REPORT

OAKDALE WEST ESTATE – BUILDINGS 2A,2C & 2D

KEMPS CREEK, NSW

NOISE & VIBRATION ASSESSMENT
RWDI # 2102730
19 October 2021

SUBMITTED TO

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RWDI

RWDI is a team of highly-specialised consulting engineers and scientists working to improve the built environment through three core areas of practice: building performance, climate engineering and environmental engineering. More information is available at www.rwdi.com.

AAAC

This firm is a member firm of the Association of Australasian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

QUALITY ASSURANCE

RWDI Australia Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015. This management system has been externally certified by SAI Global and Licence No. QEC 13457 has been issued for the following scope: The provision of consultancy services in acoustic engineering and air quality; and the sale, service, support and installation of acoustic monitoring and related systems and technologies.

GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

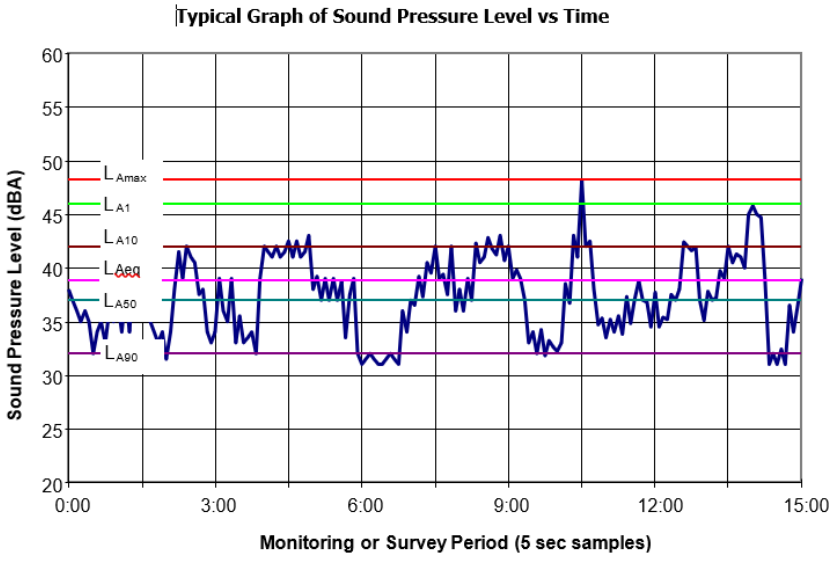
L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.



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1 INTRODUCTION

1.1 Introduction

RWDI Australia Pty Ltd (RWDI) has been commissioned by Goodman Property Services (Aust) Pty Limited (Goodman) to undertake an operational and construction noise and vibration assessment. The assessment is for Buildings 2A, 2C and 2D within the SSD 9794683 Stage 3 Development Application (stage 3 DA) proposed Oakdale West Estate (OWE), Kemps Creek NSW.

Goodman proposes to develop the OWE on a 154 ha site in Kemps Creek, NSW. The OWE would comprise of warehousing and office facilities over five precincts totalling approximately 93.4 ha of developable area.

This noise and vibration assessment has been undertaken in accordance with the *Secretary's Environmental Assessment Requirements* (SEARS) and in general accordance with the NSW *Noise Policy for Industry* (NPfI) and other relevant NSW EPA guidelines.

It is currently anticipated that Buildings 2B and 3A would operate at the estate when Buildings 2A, 2C and 2D is complete. Accordingly, this assessment has considered two separate operational noise scenarios. The first scenario consists of the operation of Lots 2A, 2C, 2D and the second scenario is the whole OWE Precinct in operation.

This assessment includes the changes associated with the proposed SSD 7348 Modification 7 (MOD 7).

A tenant has bee secured for Building 2A but not 2C or 2D.

Figure 1 shows the MOD 7 site layout and the closest sensitive receivers (N1 – N5) as nominated in Appendix 5 of the Development Consent SSD 7348. Additional surrounding receivers (N6 to N14) have been considered in this assessment. Buildings 2A, 2C and 2D are situated on the western side of the Estate and are outlined red.

1.2 Background

SLR Consulting Australia Pty Ltd (SLR) prepared the OWE Noise & Vibration Impact Assessment (NVIA) for the State Significant Development Application (SSDA). The findings of this assessment are set out in the SLR report numbered *610.15617-R2*, dated 16 February 2017.

DPIE granted Development Consent SSD 7348 in September 2019 for the Oakdale West 'Concept Proposal' and 'Stage 1 Development'. The Concept Proposal comprises a 'Masterplan' to guide the staged development of Oakdale West and core development controls that will form the basis for design and assessment of future development applications for the site.

An overview of the approvals sought is set out in Sections 1.3 and 1.4.

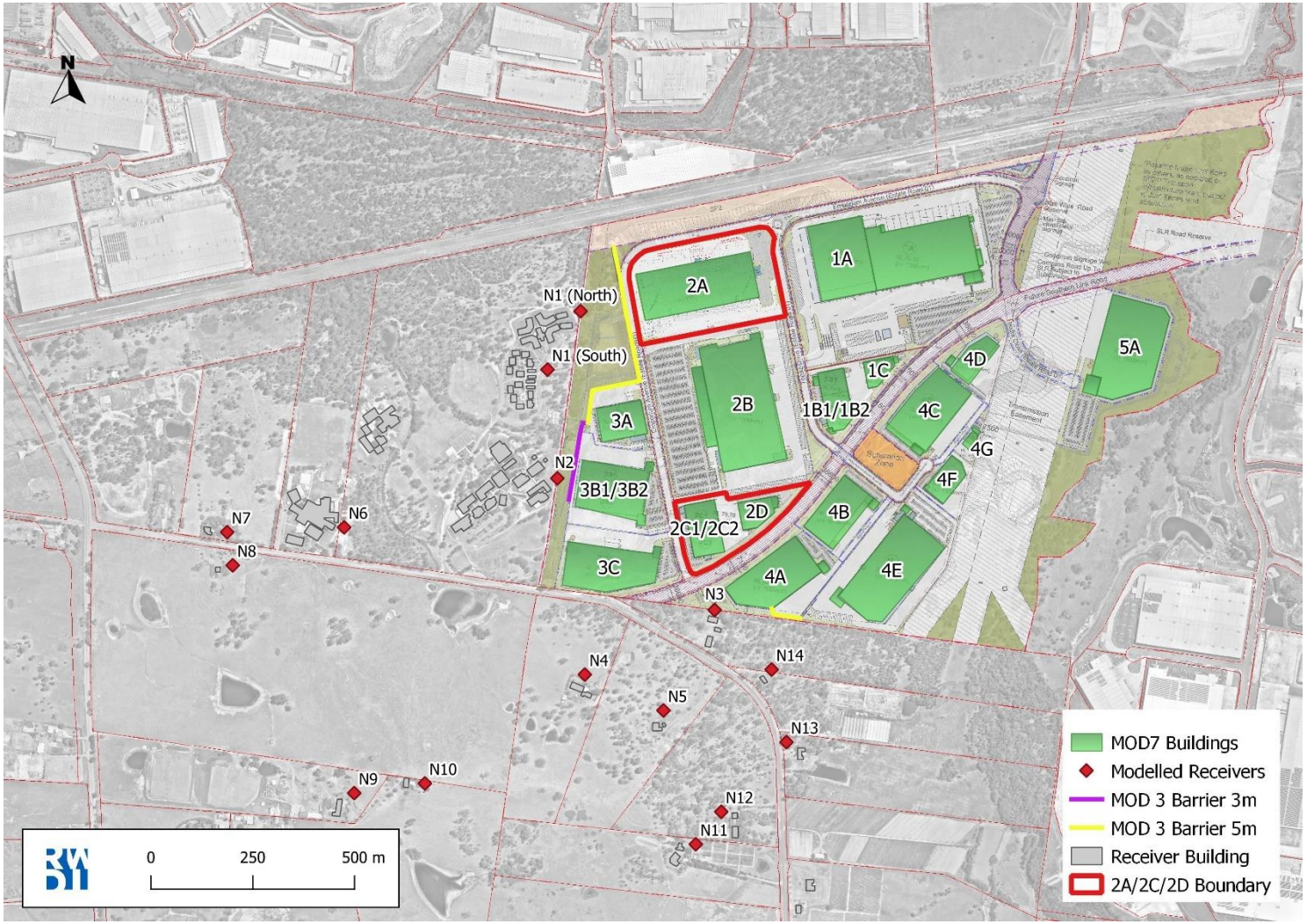


Figure 1 Oakdale West Estate (MOD 7) – Buildings 2A, 2C & 2D

1.3 Modification 7 (SSD 7348 MOD 7)

A modification to the concept plan approval including the following was sought that includes:

- Building layouts across Precinct 3 and 4, namely Lot 3B, 3C, and 4E.
- Civil design amended to accommodate changes to Precinct 3 and Precinct 4.
- The removal of an Estate Road in Precinct 4.
- Inclusion of additional retaining walls in Precinct 3 & 4.
- The proposal also includes a modification to Stage 1 of SSD 7348 to construct a 2.4 m high boundary fence between Lot 1A and Lots 1B & 1C in Precinct 1.
- Operation of a forklift at Lot 4E during the night period (10.00pm to 7.00am).

The changes assessed under MOD 7 are consistent with the proposed development under OWE Stage 3 (SSD 9794683).

1.4 Stage 3 Development Application (SSD 9794683 Stage 3 DA)

Stage 3 Development approval for the following is sought that includes:

- Construction, fit-out, and use approval of Building 2A, 2C and 2D;
- 24 / 7 operation;
- Warehouse and distribution use;
- Single level office and fit-out;
- Signage;
- Subdivision of Lot 2A, 2C and 2D;
- Landscaping; and
- Construction hours for building construction between 7.00am and 6.00pm.

2 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Assessment requirements for the project are provided by the NSW Department of Planning and Environment by way of its *Secretary's Environmental Assessment Requirements* (SEARs). Those relevant to noise and vibration are set out **Table 1**.

Table 1 Relevant Secretary's Environmental Assessment Requirements – SEARs

SEARs relevant to Noise and Vibration	Where Addressed in this Report
Description of all potential noise and vibration sources during the construction and operational phases of the development, including on and off-site traffic noise	On-site operational noise sources considered by this assessment including on-site traffic movements are set out in Section 4.1.
	Off-site traffic noise is addressed in Section 5.1.
	On-site construction noise and vibration sources considered by this assessment are set out in Section 6.
A cumulative assessment of all potential noise sources in accordance with relevant Environment Protection Authority guidelines	A cumulative noise assessment is provided in Section 4.
Demonstration of compliance with the noise limits set out in Condition B18, Schedule B of the Development consent SSD 7348	The approved noise limits are set out in Section 3. Compliance with these limits is addressed in Section 4.
Details of noise mitigation, management and monitoring measures	A summary of operational noise mitigation measures is provided in Section 4. A summary of construction noise mitigation measures is provided in Section 6.

2.1 Assessment Guidelines

The following NSW Environment Protection Authority (EPA) guidelines, as required by the SEARs, have been adopted.

- Noise from on-site operations (including on-site vehicle movements) has been assessed in accordance with the NSW *Noise Policy for Industry* (NPfI), NSW EPA, 2017, with guidance on sleep disturbance criteria taken from this Policy.
- Noise from off-site vehicle movements has been assessed in accordance with guidance provided by the EPA in the NSW *Road Noise Policy* (RNP), NSW EPA, 2011.
- Construction noise has been assessed in accordance with the *Interim Construction Noise Guideline* (ICNG), DECC, 2009.
- Vibration from construction has been considered in accordance with *Assessing Vibration: A Technical Guideline*, DEC, 2006.

3 OPERATIONAL NOISE CRITERIA

3.1 Approved Noise Limits (SSD 7348)

Conditions B18 and B19 of SSD 7348 include operational noise limits for the site as follows:

Table 2 Operational Noise Limits

Location	Day	Evening	Night	
	$L_{Aeq\ (15\ minute)}$	$L_{Aeq\ (15\ minute)}$	$L_{Aeq\ (15\ minute)}$	L_{AMax}
N1 Emmaus Village Residential	44	43	41	52
N3 Kemps Creek – nearest residential property	39	39	37	52
N4 & N5 Kemps Creek – other residences	39	39	37	52
N9 to N14	47	42	42	52
N2 Emmaus Catholic College (school)	When in use: 45 $L_{Aeq\ (1h)}$			

1. Noise generated by the development is to be measured order with the relevant persist and modification additions, including certain meteorological conditions of the Noise policy for industry [EPA, 2017].

It is understood that a Noise Agreement between the applicant and receiver N3, N4 and N5 has been made. As such, the criteria in Condition B18 of the Development Consent SSD 7348 are not applicable at receivers N3, N4 and N5.

The locations of receivers N1, N2, N3, N4 and N5 are shown in Appendix 5 of the Development Consent SSD 7348 and in **Figure 1** above.

It should be noted that the construction of the noise walls, as per Appendix 5, has already been completed.

3.2 Noise Limits for Additional Receivers N6 to N14

To develop criteria for residential receivers N7 to N14, data was obtained from the unattended noise monitoring systems located on site. The location of these monitors is shown in **Figure 2**.

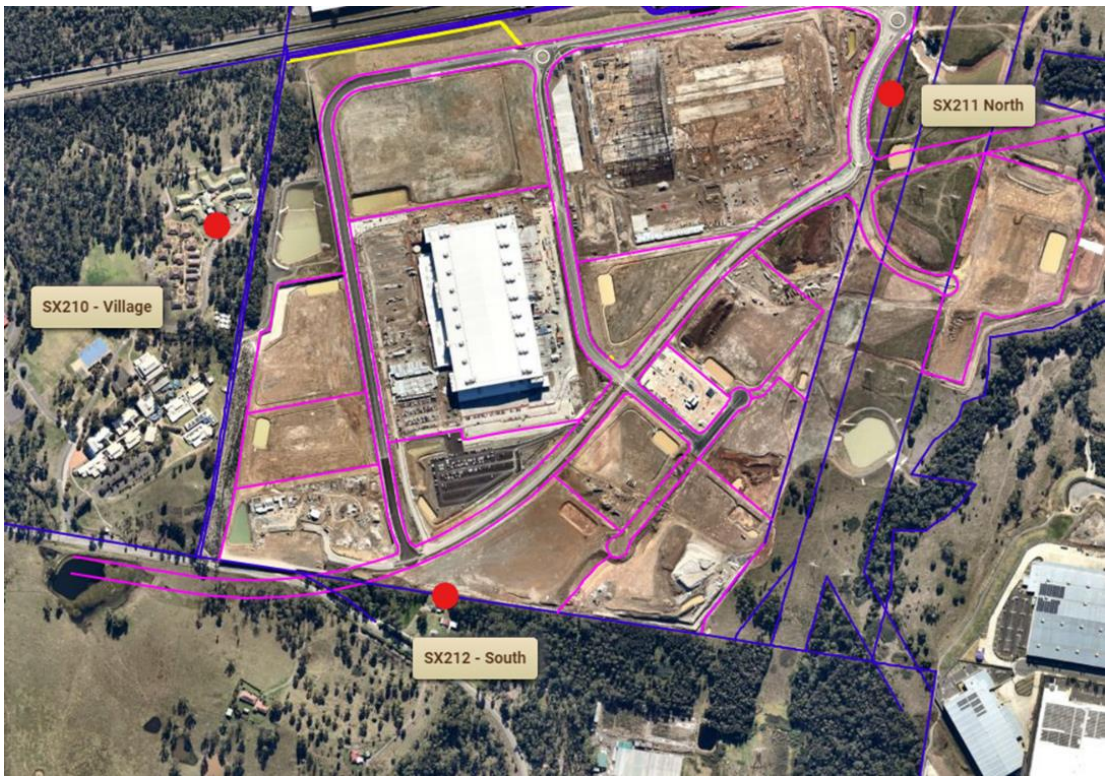


Figure 2 Noise Monitoring Locations

The 'South' location is representative of residential receivers N7 to N14. The 'Village' location is representative of residential location N1 (presented for information only).

We have re-analysed this data between 1 May 2021 and 29 June 2021 for these two locations to determine the Rating Background Levels (RBLs) in accordance with the *NPfI* (calculated ABLs are attached in Appendix A). This process avoids any potential influence from daytime construction noise on site. The resulting background levels are shown in **Table 3**. These are consistent with our expectations given the site conditions.

Table 3 Calculated RBLs

Location	RBL (dBA)		
	Day	Evening	Night
South	42	37	37
Village	39	38	37

As per Condition B18, all other 'non-associated residences' can be evaluated using background plus 5 criteria. The criteria determined in **Table 4** have been adopted for receivers N7 to N14.

Table 4 Intrusiveness Criteria (Background plus 5 dB)

Location	Criteria (dBA)		
	Day	Evening	Night
Receivers N7 to N14 (South)	47	42	42

Receiver N6 is Mamre Anglican College which will have the same noise criteria as N2 – Emmaus Catholic College (school).

4 OPERATIONAL NOISE ASSESSMENT

Operational noise emissions from the site have been predicted with a model prepared using the SoundPLAN V8.0 noise modelling software, implementing the CONCAWE prediction method. The model incorporates the OWE MOD 7 Masterplan design, including the updated civil design, buildings and sensitive receivers shown in **Figure 1.** Operational noise sources included in the model comprise fixed rooftop plant, loading activities (forklifts) and on-site light and heavy vehicles movements.

Consistent with the previous MOD 3 assessment undertaken by SLR, predictions have been undertaken with consideration to neutral meteorological conditions for the daytime, evening and night time periods and additionally under adverse meteorological conditions during the night time period (F-class temperature inversion with a 2 m/s source to receiver drainage flow).

4.1 Traffic Generation

The Traffic Impact Assessment prepared by Ason Group (Report No: P1518r01v5) identifies the estimated OWE total light and heavy vehicle traffic generation that may be expected following MOD 7, incorporating the latest information for Buildings 2A, 2C and 2D, as set out in **Table 5**.

Table 5 MOD 7 Precinct Traffic Generation

Precinct	GFA (m^2)	AM	PM	Daily
Precinct 1	125,198	108	83	2,562
Precinct 2	269,390	861	610	5,661
Precinct 3	56,759	93	93	1,082
Precinct 4	112,123	142	161	1,968
Precinct 5	35,640	58	58	674
Total	**599,455**	**1,263**	**1,006**	**11,948**

The identified vehicle movements have been apportioned across the relevant estate roads. Consistent with previous assessments, for the precincts unaffected by MOD 7, the night time vehicle volumes have been assumed to comprise 30% of day volume and heavy vehicles have been assumed to comprise 25% of total movements.

Where further information has been received from the tenant (as is the case for 2A) or the traffic consultant relating to actual use, these figures have been updated accordingly. The above vehicle movements have been derived from a mixture of first principles traffic generation assessment and where there are committed customers and relevant information available, the customers proposed vehicles movements has been adopted. This results in the following assumed peak hourly movements for each lot.

Table 6 Peak Hourly Assumed Traffic Movements

Precinct	Lot	Day (7am -6pm)		Evening (6pm-10pm)		Night (10pm -7am)	
		LV	HV	LV	HV	LV	HV
1	1A	377	54	377	54	216	54
	1B1	7	5	7	5	2	1
	1B2	7	5	7	5	2	1
	1C	14	-	14	-	4	-
2	2A	220	48	150	58	290	43
	2B	805	22	842	24	515	28
	2C-1	17	-	5	-	5	-
	2C-2	16	-	4	-	5	-
	2D	33	11	33	11	10	3
3	3A	13	3	-	-	-	-
	3B1	13	3	-	-	-	-
	3B2	13	3	-	-	-	-
	3C	13	3	-	-	-	-
4	4A	28	9	28	9	8	3
	4B	22	7	22	7	7	2
	4C	27	9	27	9	8	3
	4D	10	3	10	3	3	1
	4E	84	28	33	6	117	34
	4F	6	2	6	2	2	1
	4G	6	2	6	2	2	1
5	5A	43	14	43	14	13	4

4.2 Acoustic Data

Table 7 summarises noise level data for vehicle-related noise sources has been used for the assessment. These noise levels are taken from RWDI's internal database and external assessments and measurements of similar subject sites.

Table 7 Sound Power Reference Levels

Noise Source	Noise Characteristic	Sound Power Level SWL, dBA
Forklift operational on hardstand[3]	Quasi-steady	93 L_{Aeq}
Light Vehicles[6] on site, up to speed of 40km/h	Quasi-steady	90 L_{Aeq}
Heavy Vehicle[1] @25 km/h	Quasi-steady	106 L_{Aeq}
Heavy Vehicle[1], unloaded @ 10 km/h	Quasi-steady	106 L_{Aeq}
Heavy Vehicle[1], loaded @ 10 km/h	Quasi-steady	107 L_{Aeq}
Heavy Vehicle[1], reversing[4] @ 5 km/h	Quasi-steady	111 L_{Aeq}
Truck Idling[5]	Quasi-steady	95 L_{Aeq}
Truck Engine Starting	Instantaneous	100 L_{Amax}
Truck Airbrake Release[2]	Instantaneous	115 L_{Amax}

Note 1: Heavy vehicle defined as any cargo vehicle with three or more axles with gross vehicle weight > 12,000 kg.
Note 2: Consistent with measurements taken at Woolworths Customer Fulfillment Centre Brookvale, 16 March 2021.
Note 3: Consistent with assessment of Woolworths Moorebank Distribution Centre, 16 October 2020.
Note 4: Assume that reversing operation will not take more than 30 seconds for each vehicle, includes reversing alarm and air brake release.
Note 5: Consistent with measurements taken at Woolworths Distribution Centre Minchinbury, 1 April 2021.
Note 6: Considered conservative when compared to previous assessment of Woolworths Moorebank Distribution Centre.

The noise levels presented above are consistent with US-FHWA-TNM 2.5 technical model and are considered to be a conservative for the purposes of this assessment. Note the increased level for a truck reversing is to account for audible reversing alarms and air brake releases.

A noise survey of a similar facility proposed for Building 2A, located at 2 Hume Highway, Chullora was conducted on Thursday, 7 October, 2021. The purpose of this survey was to confirm the Sound Power Levels presented in **Table 7** for heavy vehicle activities are appropriate. Sound Power Levels of the various heavy vehicle activities measured were found to be at or below the levels presented in **Table 7**.

4.3 Mechanical Services & Fixed Plant

Table 8 presents the mechanical services / fixed plant noise source assumptions for the OWE Lots. The assumptions have been updated having regard to the operational requirements of the committed customers, some of which have changed since the initial Masterplan approval. Where there are not customers committed to development lots, assumptions have been made that are consistent with other industrial estates given the size and type of customer likely to be attracted to the building. These assumptions are consistent with what has been assumed for MOD 7, with updated assumptions for Building 2A.

Table 8 Mechanical Services / Fixed Plant Noise Sources throughout OWE

Precinct	Lot	Day (7am -6pm)	Evening (6pm-10pm)	Night (10pm -7am)
Precinct 1	1A	Refer to **Table 4** of the MOD 2 noise assessment prepared by SLR (SLR Ref: 610.15617-L04-v1.5.doc).		
	1B1	No Operation	No Operation	No Operation
	1B2	No Operation	No Operation	No Operation
	1C	No Operation	No Operation	No Operation
Precinct 2	2A	SWL 88 dBA Cumulative	SWL 88 dBA Cumulative	SWL 88 dBA Cumulative
	2B	Refer Table 4-2 of Oakdale West Estate (OWE) Noise & Vibration Assessment Report (Report No.:19940 Version F)		
	2C-1	No Operation	No Operation	No Operation
	2C-2	No Operation	No Operation	No Operation
	2D	No Operation	No Operation	No Operation
Precinct 3	3A	No Operation	No Operation	No Operation
	3B	No Operation	No Operation	No Operation
	3C	No Operation	No Operation	No Operation
Precinct 4	4A	No Operation	No Operation	No Operation
	4B	No Operation	No Operation	No Operation
	4C	SWL 90 dBA Cumulative	SWL 90 dBA Cumulative	SWL 85 dBA Cumulative
	4D	SWL 90 dBA Cumulative	SWL 90 dBA Cumulative	SWL 85 dBA Cumulative
	4E	No Operation	No Operation	No Operation
	4F	SWL 90 dBA Cumulative	SWL 90 dBA Cumulative	SWL 85 dBA Cumulative
	4G	SWL 90 dBA Cumulative	SWL 90 dBA Cumulative	SWL 85 dBA Cumulative
Precinct 5	5A	SWL 90 dBA Cumulative	SWL 90 dBA Cumulative	SWL 85 dBA Cumulative

4.4 Forklift Loading Activities

On-site forklift loading activities have been assumed to be consistent with the MOD 7 assessment and further information provided by Goodman. **Table 9** shows the number of forklifts assumed to be operating for each lot, where information is available from the customer these have been included. Remaining assumptions are consistent with other industrial estates. Majority of the forklift movements occurring at Night represent an early start for those particular users.

Table 9 Number of Operational Forklifts Assumed for each Lot

Precinct	Lot	Day (7am -6pm)	Evening (6pm-10pm)	Night (10pm -7am)
Precinct 1	1A	4	4	4
	1B1	2	No Operation	No Operation
	1B2	1	No Operation	No Operation
	1C	1	No Operation	No Operation
Precinct 2	2A	5	5	5
	2B	7	7	7
	2C-1	1	No Operation	No Operation
	2C-2	1	No Operation	No Operation
	2D	1	No Operation	No Operation
Precinct 3	3A	1	No Operation	No Operation
	3B	1	No Operation	No Operation
	3C	1	No Operation	No Operation
Precinct 4	4A	1	No Operation	No Operation
	4B	1	No Operation	No Operation
	4C	1	No Operation	1
	4D	1	No Operation	1
	4E	1	No Operation	1
	4F	1	No Operation	1
	4G	1	No Operation	1
Precinct 5	5A	1	No Operation	No Operation

4.5 Noise Barrier

The MOD 2 and MOD 3 noise assessment determined that noise walls to the west and south of the site were required and have been installed, as indicated in **Figure 1**.

The noise barrier to the west has a maximum height of 5 meters, of which sits on top of a circa 10m retaining wall that is in excess of 40m away from the estate's western boundary.

4.6 Operational Noise Scenarios

Table 10 presents the assumptions for each noise prediction scenarios.

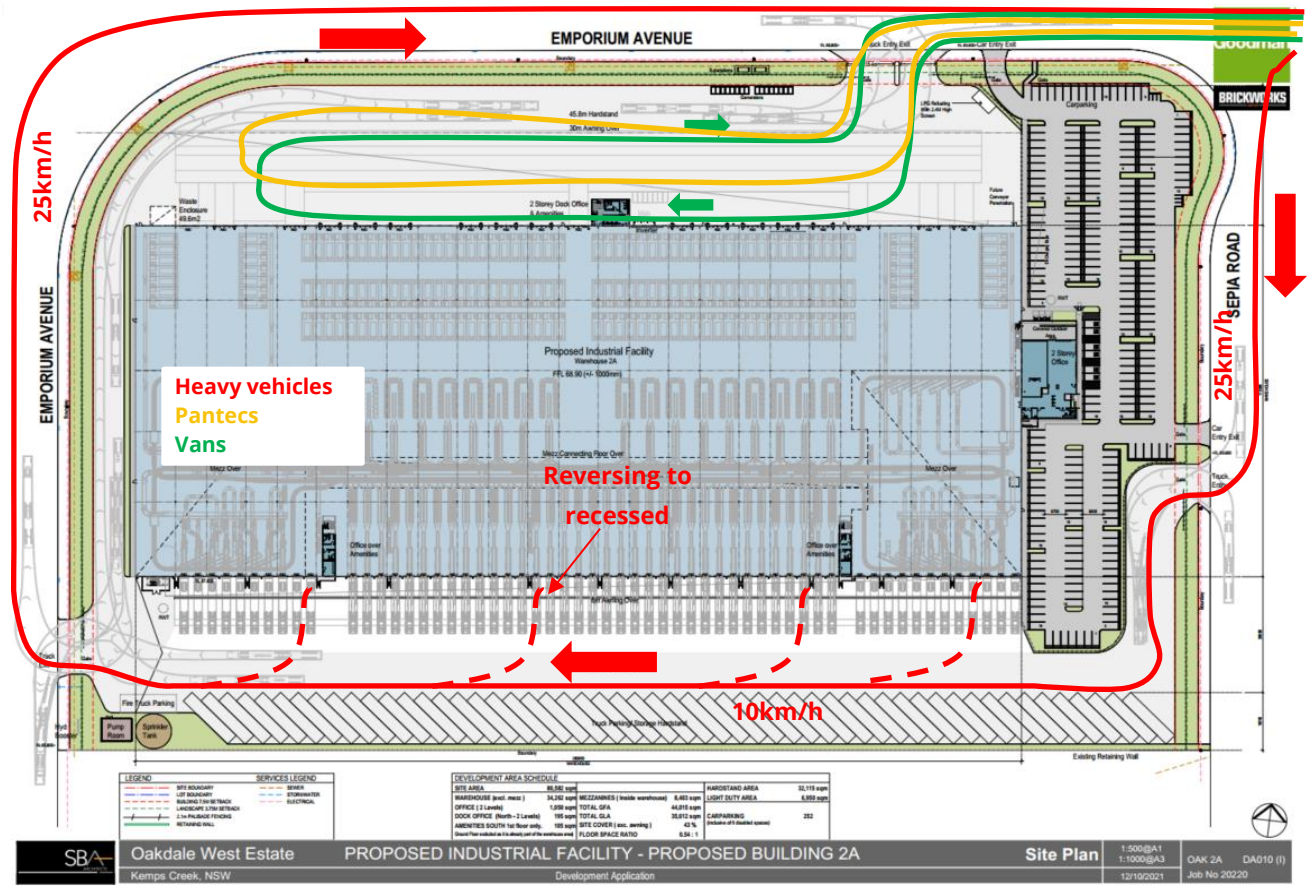
Table 10 Noise Prediction Scenarios

Scenario	Lot Operation	Description
Precinct 2	Lots 2A, 2C and 2D only	Light and Heavy onsite vehicle movements associated with Lot 2A, 2C and 2D. Mechanical services as per Section 4.3. Loading Activities as per Section 4.4. Barrier as per Section 4.5.
All OWE Precincts	All Lots	Light and Heavy onsite vehicle movements. All Lots Mechanical Operation as per Section 4.3. Loading Activities as per Section 4.4. Barrier as per Section 4.5.

Light vehicle and heavy vehicle traffic movements have been modelled as line sources with varying speed. Heavy vehicles are expected to enter the estate at 50 km/h, reduce speed to 25 km/h on estate roads, and reduce speed again to 10km/h when manoeuvring on site. For instances where heavy vehicles will be side loaded, these will park up within the bays allocated with engine off whilst loading/unloading. For rear loaded semi-trailers, these will reverse into the recessed docks where indicated. Sound Power Levels have been applied as per **Table 7**, accounting for reversing alarms.

This modelling strategy for the known tenant in Lot 2A is presented in **Figure 3**.

Figure 3 Source Layout for Lot 2A



4.7 Operational Noise Predictions

Table 11 shows the $L_{Aeq,15min}$ operational noise predictions for both operational scenarios as outlined in **Table 10** above. This includes confirmation of compliance with limits and notes any exceedances.

Table 11 Predicted $L_{Aeq,15min}$ Operational Noise Levels

Receiver	Period (weather)	$L_{Aeq,15min}$ Noise Level (dBA)			Compliance
		Approved Noise Limits	Buildings 2A, 2C, and 2D	All Precincts	
N1 – Emmaus Village Residential	Day	44	33	37	Yes
	Eve	43	34	37	Yes
	Night	41	31	37	Yes
	Night(Adverse)	41	35	41	Yes
N2 – Emmaus College (School)	Day	45	27	43	Yes
	Eve	n/a	30	32	Yes
	Night	n/a	28	34	Yes
	Night(Adverse)	n/a	33	38	Yes
N6 – Mamre Anglican College	Day	45	26	30	Yes
	Eve	n/a	27	30	Yes
	Night	n/a	25	31	Yes
	Night(Adverse)	n/a	32	36	Yes
N7 – 21-42 Bakers Ln, Kemps Creek	Day	47	24	29	Yes
	Eve	42	25	28	Yes
	Night	42	23	29	Yes
	Night(Adverse)	42	30	34	Yes
N8 – 706-752 Mamre Rd, Kemps Creek	Day	47	24	29	Yes
	Eve	42	25	29	Yes
	Night	42	23	29	Yes
	Night(Adverse)	42	30	35	Yes
N9 – 754-770 Mamre Rd, Kemps Creek	Day	47	9	15	Yes
	Eve	42	11	15	Yes
	Night	42	9	17	Yes
	Night(Adverse)	42	15	22	Yes
	Day	47	21	27	Yes
	Eve	42	22	27	Yes

Receiver	Period (weather)	$L_{Aeq,15min}$ Noise Level (dBA)			Compliance
		Approved Noise Limits	Buildings 2A, 2C, and 2D	All Precincts	
N10 – 784-786 Mamre Rd, Kemps Creek	Night	42	20	28	Yes
	Night(Adverse)	42	27	33	Yes
N11 – 99-111 Aldington Rd, Kemps Creek	Day	47	26	34	Yes
	Eve	42	26	34	Yes
	Night	42	24	33	Yes
	Night(Adverse)	42	31	39	Yes
N12 – 53 Aldington Rd, Kemps Creek	Day	47	25	33	Yes
	Eve	42	26	33	Yes
	Night	42	24	33	Yes
	Night(Adverse)	42	31	39	Yes
N13 – 54-72 Aldington Rd, Kemps Creek	Day	47	21	32	Yes
	Eve	42	21	32	Yes
	Night	42	20	33	Yes
	Night(Adverse)	42	27	38	Yes
N14 – 74-88 Aldington Rd, Kemps Creek	Day	47	15	35	Yes
	Eve	42	16	35	Yes
	Night	42	14	34	Yes
	Night(Adverse)	42	20	39	Yes

Note 1: The approved noise limit for N2 is L_{Aeq} 35 dBA which applies internally and is only applicable when the school is in use. For the purpose of this assessment a conservative inside to outside correction of +10 dBA has been applied to the internal limit for N2 to allow for comparison with the external noise predictions. An inside to outside correction of +10 dBA is typical of a building with partially open windows.

Note 2: Consistent with the MOD 2 assessment, noise-enhancing weather conditions during the daytime and evening periods have not been included in the assessment as these are not considered prevailing conditions for the site.

Note 3: This assessment has applied a revised sound power level of 90 dBA to represent a light vehicle movement. MOD 2 applied a sound power level of 96 dBA, which is considered overly conservative.

We do not believe that a modifying factor correction is warranted at this stage. We would normally apply an intermittent modifying factor to $L_{Aeq,15min}$ noise levels where all noise being assessed suddenly increases or reduces where the difference between the total $L_{Aeq,15min}$ (including all other non-industrial sources) at the receiver with the source present and not present results in a difference in L_{Aeq} of 5dB or more during a 15-minute period. It should be noted that given the number of sources at OWE, total noise emissions will not suddenly change.

Further, we believe air brake releases and reversing beepers would be defined as 'Impulsive noise' under the following *NPfI* definition:

Noise with a high peak of short duration, or a sequence of such peaks

An impulsive correction was dropped from the *NPfI* in favour of the Maximum Noise Level Event Assessment (MNLEA), included in Section 4.8 below.

We have consulted with the Noise Policy Section of the EPA. Mr Gordon Downey (Principal Technical Advisor – Noise) has advised that the intermittency modifying factor applies to a step change in continuous or quasi-continuous noise (which these sources are not).

If a modifying factor for intermittency was applied to these results, we note the following points.

- This would result in negligible exceedances during the night time period at locations N13 (1dB exceedance) and N14 (2dB exceedance).
- This would result in a moderate exceedance during the night time period of 5dB at location N1.
- We have incorporated all reasonable and feasible noise mitigation measures (noise barriers, and orientation of noise sources). Further details are provided in the mitigation matrix presented in **Table 12** below.
- The dominant source of the potential exceedance at receiver N1 is from Building 2B operations.

Table 12 Mitigation Matrix

Mitigation Option	Feasible Mitigation Test	Reasonable Mitigation Test	Justification for Adopting or Disregarding this Option
Mitigation at the Source			
Location of sources – Loud sources towards the centre of site to reduce noise impacts to external receivers – also implemented as part of earlier Mod.	Heavy vehicle sources have been located as to face away from external receivers (particularly 4E). This was feasible to implement	Noise benefits outweigh the adverse economic and cost implications.	This option was implemented and fits within the operational characteristics of tenants for these buildings.
Reduce noise from Lot 3 – Rooftop Mechanical services have been deleted and traffic limited to daytime hours only for buildings in Lot 3.	Feasible to implement.	Noise benefits outweigh the adverse economic and cost implications.	This option was implemented and fits within the operational characteristics of proposed tenants for these buildings.
Mitigation of the Transmission Path			
Earthworks bunding on western boundary – implemented as part of previous modification.	Space was available for this option and was considered feasible to implement.	The noise benefits outweigh the adverse economic and cost implications.	This option was implemented and considered reasonable and feasible for this project.

Mitigation Option	Feasible Mitigation Test	Reasonable Mitigation Test	Justification for Adopting or Disregarding this Option
Noise barriers – Implemented as part of earlier modification.	Space was available for this option and engineering was considered feasible to implement. Note: additional height beyond that installed is not considered feasible.	The noise benefits outweigh the adverse economic and cost implications. Note: this is not the case for increased heights beyond that already implemented.	This option was implemented and considered reasonable and feasible for this project.
Further enclosing of vehicle paths and unloading areas	This is not considered feasible. Engineering involved for this would be excessive.	Noise benefits would not outweigh the cost/economic implications. Minimal noise benefit when considering buildings included in this modification.	This option was not implemented as it's **not** considered reasonable and feasible for this project.
Alternative building arrangement/ orientation	This option would be feasible but may limit the operation of these buildings.	Noise benefits would be minimal if anything given the dominant noise sources are from other buildings previously approved not part of this modification.	This option was not implemented as it's **not** considered reasonable for this project.
Mitigation at the Receiver			
Noise barriers at receiver	These would be feasible to build.	Noise benefits of this approach would be minimal given the barriers and earthworks bunding already implemented. Visual/aesthetic impacts would be significant. This option is not considered reasonable.	This option was not implemented as it's **not** considered reasonable for this project.
Architectural treatment to receivers	These would be feasible to build.	Noise benefits of this approach would only be applicable to internal spaces. Outdoor amenity would not benefit and not considered reasonable.	This option was not implemented as it's **not** considered reasonable for this project.

4.8 Sleep Disturbance Assessment

An assessment of potential sleep disturbance has been undertaken considering heavy vehicle brake releases and reversing alarms (non-tonal) modelled in the hardstand areas of the development with a Sound Power Level of SWL 115 dBA.

Table 13 identifies the typical maximum operational noise predictions in comparison with the adopted L_{AMax} noise criteria. Note that the difference between the L_{AMax} and $L_{A1,1min}$ descriptor for reversing alarms and air brake releases is negligible. The table shows the $L_{A1,1min}$ maximum noise predictions in comparison with the approved noise limits for the 'Buildings 2A, 2C, and 2D' scenario and 'All OWE Precincts' scenario.

Table 13 Predicted Maximum Operational Noise Levels – All Precincts

Receiver	Period	$L_{A1,1min}$ Noise Level (dBA)			Compliance
		Adopted Criteria (Approved Limit)	Buildings 2A, 2C, & 2D	All Precincts	
N1 – Emmaus Village Residential	Night	52 (51)	43	44	Yes
	Night[Adverse]	52 (51)	48	48	Yes
N2 – Emmaus College (School)	Night	n/a	n/a	n/a	Yes
	Night[Adverse]	n/a	n/a	n/a	Yes
N6 – Mamre Anglican College	Night	n/a	n/a	n/a	Yes
	Night[Adverse]	n/a	n/a	n/a	Yes
N7 – 21-42 Bakers Ln, Kemps Creek	Night	52 (51)	30	34	Yes
	Night[Adverse]	52 (51)	35	38	Yes
N8 – 706-752 Mamre Rd, Kemps Creek	Night	52 (51)	30	34	Yes
	Night[Adverse]	52 (51)	35	39	Yes
N9 – 754-770 Mamre Rd, Kemps Creek	Night	52 (51)	16	19	Yes
	Night[Adverse]	52 (51)	20	23	Yes
N10 – 784-786 Mamre Rd, Kemps Creek	Night	52 (51)	38	38	Yes
	Night[Adverse]	52 (51)	42	43	Yes
N11 – 99-111 Aldington Rd, Kemps Creek	Night	52 (51)	20	40	Yes
	Night[Adverse]	52 (51)	24	45	Yes
N12 – 53 Aldington Rd, Kemps Creek	Night	52 (51)	20	42	Yes
	Night[Adverse]	52 (51)	24	46	Yes
N13 – 54-72 Aldington Rd, Kemps Creek	Night	52 (51)	30	50	Yes
	Night[Adverse]	52 (51)	34	54	Yes
N14 – 74-88 Aldington Rd, Kemps Creek	Night	52 (51)	22	40	Yes
	Night[Adverse]	52 (51)	27	45	Yes

1: The approved noise limit for N2 is L_{Aeq} 35 dBA which applies internally and is only applicable when the school is in use. For the purpose of this assessment a conservative inside to outside correction of +10 dBA has been applied to the internal limit for N2 to allow for comparison with the external noise predictions. An inside to outside correction of +10 dBA is typical of a building with partially open windows.

2: Consistent with the MOD2 assessment, noise-enhancing weather conditions during the daytime and evening periods have not been included in the assessment as these are not considered prevailing conditions for the site.

3: This assessment has applied a revised sound power level of 90 dBA to represent a light vehicle movement. MOD2 applied a sound power level of 96 dBA, which is considered overly conservative.

5 OFF-SITE TRAFFIC NOISE IMPACTS

5.1 Off-Site Traffic Noise Impact Assessment

The *RNP* requires noise mitigation where new land use developments increase road traffic noise by more than 2 dB. An increase of greater than 2 dB requires an increase in traffic volumes of approximately 60% or higher.

The main access route to the development site is via Compass Drive then the arterial road of Lenore Drive. The forecast traffic daily traffic volumes on Lenore Drive are approximately 28,000 vehicles (refer to SLR report 610.16083-R1), including vehicle movements from the OWE. The daily traffic volume from the OWE is estimated to be approximately 11,948 vehicles, which equates to an increase in traffic volumes of approximately 43%.

Therefore, an increase in traffic noise due to the OWE of greater than 2 dB is not considered likely. No mitigation is likely to be required as a result.

6 CONSTRUCTION NOISE & VIBRATION ASSESSMENT

Construction noise and vibration impacts from the OWE have previously been assessed by SLR (610.15617-R2). With respect to the subject DA, this assessment considers the potential construction noise and vibration impacts from the development of Buildings 2A, 2C, 2D.

The construction works are proposed to be undertaken between normal operating hours (7.00am – 6.00pm Monday to Friday and 8.00am – 1.00pm Saturdays).

The following scenarios have been assessed:

- Site clearing and earthworks at lots 2A, 2C, 2D and 3A;
- Pad and hardstand works, including concrete pours at Lot 2A, 2C, 2D and 3A; and
- Construction of warehouse and office structures.

The use of the site access road for the delivery of materials to the site is assumed in all construction work scenarios.

6.1 Construction Noise Criteria

Construction works will be undertaken within the standard construction hours (7.00am-6.00pm Monday to Friday and 8.00am-1.00pm Saturdays).

Adopting the measured background noise levels determined by SLR (SLR report 610.15617-R2), the Construction Noise Management Levels NMLs derived for the project in accordance with the NSW *Interim Construction Noise Guideline (ICNG)* are detailed in **Table 14**.

Table 14 *ICNG* Construction Noise Management Levels (CNMLs)

Receiver	Period	$L_{Aeq,15min}$ Construction NMLs (dBA)	
		Standard Hours	Highly Noise Affected
N1, N7 & N8	Day	49	75
N9 – N14	Day	44	75
N2 & N6	Day	55*	n/a

* Noise level of L_{Aeq} 55 dBA has been adopted, with consideration to the generally accepted 10 dB noise reduction typically achieved through a partially open window.

6.2 Construction Noise Impact Assessment

For the identified construction activities, this assessment considers the construction equipment and Sound Power Levels set out in **Table 15**.

Predicted $L_{Aeq,15min}$ construction noise levels are compared with the *ICNG* criteria in **Table 16**.

Table 15 Sound Power Levels for Construction Equipment

Construction Activity	Equipment	Operating minutes in 15-min period	No of Items in each Work Area	Sound Power Level (dBA)		
				$L_{Aeq,15min}$		L_{Amax}
				Item	Activity	Activity
Earthworks	Dozer	15	1	110	116	121
	Dump Truck	15	3	100		
	Excavator	15	1	102		
	Front End Loader (FEL) 962	15	1	112		
	Grader	15	1	108		
Pad & Hardstand Works	Concrete Pump	7.5	1	106	113	118
	Concrete Truck / Agitator	7.5	1	106		
	Concrete Vibrator	15	1	102		
	Paving Machine	15	1	104		
	Plate Compactor	5	1	108		
	Vibratory Roller (12 tonne)	15	1	109		
Construction of Warehouse & Office Structures	Elevated Working Platform	15	2	97	107	112
	Flatbed Truck	15	1	100		
	Hand Tools (electric)	15	4	96		
	Mobile Crane (100 tonne)	15	1	101		
	Welding Equipment	15	1	97		
Use of Access Road for Deliveries	Lot 2A: 4 HV per Hour (Daytime) Lot 2C & 2D: 4HV Movements per Hour (Daytime) Lot 3A: 4HV Movements per Hour (Daytime)			115 (Heavy Vehicle)		

Note 1: In accordance with the *ICNG*, for activities identified as particularly annoying (such as jackhammering, rock breaking and power saw operations), a 5 dB 'penalty' is added to the source sound power level when predicting noise using the quantitative method.

Table 16 Prediction $L_{Aeq,15min}$ Construction Noise Levels

Receiver	Period (weather)	$L_{Aeq,15min}$ Noise Level (dBA)				
		CNML	Highly Affected NML	Predicted		
				Earthworks	Hardstand	Construction
N1 – Emmaus Village Residential	Day (Standard)	49	75	**50**	48	43
N2 – Emmaus Catholic College (School)	Day (Standard)	55*	n/a	55	52	46
N6 – Mamre Anglican College	Day (Standard)	55*	n/a	41	39	34
N7 – 21-42 Bakers Ln, Kemps Creek	Day (Standard)	49	75	39	37	32
N8 – 706-752 Mamre Rd, Kemps Creek	Day (Standard)	49	75	25	22	18
N9 – 754-770 Mamre Rd, Kemps Creek	Day (Standard)	44	75	37	34	30
N10 – 784-786 Mamre Rd, Kemps Creek	Day (Standard)	44	75	39	36	32
N11 – 99-111 Aldington Rd Kemps Creek	Day (Standard)	44	75	36	34	29
N12 – 53 Aldington Rd Kemps Creek	Day (Standard)	44	75	35	32	28
N13 – 54-72 Aldington Rd Kemps Creek	Day (Standard)	44	75	41	39	34
N14 – 74-88 Aldington Rd Kemps Creek	Day (Standard)	44	75	39	37	32

1: The *ICNG* criterion for N2 is L_{Aeq} 45 dBA which applies internally and is only applicable when the school is in use. For the purpose of this assessment, a conservative inside to outside correction of +10 dBA has been applied to the internal limit for N2 to allow for comparison with the external noise predictions. An inside to outside correction of +10 dBA is typical of a building with partially open windows.

2: Bold text indicates an exceedance of the *ICNG* CNML.

3: The predictions assume the western site boundary noise wall, as shown in Figure 1, is in place.

All construction noise scenarios are predicted to be within the daytime CNML with exception to noise impact from earthworks at N1. It should be noted, a 1dB difference in noise is not noticeable in this context and should be considered negligible. However, noise mitigation should be implemented in order to minimise noise impact on the surrounding receivers, as provided in Section 6.3. Notably, the majority of earthworks are completed on the pad. The pad is benched and serviced with only detailed earthworks and grading to be completed.

6.3 Construction Noise Mitigation

As noted, the predictions indicate general compliance with the *ICNG* standard hours criteria without any focussed mitigation requirements, except for the minor exceedance of earthworks noise at N1.

The *ICNG* describes strategies for construction noise mitigation and control that are applicable to this proposal. The strategies are designed to minimise, to the fullest extent practicable, noise during construction.

The following construction noise mitigation measures would be applied during the works:

- Minimising the coinciding use of multiple noisy plant items;
- Equipment which is used intermittently is to be shut down when not in use;
- Equipment with directional noise emissions would be oriented away from sensitive receivers as much as practicable;
- Regular compliance checks on the noise emissions of all plant and machinery used for the proposal would indicate whether noise emissions from plant items were higher than predicted. This also identifies defective silencing equipment on the items of plant;
- Non-tonal reversing alarms should be used on all items of plants and heavy vehicles used for construction; and
- Goodman would undertake pre-construction community consultation with receivers N1, N2, N3, N4 and N5 in order clearly and transparently explain the proposed works and the potential for construction noise impacts. Regular on-going updates would be provided throughout the works in order to understand and address as far as practicable any noise related concerns of the receivers.

The identified measures would be carried out to ensure the works are undertaken with minimal noise impact.

6.4 Construction Vibration Impact Assessment

The vibration generating plant items would be set back from the site boundaries by several hundreds of metres. Given this setback distance, vibration levels would not be discernible off-site, therefore no vibration impacts would be expected.

6.5 Construction Noise & Vibration Management Plan

Indicative construction noise and vibration mitigation measures have been recommended in Section 5 of SLR report 610.15617-R2 and above.

7 CONCLUSION

RWDI has undertaken an operational noise and construction noise & vibration assessment of Buildings 2A, 2C and 2D within the SSD 9794683 Stage 3 Development Application (Stage 3 DA) on the approved Oakdale West Estate (OWE) in Kemps Creek, NSW.

7.1 Operational Phase

This assessment considered two separate operational noise scenarios. One scenario with Buildings 2A, 2C, and 2D in isolation and the second scenario with the whole OWE Precinct in operation.

The principal OWE operational noise sources comprise light and heavy vehicle movements, loading activities and fixed mechanical service plant.

The following outcomes have been found during the assessment:

- The operation of full development of the OWE is predicted to comply with the operational noise criteria during the day, evening and night time periods.
- An assessment of potential sleep disturbance has been undertaken considering heavy vehicle brake releases and reverse alarms. Sleep disturbance prediction indicate that noise impact would comply with the relevant criterion.

The cumulative effect of noise from all industrial sources has been considered in assessing potential noise impacts.

7.2 Construction Phase

This assessment has considered construction noise and vibration impacts that have potential to arise during the development of Building 2A, 2C, 2D, and 3A.

The key construction works would involve site clearing and earthworks at lots 2A, 2C, 2D and 3A, pad and hardstand works at each lot and the construction of the building warehouse and office structures at each lot in question. All construction work scenarios include the use of the site access road for the delivery of materials to the site.

Noise modelling of the anticipated construction equipment and activities has been undertaken to determine potential construction noise impacts associated with the proposed Stage 3 DA development of lots 2A, 2C, 2D and 3A. The construction works are proposed to be undertaken between normal operating hours (7.00am – 6.00pm Monday to Friday and 8.00am – 1.00pm Saturdays).

All construction noise scenarios are predicted to be within the daytime CNML with exception to noise impact from earthworks at N1. It should be noted that the 1 dB exceedance of the CNML noise is negligible. However, noise mitigation should be implemented in order to minimise noise impact on the surrounding receivers, as provided in Section 6.3.

No vibration impacts are anticipated during the proposed works.

APPENDIX A – NOISE LOGGING DATA

'South' Location

Descriptor	Date	Day	Evening	Night
ABL	01-May-21	38.0	38.4	36.1
ABL	02-May-21	34.7	38.1	34.3
ABL	03-May-21	46.4	40.3	33.9
ABL	04-May-21	37.4	35.8	35.4
ABL	05-May-21	38.5	37.8	35.0
ABL	06-May-21	38.3	39.2	35.2
ABL	07-May-21	36.5	40.1	39.1
ABL	08-May-21	35.4	38.6	32.1
ABL	09-May-21	33.3	39.1	37.0
ABL	10-May-21	45.8	39.7	37.1
ABL	11-May-21	42.1	35.7	33.4
ABL	12-May-21	47.5	37.4	34.4
ABL	13-May-21	54.6	38.0	38.0
ABL	14-May-21	49.7	37.2	37.3
ABL	15-May-21	39.6	34.2	31.1
ABL	16-May-21	32.0	33.2	34.0
ABL	17-May-21	46.0	32.8	35.9
ABL	18-May-21	49.5	42.3	38.7
ABL	19-May-21	41.4	41.0	38.3
ABL	20-May-21	40.8	37.0	35.0
ABL	21-May-21	37.8	35.4	34.3
ABL	22-May-21	34.9	35.2	34.0
ABL	23-May-21	31.8	33.3	34.3
ABL	24-May-21	42.1	39.9	40.1
ABL	25-May-21	44.8	44.0	43.1
ABL	26-May-21	43.2	36.3	32.7
ABL	27-May-21	42.5	35.8	33.7
ABL	28-May-21	40.8	34.8	33.8
ABL	29-May-21	37.0	34.4	32.6
ABL	30-May-21	33.3	32.4	33.6
ABL	31-May-21	43.4	40.6	40.5

Descriptor	Date	Day	Evening	Night
ABL	01-Jun-21	43.9	39.5	40.0
ABL	02-Jun-21	44.0	39.5	39.8
ABL	03-Jun-21	44.3	33.0	34.5
ABL	04-Jun-21	41.0	35.1	32.4
ABL	05-Jun-21	35.1	39.1	36.4
ABL	06-Jun-21	31.8	37.1	37.8
ABL	07-Jun-21	45.0	42.4	43.4
ABL	08-Jun-21	48.6	42.3	34.6
ABL	09-Jun-21	43.7	42.3	43.1
ABL	10-Jun-21	45.0	36.3	37.0
ABL	11-Jun-21	41.2	36.1	41.6
ABL	12-Jun-21	38.1	35.4	37.8
ABL	13-Jun-21	33.7	32.9	38.0
ABL	14-Jun-21	32.4	33.9	35.0
ABL	15-Jun-21	41.5	38.1	39.4
ABL	16-Jun-21	43.8	42.3	36.5
ABL	17-Jun-21	43.5	40.1	38.4
ABL	18-Jun-21	41.3	39.4	35.8
ABL	19-Jun-21	44.4	37.0	34.4
ABL	20-Jun-21	34.4	36.5	35.0
ABL	21-Jun-21	41.6	37.1	38.2
ABL	22-Jun-21	42.3	41.2	41.5
ABL	23-Jun-21	45.1	44.2	43.7
ABL	24-Jun-21	49.2	42.1	37.9
ABL	25-Jun-21	44.6	41.9	41.2
ABL	26-Jun-21	37.5	38.8	38.7
ABL	27-Jun-21	33.5	32.2	34.3
ABL	28-Jun-21	40.0	37.0	37.0
ABL	29-Jun-21	39.1	38.2	37.7
RBL	ALL	41.5	37.2	37.0

Note: Data shown as shaded has been excluded from the analysis due to non-compliant meteorological conditions.

'Village' Location

Descriptor	Date	Day	Evening	Night
ABL	01-May-21	36.5	37.2	31.1
ABL	02-May-21	33.4	37.5	34.4
ABL	03-May-21	40.3	39.4	35.5
ABL	04-May-21	37.6	35.2	34.0
ABL	05-May-21	39.6	38.5	35.5
ABL	06-May-21	40.4	40.2	36.6
ABL	07-May-21	39.9	38.9	37.4
ABL	08-May-21	35.8	37.9	36.1
ABL	09-May-21	33.5	37.0	36.0
ABL	10-May-21	38.7	40.1	37.0
ABL	11-May-21	39.2	35.3	34.4
ABL	12-May-21	40.8	36.3	35.4
ABL	13-May-21	39.8	37.1	37.1
ABL	14-May-21	42.8	39.0	40.7
ABL	15-May-21	38.7	34.4	32.2
ABL	16-May-21	32.0	34.1	33.9
ABL	17-May-21	39.5	34.8	37.8
ABL	18-May-21	39.2	42.7	38.3
ABL	19-May-21	38.2	40.2	39.0
ABL	20-May-21	39.1	37.1	35.4
ABL	21-May-21	38.9	36.8	35.7
ABL	22-May-21	34.0	36.6	34.3
ABL	23-May-21	31.3	35.2	34.6
ABL	24-May-21	37.7	36.4	35.3
ABL	25-May-21	40.0	43.3	41.7
ABL	26-May-21	40.0	35.6	34.3
ABL	27-May-21	43.3	36.3	34.6
ABL	28-May-21	42.4	38.1	34.5
ABL	29-May-21	38.4	35.3	33.1
ABL	30-May-21	34.8	33.9	35.0
ABL	31-May-21	38.2	41.1	40.0
ABL	01-Jun-21	38.6	39.3	38.6
ABL	02-Jun-21	38.2	40.3	38.7
ABL	03-Jun-21	42.2	32.3	34.1

Descriptor	Date	Day	Evening	Night
ABL	04-Jun-21	41.3	36.3	35.3
ABL	05-Jun-21	34.2	39.3	41.6
ABL	06-Jun-21	30.5	38.2	41.3
ABL	07-Jun-21	39.9	42.3	44.3
ABL	08-Jun-21	44.2	39.6	37.1
ABL	09-Jun-21	42.1	42.6	43.2
ABL	10-Jun-21	44.8	37.5	42.4
ABL	11-Jun-21	40.1	38.2	43.8
ABL	12-Jun-21	36.8	35.8	42.5
ABL	13-Jun-21	33.3	35.3	38.1
ABL	14-Jun-21	32.4	34.2	34.2
ABL	15-Jun-21	35.0	37.9	40.7
ABL	16-Jun-21	39.0	41.2	41.2
ABL	17-Jun-21	41.8	40.7	40.8
ABL	18-Jun-21	40.3	41.3	38.3
ABL	19-Jun-21	43.6	37.0	36.1
ABL	20-Jun-21	35.1	37.0	36.2
ABL	21-Jun-21	39.7	38.1	38.7
ABL	22-Jun-21	39.5	41.7	40.5
ABL	23-Jun-21	41.3	42.8	43.0
ABL	24-Jun-21	44.7	41.5	38.2
ABL	25-Jun-21	42.4	41.0	41.3
ABL	26-Jun-21	38.7	38.5	41.4
ABL	27-Jun-21	33.5	33.5	36.3
ABL	28-Jun-21	39.2	38.8	39.7
ABL	29-Jun-21	38.5	37.1	36.4
RBL	ALL	39.1	37.5	37.1

Note: Data shown as shaded has been excluded from the analysis due to non-compliant meteorological conditions.