THE SANCTUARY

Road Noise Assessment and Design Advice

Prepared for:

Bird in the hand 2 c/Certainty Wealth
Suite 103, 2 Miami Key, Broadbeach Waters

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Bird in the hand 2 c/Certainty Wealth (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30343.00000-R01-v1.1	6 April 2021	Attila Szabo	Aaron McKenzie	Aaron McKenzie
610.30343.00000-R01-v1.0	1 April 2021	Attila Szabo	Aaron McKenzie	Aaron McKenzie
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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Bird in the hand 2 c/Certainty Wealth to provide a Road Noise Assessment, and advise on likely construction requirements of residential buildings developed on the site. The site named 'The Sanctuary' is an approved residential and industrial subdivision under DA 2014/114 at LOT:206 DP: 754434, Lot: 3 DP: 565437 located at 344 John Oxley Drive and 7 Thrumster Street, Thrumster NSW 2444. It is located within the Port Macquarie-Hastings Council.

This assessment included conducting a road noise assessment, together with a 3D SoundPLAN model to determine the noise impacts on residential lots within the subdivision. The residential lots have been broken into Noise Categories, with typical construction requirements detailed in order to meet relevant local, state and national requirements. This information can be used by prospective buyers to conduct their due diligence, and in order to understand the likely construction requirements when developing residential lots within the subdivision area.

The Site is located outside the ANEF 20 Contour as shown in the *Port Macquarie Airport Master Plan 2010 Addendum Report* for the year 2030 forecast aircraft noise map. As such, this report It is purely an assessment of the impact of traffic noise and likely requirements to address these impacts. The purpose of this report is to be informative only, and no construction or decisions should be based purely on the information contained in this report.

2 Site Description

The Sanctuary site area is approximately 6km west of Port Macquarie, NSW. The Site will be developed as a residential community. Two arterial roads could potentially impact the site- namely John Oxley Drive, and the proposed link road to the airport road. **Figure 1** below shows a plan of The Sanctuary residential zone and its surrounds.

Figure 1 - Site Plan

The Pacific Highway is a dual carriageway that is west of Thrumster Street and *The Sanctuary* site.

John Oxley Drive is a two lane rural road that traverses throughout the West Lindfield investigation area with landowners on both the northern and southern sides of the existing highway. The road currently links the Pacific Highway to the Oxley Highway, which then leads on to Port Macquarie.

The Oxley Highway to the south is the main link between the Pacific Highway and Port Macquarie. It is positioned south of John Oxley Drive, and its construction resulted in reduction of traffic volumes on John Oxley Drive.

3 Criteria - Road Noise

The traffic noise impact assessment has been prepared with reference to the following local, state and national documents:

- NSW Government Department of Environment, Climate Change and Water (DECCW) policy document: NSW Road Noise Policy (RNP) 2011
- AS/NZS 2107:2016 – Acoustics – Recommended design sound levels and reverberation times for building interiors
- AS 3671:1989 - Acoustics – Road Traffic Noise Intrusion – Building siting and construction
- NSW Government Department of Planning – Development near rail corridors and busy roads – interim guideline

Our assessment will consider all of the above documents, and provide specific typical building constructions in order to meet the relevant criteria. The two documents which will drive building envelope design are the designation of internal noise levels resulting from external noise sources as per the NSW EPA Road Noise Policy 2011 (RNP) and the AS/NZS 2107:2016 standards, detailed in the following sections.

3.1 Road Noise Policy

The NSW Environment Protection authority (EPA), formerly known as the Department of Environment, Climate Change and Water, released the Road Noise Policy (RNP) March 2011 which provides noise criteria for proposed residential developments adjacent to major roads. With relevance to the proposed subdivision it states that "Land use developers must meet internal noise goals in the Infrastructure SEPP (Department of Planning 2007) for sensitive developments near busy roads".

The Department of Planning and Infrastructure (DoPI) State Environmental Planning Policy (SEPP) (Infrastructure) 2007 outlines provisions to ensure noise sensitive developments located near major roadways are not adversely affected by road traffic noise.

The policy applies to (and is mandatory for) developments located near major roadways where the annual average daily traffic (AADT) volume exceeds 40,000 vehicles and the relevant consent authority considers that the roadway is likely to cause adverse noise impacts.

Residential developments adjacent to roadways which meet these criteria must demonstrate that appropriate ameliorative measures have been applied to ensure the following internal noise level criteria are met.

- LAeq noise level not exceeding 35 dBA between 10:00 pm and 7:00 am, in any bedroom within the development.

- LAeq noise level not exceeding 40 dBA in any other room within the development (excluding garage, kitchen, bathroom or hallway) at any time.

Although the major roads in the vicinity of this location do not experience 40,000 vehicles per day, these criteria have been utilised for the purpose of assessing potential road traffic noise impacts as it is consistent the most relevant criteria, and is consistent with Australian Standard AS/NZS 2107:2016 outlined below.

3.2 Australian Standard AS/NZS 2107:2016

Australian Standard AS/NZS 2107:2016 – 'Acoustics – Recommended design sound levels and reverberation times for building interiors' recommends suitable internal noise levels for residential habitation and other buildings. The buildings should be constructed to achieve an internal noise level equal to or lower than the levels outlined in **Table 1**. How this is achieved will depend strongly on the location, orientation and type of construction of each building.

Table 1 - Extract from AS/NZS2107:2016 Table 1

Table 1 – AS 2107:2016 Internal Noise Level Criteria – Residential Buildings		
Type of Occupancy – Houses and apartments near major roads	Recommended design sound level, LAeq, dBA	
	Minimum	Maximum
Living Areas	35	45
Sleeping areas (night-time)	35	40
Work Areas	35	45

3.3 Project Specific Road Traffic Noise Goals

The criteria supplied by the RNP have been adopted for the purposes of this noise assessment. The noise descriptors utilised in the RNP are unambiguous and the noise criteria specified are consistent with the relevant Australian Standards. The relevant road traffic noise criteria for the subject development used in this assessment are as follows:

- LAeq noise level not exceeding 35 dBA between 10:00 pm and 7:00 am, in any bedroom within the development.
- LAeq noise level not exceeding 40 dBA in any other room within the development (excluding garage, kitchen, bathroom or hallway) at any time.

4 Road Noise Assessment Modelling

4.1 Methodology

Noise modelling of the project area was carried out as part of the Noise Impact Assessment of the West Lindfield & Partridge Creek Urban Growth Area 13 conducted by SLR. The report reference is '630-02179R1' dated 13 December 2011. This report may be referenced for a detailed description of the road noise assessment.

In summary, noise modelling of the project area was carried out using the CORTN algorithms incorporated in the SoundPLAN noise modelling software. The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections off building surfaces, ground absorption and shielding from ground topography and physical noise barriers.

The algorithm output of CORTN was modified to calculate the relevant LAeq road traffic noise emission descriptors, as required. All reported noise levels are façade-corrected. The predicted noise levels have been adjusted upwards to include a notional 2.5 dBA reflection within the noise model computation.

It should be noted that the road traffic levels were created in 2011, but the CORTN model predicted levels for an expected 2020 road traffic noise level. This data was discussed with the client, and agreed to be a valid model input. The traffic volumes adopted in the model are described below:

- John Oxley Drive
    - Day time 25,408 vehicles 1.7% heavy vehicles

- Night time 1622 vehicles, 1.7% heavy vehicles

- Future Arterial Road
  - Day time 8,387 movements 1.7% heavy vehicles
  - Night time 535 movements, 1.7% heavy vehicles

SLR has created a new SoundPLAN model utilising these previous road traffic noise predictions as an input. The model uses updated imported terrain data, road alignment data, and other relevant revised inputs.

Figure 2 - SoundPLAN model showing basic road features and residential dwellings

Table 2 - Summary of road traffic inputs for our model taken from 2011 predictions

Road Traffic Volumes Utilised in Noise Model			
Location	Height above road surface	Period	Predicted value from SLR NIA report
John Oxley Drive	1.5m	Daytime LAeq (15-hour)	76 dBA
	1.5m	Night-time LAeq (9-hour)	68 dBA
	4.5m	Daytime LAeq (15-hour)	76 dBA
	4.5m	Night-time LAeq (9-hour)	71 dBA
Arterial Road	1.5m	Daytime LAeq (15-hour)	73 dBA
	1.5m	Night-time LAeq (9-hour)	60 dBA
	4.5m	Daytime LAeq (15-hour)	74 dBA
	4.5m	Night-time LAeq (9-hour)	60 dBA

The model has utilised the predicted traffic noise levels for day and night periods, and positioned these on a 3D model of the site. Terrain data has been imported and incorporated in our model. Details on lot division and residential dwelling sizing has been provided and included into our models. Sound propagation modelling has been completed, and noise exposure to the facades of all residential dwellings determined. Based on these model outputs, calculations have been completed to determine the most affected dwellings, as well as the differing impacts on their respective facades.

4.2 Assumptions

A number of assumptions have been made in our modelling. These are listed below.

- Traffic noise level predictions taken from the Noise Impact Assessment prepared by SLR in 2011 are assumed to be valid.
- Residential dwellings have been modelled with a typical 180sqm footprint.
- For modelling purposes, the row of dwellings adjacent to roads have been assumed to be single-storey, with houses directly behind assumed to be double-storey. This would be the worst case scenario, with the two-storey houses in the second row also being directly exposed to road traffic.
- Our assessment only includes road traffic noise sources. Aircraft and industrial noise sources have not been considered.
- Facades have been simplified for modelling purposes, assuming typical architectural constructions and compositions. Glazing areas have also been assumed to be of typical sizing.

4.3 Road Traffic Noise Predictions and Discussion

The prepared SoundPLAN model provided estimates of the noise impact on individual dwellings and differing impacts on their facades based on orientation to the road noise sources. Based on these results, the dwellings have been separated into a number of noise categories. The purpose of this is to simplify reporting of the likely construction requirements for dwellings located in different parts of the site.

Noise level predictions are presented as noise contour plots for day and night-time periods. See **Appendix B** for detailed noise contour plots shown at both 1.5m and 4.5m heights.

The noise contour predictions are external noise levels, and drive the construction requirements of each dwelling. The required road traffic noise reduction has been determined for each residential lot assuming a noise-sensitive area (sleeping area) is located on the façade where noise predictions have been conducted. Where this noise reduction is greater than 20 dBA, Category A construction methods will likely reduce internal noise levels from traffic noise levels to be below recommended values. Where the reduction required is less than 20 dBA, Category B construction methods will likely reduce internal noise levels due to traffic below recommended values. **Section 5** of this report outlines typical construction recommendations for each Construction Category.

Based upon the predicted traffic noise levels, and considering the internal noise level targets as per **Table 1**, the required façade noise reduction for traffic noise is provided below.

Table 3 - Traffic Noise reduction required in each building category type

Construction Category	Room Occupancy	External Traffic Noise corrected to front facade LAeq, dB(A)[1]	Traffic Noise Reduction required, dB(A)
Category A	Sleeping Areas	53	18
	Other Habitable spaces	62	22
Category B	Sleeping Areas	53	18
	Other Habitable spaces	62	22

Note that the above Table references noise levels and construction types at the front facades facing roads. If 'rear facades' are expected to require lower construction requirements, this distinction will be made in the following Section.

5 Building Construction Recommendations

5.1 Building Category Zoning

The reason for only utilising two separate construction categories is due to the building geometry, footprint, orientation, window style and sizing, door style and sizing, and other design elements being unknown and varying between each dwelling. Recommendations are made for each dwelling, and different façade requirements are distinguished between where possible. See **Figure 3** for construction category zoning layouts and **Figure 4** for the corresponding lot numbers. **Table 4** lists all the lot numbers and construction categories.

Figure 3 - Construction Category Zoning

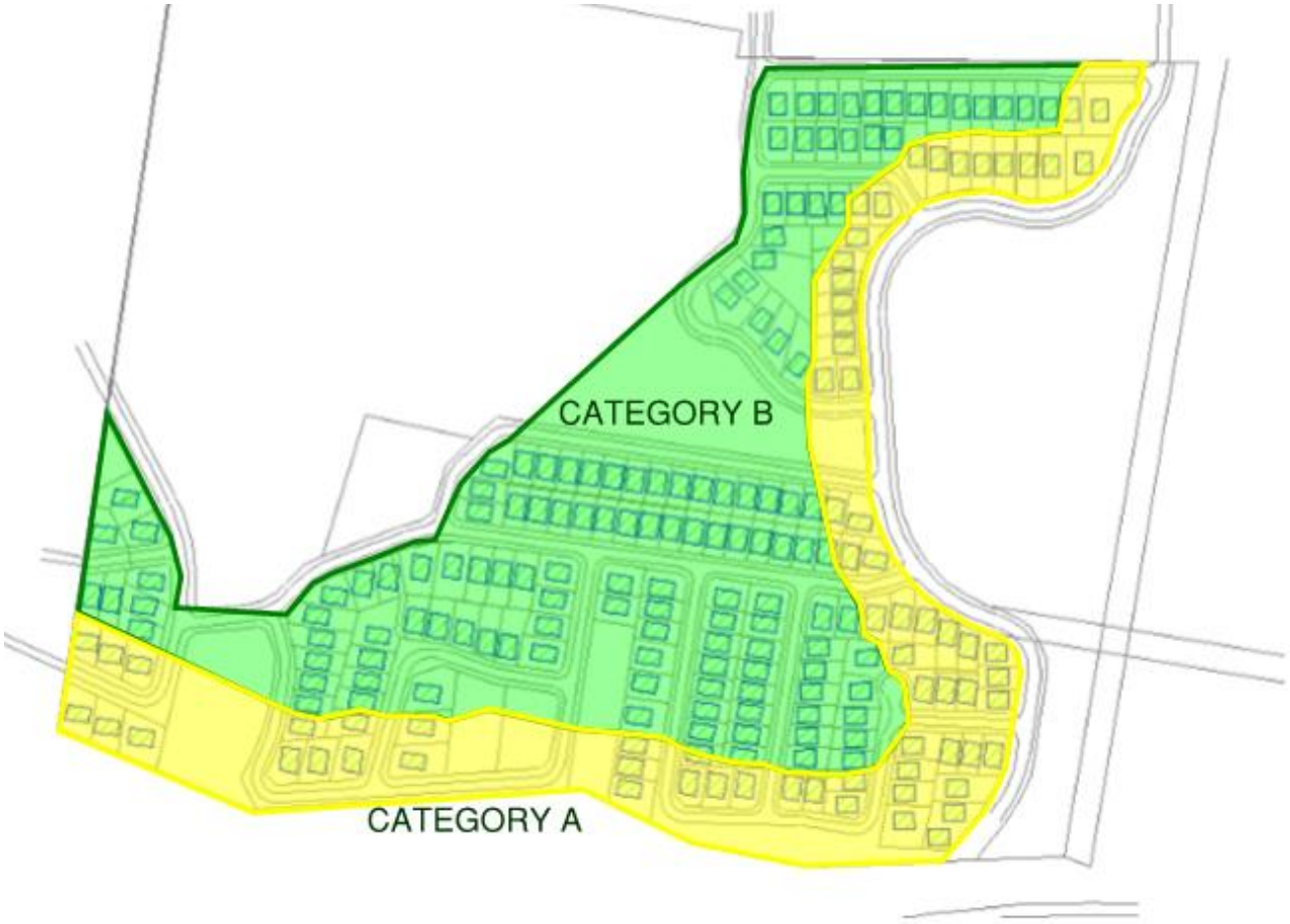


Figure 4 – Subdivision Lot Numbers

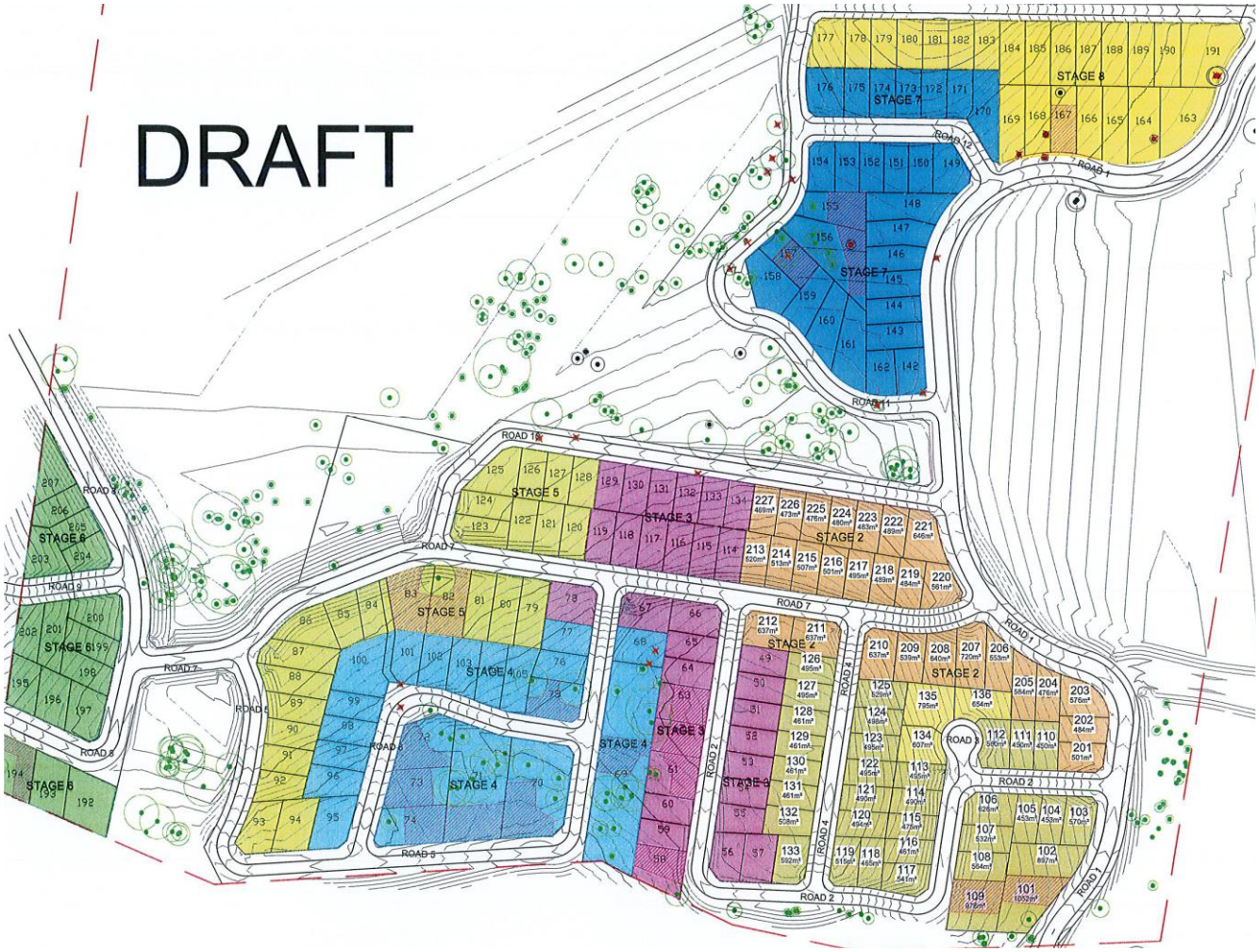


Table 4 – Lot Numbers and Construction Category

Lot Number	Category	Lot Number	Category	Lot Number	Category	Lot Number	Category
49	B	94	A	139	B	184	B
50	B	95	A	140	B	185	B
51	B	96	A	141	B	186	B
52	B	97	B	142	A	187	B
53	B	98	B	143	A	188	B
54	B	99	B	144	A	189	B
55	B	100	B	145	A	190	A
56	A	101	A	146	A	191	A
57	A	102	A	147	A	192	A
58	A	103	A	148	A	193	A
59	A	104	A	149	A	194	A
60	A	105	A	150	A	195	A
61	B	106	A	151	B	196	A
62	B	107	A	152	B	197	A
63	B	108	A	153	B	198	B
64	B	109	A	154	B	199	B
65	B	110	A	155	B	200	B
66	B	111	A	156	B	201	A
67	B	112	A	157	B	202	A
68	B	113	B	158	B	203	A
69	B	114	B	159	B	204	A
70	B	115	B	160	B	205	A
71	B	116	A	161	B	206	A
72	B	117	A	162	A	207	A
73	A	118	A	163	A	208	A
74	A	119	A	164	A	209	B
75	B	120	B	165	A	210	B
76	B	121	B	166	A	211	B
77	B	122	B	167	A	212	B
78	B	123	B	168	A	213	B
79	B	124	B	169	A	214	B
80	B	125	B	170	A	215	B
81	B	126	B	171	B	216	B
82	B	127	B	172	B	217	B

Lot Number	Category	Lot Number	Category	Lot Number	Category	Lot Number	Category
83	B	128	B	173	B	218	B
84	B	129	B	174	B	219	A
85	B	130	B	175	B	220	A
86	B	131	B	176	B	221	A
87	B	132	B	177	B	222	A
88	B	133	A	178	B	223	B
89	B	134	B	179	B	224	B
90	B	135	B	180	B	225	B
91	B	136	A	181	B	226	B
92	A	137	B	182	B	227	B
93	A	138	B	183	B		

5.2 External Construction Recommendations

This Section of the report will detail typical construction requirements expected of each Construction Category. **Figure 3** should be referenced back to, in order to understand where a property in question may lie. It should also be noted that high level typical constructions are described. Performance values should be taken as the key indicator, with examples only used for comparison. Alternate constructions can be assessed against the provided performance requirement estimate to understand what alternate constructions may be suitable.

Following SLR calculations, the following performance ratings and proposed typical constructions are recommended for the development.

Table 5 – Example construction types to achieve acoustic requirements

Facade	Orientation	Construction Element	Minimum Sound Insulation Performance	Example construction to achieve the recommended rating
Construction Category A	Front and Side facades facing the traffic noise source	Glazing	**Sleeping areas**: Rw 32 dB **Living Areas**: Rw 30 dB	**Rw 32 dB**: 6.38mm laminated glass with acoustic perimeter seals **Rw 30 dB**: 6mm float glass with acoustic perimeter seals.
		Solid Wall	Rw 50 dB	Rendered/coated brick veneer with cavity insulation. Level 2 is clad externally with Colourbond.
		Roof	Rw 40 dB	Metal deck roof with build-up similar to Gyprock CSR6636: Sheet metal roof, Bradford Anticon 60 MD over purlins, 150mm thick purlins, 140mm insulation, 13mm standard density plasterboard (8.7kg/m^3).

Facade	Orientation	Construction Element	Minimum Sound Insulation Performance	Example construction to achieve the recommended rating
	Rear Facade	Glazing	**Sleeping areas**: Rw 30 dB **Living Areas**: Rw 28 dB	**Rw 30 dB**: 6mm float glass with acoustic perimeter seals. **Rw 28 dB**: 4mm float glass
Construction Category B	Front and Side facades facing the traffic noise source	Glazing	**Sleeping areas**: Rw 30 dB **Living Areas**: Rw 28 dB	**Rw 30 dB**: 6mm float glass with acoustic perimeter seals. **Rw 28 dB**: 4mm float glass
		Solid Wall	40	Lightweight wall construction. E.g. 9mm CFC, 64mm stud with 11kg/m^3 insulation in cavity, 13mm plasterboard inner lining.
		Roof	40	Metal deck roofing, sarking over roof trusses, plasterboard ceiling, insulation on back of ceiling
	Rear Facade	Glazing	**All areas**: Rw 28 dB	**Rw 28 dB**: 4mm float glass

6 Conclusion

SLR has conducted a high-level preliminary road noise assessment in order to determine likely construction requirements for single and double-storey residential dwellings located on the project site. Acoustic performance requirements of construction elements were predicted, and example typical constructions defined. As project and construction details are refined, all assessment details will need to be reviewed and updated accordingly.

SLR confirms that the information contained herein is purely to assist in the provision of initial concept design for dwelling purchases. This report should not be taken as guidance to inform final construction. Appropriate dwelling specific acoustic design must be conducted prior to construction of any dwelling.

This report was prepared by a qualified and practising acoustic consultant, to the best of their knowledge and understanding of the project.

APPENDIX A

Acoustic Terminology

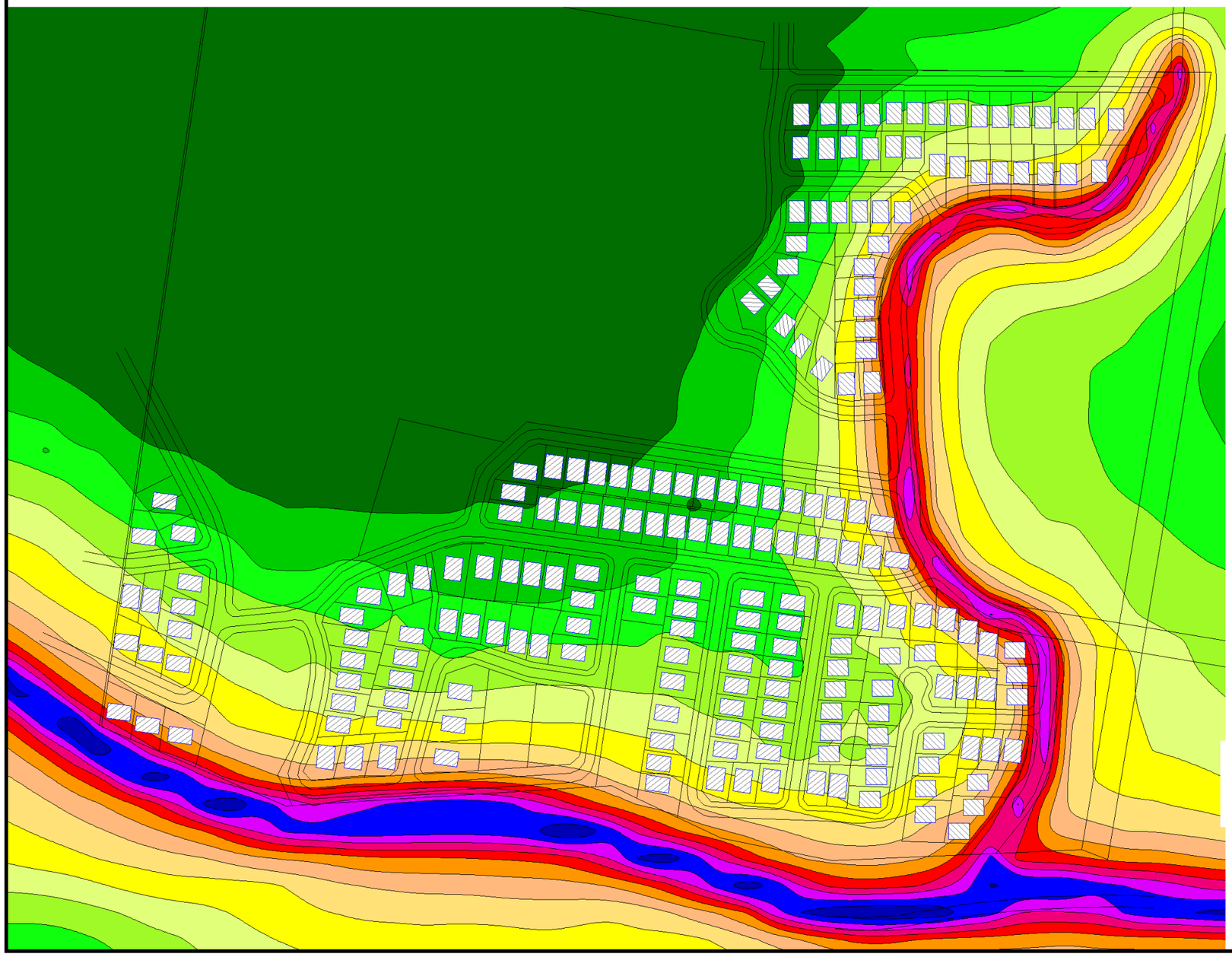
Term	Description
'A' weighted	A frequency adjustment which represents how humans hear sounds.
ABL	Assessment Background Level. The single-figure background level representing each assessment period (day, evening and night). Defined in the *Noise Policy for Industry*.
Ambient noise level	The all-encompassing sound associated with an environment or area.
Background creep	The incremental increase in background noise levels over time as new developments are built in an area.
Ctr	A frequency adaptation term applied in accordance with the procedures described in ISO 717, generally to account for increased significance of low-frequency noise transfer being assessed.
dB	Decibel
dBA	'A' weighted decibel
DW	The weighted level difference between two rooms, that is, the on-site sound insulation between two spaces.
Facade affected	A monitoring location which is influenced by facade reflections. Measurements at facades are typically taken at a distance of 1 m away and the measured noise level generally regarded as being +2.5 dB higher than 'free field'.
Free field	A monitoring location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise.
Hz	Hertz
Impulsive noise	Noise with a high peak of short duration, or sequence of peaks.
Intermittent noise	Noise which varies in level with the change in level being clearly audible
L_{90} , L_{10}, etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
L_{AE} (or SEL)	Sound Exposure Level. This is the constant sound level that has the same amount of energy in one second as the original noise event.
LA_{eq}	The 'A' weighted equivalent noise level. It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
L_{Amax}	The A' weighted maximum sound pressure level of an event.
LnTw	The weighted, standardised impact sound pressure level of a floor/ceiling system. A lower LnTw value represents a better acoustic performance.
LnTw+Ci	The combined weighted, standard plus spectrum adaption term that describes the impact sound insulation performance of floor and ceiling systems. A lower LnTw value represents a better acoustic performance.
Term	Description
Low frequency	Noise containing energy in the low frequency range.
L_P or SPL	Sound Pressure Level
Lw or SWL	Sound Power Level
Noise logger	A self-contained, battery powered item of equipment that is used to measure noise levels over several days.
Noise reduction	The difference in sound pressure level between any two areas.
NR noise rating	Single number evaluation of the background noise level in a space. The NR level is typically around 5 to 6 dB below the 'A' weighted noise level.
Octave-band	A frequency band where the highest frequency is twice the lowest frequency.
Offensive noise	Noise that is considered harmful or which interferes unreasonably with affected receivers.
Over pressure	A term used to describe the air pressure pulse emitted during blasting or similar events.
PNTL	Project Noise Trigger Levels. Target noise levels for a particular noise generating development.
RBL	Rating Background Level. The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period. Defined in the *Noise Policy for Industry*.
Reverberation time (or RT or T-60)	The time taken (in seconds) for a sound to decay by 60 dB within a space.
Rw	Weighted Sound Reduction Index of a building element. That is, the laboratory tested (or theoretically calculated) sound insulation performance of a single element.
Sound Insulation	A reference to the degree of acoustical separation between any two areas.
Steady state noise	Noise which remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Speech privacy	The privacy achieved between two spaces, being a combination of source strength (vocal effort), sound insulation (D_W) between the spaces and the background noise levels in the receiving location.
Time weighting	Sound level meters can be set to 'fast' or 'slow' response. 'Fast' corresponds to a 125 ms time constant and 'slow' corresponds to a 1 second time constant.
Tonality	Noise containing a prominent frequency.
Transmission loss (or sound transmission loss or sound reduction index)	A test which rates the sound transmission properties of a wall, floor or roof construction.

APPENDIX B

Road Traffic Noise Contours

The Sanctuary - Road Traffic Noise Assessment

2020 Road Traffic Noise Levels (dBA) - Day LAeq (15hour) @ 1.5m above ground - No Mitigation - 2.5dBA Facade Correction



Noise levels day dB(A)

	< 52
52 <=	< 54
54 <=	< 56
56 <=	< 58
58 <=	< 60
60 <=	< 62
62 <=	< 64
64 <=	< 66
66 <=	< 68
68 <=	< 70
70 <=	< 72
72 <=	< 74
74 <=	< 76
76 <=	

Signs and symbols

- Road axis
- Emission line
- Surface
- Main building
- Ground absorption

Date

Length Scale 1:4539

0 25 50 100 150 2(

The Sanctuary - Road Traffic Noise Assessment

2020 Road Traffic Noise Levels (dBA) - Night LAeq (9hour) @ 1.5m above ground - No Mitigation - 2.5dBA Facade Correction

Noise levels day dB(A)

	< 52
52 <=	< 54
54 <=	< 56
56 <=	< 58
58 <=	< 60
60 <=	< 62
62 <=	< 64
64 <=	< 66
66 <=	< 68
68 <=	< 70
70 <=	< 72
72 <=	< 74
74 <=	< 76
76 <=	

Signs and symbols

- Road axis
- Emission line
- Surface
- Main building
- Ground absorption

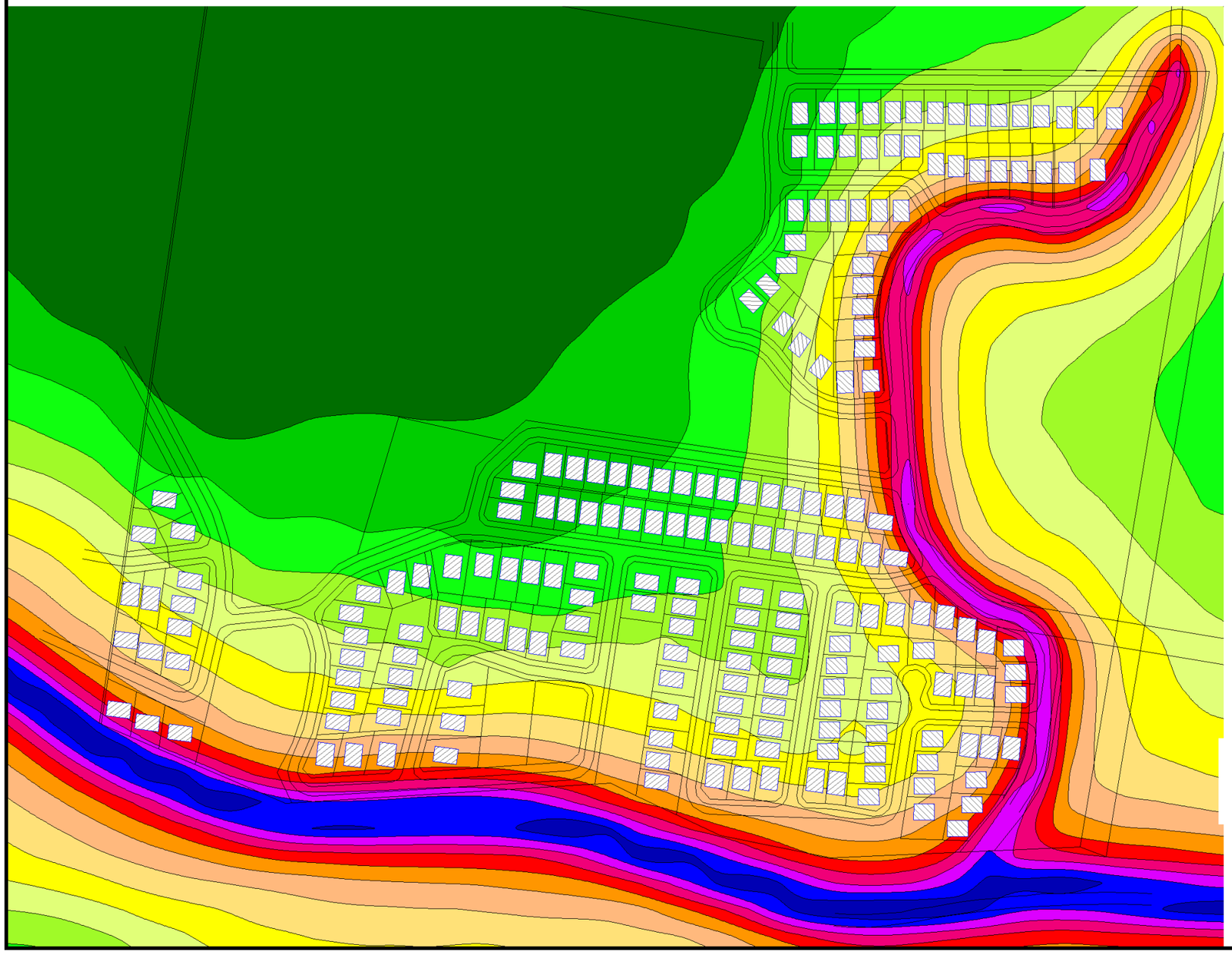
Date

Length Scale 1:4539

0 25 50 100 150 20

The Sanctuary - Road Traffic Noise Assessment

2020 Road Traffic Noise Levels (dBA) - Day LAeq (15hour) @ 4.5m above ground - No Mitigation - 2.5dBA Facade Correction



Noise levels day dB(A)

	< 52
52 <=	< 54
54 <=	< 56
56 <=	< 58
58 <=	< 60
60 <=	< 62
62 <=	< 64
64 <=	< 66
66 <=	< 68
68 <=	< 70
70 <=	< 72
72 <=	< 74
74 <=	< 76
76 <=	

Signs and symbols

- Road axis
- Emission line
- Surface
- Main building
- Ground absorption

Date

Length Scale 1:4539

0 25 50 100 150 20

The Sanctuary - Road Traffic Noise Assessment

2020 Road Traffic Noise Levels (dBA) - Night LAeq (9hour) @ 4.5m above ground - No Mitigation - 2.5dBA Facade Correction

Noise levels day dB(A)

	< 52
52 <=	< 54
54 <=	< 56
56 <=	< 58
58 <=	< 60
60 <=	< 62
62 <=	< 64
64 <=	< 66
66 <=	< 68
68 <=	< 70
70 <=	< 72
72 <=	< 74
74 <=	< 76
76 <=	

Signs and symbols

- Road axis
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0 25 50 100 150 20

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