Appendix **Nine** – Acoustic Assessment

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SPIRES ESTATE
BALDIVIS

SPP 5.4 ACOUSTIC ASSESSMENT

APRIL 2014

OUR REFERENCE: 17756-1-14082

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ACOUSTIC ASSESSMENT

SPIRES ESTATE

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FOR

PLANNING DEVELOPMENT STRATEGIES

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APPENDICIES

EXECUTIVE SUMMARY

Herring Storer Acoustics was commissioned by Development Planning Strategies to carry out a road traffic noise assessment for the proposed Spires Estate, Baldivis residential areas.

The purpose of this study was to assess noise received at future residences within the subdivision from vehicles travelling on Baldivis Road and the future Nairn Road and where applicable, comment on possible noise attenuation measures that could control noise intrusion to acceptable levels. The traffic noise assessment has been carried out in accordance with the new WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"*. We note that under the Planning Policy, the appropriate acoustic criteria would be the "Noise Limits". Thus the acoustic criteria would be:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

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

The noise modelling indicates that without any noise amelioration, noise received at the residence located adjacent Nairn Road would exceed the "Noise Limits". For this development a 2.2 metre high barrier located at the boundary of the Nairn Road reserve is recommended. With this barrier, the lots requiring "Quiet House" design and Notifications on Titles would be as shown on Figure E1 in Appendix E.

Modelling shows that noise received at the residence located adjacent to Baldivis Road would in the future marginally exceed the "Noise Targets". For these residences, our analysis indicates that compliance with the above internal noise levels would be achieved with standard construction. Hence, no upgrade in the construction is required for these residences. It is also recommended that for those residence that either back on to or side on to Baldivis Road, that a 1.8m high barrier be constructed, as shown on Figure B1 in Appendix B.

Finally, it is noted that under the policy, that for those residence where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles. These residence are indicated on Figure E1, attached in Appendix E. Additionally, information on Packages A and B "Quiet House" design measures as contained in the Implementation Guidelines are also attached in Appendix E.

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Development Planning Solutions to undertake an acoustical assessment of noise received within the proposed Spires Estate residential area. As part of the study, the following was carried out:

- Determine by noise modelling of the noise levels that would be received at residences within the development from vehicles travelling on the Baldivis Road and the future Nairn Road.
- Assess the predicted noise levels received at residence for compliance with the requirements of the WAPC State Planning Policy 5.4 *"Road and Rail Transportation Noise and Freight Consideration in Land Use Planning"* (SPP 5.4).
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For information, the local structure plan is attached in Appendix A.

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", the appropriate acoustic criteria for this subdivision would be the "Noise Limits" as described below.

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

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

Additional to the above external noise levels, SPP 5.4 also lists the following internal acoustic criteria:

Internal

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

Firstly, we note that from previous noise monitoring, for Baldivis Road the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is less than 5 dB(A). Hence for noise received from Baldivis Road the critical period for compliance is the night period and if compliance with the night period is achieved, then compliance with the day period will also be achieved. However, with regard to the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ for Nairn Road, guidance is taken from the DEFRA publication and using this publication, the difference would be greater than 5 dB(A). Thus for Nairn Road, the critical period for compliance is the day period, for if compliance with the day period is achieved, then compliance with the night period would also be achieved.

With regards to Baldivis Road, the modelling shows that noise received at the adjacent residence comply with the "Noise Limits", but marginally exceed the "Noise Targets" as outlined in SPP 5.4. Our analysis indicates that compliance with the above internal noise levels would be achieved with standard construction. Hence, no upgrade in the construction is required for these residences. However, Notifications on Titles would still be required to the first row of residence located adjacent to Baldivis Road, as shown on Figure E1 in Appendix E. It is also recommended that for those residences that either back on to or are side on to Baldivis Road, that a 1.8m high barrier is constructed, as shown on Figure B1 in Appendix B.

The noise modelling indicates that without any noise amelioration, noise received at the residence located adjacent to the future Nairn Road would exceed the "Noise Limit" criteria by up to 3 dB(A). For this development a 2.2 metre high barrier located at the boundary of the Nairn Road reserve is to be constructed.

With the construction of a 2.2 metre high barrier to Nairn Road, noise received at these residences would, on the ground floor, comply with the "Noise Limits". However, noise received at any first floors would exceed the "Noise Limits" and to comply with SPP5.4, "Quiet House" design by way of Package B measures would be required. Additionally, if any back yards abutting Nairn Road, to comply with the requirements for outdoor areas, they should be designed with either a courtyard down the side of the residence or a separate outdoor area on the side of the residence opposite Nairn Road. The Lots requiring "Quiet House" design and/or Notification on Titles are shown on Figure E1 in Appendix E.

It is noted that under the policy, that for those residences where noise would exceed the "Noise Target", notification of vehicle noise will need to be stated on the titles. These residences are indicated on Figure E1, attached in Appendix E. Information on Packages A and B "Quiet House" design measures are also attached in Appendix E.

It is noted that the requirement for "Notification on Titles" are based on the noise that would be received at the first floor of a residence.

3. CRITERIA

3.1 STATE PLANNING POLICY 5.4

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". Section 5.3 – Noise Criteria, which outlines the acoustic criteria, 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*
Day (6 am–10 pm)	$L_{Aeq(Day)}$ *= 55 dB(A)*	$L_{Aeq(Day)}$ *= 60 dB(A)*
Night (10 pm–6 am)	$L_{Aeq(Night)}$ *= 50 dB(A)*	$L_{Aeq(Night)}$ *= 55 dB(A)*

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 lot*[1].

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.

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 lot[1]. 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 bedrooms[2]. 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 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."

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

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).

"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."

3.2 APPROPRIATE CRITERIA

Based on the above, the following criteria are proposed for this development:

External	
Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}
Internal	
Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

Additional to these criteria, noise received at an outdoor area, where practicable, should also achieve an L_{Aeq} of 50 dB(A) during the night period.

4. MONITORING

As part of previous assessments, noise monitoring of Baldivis Road has been carried out and the results of the monitoring are shown on Table 4.1.

TABLE 4.1 – SUMMARY OF 2005 MONITORING

Location	Measured Noise Level (dB(A))		
	$L_{10,18hour}$	$L_{eq,16hour}$	$L_{eq,8hour}$
Baldivis Road	52.6	51.1	47.1

The results of the noise monitoring are shown graphically in Appendix B.

Based on the noise monitoring results, the relationship between the $L_{A10(18\ hour)}$ and the $L_{Aeq(16hour)}$ and $L_{Aeq(8hour)}$ are as listed in Table 4.2.

TABLE 4.2 – RELATIONSHIP BETWEEN ACOUSTIC PARAMETERS

Road	Parameter	Measured Level dB(A)*	Difference between $L_{10(18hour)}$ and $L_{Aeq(parameter)}$ dB(A)
Baldivis Road	$L_{A10\ (18\ hour)}$	52.6	N/A
	$L_{Aeq,\ day\ (6am\ to\ 10pm)}$	51.1	= $L_{A10\ (18\ hour)}$ – 1.4
	$L_{Aeq,\ night\ (10pm\ to\ 6am)}$	47.1	= $L_{A10(18\ hour)}$ – 5.5

* It is normal practice to quote decibels to the nearest whole number. Fractions are retained here to minimise any cumulative rounding error.

With regards to the noise monitoring, we note that given the night period noise levels recorded adjacent to Baldivis Road, we believe that the night period L_{Aeq} of 47.1 dB was influenced by other environmental noises (such as wind in trees). Therefore, the assessment of noise received at residence located adjacent to Baldivis Road would be conservative.

5. MODELLING

Current and future road traffic volumes were based on information used in previous noise assessments or as supplied by the client. This and other information relevant to the calculations are shown below in Table 5.1.

TABLE 5.1 - NOISE MODELLING INPUT DATA

Parameter	Value	
	Current	Future
Traffic flows		
Nairn Road	-	20,400
Baldivis Road	2370	14,400
Heavy Vehicles (%)	8.0	

Other input data for the model included:

- Topographical data, with the ground level within the subdivision from information supplied by client;
- For future traffic, as listed in Table 5.1.
- A +2.5 dB adjustment to allow for façade reflection.

To determine the noise that would be received within the development from the surrounding road network, acoustic modelling was carried out using the computer program ‘SoundPlan’.

Apart from noise modelling of current road traffic flows to calibrate the noise model for Baldivis Road, the following future traffic flow scenarios were also modelled:

1. Without any noise amelioration.

2. With a 2.2m high barrier at boundary of the road reserve to Nairn Road and a standard 1.8m high side and rear fencing for those residences adjacent to Baldivis Road. The extent of fencing is shown in Appendix B on Figure B1.

We note that noise received at residence located adjacent to Baldivis Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be less than 5 dB(A) and the night period is the critical period for compliance. However, as Nairn Road would be constructed sometime in the future as per the Implementation Guidelines for SPP 5.4, reference is made to the DEFRA publication. Thus based on the DEFRA publication, for Nairn Road the difference between the $L_{A10(18hr(}$ and the $L_{Aeq(8hr)}$ and the $L_{Aeq(16hr)}$ has been determined to be around 10 and 2 dB(A) respectively. Thus, for residence located adjacent to Nairn Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be greater than 5 dB(A) and the day period is the critical period for compliance.

Based on the above, the noise contours for noise the above modelling scenarios are :

Nairn Road – Day period noise contours are attached in Appendix C.

Baldivis Road – Night period noise contours are attached in Appendix D.

Additional to the above, to determine the extent of residences requiring “Quiet House” design and/or Notifications, noise modelling was also undertaken for the noise received at the first floor. For this scenario, generic residence were included in the noise model and the day noise contours for Nairn Road attached in Appendix C as Figure C3, with the night noise contours for Baldivis Road attached in Appendix D as Figure D3.

6. DISCUSSION / RECOMMENDATION

Under the WAPC State Planning Policy 5.4, for this development, the "Noise Limits" as listed in Table 1 are the appropriate noise levels for to be achieved for this development. Under The SPP 5.4, the "Noise Limits" criteria which are applicable external to a residence are:

External

Day	Maximum of 60 dB(A) L_{Aeq}
Night	Maximum of 55 dB(A) L_{Aeq}

The policy states that the outdoor criteria applies to the ground floor level only, however, it also states that noise mitigation measures should be implemented with a view to achieving the “Noise Target” levels in least one outdoor living area. The Policy states the following acceptable internal noise levels:

Internal

Living and Work Areas	$L_{Aeq(Day)}$ of 40 dB(A)
Bedrooms	$L_{Aeq(Night)}$ of 35 dB(A)

From previous noise monitoring of Baldivis Road, the difference between the $L_{Aeq(16hr)}$ and the $L_{Aeq(8hr)}$ would be less than 5 dB(A) and for Baldivis Road the night period is the critical period for compliance. However, with Nairn Road still to be constructed, to determine the difference between the $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$, guidance is taken from the DEFRA publication and using this publication, the difference would be greater than 5 dB(A). Thus for Nairn Road, the critical period for compliance is the day period.

For this development, compliance with the requirements of SP 5.4, noise modelling and assessment are based on the day period for residence located adjacent to Nairn Road and the night period for these residence located adjacent to Baldivis Road.

The results of the acoustic assessment indicate that noise received at residences located adjacent to Nairn Road would exceed the "Noise Limits" as outlined in the Western Australian Planning Commission (WAPC) Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning". To comply with the requirements of SPP 5.4 a 2.2 metre high barrier located at the boundary of the road reserve to Nairn Road be constructed.

With the construction of the barrier to Nairn Road, noise received at these residences would, on the ground floor, comply with the "Noise Limits". However, noise received at any first floors would exceed the "Noise Limits" and to comply with SPP5.4, "Quiet House" design by way of Package B measures would be required. Additionally, for residences with back yards abutting Nairn Road, to comply with the requirements for outdoor areas, they should be designed with either a courtyard down the side of the residence or a separate outdoor area on the western side of the residence.

We note that the requirement for "Notification on Titles" and "Quiet House" Design are based on the noise that would be received at the first floor of a residence, with the construction of a 2.2m high barrier and including the construction of residences.

With regards to Baldivis Road, the modelling shows that noise received at the adjacent residence would comply with the "Noise Limits", but marginally exceeds the "Noise Targets" as outlined in SPP 5.4. Our analysis indicates that for these residence adjacent to Baldivis Road, compliance with the above internal noise levels would be achieved with standard construction and no upgrade in constructions or "Quiet House" design would be required. However, as the noise levels exceed the "Target Noise" levels, Notifications on Titles are still required for this first row of residence. Thus, for residence located adjacent to Baldivis Road, it is recommended that :

- 1.8m high barriers be constructed for those residence that either back on to or are side on to Baldivis Road, as shown on Figure B1 in Appendix B; and

- Notification on Titles be placed on the Lots as shown on Figure E1 in Appendix E.

It is noted that the first rows of residences provide a significant barrier to those residence behind. Thus, without the inclusion of residence, as shown on Figures C2 and D2 in Appendices C and D, the extent of those residence that would appear to required "Quiet House" design and Notifications is significantly greater than is actually the case. Therefore, additional modelling, with the inclusion of residence has been undertaken. The results of this modelling are shown on Figures C3 and D3 in Appendices C and D. With the inclusion of the residence, the actual number of residence requiring "Quiet House" design and "Notification on Titles" does not extend as far into the development. Based on the above, the "Quiet House" Design and Notifications will be as shown on Figure E1 attached in Appendix E. Also attached in Appendix E, is some general information on the Packages construction requirements.

Note : Given the small noise reduction required to be achieved by the fences to Baldivis Road, standard fencing such as a colourbond fence would be acceptable.

APPENDIX A

LOCAL STRUCTURE PLAN

RESIDENTIAL LOT SUMMARY:

LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
$201m^2$ - $300m^2$	7	2.07%	$255m^2$	1.12%	$1787m^2$
$301m^2$ - $400m^2$	98	28.99%	$367m^2$	22.65%	$36027m^2$
$401m^2$ - $500m^2$	186	55.03%	$445m^2$	52.15%	$82949m^2$
$501m^2$ - $600m^2$	26	7.69%	$529m^2$	8.65%	$13766m^2$
$601m^2$ - $700m^2$	10	2.96%	$637m^2$	4.01%	$6379m^2$
$701m^2$ - $800m^2$	6	1.78%	$736m^2$	2.78%	$4417m^2$
$801m^2$ - $1000m^2$	2	0.59%	$905m^2$	1.14%	$1811m^2$
$1001m^2$ - $5000m^2$	2	0.59%	$1995m^2$	2.51%	$3990m^2$
$5001m^2$+	1	0.30%	$7929m^2$	4.99%	$7929m^2$
Total Number of Lots	338				

Minimum Lot Size $225m^2$
Maximum Lot Size $7929m^2$

Average Lot Size $470m^2$
Total Lot Area $159055m^2$

CONCEPT LAYOUT PLAN

Spires Estate, Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group™

LEGEND:

- Spires Estate Local Structure Plan Boundary
- Buffer to Egg Farm
- Gas Pipeline Corridor
- Future Road Widening
- Surrounding Cell Layout
- Public Open Space
- Commercial

NOTES:

NORTH

Scale 1: 2000 @ A1

0 20 40 60 80 100 metres

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APPENDIX B

EXTENT OF FENCING

SPIRES ESTATE
LOCATION OF BARRIERS

Herring Storer Acoustics
Date : 29 April 2014
Job No : 14082

Figure B1
Appendix B

RESIDENTIAL LOT SUMMARY:

LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
$201m^2$ - $300m^2$	7	2.07%	$255m^2$	1.12%	$1787m^2$
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$801m^2$ - $1000m^2$	2	0.59%	$905m^2$	1.14%	$1811m^2$
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NOTES:

NORTH

Scale 1: 2000 @ A1

0 20 40 60 80 100 metres

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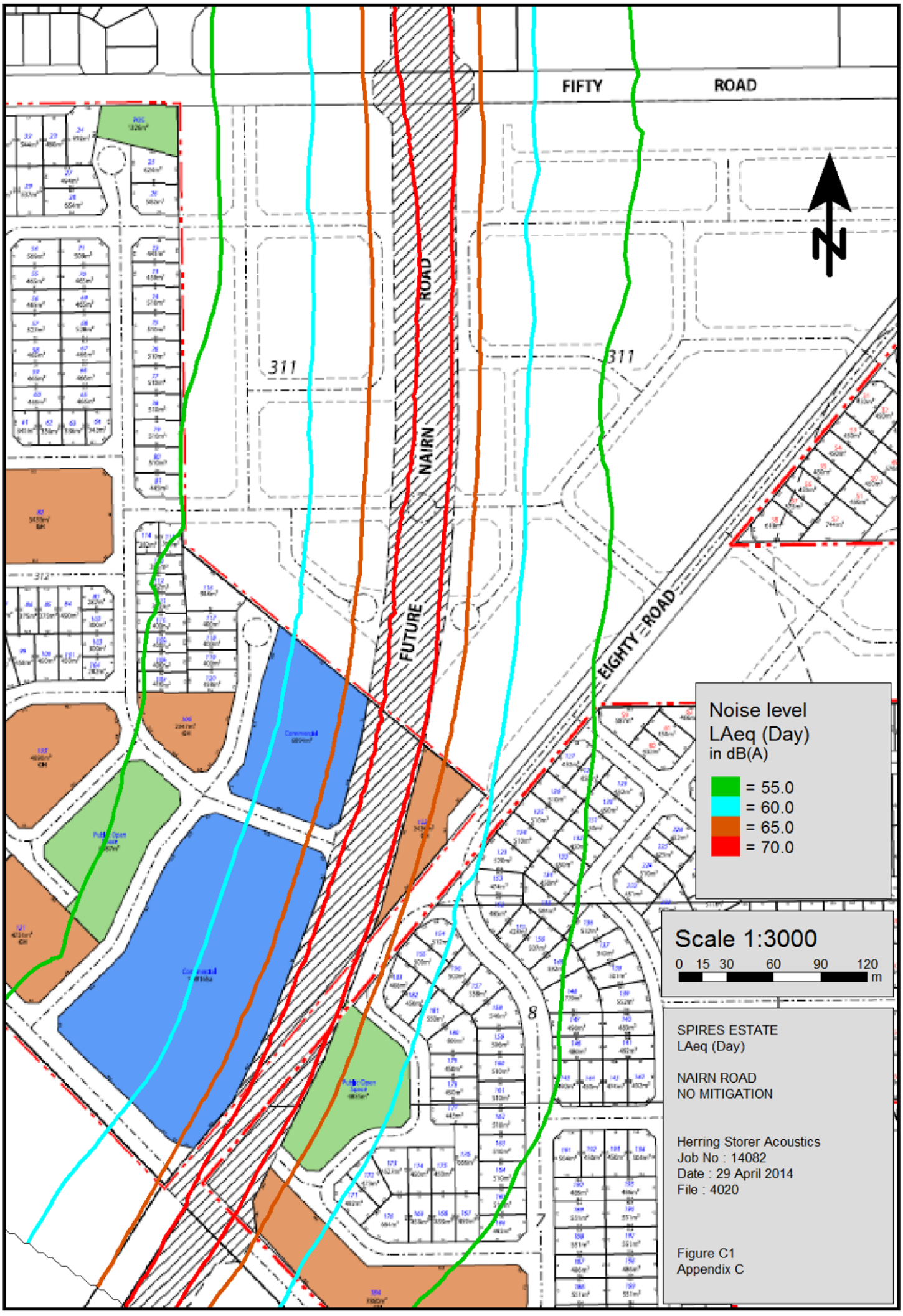
APPENDIX C

FIGURES C1 TO C3
$L_{Aeq(16hr)}$ NOISE CONTOURS FOR NAIRN ROAD


FIFTY ROAD
NAIRN ROAD
FUTURE
EIGHTY ROAD
311
312
N
Noise level
LAeq (Day)
in dB(A)
= 55.0
= 60.0
= 65.0
= 70.0
Scale 1:3000
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SPIRES ESTATE
LAeq (Day)
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NO MITIGATION
Herring Storer Acoustics
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Date : 29 April 2014
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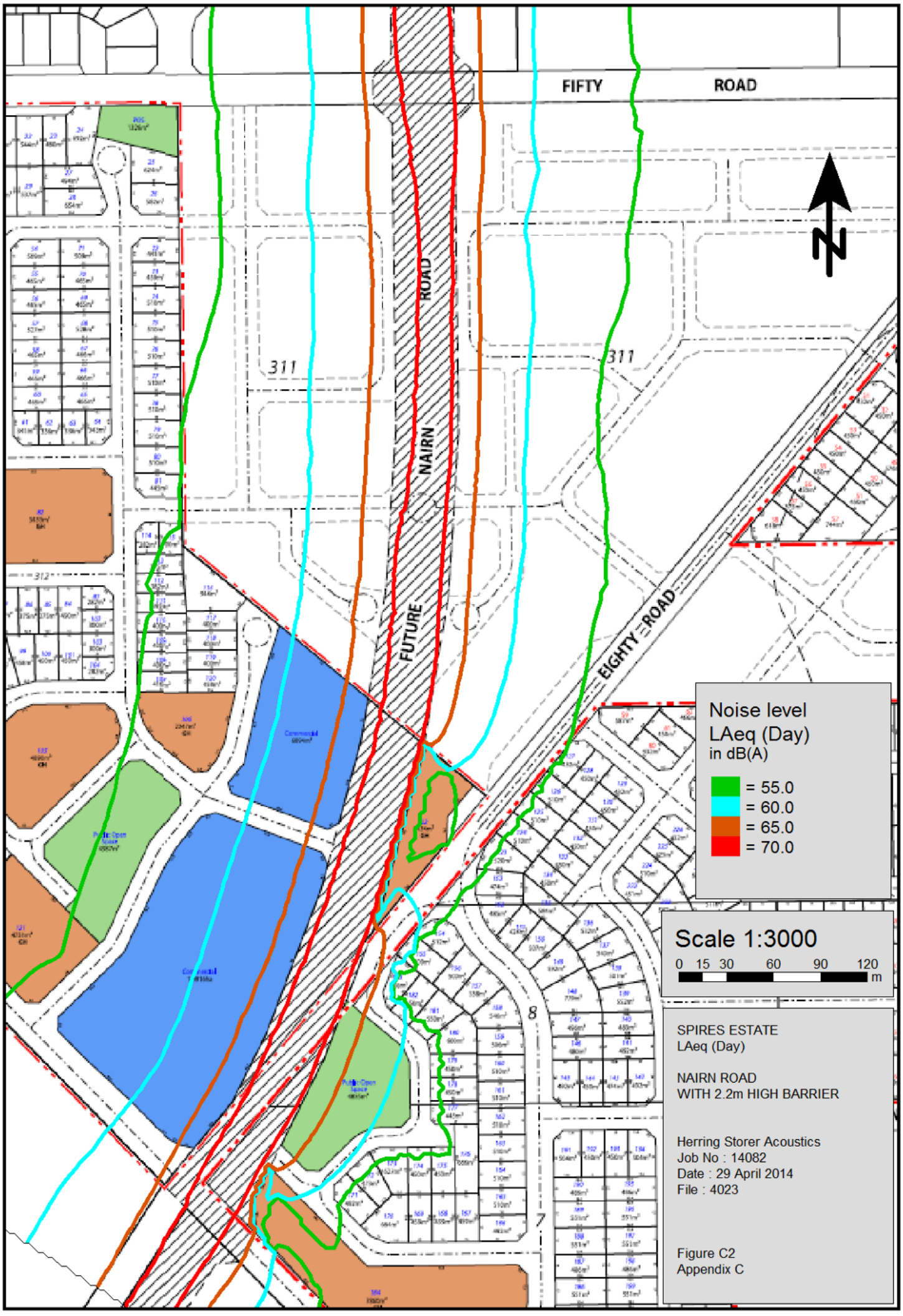
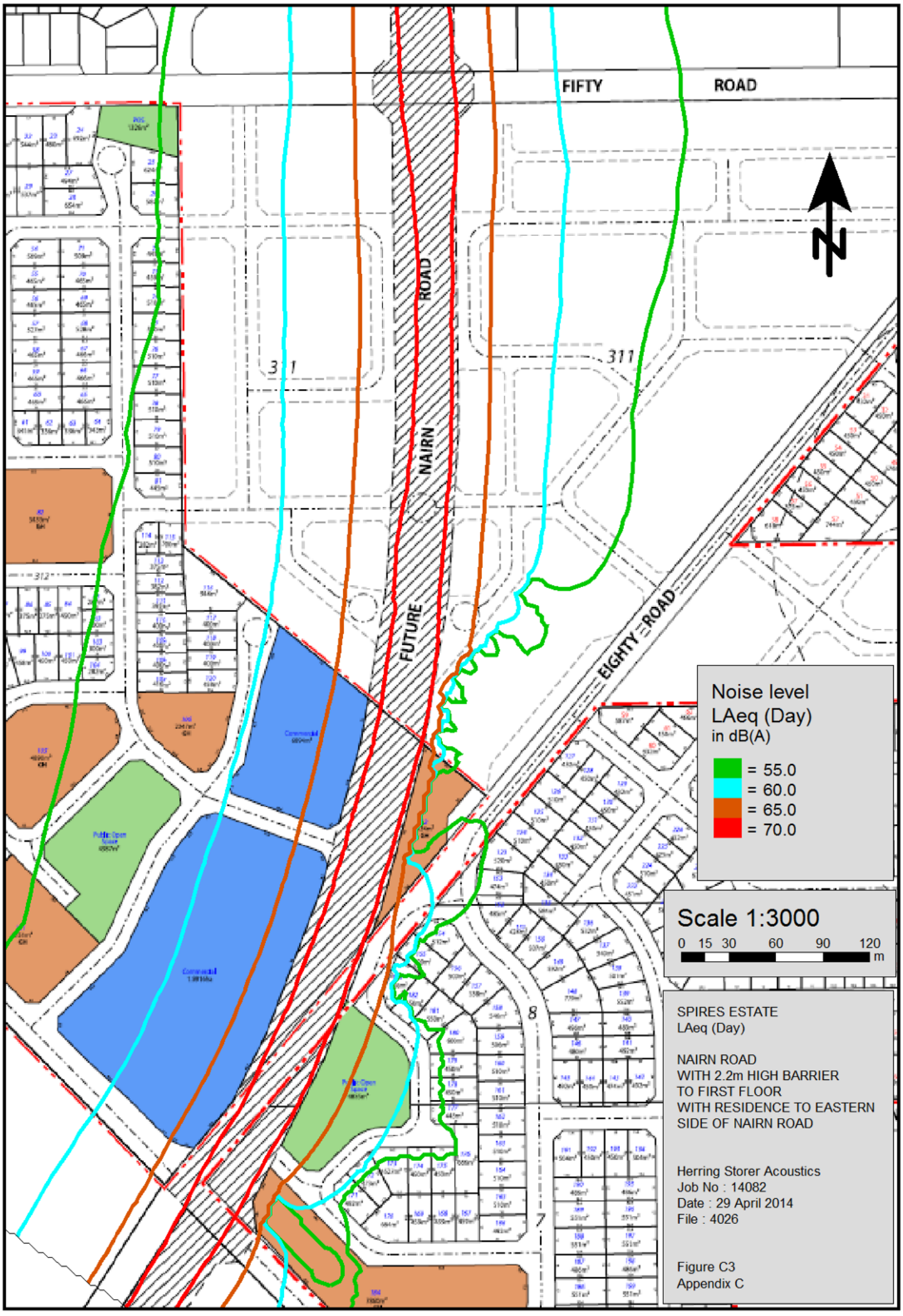
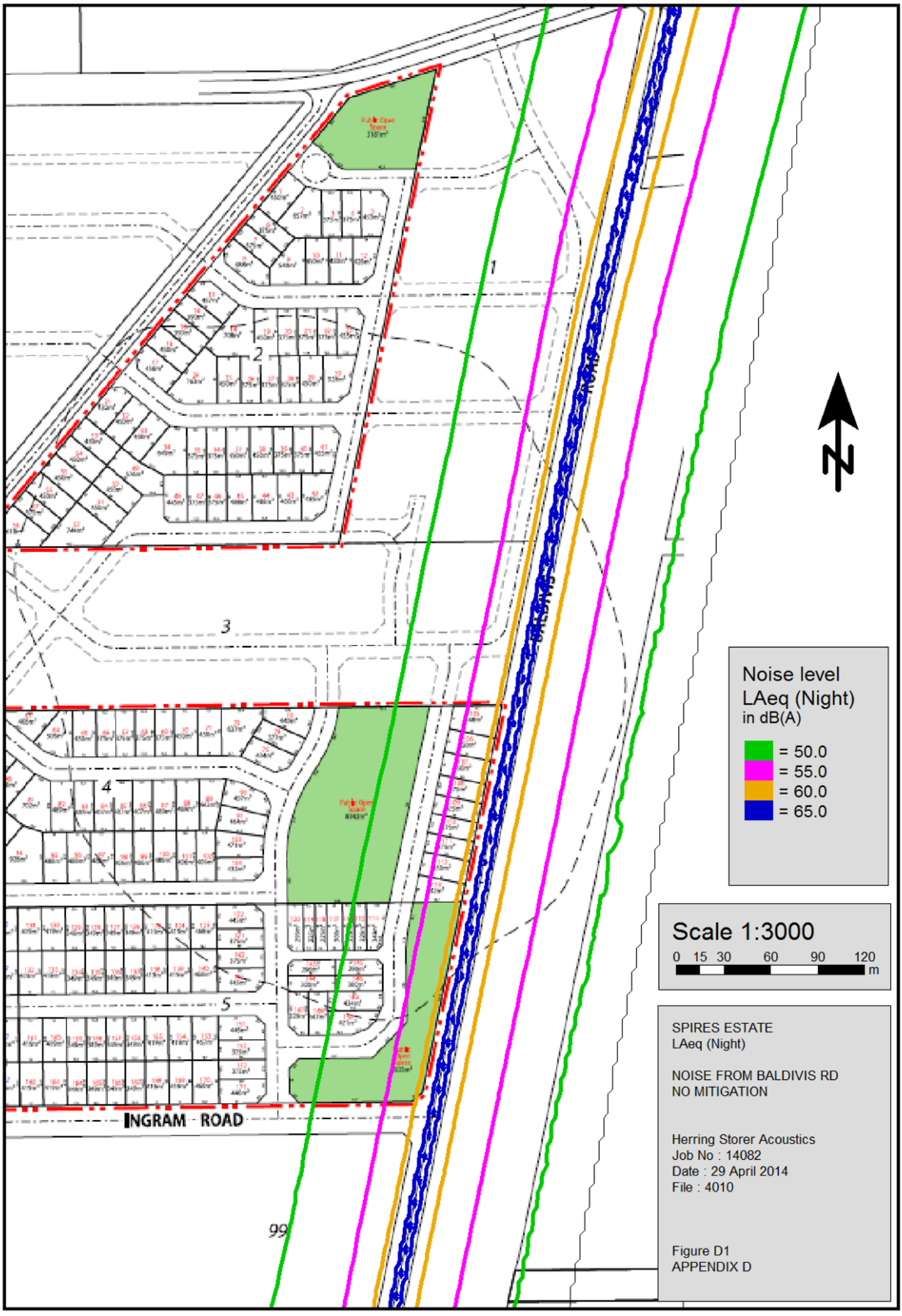
Figure C1
Appendix C

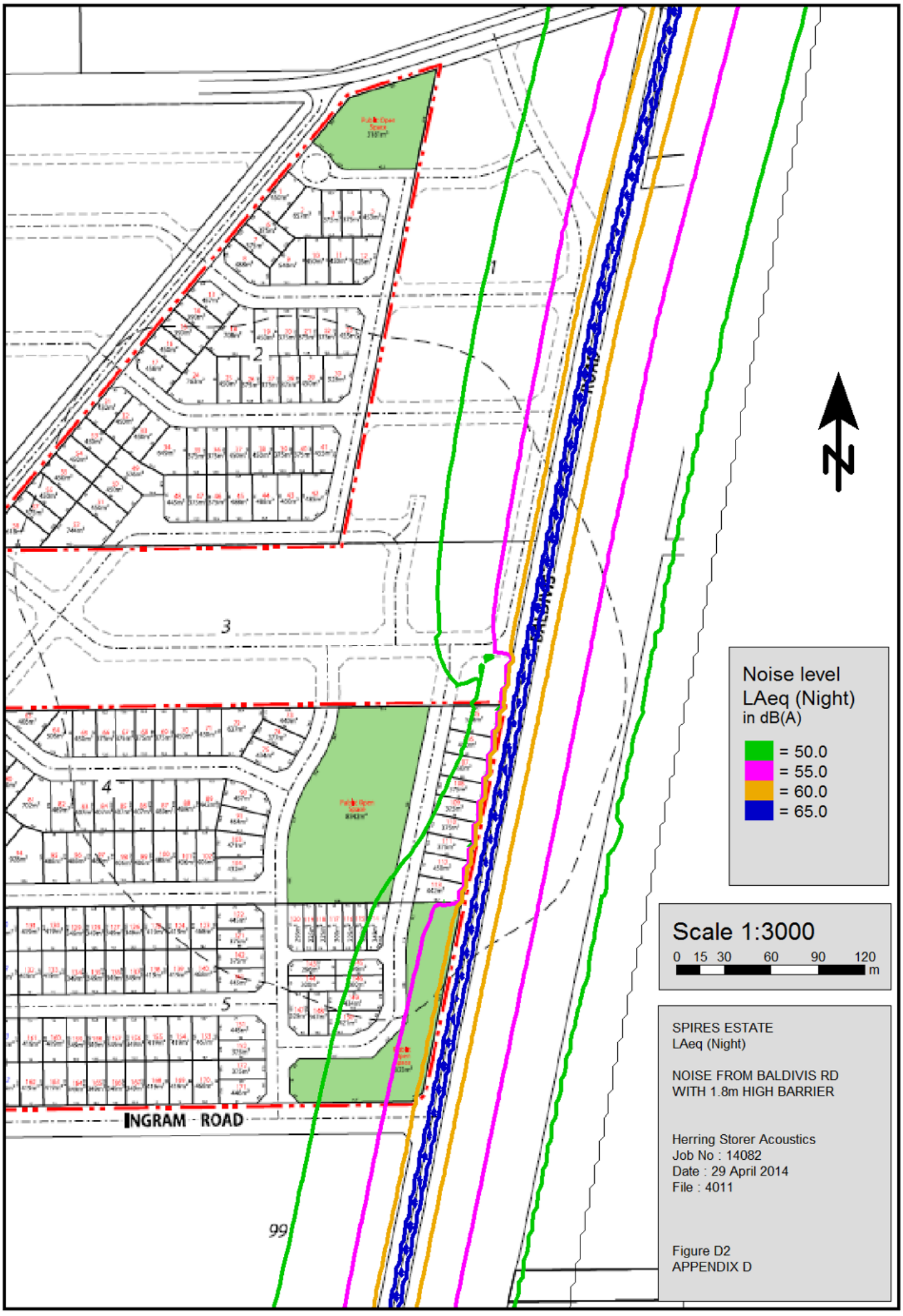

FIFTY ROAD
NAIRN ROAD
FUTURE
EIGHTY ROAD
311
312
N
Noise level
LAeq (Day)
in dB(A)
= 55.0
= 60.0
= 65.0
= 70.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Day)
NAIRN ROAD
WITH 2.2m HIGH BARRIER
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4023
Figure C2
Appendix C

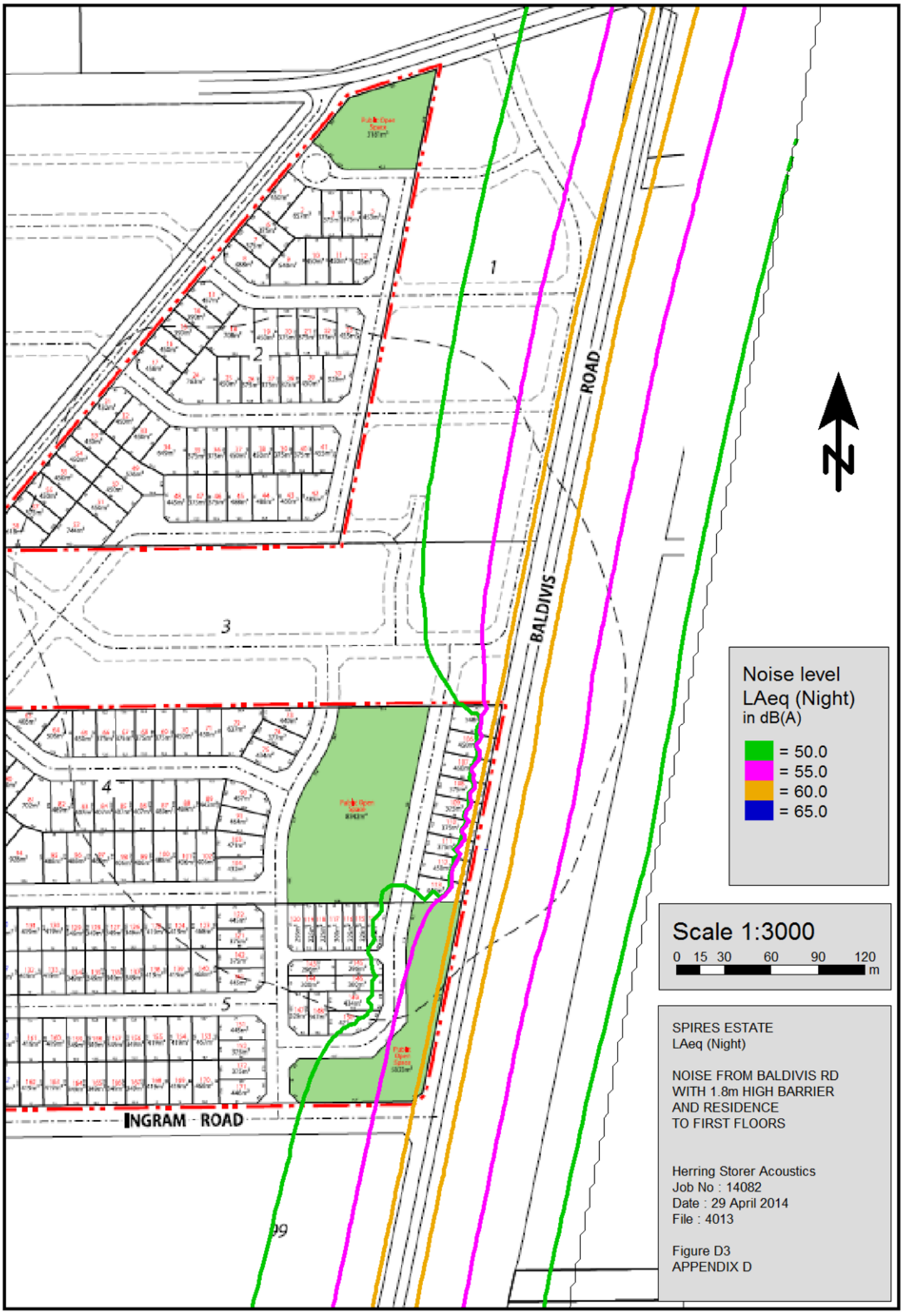

FIFTY ROAD
NAIRN ROAD
FUTURE
EIGHTY ROAD
311
312
N
Noise level
LAeq (Day)
in dB(A)
= 55.0
= 60.0
= 65.0
= 70.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Day)
NAIRN ROAD
WITH 2.2m HIGH BARRIER
TO FIRST FLOOR
WITH RESIDENCE TO EASTERN
SIDE OF NAIRN ROAD
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4026
Figure C3
Appendix C

APPENDIX D

FIGURES D1 TO D3
$L_{Aeq(8hr)}$ NOISE CONTOURS FOR BALDIVIS ROAD


Noise level
LAeq (Night)
in dB(A)
= 50.0
= 55.0
= 60.0
= 65.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Night)
NOISE FROM BALDIVIS RD
NO MITIGATION
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4010
Figure D1
APPENDIX D
INGRAM ROAD
BALDIVIS ROAD
1
2
3
4
5
99


Noise level
LAeq (Night)
in dB(A)
= 50.0
= 55.0
= 60.0
= 65.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Night)
NOISE FROM BALDIVIS RD
WITH 1.8m HIGH BARRIER
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4011
Figure D2
APPENDIX D
INGRAM ROAD
BALDIVIS ROAD
1
2
3
4
5
99


BALDIVIS ROAD
INGRAM ROAD
1
2
3
4
5
N
Noise level
LAeq (Night)
in dB(A)
= 50.0
= 55.0
= 60.0
= 65.0
Scale 1:3000
0 15 30 60 90 120
m
SPIRES ESTATE
LAeq (Night)
NOISE FROM BALDIVIS RD
WITH 1.8m HIGH BARRIER
AND RESIDENCE
TO FIRST FLOORS
Herring Storer Acoustics
Job No : 14082
Date : 29 April 2014
File : 4013
Figure D3
APPENDIX D

APPENDIX E

FIGURE E1 LOTS REQUIRING “QUIET HOUSE” DESIGN AND NOTIFICATIONS
“QUIET HOUSE” DESIGN – GENERAL INFORMATION

PACKAGE B QUIET HOUSE DESIGN TO FIRST FLOORS AND ABOVE
PACKAGE B QUIET HOUSE DESIGN TO GROUND FLOOR
PLUS NOTIFICATIONS ON TITLES

NOTIFICATIONS ON TITLES ONLY

NOTIFICATIONS ON TITLES ONLY

PACKAGE A QUIET HOUSE DESIGN TO BOTH GROUND AND FIRST FLOORS
PLUS NOTIFICATIONS ON TITLES

PACKAGE B QUIET HOUSE DESIGN TO FIRST FLOORS AND ABOVE
PACKAGE B QUIET HOUSE DESIGN TO GROUND FLOOR
PLUS NOTIFICATIONS ON TITLES

FIFTY ROAD

EIGHTY FIVE ROAD

FUTURE NAIRN ROAD

BALDIVIS ROAD

INGRAM ROAD

GAS PIPELINE CORRIDOR

RESIDENTIAL LOT SUMMARY:

LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
201m² - 300m²	7	2.07%	255m²	1.12%	1787m²
301m² - 400m²	98	28.99%	367m²	22.65%	36027m²
401m² - 500m²	186	55.03%	445m²	52.15%	82949m²
501m² - 600m²	26	7.69%	529m²	8.65%	13766m²
601m² - 700m²	10	2.96%	637m²	4.01%	6379m²
701m² - 800m²	6	1.78%	736m²	2.78%	4417m²
801m² - 1000m²	2	0.59%	905m²	1.14%	1811m²
1001m² - 5000m²	2	0.59%	1995m²	2.51%	3990m²
5001m²+	1	0.30%	7929m²	4.99%	7929m²
Total Number of Lots	338				

Minimum Lot Size 225m²
Maximum Lot Size 7929m²
Average Lot Size 470m²
Total Lot Area 159055m²

SPIRES ESTATE
QUIET HOUSE DESIGN AND NOTIFICATIONS ON TITLES

Herring Storer Acoustics
Date : 29 April 2014
Job No : 14082

Figure E1
Appendix E

CONCEPT LAYOUT PLAN

Spires Estate, Fifty and Eighty Road, BALDIVIS

for: Spatial Property Group

SPATIAL Property Group

LEGEND:

- Spires Estate Local Structure Plan Boundary
- Buffer to Egg Farm
- Gas Pipeline Corridor
- Future Road Widening
- Surrounding Cell Layout
- Public Open Space
- Commercial

NOTES:

NORTH
Scale 1: 2000 @ A1
0 20 40 60 80 100 metres

COMPILED: DPS	DRAWN BY: RF
DATE: 13/01/2014	REVISED:
GRID: MGA 50	DATUM: AHD
DRAWING NUMBER: CARRD-1416	JOB CODE: CARROLDP
FILE ID: M:\CARRD\BASE\FEASIBILITY & CONCEPT\CARRD-1416 STG1.DGN	

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QUIET HOUSE DESIGN PACKAGES

AREA TYPE	ORIENTATION	PACKAGE A	PACKAGE B
Bedrooms	Facing Road	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board Hinged doors only, fitted with acoustic seals No vents to outside walls/eaves	Casement or awning windows with 10.38mm or 6.5mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No external doors No vents to outside walls/eaves
	Side-on to Road	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No vents to outside walls/eaves	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No vents to outside walls/eaves
	Away from Road	No Requirements	No Requirements
Living and Work Areas	Facing Road	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board 35mm (min) solid core external doors with acoustic seals Sliding doors to be fitted with acoustic seals and have overlapping meeting stiles No vents to outside walls/eaves	Casement or awning windows with 10.38mm or 6.5mm laminated glass Eaves enclosed with 6mm compressed fibre cement board No vents to outside walls/eaves Sliding doors to be fitted with acoustic seals and have overlapping meeting stiles Front door to be 40mm solid core with acoustic seals
	Side-on to Road	Casement or awning windows with 6mm glass Eaves enclosed with 6mm compressed fibre cement board	Casement or awning windows with 6.38mm laminated glass Eaves enclosed with 6mm compressed fibre cement board
	Away from Road	No Requirements	No Requirements
Other indoor areas	Any orientation	No Requirement	No Requirements