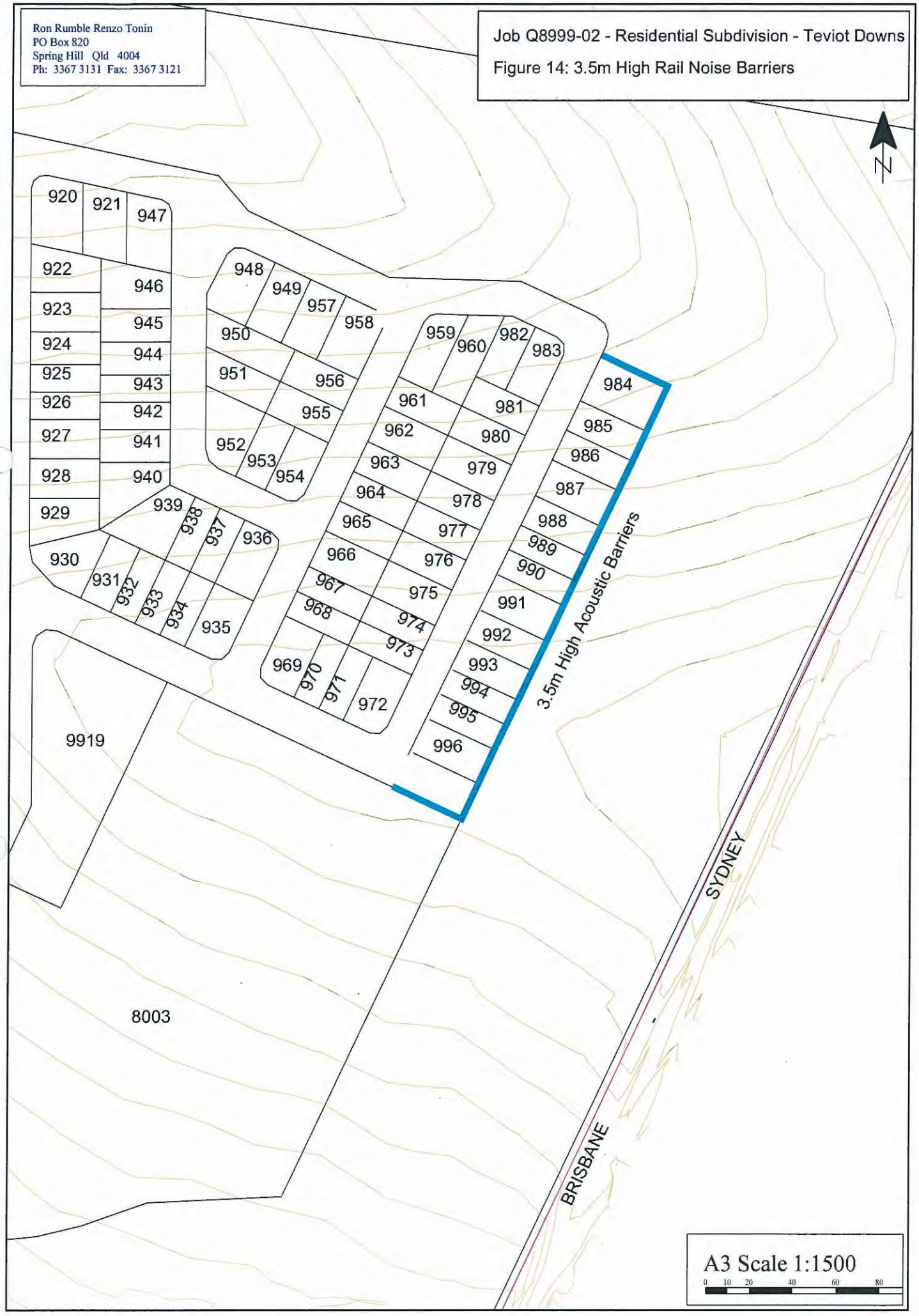
Figure 13: Railway Noise Level Contours - No Barriers

Figure 14: Rail noise barriers – 3.5m high

Ron Rumble Renzo Tonin
PO Box 820
Spring Hill Qld 4004
Ph: 3367 3131 Fax: 3367 3121

Job Q8999-02 - Residential Subdivision - Teviot Downs

Figure 14: 3.5m High Rail Noise Barriers



The specific outcomes in terms of protection and enhancement of personal health and safety and property are presented in terms of the protection and enhancement of amenity and character intended for the zone and sub-area. Specifically:-

O1 *Development protects and enhances the amenity and character intended for the zone and sub-area from noise related to a road transport activity (or) a rail transport activity by the use of noise attenuation measures such as-*

(a) locating an activity which is not a noise-sensitive place between a major noise source and a noise-sensitive place to ensure that it provides a buffer or a noise barrier; and

(b) building construction techniques; and

(c) using building materials which have a high noise transmission loss; and

(d) minimising the area of windows and doors in walls facing the major noise source.

Probable solutions to achieve compliance with the specific outcomes in terms of protection and enhancement of personal health and safety and property are also presented in Table 4.12.9 as follows:-

S1.1 *Development for a residential use or other noise sensitive place within 50m of a major road, 80m of the Brisbane-Gold Coast rail corridor or 100m of the Brisbane-Sydney rail corridor complies with:*

a) in relation to a noise level external to the building –

i. 65dBA, assessed as the 24 hour average equivalent continuous A-weighted sound pressure level; and

ii. 87dBA, assessed as a single event maximum sound pressure level when measured one metre from the most exposed part of the noise sensitive place; and

b) In relation to the noise level in a habitable room internal to the building, an average $L_{Max\ (10pm\text{-}6am)}$ of 50dBA or less.

S1.2 *Development is designed and constructed in accordance with –*

a) AS3671-1989 Acoustics – Road Traffic Noise Intrusion – Building Siting and Construction; and

b) AS2377-2002: Acoustics – Methods for the Measurement of Railbound Vehicle Noise; and

c) AS/NZS2107: 2000 Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors.

The specific outcomes in terms of amenity and character are:-

O2 *Development provides a noise barrier as a noise attenuation measure only where-there is no prudent or feasible alternative to the noise barrier; and*

(a) the noise barrier does not have an adverse impact on the amenity and character of the zone and sub-area.

O3 *Development provides that where a mound is provided adjacent to a noise barrier, the mound is –*

(a) landscaped...; and

(b) of stable construction; and

(c) free draining.

O4 *Development provides that where a noise barrier is provided, landscape area is provided on the premises adjacent to the noise barrier which provides visual screening of the noise barrier.*

O5 *Development provides that where a densely planted landscaped area is provided adjacent to a road, the densely planted landscaped area reflects the character of the adjoining landscape and contributes to the landscape character of the zone and sub-area.*

No probable solutions to achieve compliance with the specific outcomes in terms of protection and enhancement of amenity and character are provided for O2, O3 or O4. S5.1 is a probable solution to achieve compliance with the specific outcomes in terms of protection and enhancement of amenity and character for O5, which states: "Development provides a densely planted landscaped area is provided adjacent to a road".