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PUBLIC TRANSPORT AUTHORITY

NORTHERN SUBURBS RAILWAY EXTENSION BUTLER TO YANCHEP

NOISE ASSESSMENT

SEPTEMBER 2012

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1. INTRODUCTION

Herring Storer Acoustics was commissioned by the Public Transport Authority to undertake a noise study relating to extension of the northern suburbs passenger railway line between Romeo Road and Yanchep Station. As part of the study, the following was carried out:

- Determine by noise modelling, noise emissions from trains travelling on the extension of the Northern Suburbs passenger railway line.
- Assess the predicted noise levels for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, a plan indicating the general study area is attached in Appendix A. Additionally, for information a Glossary of Terms is attached in Appendix F.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 “Road and Rail Transport Noise and Freight Considerations in Land Use Planning” (SPP5.4), transport infrastructure providers should design mitigation measures to achieve the noise limit of $L_{Aeq(Day)} 60 \text{ dB(A)}$ and $L_{Aeq(Night)} 55 \text{ dB(A)}$, when assessed at one metre from the façade at ground floor level. Additionally, transport infrastructure providers are also required to consider design measures to meet the noise target of $L_{Aeq(Day)} 55 \text{ dB(A)}$ and $L_{Aeq(Night)} 50 \text{ dB(A)}$, and to implement these measures where reasonable and practicable.

For the majority of the extension, as this is a new rail infrastructure development in the vicinity of future noise-sensitive land uses, it is noted that under the policy than “in these instances, the infrastructure provider (i.e. PTA) and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.” Additionally, under Section 5.1 – Roles and Responsibilities of the Implementation Guidelines it states:

“Where major transport corridors are planned for an approved structure plan but are not yet constructed, as a general principle, the infrastructure provider or proponent that wishes to undertake construction first would be expected to undertake ‘noise mitigation’ measures.”

From the single point calculations, we note that the difference between the day and night period noise levels is approximately 7 dB(A). Therefore, if compliance is achieved with the day period acoustic criteria, compliance with the night period acoustic criteria would also be achieved. Thus the day period is the critical period with regards to achieving compliance.

Additionally, the results of single point calculations indicate that during the day, without any barriers and over flat ground, compliance with the above the "Noise Limit" would be achieved at a setback of approximately 35 metres from the boundary of the rail reserve. However, for this extension, the railway is generally in cut and as shown on the noise contour plots attached in Appendix B, compliance is achieved in the majority of locations where there is an access road between the railway and residence. For information, noise mitigation could include:

- 1 Appropriate setbacks from the railway line (when in cut);
- 2 Barriers;
- 3 "Quiet House" design; or
- 4 A combination of some or all three options outlined above.

Also from single point calculations, to achieve compliance with the required acoustic criteria, barriers of approximately the following heights could be used:

In cutting	-	1.8m
Flat Ground	-	1.8m
Raised	-	2.5m

Note: The above barrier heights would vary, depending on the depth of cut or the height of the fill.

The above barriers have little effect on the noise received at a first floor of residences. The noise received at the first floor of a residence located at 10 and 20 metres from the rail reserve has been calculated at 63 and 62 dB(A) respectively.

Given the stage of the project and the surrounding developments, it is recommended that in locations where the railway is on fill, that the PTA negotiate with developers such that there is an access road between the residence and the railway line. We note that this also has advantages for the developer, in that compliance with the requirement to reduce noise received at an outdoor area should be reduced as far as practical with the aim to comply with the L_{Aeq} of 50 dB(A) during the night period. To this end, we understand that PTA has requested that all land developers located adjacent to the railway reserve, plan for a road reserve or parkland to be directly adjacent the railway line. Information regarding spatial separation is contained in Section 4.1.1 – Spatial Separation of the Implementation Guidelines (a copy of Section 4.1.1 is attached in Appendix E).

We note that for area where information on the sub-divisions was supplied, noise modelling indicates that in location where there is an access road located between the railway line and the first row of houses, then compliance with the "Noise Limits" and thus comply with the requirements of SPP 5.4 would be achieved. In other locations, where residence back on to the railway reserve, the noise modelling indicates that noise received at these residences would exceed the requirements of the "Noise Limits" and noise amelioration would be required. For information the locations of barriers would be required to achieve compliance are shown on the figures attached in Appendix D. Alternatively, we understand that with a couple of exceptions, that conditions have been placed on developers to ensure that subdivisions are designed such that residence do not back on to the railway line and that an access road is constructed. We believe that this is an acceptable alternative. As such, barriers would be required for the full length of the proposed extension and that as required under the policy, the PTA should enter into discussions with developers to determine the best noise mitigation options.

We also note that under normal circumstances, the first row of residences adjacent to railway line would provide a sufficient barrier to those residence located behind that notification of train noise would only be required on the first row of residence.

3. CRITERIA

The Western Australian Planning Commission (WAPC) released on 22 September 2009 State Planning Policy 5.4 “Road and Rail Transport Noise and Freight Considerations In Land Use Planning” (SPP 5.4). Section 5.3 – Noise Criteria, outlines the acoustic criteria and states:

“5.3 - NOISE CRITERIA

Table 1 sets out the outdoor noise criteria that apply to proposals for new noise-sensitive development or new major roads and railways assessed under this policy.

These criteria do not apply to—

- *proposals for redevelopment of existing major roads or railways, which are dealt with by a separate approach as described in section 5.4.1; and*
- *proposals for new freight handling facilities, for which a separate approach is described in section 5.4.2.*
- *The outdoor noise criteria set out in Table 1 apply to the emission of road and rail transport noise as received at a noise-sensitive land use. These noise levels apply at the following locations—*
- *for new road or rail infrastructure proposals, at 1 m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and*
- *for new noise-sensitive development proposals, at 1 m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.*

Further information is provided in the guidelines.

Table 1: Outdoor Noise Criteria

Time of day	Noise Target	Noise Limit
<i>Day (6 am–10 pm)</i>	<i>$L_{Aeq(Day)} = 55 \text{ dB(A)}$</i>	<i>$L_{Aeq(Day)} = 60 \text{ dB(A)}$</i>
<i>Night (10 pm–6 am)</i>	<i>$L_{Aeq(Night)} = 50 \text{ dB(A)}$</i>	<i>$L_{Aeq(Night)} = 55 \text{ dB(A)}$</i>

The 5 dB difference between the outdoor noise target and the outdoor noise limit, as prescribed in Table 1, represents an acceptable margin for compliance. In most situations in which either the noise-sensitive land use or the major road or railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. In relation to greenfield sites, however, there is an expectation that the design of the proposal will be consistent with the target ultimately being achieved.

Because the range of noise amelioration measures available for implementation is dependent upon the type of proposal being considered, the application of the noise criteria will vary slightly for each different type. Policy interpretation of the criteria for each type of proposal is outlined in sections 5.3.1 and 5.3.2.

The noise criteria were developed after consideration of road and rail transport noise criteria in Australia and overseas, and after a series of case studies to assess whether the levels were practicable. The noise criteria take into account the considerable body of research into the effects of noise on humans, particularly community annoyance, sleep disturbance, long-term effects on cardiovascular health, effects on children's learning performance, and impacts on vulnerable groups such as children and the elderly. Reference is made to the World Health Organization (WHO) recommendations for noise policies in their

publications on community noise and the Night Noise Guidelines for Europe. See the policy guidelines for suggested further reading.

5.3.1 Interpretation and application for noise-sensitive development proposals

In the application of these outdoor noise criteria to new noise-sensitive developments, the objective of this policy is to achieve –

- acceptable indoor noise levels in noise-sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- a reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot¹.*

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

In areas where the noise target is likely to be exceeded, but noise levels are likely to be within the 5dB margin, mitigation measures should be implemented by the developer with a view to achieving the target levels in a least one outdoor living area on each residential lot¹. Where indoor spaces are planned to be facing any outdoor area in the margin, noise mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces. In this case, compliance with this policy can be achieved for residential buildings through implementation of the deemed-to-comply measures detailed in the guidelines.

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 detailed noise assessment in accordance with the guidelines should be undertaken by the developer. Customised noise mitigation measures should be implemented with a view to achieving the noise target in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin. Where indoor spaces will face outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces, as specified in the following paragraphs.

For residential buildings, acceptable indoor noise levels are $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas and $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms². For all other noise-sensitive buildings, acceptable indoor noise levels under this policy comprise noise levels that meet the recommended design sound levels in Table 1 of Australian Standard AS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors.

These requirements also apply in the case of new noise-sensitive developments in the vicinity of a major transport corridor where there is no existing railway or major road (bearing in mind the policy's 15-20 year planning horizon). In these instances, the developer should engage in dialogue with the relevant infrastructure provider to develop a noise

1 For non residential noise-sensitive developments, (e.g. schools and child care centres) consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.

2 For residential buildings, indoor noise levels are not set for utility spaces such as bathrooms. This policy encourages effective "quiet house" design, which positions these non-sensitive spaces to shield the more sensitive spaces from transport noise (see guidelines for further information).

management plan to ascertain individual responsibilities, cost sharing arrangements and construction time frame.

If the policy objectives for noise-sensitive developments are not achievable, best practicable measures should be implemented, having regard to section 5.8 and the guidelines.”

5.3.2 Interpretation and application for new major road and rail infrastructure proposals

In the application of the noise criteria to new major road and rail infrastructure projects, the objective of this policy is that the new infrastructure be designed and constructed so that the noise emissions are at a level that—

- provides an acceptable level of acoustic amenity for existing noise-sensitive land uses and for the planning of new noise-sensitive developments;*
- is consistent with other planning policies and community expectations; and*
- is practicably achievable.*

For transport infrastructure projects within the scope of this policy, a noise assessment should be conducted in accordance with the guidelines to predict future noise levels resulting from the project and to identify relevant noise mitigation measures.

If a transport infrastructure project will emit transport noise levels that meet the noise target, no further measures are required under this policy. Otherwise, transport infrastructure providers should design mitigation measures to achieve the noise limit of $L_{Aeq(Day)}$ 60 dB(A) and $L_{Aeq(Night)}$ 55 dB(A), when assessed at one metre from the façade at ground floor level.

Transport infrastructure providers are also required to consider design measures to meet the noise target of $L_{Aeq(Day)}$ 55 dB(A) and $L_{Aeq(Night)}$ 50 dB(A), and to implement these measures where reasonable and practicable.

If a new rail or major road infrastructure project is to be constructed in the vicinity of a future noise-sensitive land use, mitigation measures should be implemented in accordance with this part of the policy. For this purpose, a proposed noise-sensitive land use is any noise-sensitive development that is subject to an approved detailed area plan, subdivision approval or development approval, such that the transport infrastructure provider is able to adequately design noise mitigation measures to protect that development. In these instances, the infrastructure provider and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.

It is recognised that in some cases it may not be practicable to achieve the noise criteria. In these circumstances reference should be made to section 5.8 and the guidelines.

The Policy, under Section 5.7, also provides the following information regarding “Notifications on Titles”:

“5.7 - NOTIFICATION ON TITLE

If the measures outlined previously cannot practicably achieve the target noise levels for new noise-sensitive developments, this should be notified on the certificate of title.

Notifications on certificates of title and/or advice to prospective purchasers advising of the potential for noise impacts from major road and rail corridors can be effective in warning people who are sensitive to the potential impacts of transport noise. Such advice can also bring to the attention of prospective developers the need to reduce the impact of noise through sensitive design and construction of buildings and the location of outdoor living areas.

The notification is to ensure that prospective purchasers are advised of –

- *the potential for transport noise impacts; and*
- *the potential for quiet house design requirements to minimise noise intrusion through house layout and noise insulation (see the guidelines).*

Notification should be provided to prospective purchasers and be required as a condition of subdivision (including strata subdivision) for the purposes of noise-sensitive development as well as planning approval involving noise-sensitive development, where noise levels are forecast or estimated to exceed the target outdoor noise criteria, regardless of proposed noise attenuation measures. The requirement for notification as a condition of subdivision and the land area over which the notification requirement applies, should be identified in the noise management plan in accordance with the guidelines.

An example of a standard form of wording for notifications is presented in the guidelines.”

Additional information is contained within the Implementation Guidelines, specifically the following sections:

- 4.1.1 – Spatial Separation; and
- 5.1 – Roles and Responsibilities.

For information, copies of these sections are contained in Appendix E.

4. NOISE MODELLING

To determine the noise propagation from train movements along the proposed extension of the Northern Suburbs Passenger Railway Line, acoustic modelling was carried out using SoundPlan 7.0, utilising the Nordic Rail Prediction Method (Kilde rep. 130) algorithms.

The noise modelling was carried out based on the number of train movements as summarised in Table 4.1. We understand that these movements were used to model noise emissions from other section of the Northern Suburbs Passenger Railway Line.

Table 4.1 – Train Movements

Parameter	Train Movements (per hour)	
	Day	Night
North Bound		
3 Car Set (75 metres long)	5.0	0.75
4 Car Set (100 metres long)	0.5	0
6 Car Set (150 metres long)	0.4	0
South Bound		
3 Car Set (75 metres long)	5.4	0.9
4 Car Set (100 metres long)	0.5	0
6 Car Set (150 metres long)	0.4	0

As for previous acoustic studies, the noise modelling was based on the trains achieving a L_{Amax} noise level of 87 dB(A).

The noise modelling was also based on a train speed of 130km/hr. This is consistent with the previous acoustic study for the extension of the Northern Suburbs Passenger Railway Line.

We note that the ground contour data available was limited, thus for areas where ground contours were not available/provided, Herring Storer Acoustics obtained the existing ground contours from Landgate. These contours were then modified for the railway alignment to limit the gradient along the railway line. This resulted in the majority of the railway being in a cut, which is the preferred option with regards to possible noise amelioration.

Both single point and contour plot calculations were undertaken based on the train movements outlined in Table 4.1.

With regards to residential developments, we believe that the following 2 typical cases that need to be considered are:

- 1 Residence backing on to the railway reserve.
- 2 Residence facing the railway line, with an access road located between the residence and the railway reserve.

For the railway, there are 3 basic situations that need to be considered, these being :

- A Railway in cut;
- B Railway on flat ground; and
- C Railway being on fill.

To determine the barriers required to achieve compliance with both the State Planning Policies "Noise Limits" and "Noise Targets" single point calculations were undertake for the various combinations outlined above, however, to simplify the number of railway line variations, calculations were undertaken for situation A (in cut) with the railway in a 4m cut, and for situation C (on fill) with the railway line on 2m of fill.

For the residence, calculations were undertaken with receivers located at 10 and 20m from the boundary of the railway reserve. With the 10m distance representing the case 1 with residence backing on to the railway reserve; and 20m representing case 2 with residence facing the railway line with as access road.

Thus the barrier heights required to achieve compliance with both the State Planning Policies "Noise Limits" and "Noise Targets" for the day period, are summarised in Tables 4.2 and 4.3.

Table 4.2 – Barrier Heights with Access Road (Case 1)

Situation	Criteria / Barrier Height (m)	
	Noise Limit ($L_{Aeq(Day)}$ of 60 dB(A))	Noise Target ($L_{Aeq(Night)}$ of 55 dB(A))
Cut	1.8*	2.8
Flat	2.0	3.2
Fill	2.5	3.4

Note: *Compliance would be achieved with a lower height barrier, however, we would consider that a standard 1.8m boundary wall to be a minimum height.

Table 4.3 – Barrier Heights with Residence Backing on to Railway (Case 2)

Situation	Criteria / Barrier Height (m)	
	Noise Limit ($L_{Aeq(Day)}$ of 60 dB(A))	Noise Target ($L_{Aeq(Night)}$ of 55 dB(A))
Cut	1.8*	2.4
Flat	1.8	3.0
Fill	2.5	3.4

Notes: *Compliance would be achieved with a lower height barrier, however, we would consider that a standard 1.8m boundary wall to be a minimum height.

From the single point calculations, we note that the difference between the day and night period noise levels is approximately 7 dB(A). Therefore, if compliance is achieved with the day period acoustic criteria, compliance with the night period acoustic criteria would also be achieved. Thus the day period is the critical period with regards to achieving compliance.

The above barriers have little effect on the noise received at a first floor of residence. The noise received at the first floor of a residence located at 10 and 20 metres from the rail reserve has been calculated at 63 and 62 dB(A) respectively.

The noise contour plots for the day and night periods are attached as follows:

Day period - Appendix B
Night period - Appendix C

Additional to the above, in the following areas, where information regarding the sub-divisional layout is known, additional assessment was undertaken to determine the noise amelioration required to comply with the “Noise Limits” :

- LWP (north of Butler)
- Alkimos
- Eglinton
- Australand Development Area, Yanchep

For those areas above where noise received at a residence exceeded the “Noise Limits”, the barriers required to achieve compliance are attached in Appendix D.

5. DISCUSSION / RECOMMENDATIONS

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 “Road and Rail Transport Noise and Freight Considerations in Land Use Planning” (SPP5.4), transport infrastructure providers should design mitigation measures to achieve the noise limit of $L_{Aeq(Day)}$ 60 dB(A) and $L_{Aeq(Night)}$ 55 dB(A), when assessed at one metre from the façade at ground floor level. Additionally, transport infrastructure providers are also required to consider design measures to meet the noise target of $L_{Aeq(Day)}$ 55 dB(A) and $L_{Aeq(Night)}$ 50 dB(A), and to implement these measures where reasonable and practicable.

For the majority of the extension, as this is a new rail infrastructure development in the vicinity of future noise-sensitive land uses, it is noted that under the policy that “in these instances, the infrastructure provider (i.e. PTA) and developer are both responsible for ensuring that the objectives of this policy are achieved, and a mutually beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.” Additionally, under Section 5.1 – Roles and Responsibilities of the Implementation Guidelines it states:

“Where major transport corridors are planned for an approved structure plan but are not yet constructed, as a general principle, the infrastructure provider or proponent that wishes to undertake construction first would be expected to undertake ‘noise mitigation’ measures.”

We also note that under the SPP 5.4, where external noise levels exceed the “Noise Target” noise levels, then the residential premises should be designed to comply with the following internal noise levels:

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
 $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

Noise received at an outdoor area, as far as practicable, should also comply with the L_{Aeq} of 50 dB(A) during the night period.

Results of single point calculations indicate that during the day without any barriers and over flat ground, compliance with the above external criteria would be achieved at a setback of approximately 50 metres from edge of nearest track. During the night period, due to the reduction in train movements, compliance would be achieved at approximately 20 metres from the edge of nearest track. Also from the single point calculations, we note that the difference between the day and night period noise levels is approximately 7 dB(A). Therefore, if compliance is achieved with the day period acoustic criteria, compliance with the night period acoustic criteria would also be achieved. Thus the day period is the critical period with regards to achieving compliance.

To comply with the “Noise Limits”, barriers of between 1.8 and 2.5 metres are required, depending on whether the railway line is in cut, flat ground or on fill; and if the residence backs on to the railway line or faces the railway line with an access in between. Given the stage of the project and the surrounding developments, it is recommended that in locations where the railway is on fill, that the PTA negotiate with developers such that there is an access road between the residence and the railway line. We note that this also has advantages for the developer, in that compliance with the requirement to reduce noise received at an outdoor area should be reduced as far as practical with the aim to comply with the L_{Aeq} of 50 dB(A) during the night period. It is also noted that for this extension, the railway is generally in cut and as shown on the noise contour plots attached in Appendix B, compliance is achieved in the majority of locations where there is an access road between the railway and residence.

To this end, we understand that all land developers, located adjacent to the railway reserve, plan for a road reserve or parkland to be directly adjacent the railway line. Information regarding spatial separation is contained in Section 4.1.1 – Spatial Separation of the Implementation Guidelines (a copy of Section 4.1.1 is attached in Appendix E).

We note that we do not believe that barriers would be required for the full length of the proposed extension and that as required under the policy, the PTA should enter into discussions with developers to determine the best noise mitigation options. These options include:

- 1 Appropriate setbacks from the railway line (when in cut);
- 2 Barriers;
- 3 “Quiet House” design; or
- 4 A combination of some or all three options outlined above.

The following is also recommended:

- A where possible, residence do not back on to the railway line in location where the railway line is on fill.
- B where residence do back on to the railway line, that 2 metre high barrier be constructed along the boundary to the railway.

The above barriers have little effect on the noise received at a first floor of residences. The noise received at the first floor of a residence located at 10 and 20 metres from the rail reserve has been calculated at 63 and 62 dB(A) respectively.

We also note that under normal circumstances, the first row of residences adjacent to railway line would provide a sufficient barrier to those residence located behind that notification of train noise would only be required on the first row of residence.

For the following areas, where information regarding the sub-divisional layout is known, additional assessment was undertaken to determine the noise amelioration required to comply with the “Noise Limits” :

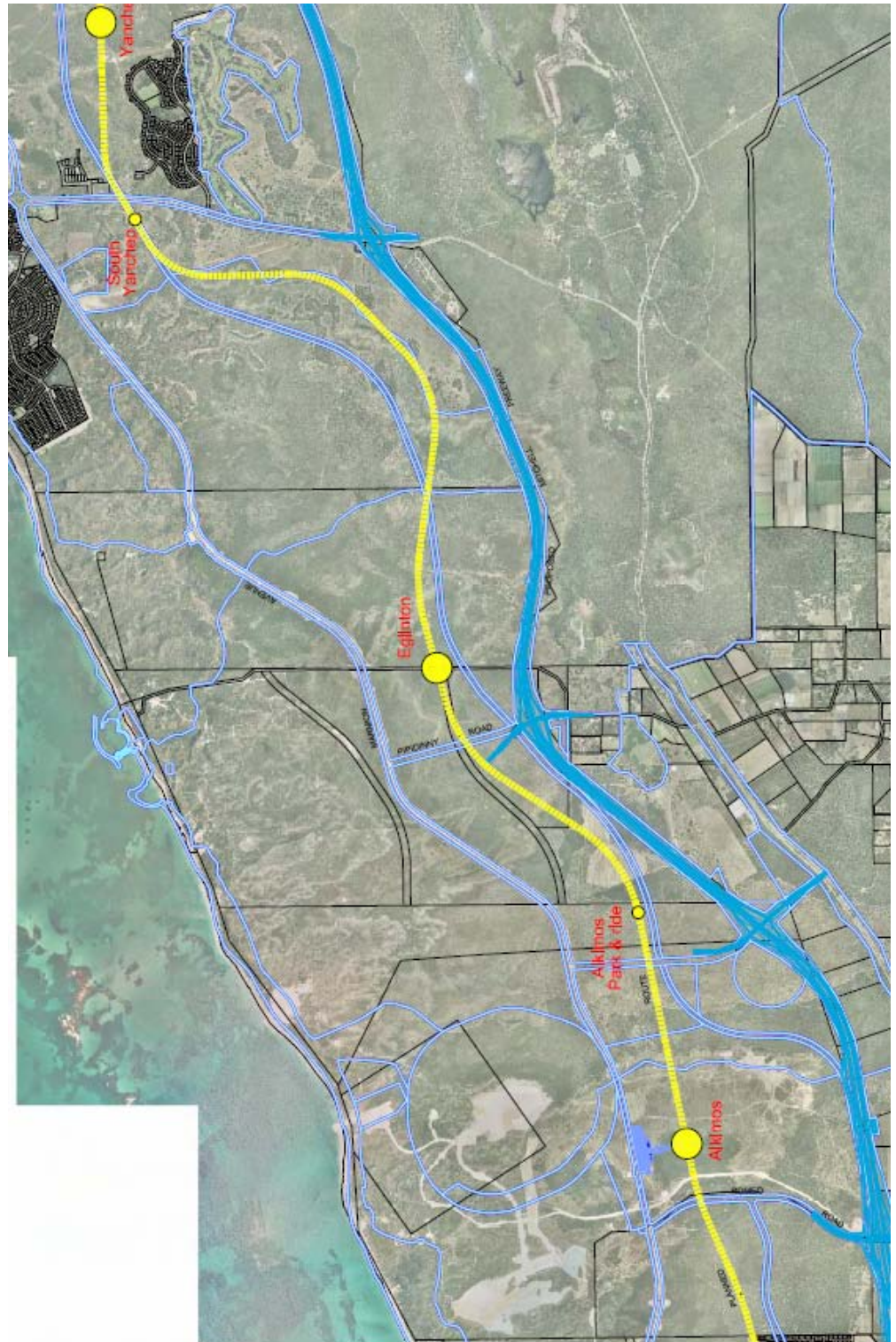
- LWP (north of Butler)
- Alkimos
- Eglinton
- Australand Development Area, Yanchep

We note that for area where information on the sub-divisions was supplied, noise modelling indicates that in location where there is an access road located between the railway line and the first row of houses, then compliance with the “Noise Limits” and thus comply with the requirements of SPP 5.4 would be achieved. In other locations, where residence back on to the railway reserve, the noise modelling indicates that noise received at these residences would exceed the requirements of the “Noise Limits” and noise amelioration would be required. For information the locations and heights of barriers required to achieve compliance are shown on the figures attached in Appendix D. Alternatively, we understand that with a couple of exceptions, that conditions have been placed on developers to ensure that subdivisions are designed such that residence do not back on to the railway line and that an access road is constructed. We believe that this is an acceptable alternative.

APPENDIX A

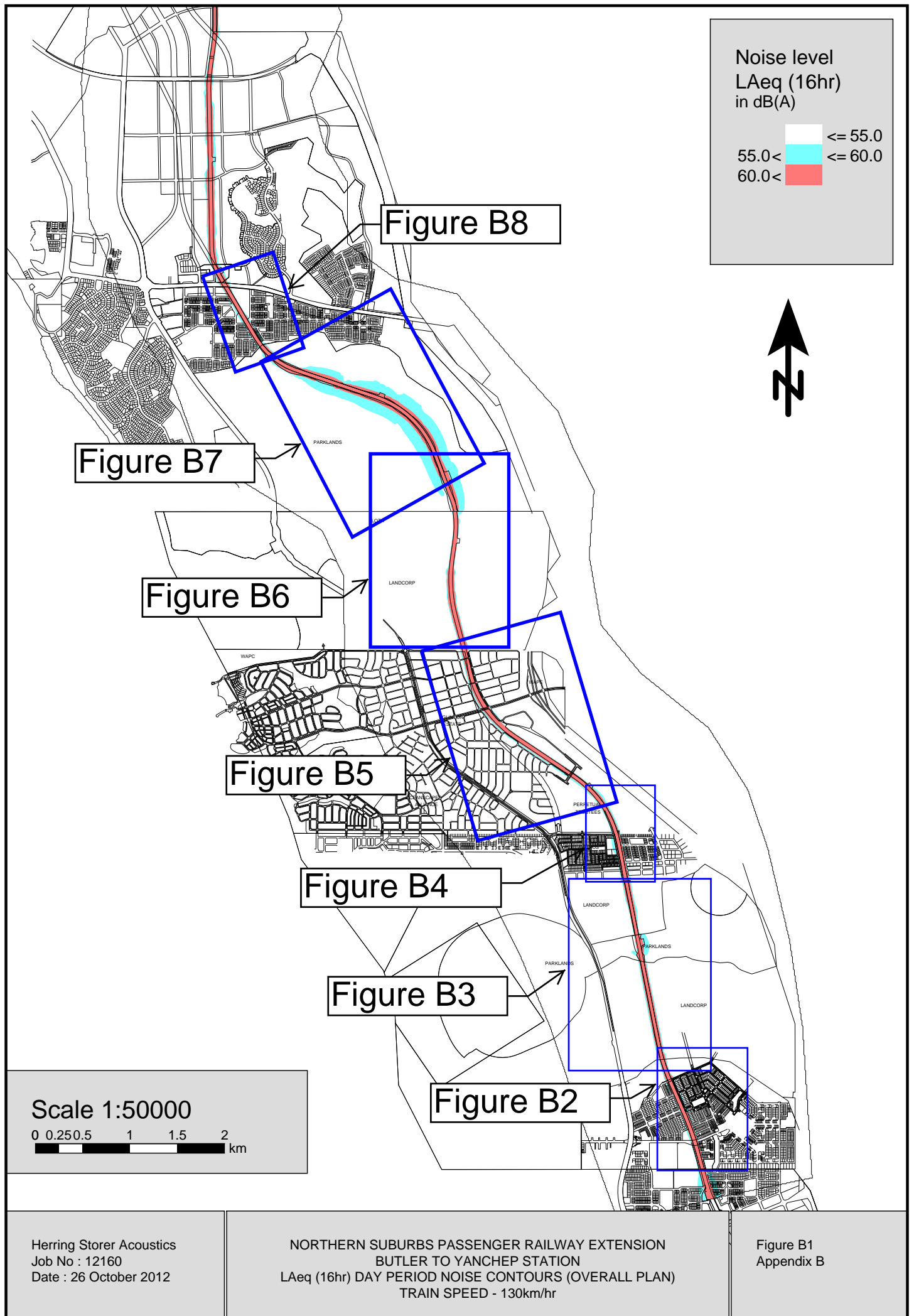
STUDY AREA

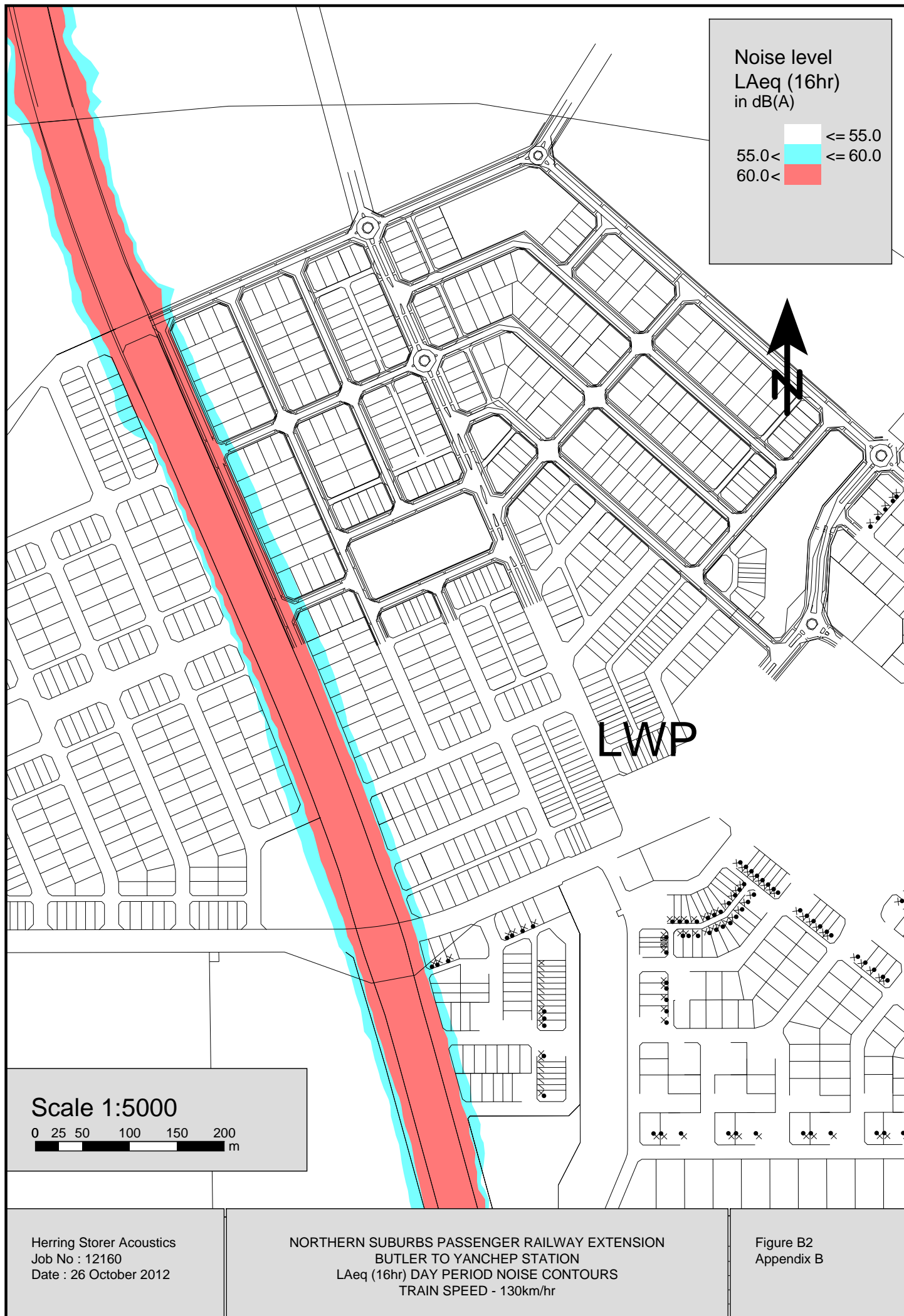
Northern Suburbs Railway Butler to Yanchep – Noise and Vibration Assessment (Fig attachment)



APPENDIX B

$L_{Aeq(16hr)}$ DAY PERIOD NOISE CONTOURS





Noise level
LAeq (16hr)
in dB(A)

	≤ 55.0
55.0 <	≤ 60.0
60.0 <	

LWP

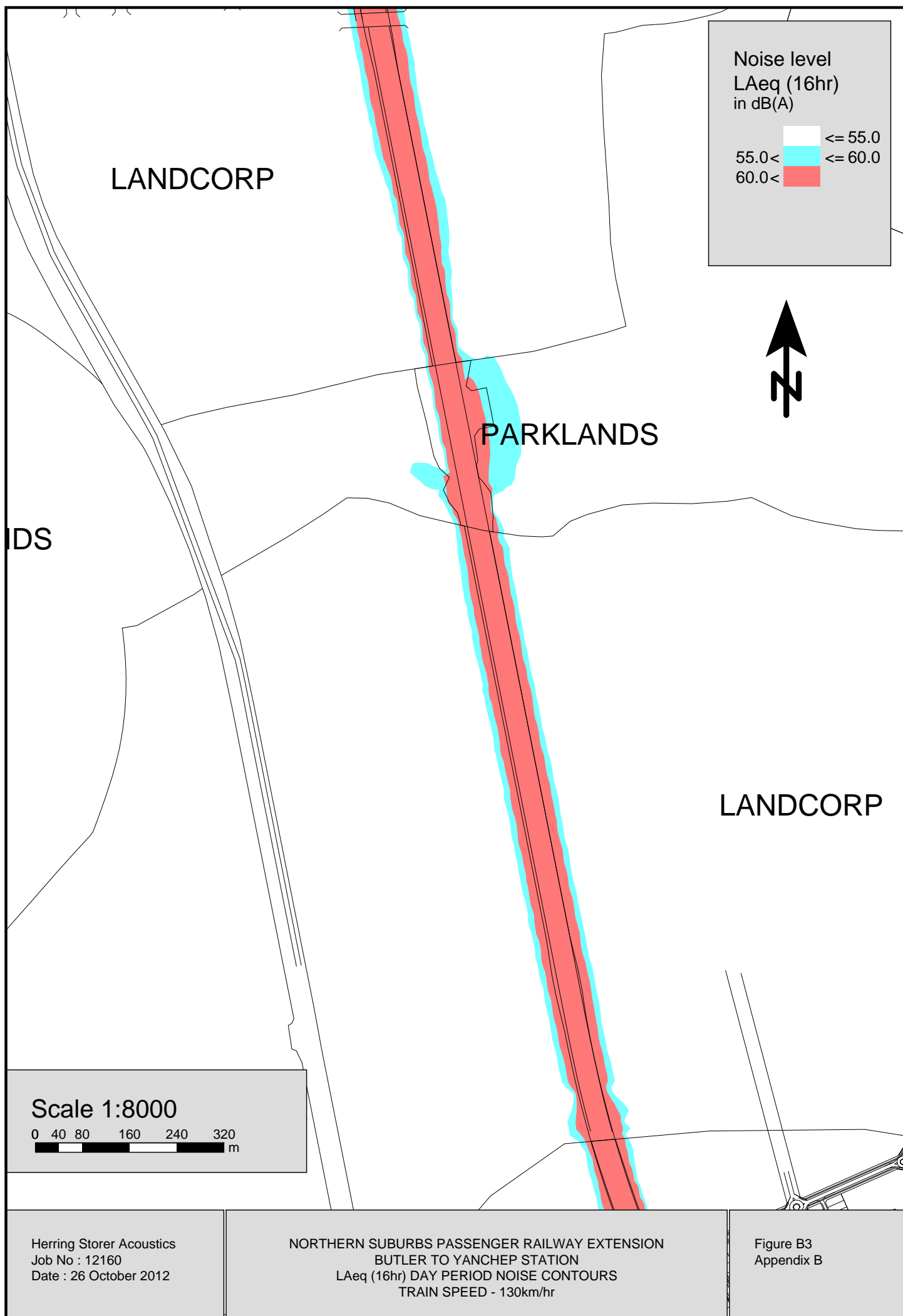
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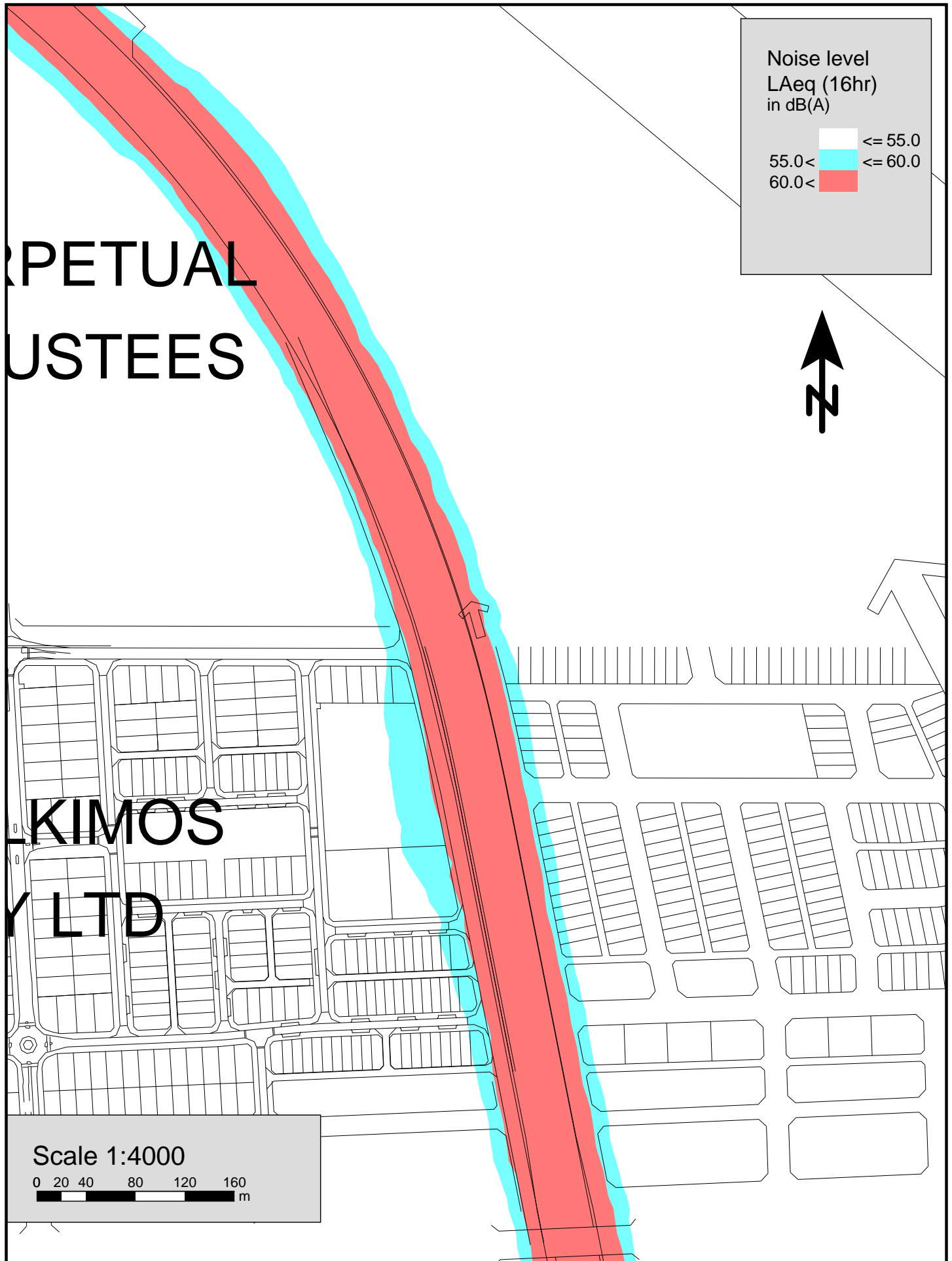
0 25 50 100 150 200
m

Herring Storer Acoustics
Job No : 12160
Date : 26 October 2012

NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (16hr) DAY PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

Figure B2
Appendix B





Noise level
LAeq (16hr)
in dB(A)

<= 55.0
55.0 < <= 60.0
60.0 < <= 65.0



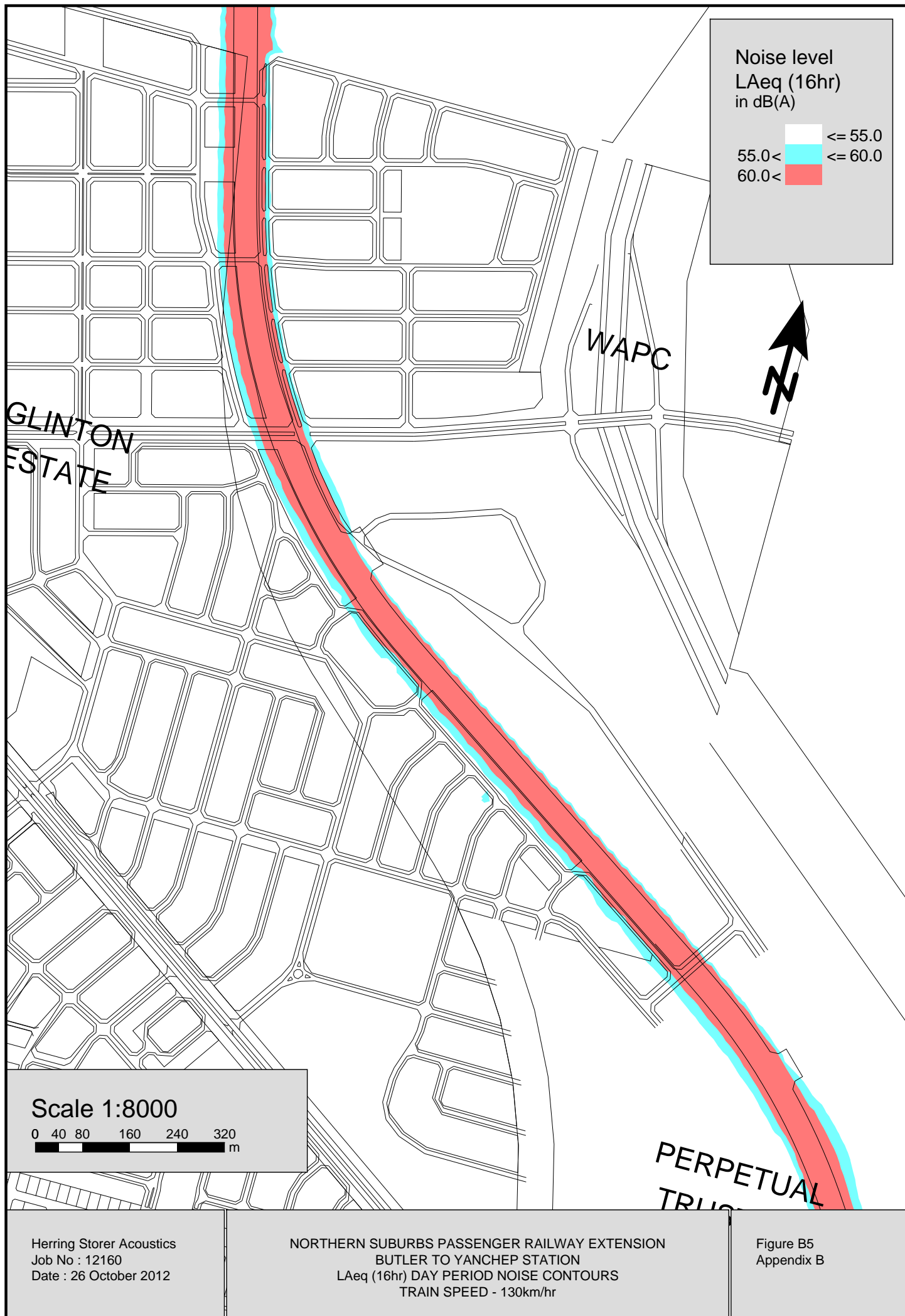
Scale 1:4000

0 20 40 80 120 160
m

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NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (16hr) DAY PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

Figure B4
Appendix B



Noise level
LAeq (16hr)
in dB(A)

<= 55.0	White
55.0 < <= 60.0	Cyan
60.0 <	Red



LOT 1

LANDCORP

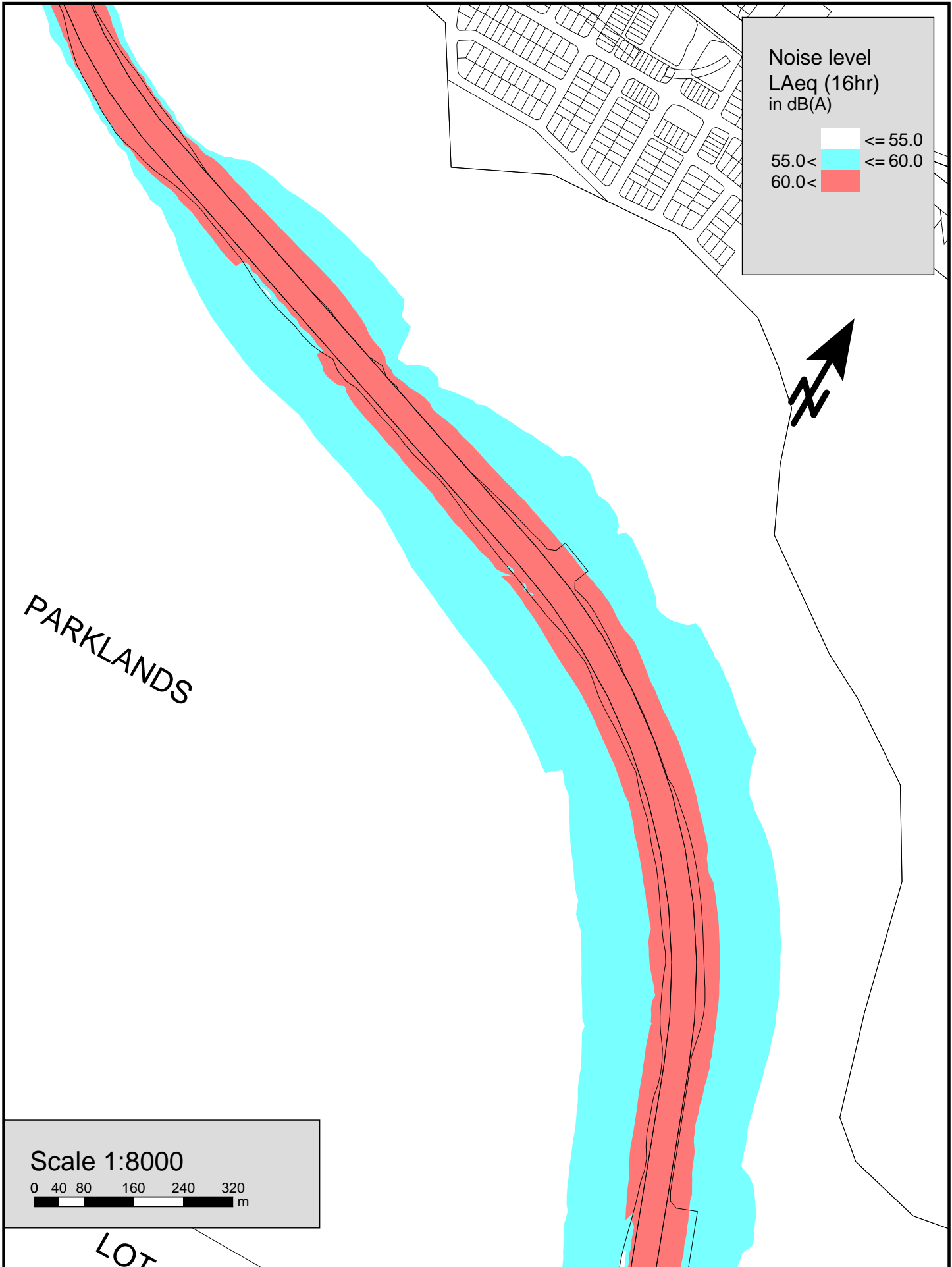
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m

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NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (16hr) DAY PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

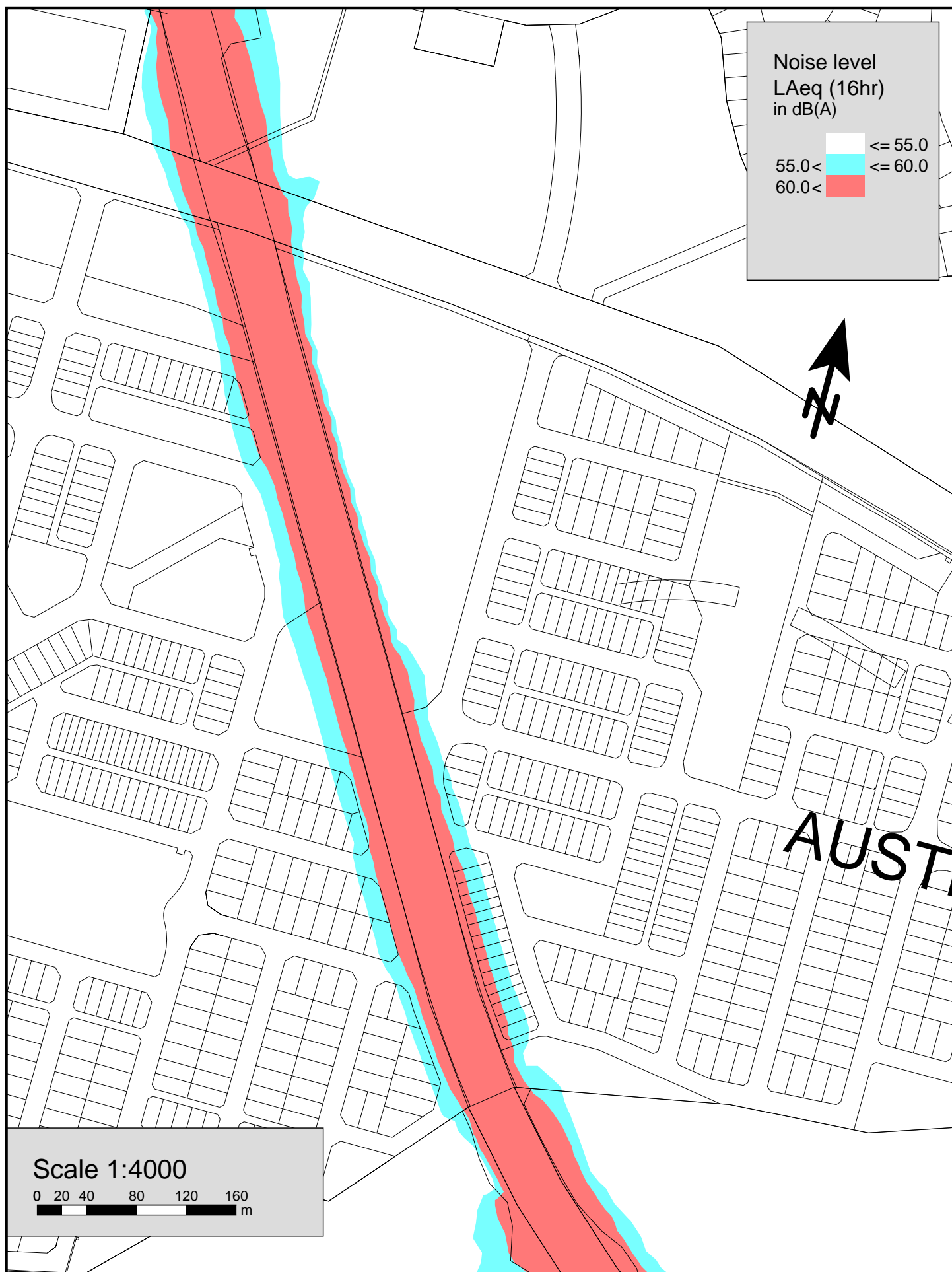
Figure B6
Appendix B



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NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (16hr) DAY PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

Figure B7
Appendix B



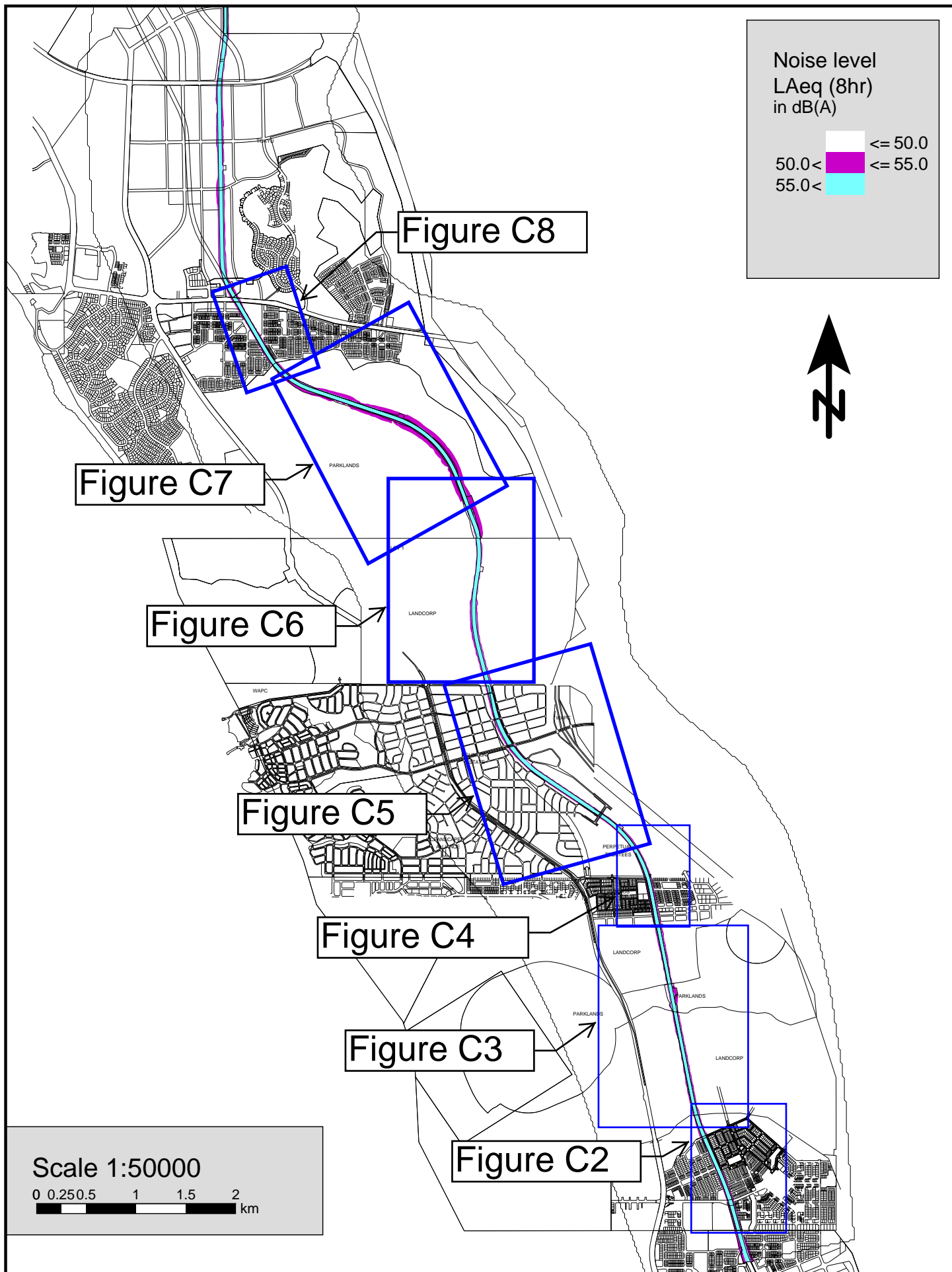
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Date : 26 October 2012

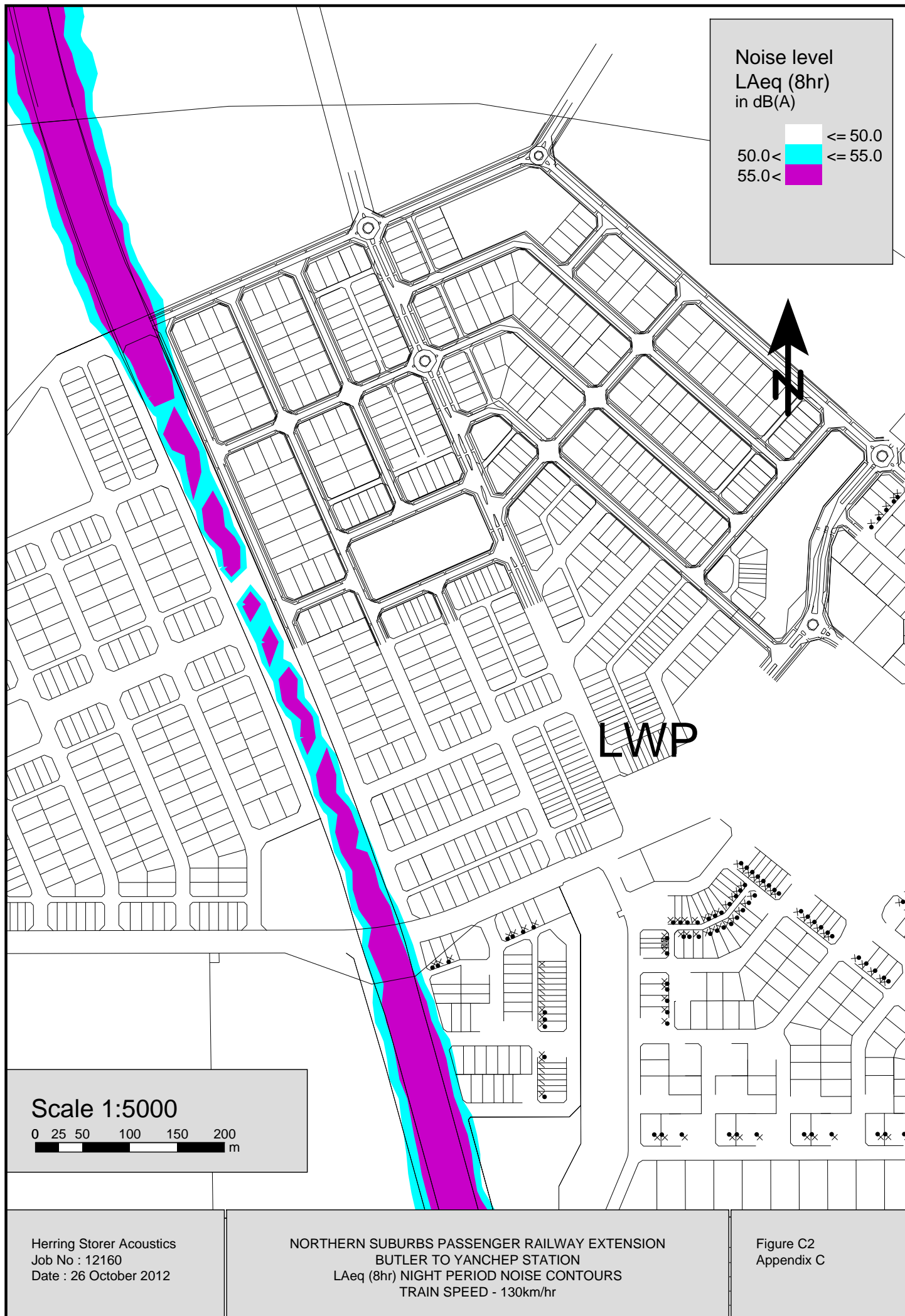
NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (16hr) DAY PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

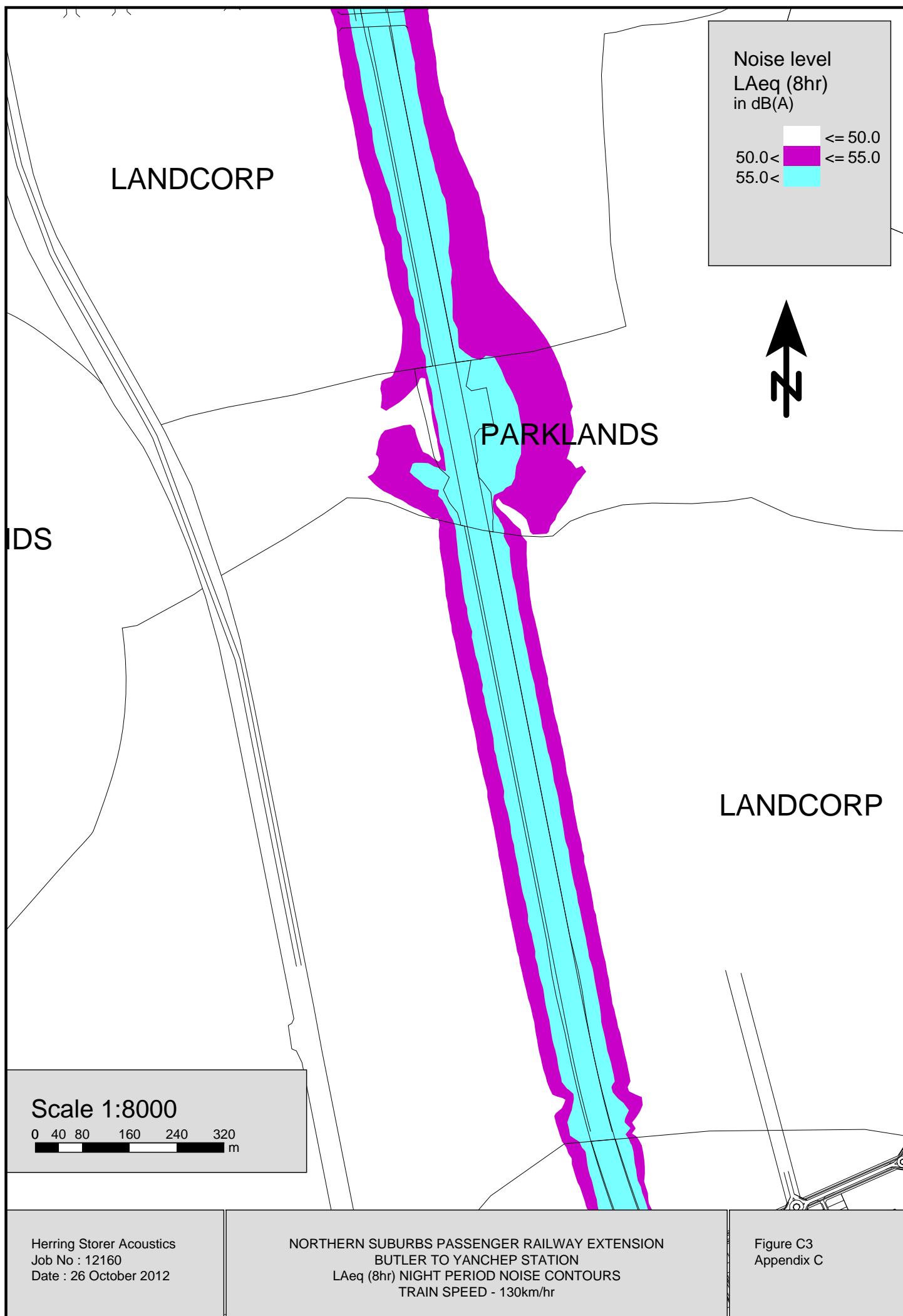
Figure B8
Appendix B

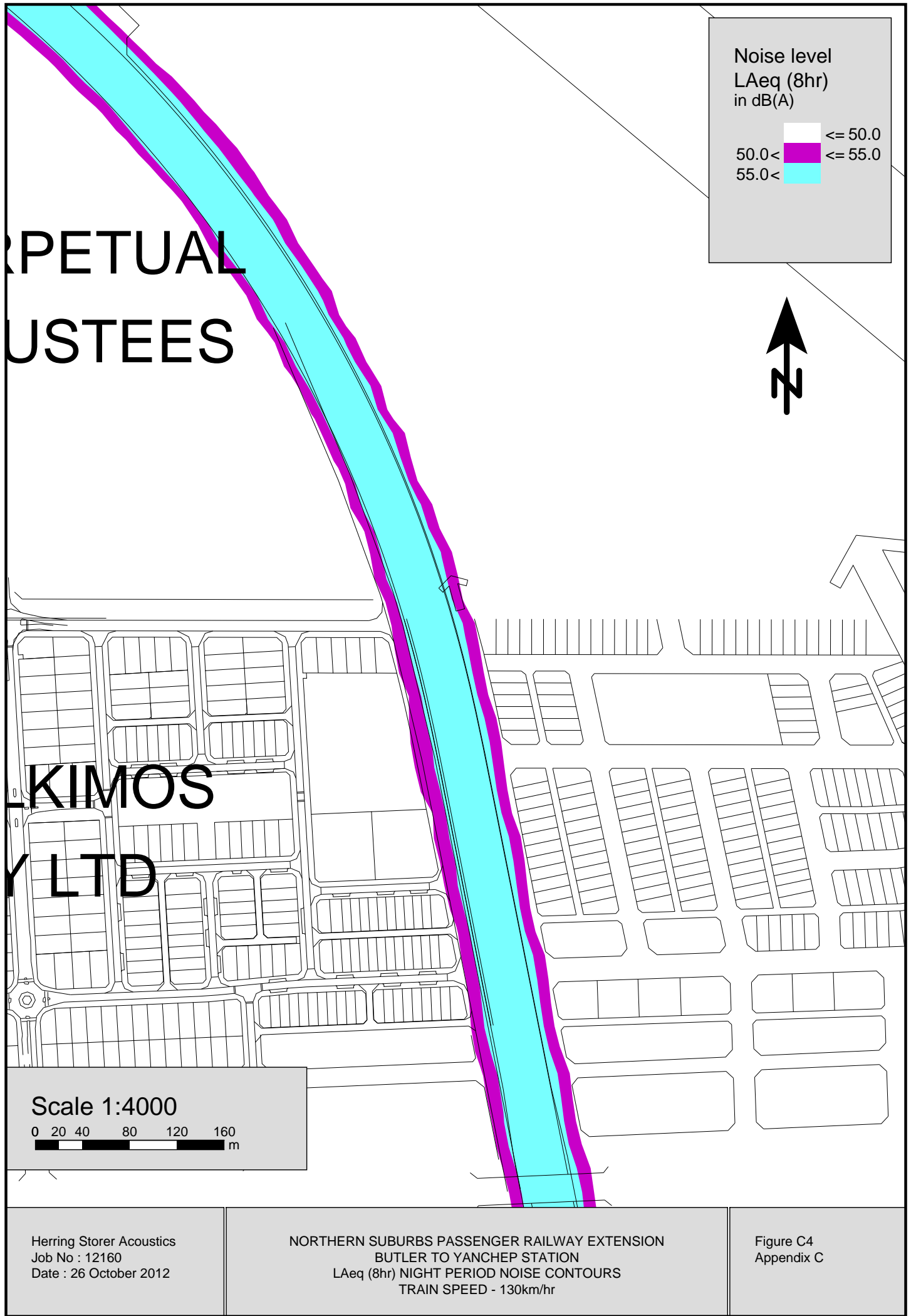
APPENDIX C

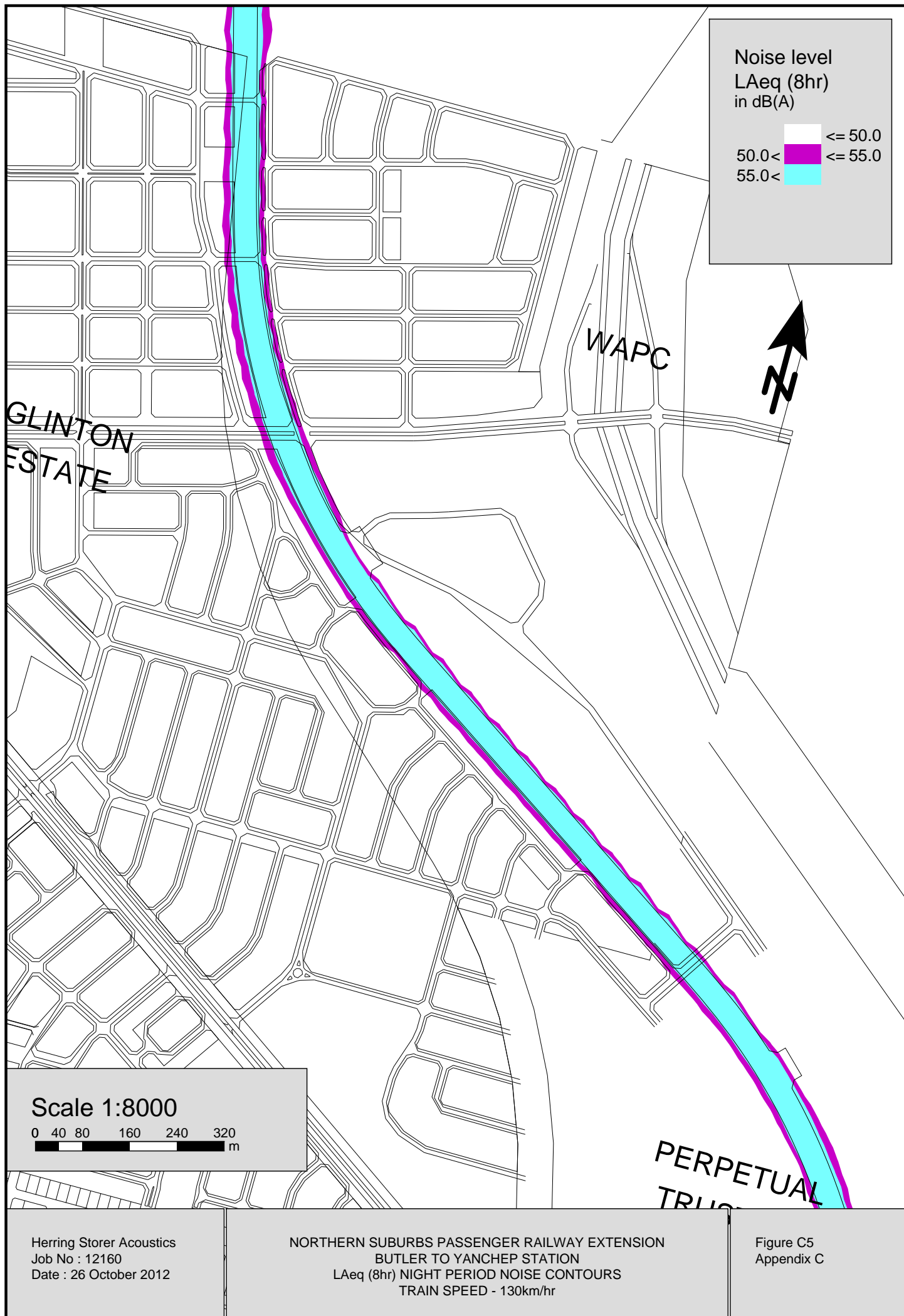
$L_{Aeq(8hr)}$ NIGHT PERIOD NOISE CONTOURS














Noise level
LAeq (8hr)
in dB(A)

	<= 50.0
	50.0 < <= 55.0
	55.0 <



LOT 1

LANDCORP

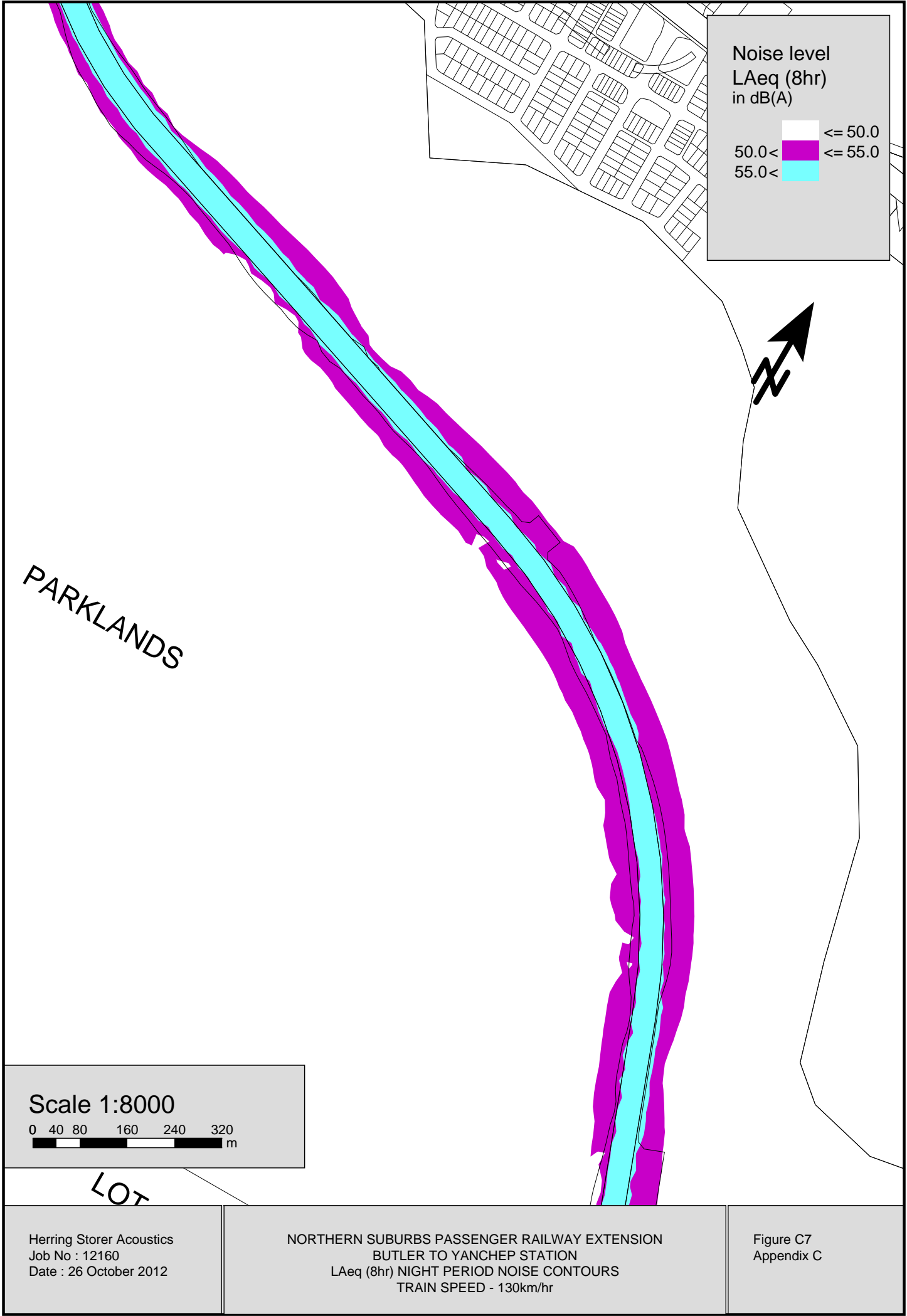
Scale 1:8000

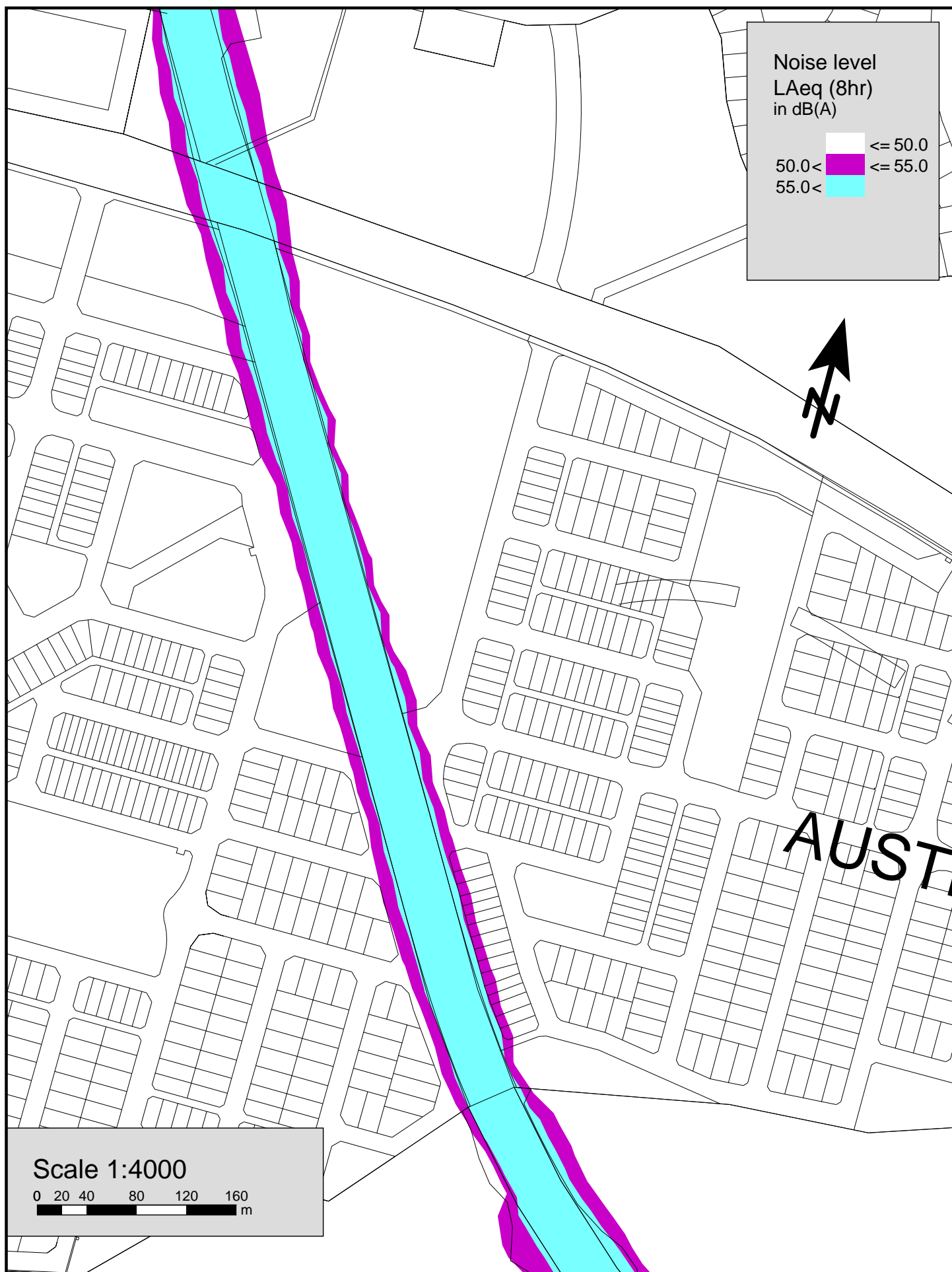
0 40 80 160 240 320
 m

Herring Storer Acoustics
Job No : 12160
Date : 26 October 2012

NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (8hr) NIGHT PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

Figure C6
Appendix C





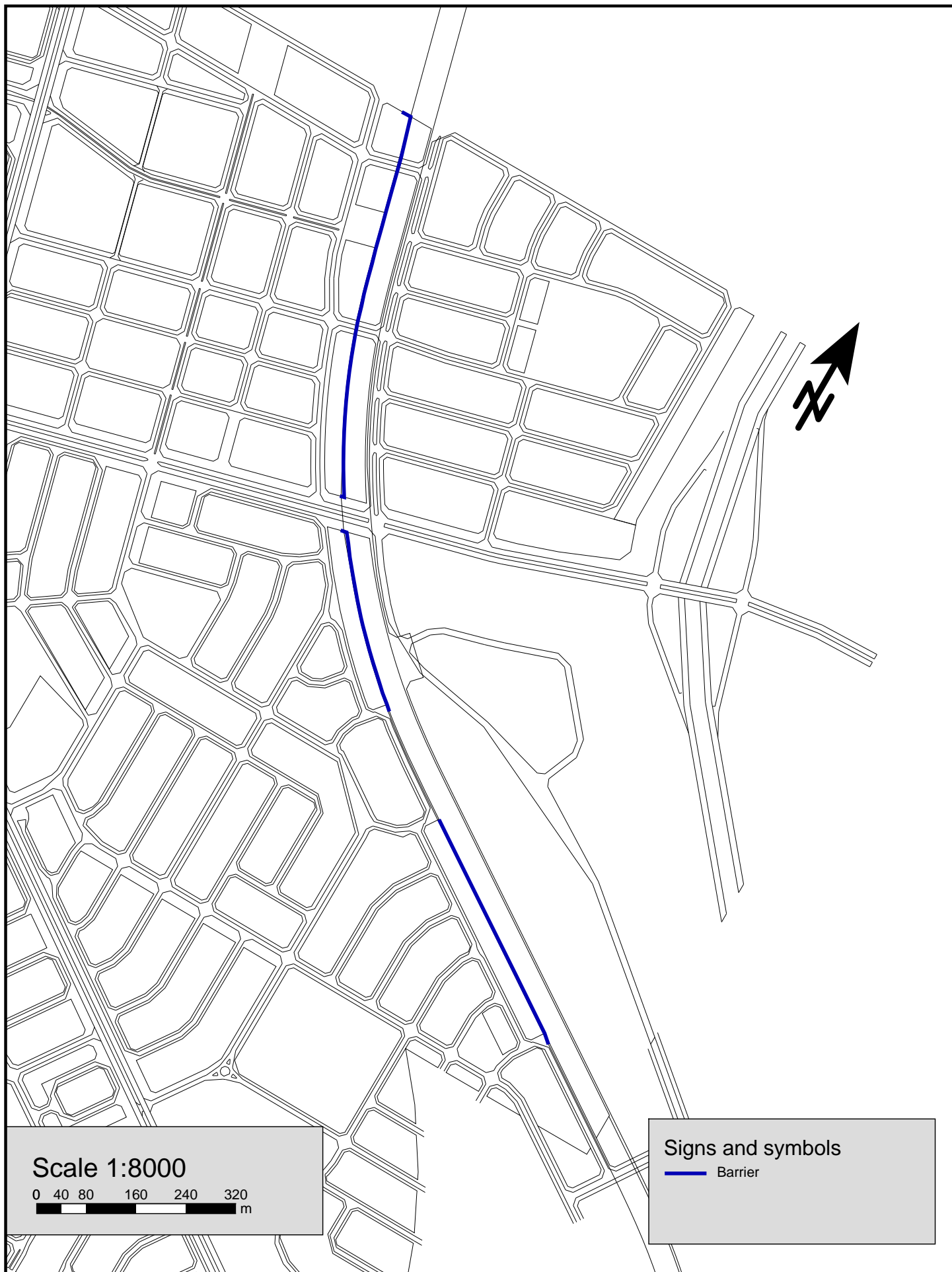
Herring Storer Acoustics
Job No : 12160
Date : 26 October 2012

NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
LAeq (8hr) NIGHT PERIOD NOISE CONTOURS
TRAIN SPEED - 130km/hr

Figure C8
Appendix C

APPENDIX D

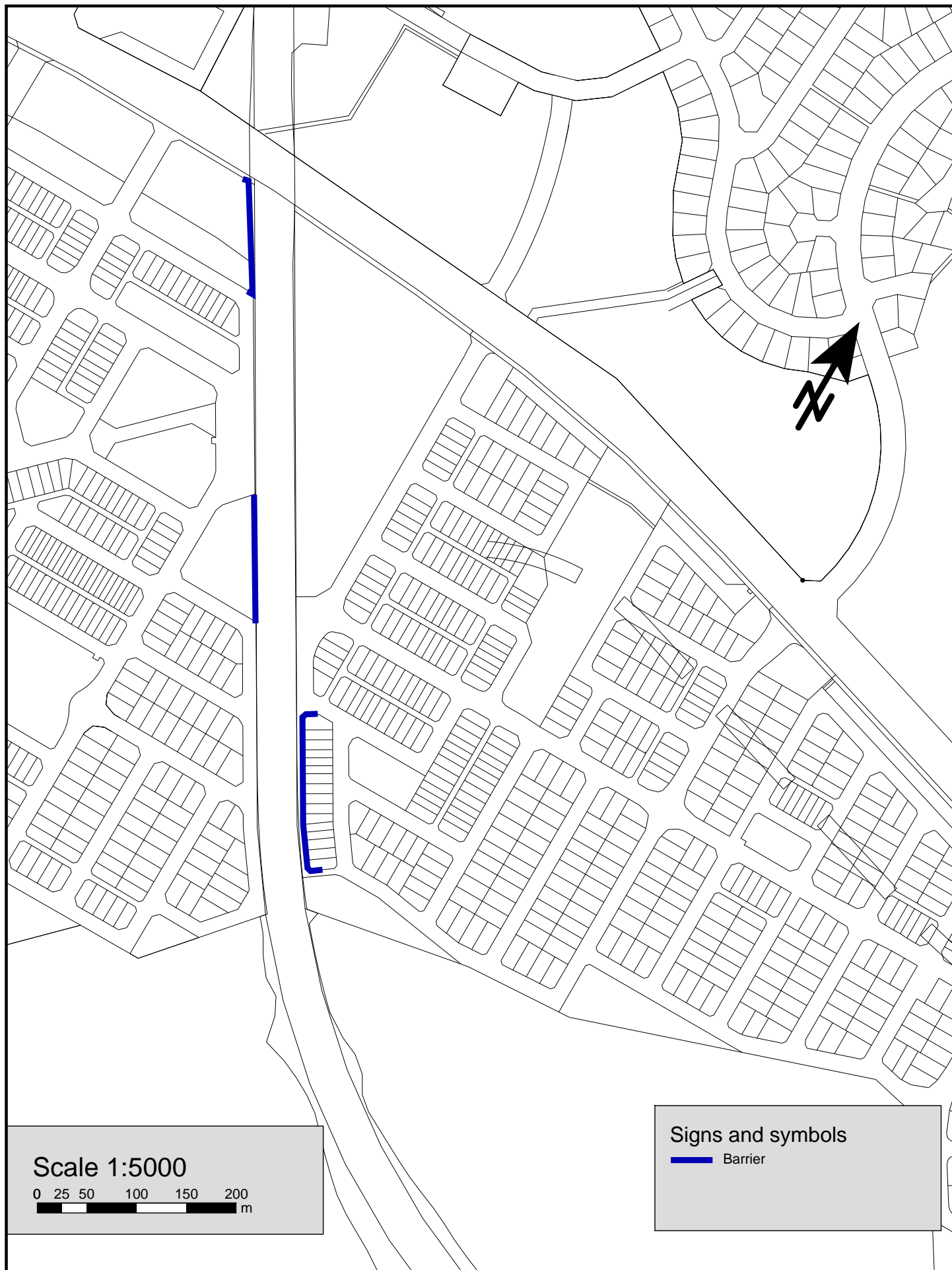
BARRIERS



Herring Storer Acoustics
Job No : 12160
Date : 26 October 2012

NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
EGLINTON BARRIER LOCATIONS

Figure D1
Appendix D



Scale 1:5000

0 25 50 100 150 200
m

Signs and symbols

Barrier

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Date : 26 October 2012

NORTHERN SUBURBS PASSENGER RAILWAY EXTENSION
BUTLER TO YANCHEP STATION
YANCHEP BARRIER LOCATIONS

Figure D2
Appendix D

APPENDIX E

SECTIONS OF “IMPLEMENTATION GUIDELINES”

ATTACHMENT 2

Implementation Guidelines

for

**State Planning Policy 5.4
Road and Rail Transport Noise
and Freight Considerations in Land Use Planning**

May 2009

4.1.1 Spatial separation

The first principle of noise-compatible land use planning is to increase the spatial separation between major transport corridors and noise-sensitive development. For example, doubling the distance from the transport corridor to the receiver from 20 metres to 40 metres will typically provide about a 3dB noise reduction. However, distance separation is not as effective as other noise reduction measures. Achieving the noise target through separation distance alone will generally require large buffer zones, which are likely to be impractical in many urban contexts. Distance separation is therefore better suited to rural areas, where there is less concern about land availability and value.

Nevertheless, the concept of spatial separation also has application to urban areas. For example, consider a proposed residential development located next to a district distributor road estimated to carry 30 000 vehicles per day in the year 2029. Using Table 1.3 of Appendix 3, if the distance between the road and the nearest residences was 30 metres the estimated day time noise level would be 63dB(A), which exceeds the noise limit in the policy. However, if the separation distance could be increased to 50 metres, (for example, by introducing a service road between the district distributor and the residences), then the noise level (60dB(A)) would be at the “margin”, and the Package A “deemed-to-comply” building measures could be implemented in order to comply with the policy.

With respect to railway lines used solely for passenger services, inclusion of a road fronting the railway reserve provides both a good noise (and vibration) buffer and a more pleasant visual outlook for the passengers. The width of the frontage road reserve should comply with Liveable Neighbourhoods guidelines, and it would depend on traffic volumes and street type and function. This separation approach works well in combination with the noise barrier effect created by placing the railway in a shallow cutting.

For railway lines used for freight purposes, spatial separation is important from the noise and vibration viewpoint, although different considerations apply in terms of visual impacts.

There are other mechanisms for increasing separation distances in an urban environment, such as inserting a dual use pathway or a planting buffer between residences and major roads or railways. In some cases it may also be appropriate to locate open space, including parks, playgrounds and natural bushland adjacent to the transport corridor, thereby creating a natural buffer to residences.



Example of application to freight railway:

A developer is preparing a detailed area plan for residential development in which the nearest row of houses along a freight railway will be located with their façades at a distance of 50 m from the track. The first row of houses will face the railway.

Given the distance of 50 m, the $L_{Aeq(Night)}$ noise level is likely to be in the range 55-60dB(A), which exceeds the "limit" criterion. The developer has therefore prepared a noise management plan (NMP) based on a detailed noise assessment. Because the new residences will face the railway, their main outdoor areas will face away, and therefore be screened by the buildings. Because a noise barrier would not be appropriate, the NMP instead specifies that living areas be provided with quiet house package A. The predicted noise level outside the bedrooms is 57dB(A), which is less than 58dB(A) (or 3dB above the "limit"), so the NMP requires quiet house package B for the bedrooms.

The noise predictions show that the second and further rows of houses are adequately screened by the first row, and no further policy measures are required. The approval of the detailed area plan requires that the noise management plan be implemented.

5. Policy implementation through planning mechanisms**5.1 Roles and responsibilities**

Where noise-sensitive development is proposed adjacent to an existing major transport corridor, the adjoining landowner is responsible for meeting all the costs associated with noise assessment and management. There may also be opportunity for an infrastructure provider to consider its role in assisting in noise control efforts within the corridor.

Where major transport corridors are planned for an approved structure plan but are not yet constructed, as a general principle, the infrastructure provider or proponent that wishes to undertake construction first would be expected to undertake noise mitigation measures.

In cases in which an infrastructure provider or private developer proposes redevelopment, the proponent would provide the noise assessment and noise management plan, and undertake to carry out works deemed practical and reasonable by the approval agency.

The requirement for individual landowners to meet noise mitigation measures for noise-sensitive development along existing major transport corridors may result in a variety of different measures being used to implement the policy, with reduced urban form and amenity in which some developments address noise and others do not. There may not be a consistent and uniform design approach; for example, contiguous noise walls of various heights and design.

In such cases, noise mitigation measures for existing major transport corridors will be more constrained and require greater flexibility in application of the policy, to ensure a balanced approach. Such situations need to be assessed on a case-by-case basis, as the policy is seen as a performance-based approach. The formation of special control areas may assist in these situations.

There may be instances in which developers contribute towards noise attenuation works for which they are not primarily responsible; e.g. where their site is not located immediately adjacent to a noise source. In such cases, contributions for greenfield development sites should be undertaken in

accordance with established WAPC policy and practice, as currently set out in planning bulletin 18. Bulletin 41 also contains relevant material regarding draft model scheme text provisions for development contributions, including the content and principles of developer contribution plans.

The table below identifies: the appropriate broad planning measures that can be applied to various planning processes; the noise assessment required to provide the basis for applying these measures; and the proponent/agency's roles.

Table 11

Planning process	Application of policy	Noise assessment required and those responsible
Scheme preparation and review	Identify potential noise-sensitive development areas near major roads, railways and freight handling facilities. Identify and designate major transport corridors.	Screening assessment (section 3.1 and Appendix 3) by strategic planners to identify potential noise-sensitive development areas that may be noise affected.
Strategic planning; e.g. structure planning and local planning strategies	Provide space for buffers, appropriate segregation of noise-sensitive uses from major transport corridors.	Screening assessment by strategic planners at state and local government agencies, to determine policy measures. Detailed noise assessment (section 3.2) by agency, and/or noise management plan (section 4.7), where required. Outcomes used to develop design guidelines.
Scheme amendments	Options for density of land uses adjacent to major transport corridors.	Screening assessment by proponent of amendment, to justify proposed changes. Detailed noise assessment by proponent, where required. Noise management plan and works by proponent, to approval of relevant agencies, on advice of DEC.
Subdivision approval	Subdivision layout to address transport noise; for example, by optimising the buffering effect of front row of dwellings, use of frontage roads and open space as distance buffers etc.	Screening assessment by developer, to inform and justify proposed layout of lots and roads, location of open space etc. Detailed noise assessment by proponent, where required. Noise management plan provided and implemented by proponent, to approval of relevant agencies.
Development approval	Quiet house design measures such as living areas furthest from noise source, continuous external noise walls.	Reference to "deemed to comply" packages (section 4.5) to determine whether the policy will be met. Approval agency may require one of these packages as a condition of development, as well as notification on title. If a noise management plan has been provided at a previous planning stage, this will identify measures relevant to development approval. Otherwise, noise assessment and noise management plans may now be required. They should be provided and implemented by the proponent, to approval of relevant agencies.

APPENDIX F

GLOSSARY OF TERMS

Glossary of terms

A-weighted

An A-weighted sound level includes the 'A' frequency weighting in the measurement of a sound, to approximate the frequency response of the normal human ear.

dB(A)

The level of a sound, measured in decibels, A-weighted (i.e. the level corresponding to the A-scale on a standard sound level meter).

LAeq

The equivalent steady-state, A-weighted sound level (equal energy) which in a specified time period contains the same acoustic energy as the time-varying level during the same period.

LAeq(Day) / LAeq(16 hour)

The logarithmic average of the hourly L_{Aeq} levels between 6 am to 10 pm.

LAeq(Night) / LAeq(8hour)

The logarithmic average of the hourly L_{Aeq} levels between 10 pm to 6 am.

Major transport corridor

Land set aside for the movement of road and/or rail traffic, including railways, and major roads.

Noise-sensitive development

Any proposed development for a noise-sensitive land use that would normally require planning approval. This includes proposals at the following stages of the approval process: structure planning, rezoning, subdivision (including strata subdivision) and development applications. Refer also to section 5.2.1.

Noise-sensitive land use

Includes land used for noise-sensitive premises (as defined in the *Environmental Protection (Noise) Regulations 1997*) occupied solely or mainly for residential or accommodation purposes, rural premises and premises used for the purpose of—

- a caravan park or camping ground;
- a hospital;
- a sanatorium, home or institution for the care of persons, a rehabilitation centre, home or institution for persons requiring medical or rehabilitative treatments;
- education (school, college, university, technical institute, academy or other educational centre, lecture hall or other premises used for the purpose of instruction);
- public worship;
- a tavern, hotel, club premises, reception lodge or other premises that provide accommodation for the public;
- aged care;
- child care; and
- prison or detention centre.

Outdoor living area

Is defined in the Residential Design Codes of Western Australia as the area external to a single house or grouped dwelling to be used in conjunction with that dwelling such that it is capable of active or passive use but excludes any area with a dimension of less than 1m minimum dimension or which, by reason of its development or topography, is not readily accessible from the dwelling.

Transport infrastructure provider

An agency responsible for the design, construction and/or management of transport infrastructure as identified by the policy, including local and state government agencies.
