Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
Suite 34, 11 Preston Street, Como, W.A. 6152
P.O. Box 219, Como, W.A. 6952
Telephone: (08) 9367 6200
Facsimile: (08) 9474 2579
Email: hsa@hsacoustics.com.au

ROBERTS DAY

VILLAGE 7 SUBDIVISION

ELLENBROOK

ACOUSTIC ASSESSMENT

MARCH 2009

OUR REFERENCE: 10100-1-09006

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ACOUSTIC ASSESSMENT

ELLENBROOK VILLAGE 7

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FOR

ROBERTS DAY

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APPENDICIES

1. INTRODUCTION

Roberts Day commissioned Herring Storer Acoustics (HSA), to measure the existing noise and vibration levels caused by train movements on the Westnet Rail Line adjacent the Ellenbrook Village 7 Sub-division.

Noise and vibration monitoring was undertaken adjacent to the rail line on the property boundary approximately 250m South of the Railway Parade – Maralla Road intersection.

2. SUMMARY

Based on the measurements carried out and our analysis of train noise and vibration, noise and ground vibration from passing trains will comply with the appropriate criteria, and no amelioration is required.

3. ACOUSTIC CRITERIA

3.1 NOISE

Guidance for acceptable rail noise levels has been extracted from the WA Planning Commission document *"State Planning Policy: Road and Rail Transport Noise and Freight Considerations in Land-use Planning"*, draft version dated 11 July 2008.

Table 1, taken from the Policy, outlines the outdoor noise criteria that apply to the emission of road and rail transport noise as received at a noise-sensitive land use.

Table 1 – Outdoor Noise Level Criteria (dB(A))

Time Period	Noise "Target"	Noise "Limit"
Day 6.00am – 10.00pm	$L_{Aeq,16hr}$ = 55dB(A)	$L_{Aeq,16hr}$ = 60dB(A)
Night 10.00pm – 6.00am	$L_{Aeq,8hr}$ = 50dB(A)	$L_{Aeq,8hr}$ = 55dB(A)

It is relevant to note that the draft State Planning Policy, from which these criteria have been extracted, is intended to provide guidance for development of future projects and not for assessment of existing transport infrastructure and the relationship with existing developments/noise sensitive premises.

The 5 dB(A) difference between the outdoor noise "target" and the outdoor noise "limit", as prescribed in Table 1, represents and acceptable "margin" for compliance. In most situations it would be practicable to achieve outdoor noise levels within this acceptable margin.

In applying these outdoor noise criteria to new noise-sensitive developments, the objectives of the Policy are to achieve;

- 'Acceptable indoor noise levels' in noise sensitive areas (for example, bedrooms and living rooms of houses, classrooms in schools, etc). Where 'acceptable indoor noise levels' are as outlined in *AS/NZS 2107:2000 'Acoustics – Recommended design sound levels and reverberation times for building interiors'*; and

- A reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot.

Where a noise-sensitive development takes place in an area where outdoor noise levels will meet or fall below the noise target, no further noise amelioration measures are required under this policy.

In areas where the noise target is likely to be exceeded, but still be within the 5 dB(A) margin, mitigation measures should be implemented by the developer with a view to achieving the target noise levels in at least one outdoor living area on each residential lot. Where indoor spaces are planned to be facing any outdoor area the lies within the margin, noise mitigation measures should be implemented to achieve 'acceptable indoor noise levels' in those spaces.

In areas where the outdoor noise limit is likely to be exceeded (i.e. above $L_{Aeq(Day)}$ of 60 dB(A) or $L_{Aeq(Night)}$ of 55 dB(A)), a noise assessment should be undertaken by the developer to identify customised noise mitigation measures with a view to achieving the noise target in at least one outdoor living area on each residential lot, or if this is not practicable, within the 5 dB(A) margin. Where indoor spaces are planned to be facing outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve 'acceptable indoor noise levels' in those spaces.

3.2 VIBRATION

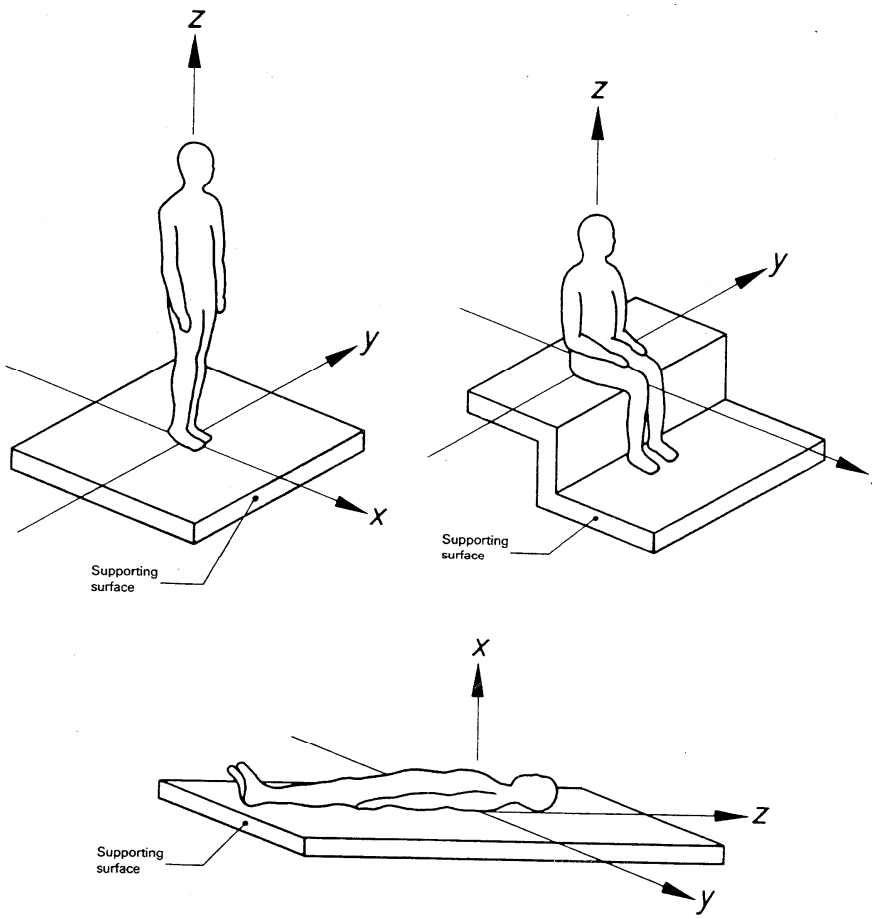
3.2.1 Human Response to Vibration

The criteria for Human response to vibration is Australian Standard AS 2670.2-1990 "Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock induced vibration in buildings (1 to 80Hz)" (AS2670.2-1990) and uses acceleration with units of m/s^2. These criteria is outlined below.

Ground vibration generated by train movements is caused by the impact of the train wheels with the rail. This impact causes the ground under the rail to vibrate, which then radiates through the ground.

As a building may be used for many different human activities, for example standing, sitting, lying or a combination of all three, vertical vibration of the building may enter the body as either z-axis, x-axis or y-axis vibration, as shown in Figure 1.

Figure 1 – Axis of Vibration (Extract from AS2670.2-1990)



a_x, a_y, a_z = acceleration in the directions of the x-, y-, z-axes

x-axis = back-to-chest

y-axis = right side to left side

z-axis = foot-(or buttocks-)to-head

Figure 1 — Directions of basicentric coordinate systems for mechanical vibrations influencing humans

As it is not clear which direction vibration would enter the body, a combination curve of the base curves is used. The combination curve combines the worst-case combination of the z-axis, x-axis and y-axis curves.

The combined base curve from AS2670.2-1990 is shown in Figure 2. This base curve represents magnitudes of approximately equal human response with respect to human annoyance and/or complaints about interference with activities. The satisfactory vibration magnitudes in rooms and building are specified as multiples of this base curve.

Figure 2 – Combined Direction Base Curve

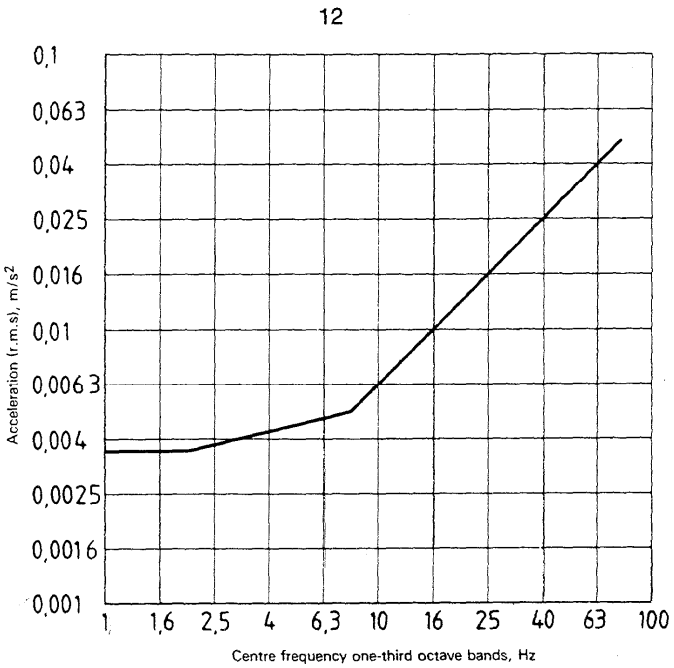


Figure 4a — Building vibration combined direction (*x*- , *y*- , *z*-axis) acceleration base curve (this curve shall be used when the direction of the human occupants varies or is unknown with respect to the most interfering or annoying vibration. See 4.2.3)

The multiplying factors used within the AS2670.2-1990 standard, specify satisfactory magnitudes of building vibration within residential buildings with respect to human response and are listed in Table 2 of Annex A of the standard. The residential section of Table 2 of Annex A is summarised in Table 2 below.

Table 2 - Summary of Multiplying Factors Within Residential Buildings

Place	Time	Continuous or Intermittent Vibration	Transient Vibration Excitation With Several Occurrences
Residential	Day	2 to 4	30 to 90
	Night	1.4	1.4 to 20

4. METHODOLOGY

Noise and vibration measurements of train passes were carried out adjacent to the Westnet Rail line on the property boundary at a distance of around 45m from the railway and approximately 250m south of the Railway Parade – Maralla Road intersection. A schematic of the rail line, proposed development and measurement location is given in Appendix A.

Measurements were recorded on 2 separate occasions, these are listed below;

- 20th January 2009 8:00PM to 21st January 2009 11:00AM; and
- 18th February 2009 3:30PM to 20th February 2009 3:30PM.

A Svan 948 Sound and Vibration Data Logger and a Dytran 3233A Tri-axial accelerometer were used to record the noise and vibration simultaneously. The microphone was located approximately 1.5 metres above ground, and the accelerometer was firmly fixed to the ground.

All instruments used are currently factory calibrated. Calibration checks were carried out prior to, and after all measurements. Calibration certificates are available on request.

5. MEASUREMENTS AND OBSERVATIONS

5.1 NOISE

Train passes were identified to occur at the following times during the monitoring periods.

- 20th January at 2:01 AM, empty train from Kwinana, 24 wagons and one locomotive.
- 18th February at 8:14 PM, loaded coal train to Kwinana, 22 wagons and one locomotive.
- 19th February at 11:48PM, empty train from Kwinana, 25 wagons and one locomotive.

Train events were generally observed to last for 1 minute, as such, the 1 minute L_{Aeq} levels are noted in Table 3.

Table 3: Measured Noise Levels for Train Pass Events

Train Time	Measured 1 minute L_{Aeq}	Measured L_{Amax}
20th January at 2:01 AM	66 dB(A)	79 dB(A)
18th February at 8:14 PM	70 dB(A)	72 dB(A)
19th February at 11:48PM	65 dB(A)	71 dB(A)

5.2 VIBRATION

Appendix B contains graphical vibration data recorded for each train pass, plotted against the baseline curves specified in AS2670.2-1990.

6. COMPLIANCE ASSESSMENT

6.1 NOISE

From information we have been able to obtain, we understand that the maximum daily usage of the railway line is 4 trains per day. This comprises:

1 Quartz Train
1 Coal Train
2 Grain Trains.

Although the number of train movements can vary from day to day, (i.e. between 0 and 4), the assessment has been based on 4 trains or 8 movements per day. Table 4 shows the noise that would be received at the closest residence during both the day and night periods for the following scenarios.

1) 8 movements per day, divided equally between day and night (i.e. 4 movements during the day period and 4 movements during the night period).

2) 8 movements per day, but with all movements occurring either during the day or night periods (i.e. 8 movements during the day period and 8 movements during the night period).

The calculations were based on the recorded 1 minute values stated in Table 3.

Table 4: Calculated Day and Night Noise Levels for Train Passes

Number of Train Passes (Per Time Period)	**Calculated $L_{Aeq,16hr\ (Day)}$ Target = 55 dB(A) Limit = 60 dB(A)**	**Calculated $L_{Aeq,8hr\ (Night)}$ Target = 50 dB(A) Limit = 55 dB(A)**
4 (Normal)	46 dB(A)	49 dB(A)
8 (Worst Case)	49 dB(A)	52 dB(A)

Note: The first scenario of 4 movements during the day and night periods would be considered the normal worst case scenario. However, to be conservative and allow some increase and/or variation in train movements, the actual assessment has been based on worst case with the day and night periods each having 8 train movements. This would be 16 train movements in a single 24 hour day or double the current maximum usage.

6.2 VIBRATION

The graphs in Appendix B illustrate that for all 3 recorded train passes, the vibration levels do not exceed the criteria set out in AS2670.2-1990 at the property boundary approximately 45m from the train line.

7. OPTIONS / DISCUSSION

7.1 NOISE

As illustrated in Table 4, for the current maximum usage with 4 train passes during the day and another 4 during the night, noise levels would not exceed the target levels set out in the *"State Planning Policy: Road and Rail Transport Noise and Freight Considerations in Land-use Planning"*, draft version dated 11 July 2008. With 8 train movements in the night, a highly unlikely possibility, noise received at the closest possible residence, although marginally exceeding the Target noise level, would still comply with the Limit $L_{Aeq,8hr}$ noise level of 55 dB(A).

7.2 VIBRATION

As shown in the attached graphs, ground vibration for passing trains is below the base curve and therefore complies with the criteria for ground vibration.

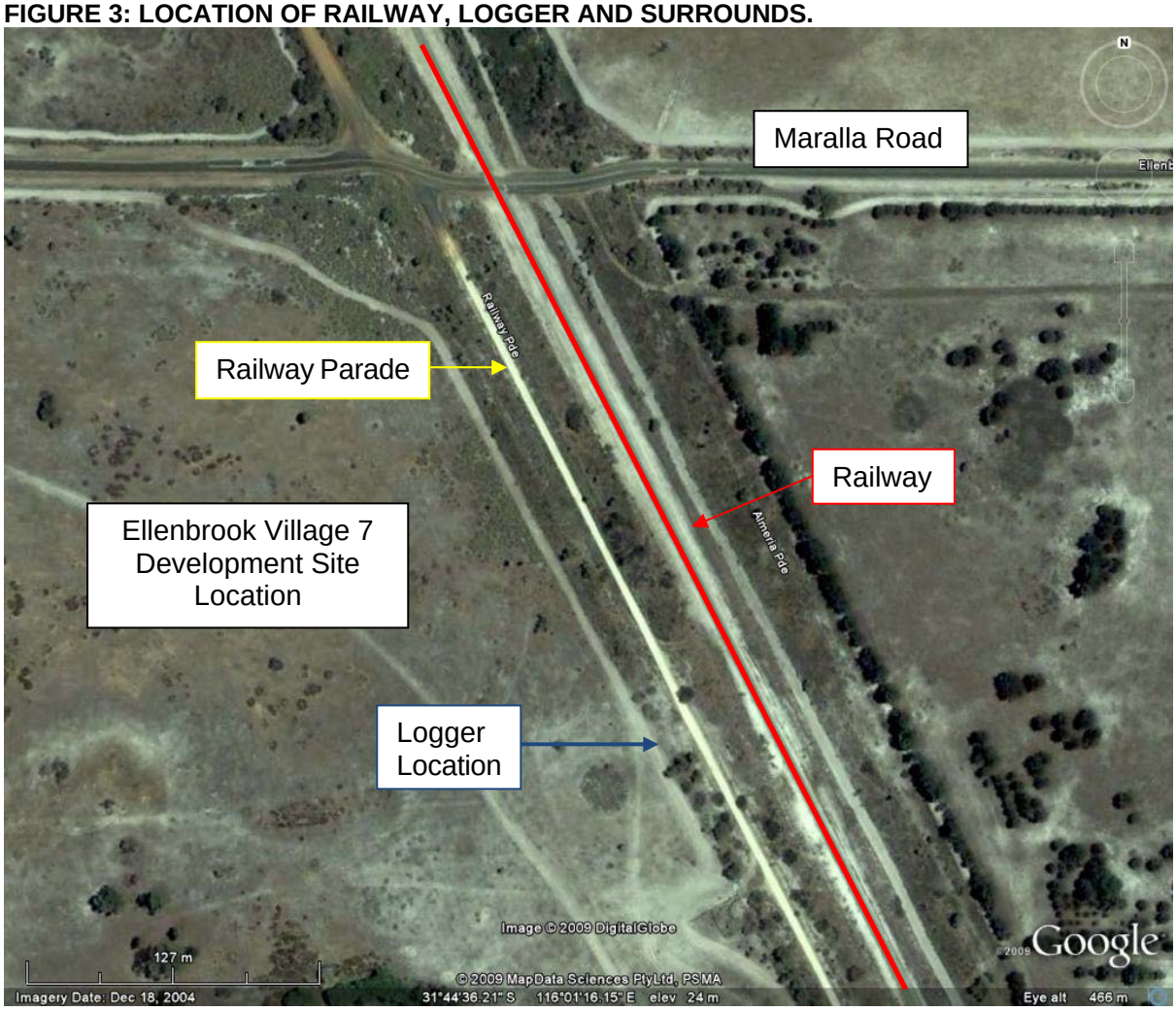
8. CONCLUSION

Based on the measurements carried out and our analysis of train noise and vibration, noise and ground vibration from passing trains will comply with the appropriate criteria, and no amelioration is required.

APPENDIX A

SITE and MEASUREMENT LOCATIONS

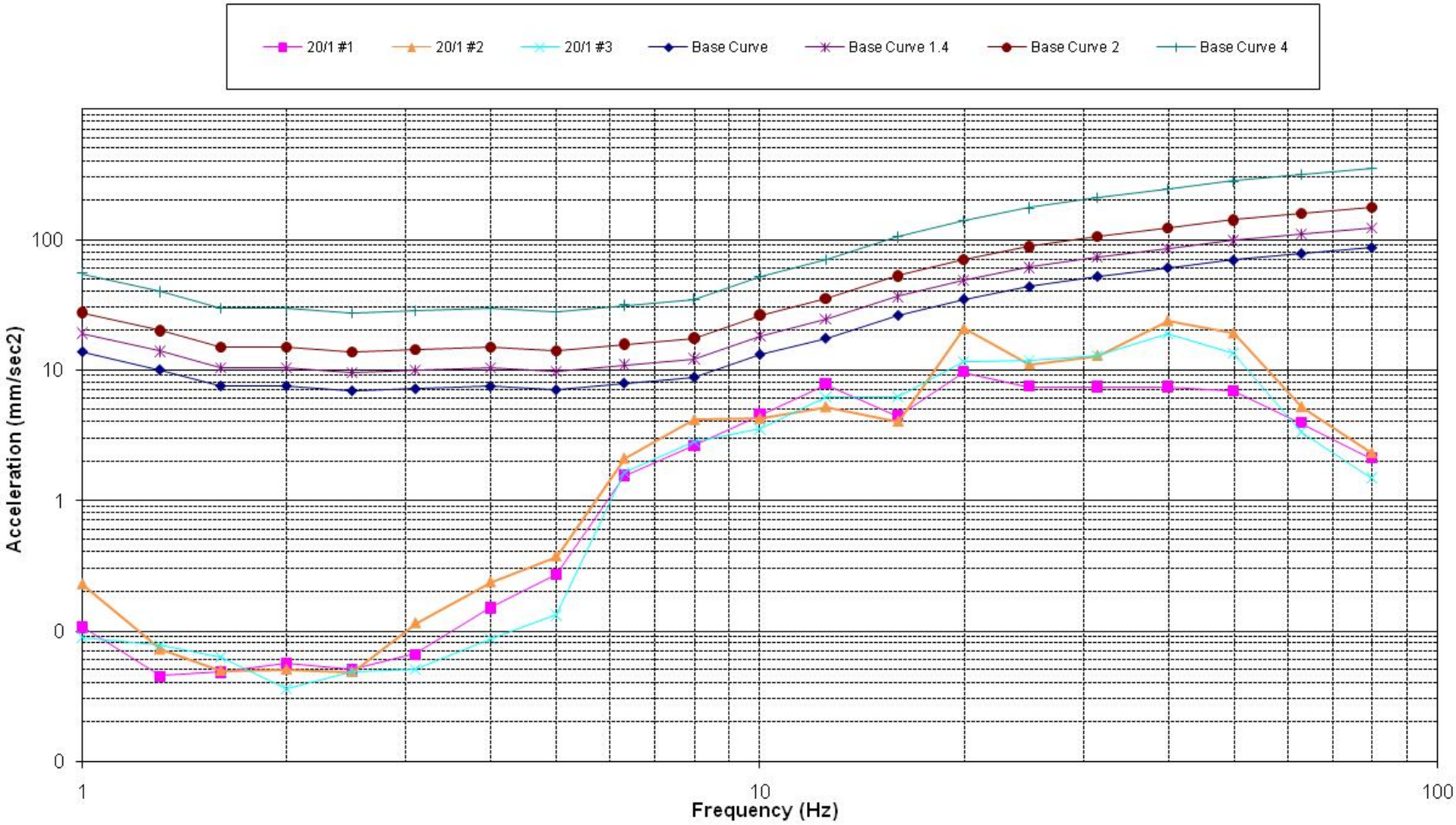
FIGURE 3: LOCATION OF RAILWAY, LOGGER AND SURROUNDS.



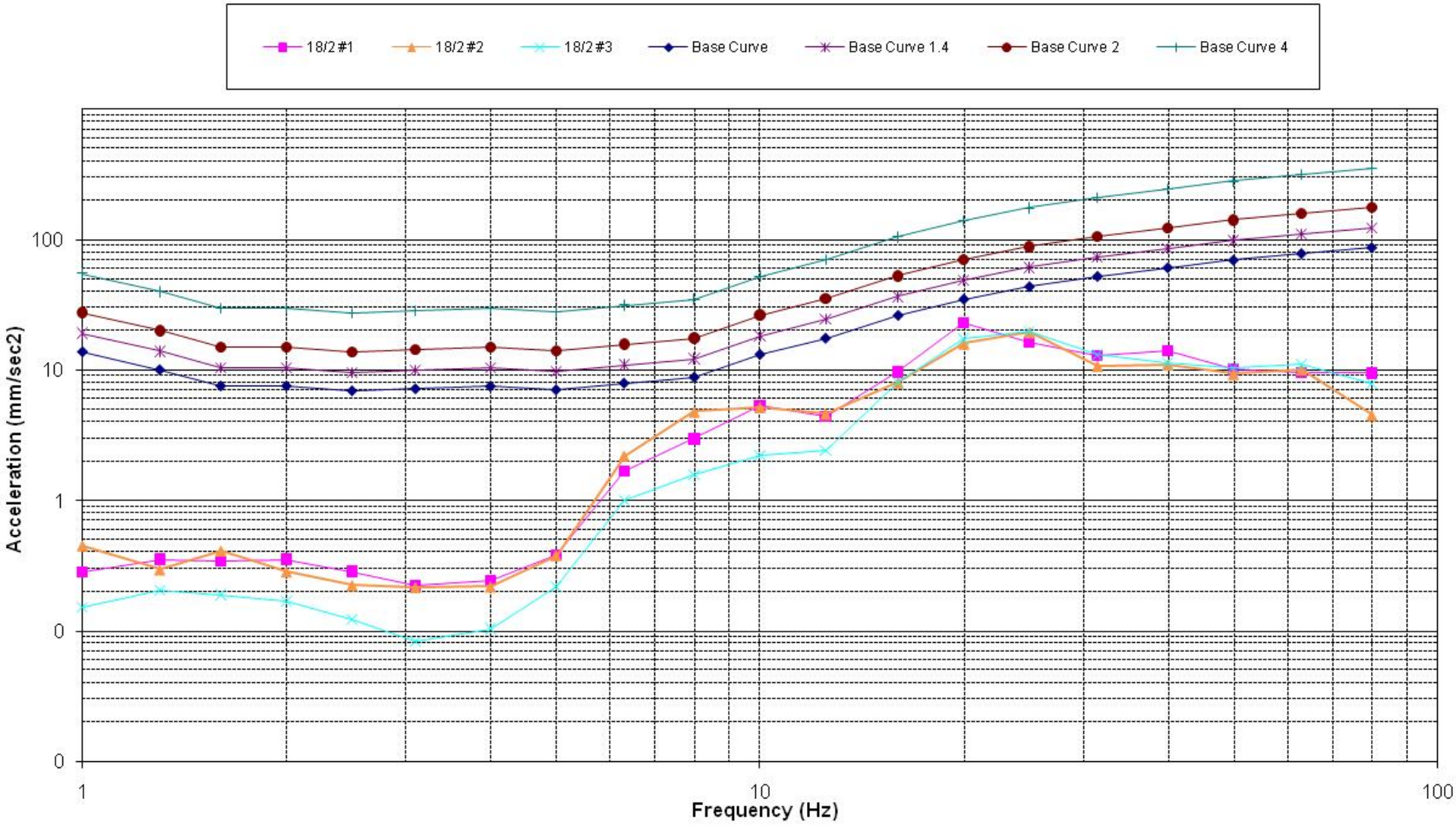
APPENDIX B

GRAPHICAL VIBRATION DATA

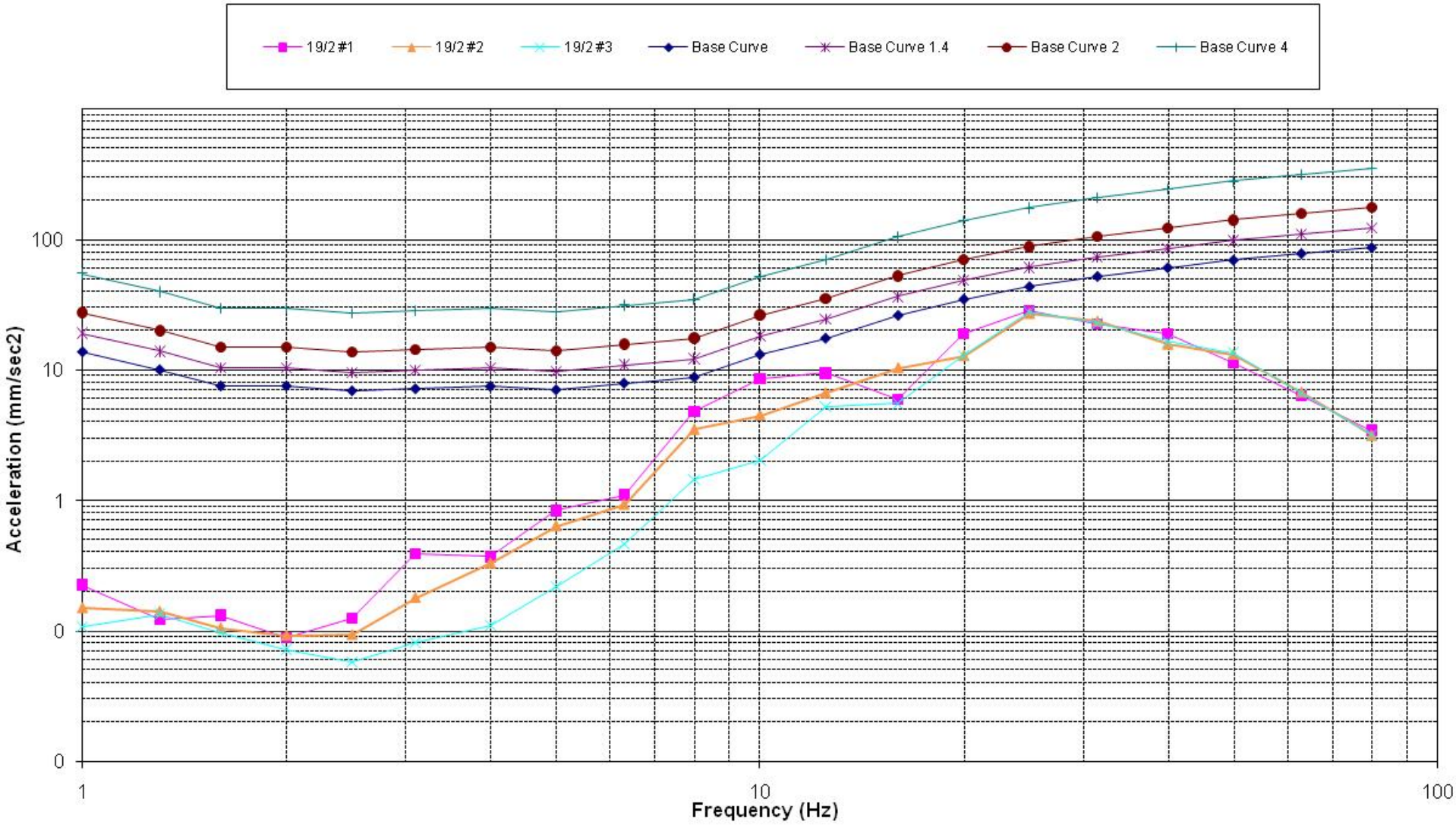
Vibration Criteria Empty Coal Train (21/1/09)



Vibration Criteria Loaded Coal Train (18/2/09)



Vibration Criteria Empty Coal Train (19/2/09)



Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
Suite 34, 11 Preston Street, Como, W.A. 6152
P.O. Box 219, Como, W.A. 6952
Telephone: (08) 9367 6200
Facsimile: (08) 9474 2579
Email: hsa@hsacoustics.com.au

Our ref: 14096-2-09006-02

15 February 2012

Roberts Day
GPO Box 6369
EAST PERTH, WA, 6892

Attention: Anthony Morcombe
Address: anthony.morcombe@robertsday.com.au

Dear Anthony,

ELLENBROOK VILLAGE 7B SPEEDWAY NOISE
PROPOSED NOISE CONTOUR FOR NOTIFICATIONS ON TITLES

As requested, we provide the following in response to the Shire of Swan's comments regarding the lots requiring Notifications on Titles.

COUNCIL COMMENTS

In summary, we believe that the Council's position regarding the lots requiring notifications on titles is that:

1. *Regardless of any alternative, basically compliance needs to be achieved with the Environmental Protection (Noise) Regulations 1997.*

2. *Council contention is that section 70A notifications be required where your model predicts external noise exposure at 45 dB(A) and above (i.e. where levels are predicted to exceed the 'assigned levels' of the Regulations).*

RESPONSE TO ABOVE QUERIES

The first thing to note is that the contours previously produced and presented to council were worst case L_{Amax} noise levels, whereas the Regulatory criteria is an L_{A10} noise level. More specifically, the previous noise contours produced were based on worst case wind conditions for the L_{Amax} noise level for the loudest class of vehicles (i.e. late model sedans) raced at the speedway. For this class of vehicle, we believe that there are 12 - 14 meets per year of which Late Models race at 4. Within these meetings, we understand that they have 2 heats and a final, which is about 15 minutes of racing. Therefore, they basically race for about 1 hour per year. Thus, the contour plot previously produced should not be used to relate to an assigned L_{A10} noise criteria.

From monitoring undertaken, of a race meeting (including Late Model Sedans) the L_{A10} noise level is 3 dB(A) less than the L_{Amax} noise level. Based on this differential of 3 dB(A), the L_{A10} noise contours have been determined and are attached for information as Attachment 1. It should be noted that the noise contours shown in Attachment 1 are without any development having been undertaken.

Note: The above differential is for a race meeting that includes the Late Model Sedans. Excluding the Late Model Sedans the differential between the L_{A10} and the L_{Amax} noise levels is 4 dB(A).

We note that the noise contours shown on Attachment 1, would still be conservative, as they do not include any homes that would be built as part of the residential development. We believe that the first couple of rows of residence would provide a barrier and noise received at the residences behind, would comply with the required Council Criteria. The L_{A10} noise contours with the residential buildings are attached for information as Attachment 2.

Finally, we note that the modelling is based on worst case with winds from the speedway towards the residence. With winds blowing from the south west, modelling indicates that noise received within Ellenbrook would be about 7 dB(A) less than what has been used.

RECOMMENDATIONS

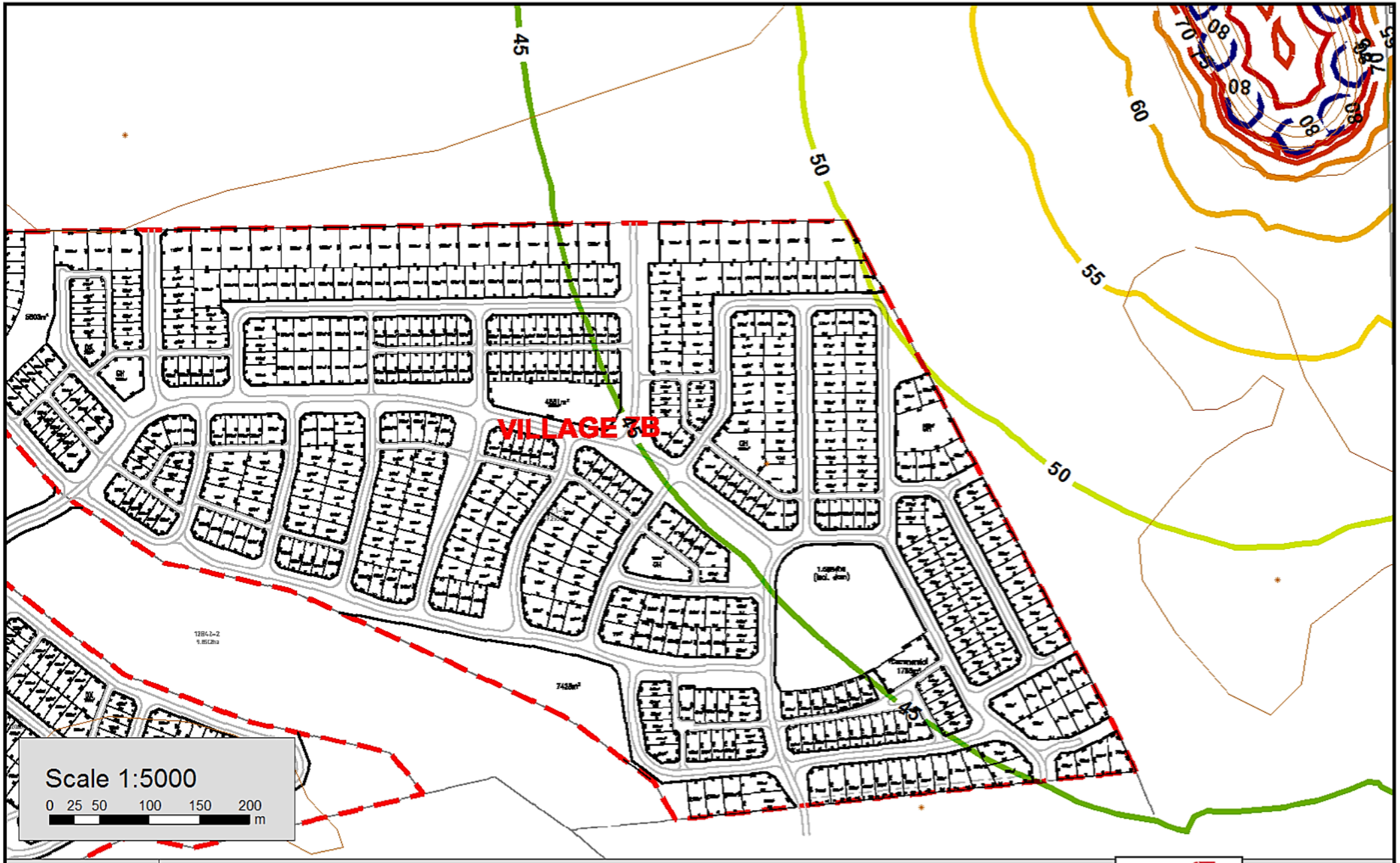
Taking Council's position into consideration, then it is recommended that the 45 dB L_{A10} noise contour be used to determine the lots requiring Notifications of Titles. However, given the barrier affect afforded by residential buildings, we recommend that the 45 dB(A) for the L_{A10} noise contour, as shown on Attachment 2 (with the residence in place) be used as the bases of the lots requiring Notifications on Titles. For information, based on the 45 dB(A) noise contour shown on Attachment 2, the Lots requiring Notifications on Titles are shown on Attachment 3.

We trust the above meets your requirements on this matter and should you have any further queries please do not hesitate to contact this office.

Yours faithfully,
For **HERRING STORER ACOUSTICS**

Tim Reynolds

Att.



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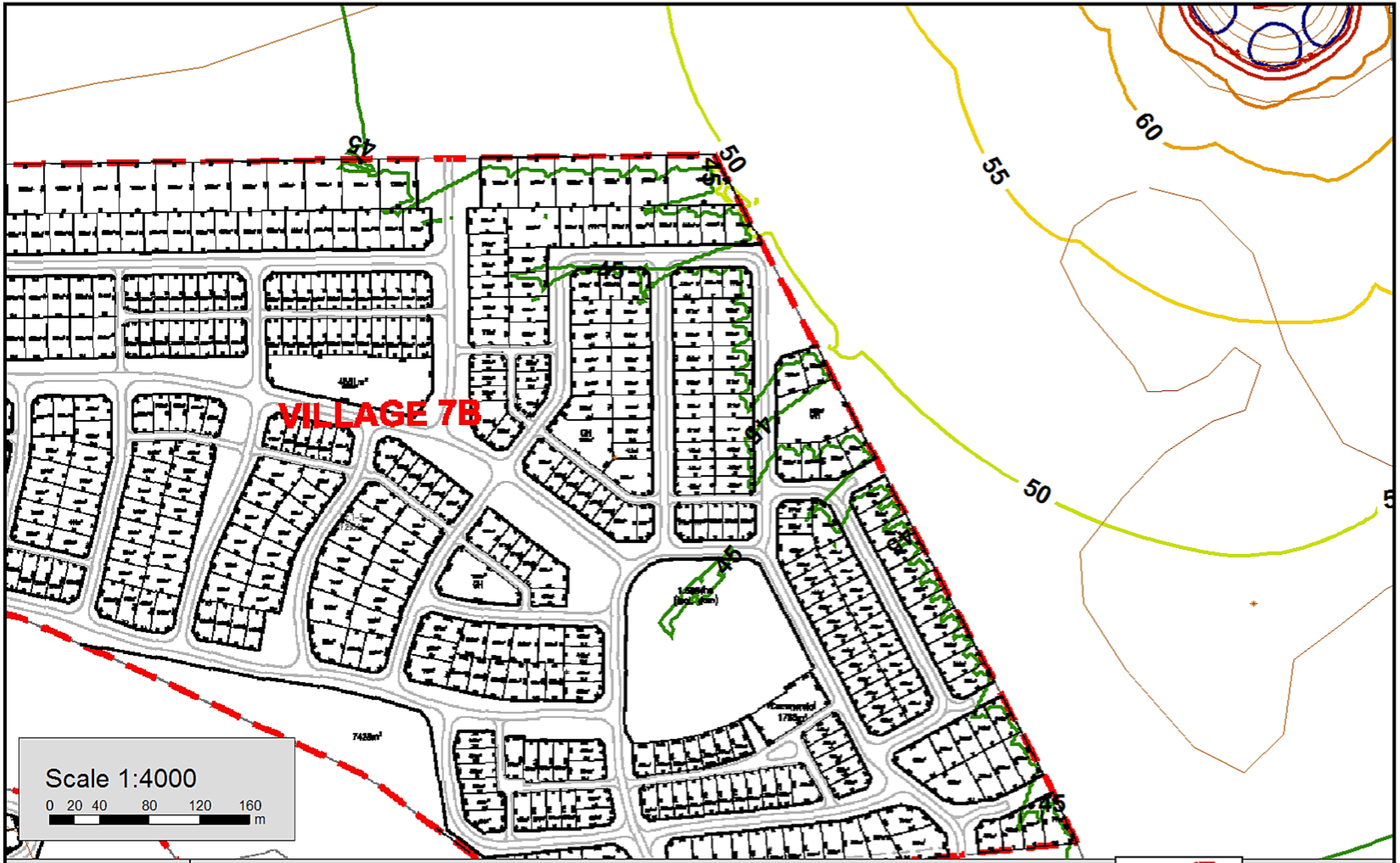
VILLAGE 7B - LA10 NOISE CONTOUR PLOT FOR ALL WIND SCENARIOS at 3 METRES PER SECOND

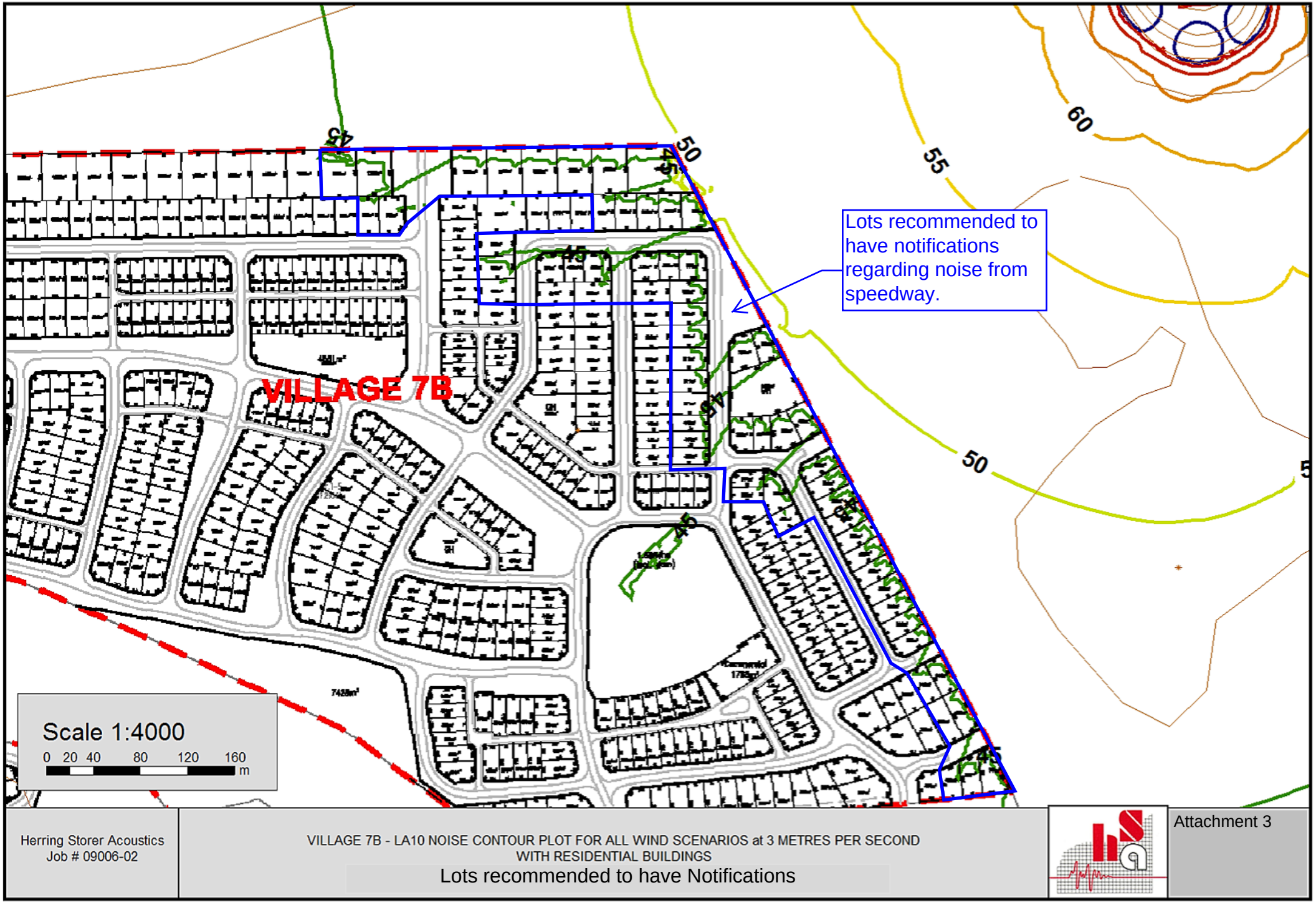
Attachment 1



Herring Storer Acoustics
Job # 09006-02

VILLAGE 7B - LA10 NOISE CONTOUR PLOT FOR ALL WIND SCENARIOS at 3 METRES PER SECOND
WITH RESIDENTIAL BUILDINGS

Attachment 2



Herring Storer Acoustics
Job # 09006-02

VILLAGE 7B - LA10 NOISE CONTOUR PLOT FOR ALL WIND SCENARIOS at 3 METRES PER SECOND
WITH RESIDENTIAL BUILDINGS
Lots recommended to have Notifications

Attachment 3