

9 December 2019

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Goodman Property Services (Aust) Pty Ltd
Level 17
60 Castlereagh Street
Sydney NSW 2000

Attention: Stephanie Partridge

Dear Stephanie

Oakdale West Industrial Estate
SSD 7348 - MOD 2
Noise Impact Assessment

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Goodman Property Services (Aust) Pty Ltd (Goodman) to assess the potential noise impacts of the Oakdale West Industrial Estate (Oakdale West), located in Kemps Creek.

Goodman obtained Development Consent SSD 7348 from the Department of Planning, Industry and Environment (DPIE) for the Oakdale West 'Concept Proposal' and 'Stage 1 Development' on 13 September 2019. The Concept Proposal comprises a 'Master Plan' 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. The Development Consent SSD 7348 was subsequently modified by submission of MOD 1 which is currently under assessment by DPIE.

The design of the development has been updated as part of a modification (MOD 2) to the Development Consent SSD 7348. Secretary's Environmental Assessment Requirements (SEARs) for MOD 2 were issued by DPIE on 15 November 2019.

This letter presents a review of the potential noise impacts for the MOD 2 design of the development and compares the predicted noise levels to the noise criteria for the site, as specified in the Development Consent SSD 7348.

Executive Summary

MOD 2 consists of changes to the layout of Precinct 1 to accommodate requirements of the future customer for Lot 1A. Noise impacts from Oakdale West have been modelled and assessed against the relevant criteria outlined in the Development Consent SSD 7348 and the relevant SEARs addressed.

Operational Noise Mitigation Measures

The noise barriers in Precinct 2 in the western area of the development are proposed to be constructed prior to commencement of operations in Precinct 1. The increase in noise levels from Precinct 1 results in exceedances at receivers N1 to the west prior to the construction of the Warehouse 2B structure, which is located adjacent to the northern section of the barrier. A 60 m section at the northern end of the barrier is required to be increased to 5 m height from an approved height of 2 m, and extended for a further 30 m. All other sections of this barrier remain at an approved height of 5 m.

Acoustic screening is proposed to be installed around the rooftop plant in Lot 1A. The specifications and design for the acoustic screens, along with the proposed plant models and locations and any additional mitigation measures such as silencers, must be confirmed during the detailed design stage for Lot 1A.

The above mitigation measures have been applied in all predicted noise results.

Predicted Operational Noise Impacts – All Oakdale West Precincts Cumulative

Peak operational noise emissions from the development are predicted to comply with the relevant criteria at the surrounding sensitive receivers (noting that the criteria are not applicable at N3 in accordance with Condition C29 of the Development Consent).

Noise levels for the MOD 2 development are generally predicted to be higher than the approved development during the daytime and evening periods, and marginally higher during the night-time period under noise-enhancing weather conditions. The increase is limited by the separation distance between Precinct 1 and the receivers, along with the intervening shielding provided by structures and topography in the other lots.

Overall, the predicted operational noise impacts from the MOD 2 design are generally consistent with the approved design and comply with the relevant L_{Aeq} criteria at the surrounding receivers.

Predicted Operational Noise Impacts – Precinct 1 Only

The temporary scenario of Precinct 1 being operational while no structures have been built in other precincts of Oakdale West was modelled to assess potential noise impacts of this temporary scenario.

Peak operational noise emissions from Precinct 1 for the temporary scenario are predicted to comply with the relevant criteria at the surrounding sensitive receivers with the exception of N4/N5 during the night-time under noise-enhancing weather conditions (up to 2 dBA). No exceedance is predicted at these receivers during standard weather conditions or during other periods.

The EPA's *Noise Policy for Industry* (NPfI) notes that a residual impact of this magnitude is considered to be negligible. It is considered that this exceedance is minor and temporary in nature, and as such would be acceptable during construction of the estate.

Predicted Operational Maximum Noise Levels and Proposed Modification to Approved Noise Limits

The maximum noise levels are predicted to exceed the screening level at the most affected receivers in N1, N4 and N5 during the night-time period. It is noted that the SSDA Noise Impact Assessment for the approved development predicted exceedances of the sleep disturbance screening level at the Kemps Creek residences (N4/N5).

Guidance is provided in the EPA's *Road Noise Policy* (RNP) and *Noise Policy for Industry* (NPfI) on the potential for maximum noise events to result in sleep disturbance. The maximum noise level assessment concludes that the predicted noise levels are below the levels outlined in the RNP that would be considered to have potential to cause sleep disturbance, and would be similar in level to the existing ambient noise environment. As such, the predicted maximum noise levels would be unlikely to result in sleep disturbance.

As the LA_{1(1minute)} noise limits specified in Development Consent SSD 7348 are lower than the sleep disturbance screening level specified in the NPfI, it is recommended that the LA_{1(1minute)} noise limits be modified to be 52 dBA, as outlined below, consistent with the NPfI sleep disturbance screening level.

Location	Development Consent SSD 7348 Noise Limit – Night LA _{1(1minute)} dBA	Proposed Noise Limit Night LA _{1(1minute)} dBA
N1 Emmaus Village Residential	51	52
N3 Kemps Creek – nearest residential property	47	52
N4 & N5 Kemps Creek – other residences	47	52

Note: No change is proposed to the LA_{eq(15minute)} noise limits specified in the Development Consent SSD 7348.

Off-Site Operational Road Traffic Noise Impacts

Once vehicles leave the Oakdale West site and move onto public roads they are assessed under the RNP. The RNP requires noise mitigation to be considered 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 Oakdale West is via the approved Western North-South Link Road (WNSLR) and the existing arterial road of Lenore Drive.

The Traffic Impact Assessment for MOD 2 (prepared by ASON) details the total daily traffic volumes for Oakdale West. The daily traffic equates to an increase in traffic volumes on Lenore Drive of less than 50%. Therefore an increase of greater than 2 dB is not considered likely and consideration of mitigation is not required as a result, consistent with the approved development.

Construction Noise and Vibration Impacts

Construction noise and vibration impacts for the approved development were assessed at a precinct and estate level in the SSDA NIA. The MOD 2 changes to the layout of Precinct 1 do not affect the assessed general construction activities and locations. As such, the construction noise and vibration impacts are considered to be consistent with those detailed in the SSDA NIA.

Details of monitoring, mitigation and management of construction noise and vibration will be detailed in construction noise and vibration management plans prepared separately to this report.

1 Environmental Assessment Requirements

Secretary's Environmental Assessment Requirements (SEARs) for MOD 2 were issued by DPIE on 15 November 2019. The SEARs relevant to this report have been considered and are addressed as outlined in **Table 1**.

Table 1 Secretary's Environmental Assessment Requirements (SEARs) – Noise and Vibration

Relevant SEARs – Noise and Vibration	Where addressed
An updated description of all potential noise and vibration sources during the construction and operational phases of the development, including on and off-site traffic noise.	Operational noise sources including onsite traffic are discussed in Section 3.2 . Operational off-site traffic is discussed in Section 3.4 . Construction noise and vibration impacts are discussed in Section 4 .
An updated cumulative noise impact assessment of all potential noise sources in accordance with relevant Environment Protection Authority guidelines.	Assessment of all cumulative noise sources is detailed in Section 3.3 .
Demonstration that the modification will comply with the noise limits set out in the existing approval.	The applicable noise criteria outlined in the Development Consent is detailed in Section 3.1 . Assessment of predicted noise impacts against the approved noise criteria is detailed in Section 3.3 .
Justification for any proposed changes to the approved noise limits.	Justification for proposed changes to the approved noise limits (where applicable) is detailed in Section 3.3.1.2 and Section 5 .
Updated details of noise mitigation, management and monitoring measures.	Updated mitigation measures are detailed in Section 3.2.3 . Monitoring requirements will be detailed in operational and construction noise and vibration management plans prepared separately to this report.

2 MOD 2 Design Plans

The MOD 2 design includes the following modifications from the approved design:

- Layout changes to Precinct 1 to accommodate requirements of the future customer for Lot 1A
- Increase in warehouse heights within Lot 1A to accommodate high bay (around 36.0 m height) and low bay (around 27.0 m height) warehousing
- Pad height of Lot 1B/1C area raised by around 4.5 m to a height of 74.8 m
- Revision of proposed traffic volumes for Precinct 1 to account for layout changes and requirements of the future customer for Lot 1A
- Revision of mechanical plant for Lot 1A to account for requirements of the future customer including temperature control for the high bay and low bay warehousing.

No other areas of Oakdale West have been modified by the MOD 2 design. Proposed traffic volumes for the other precincts of Oakdale West are not affected by the MOD 2 design.

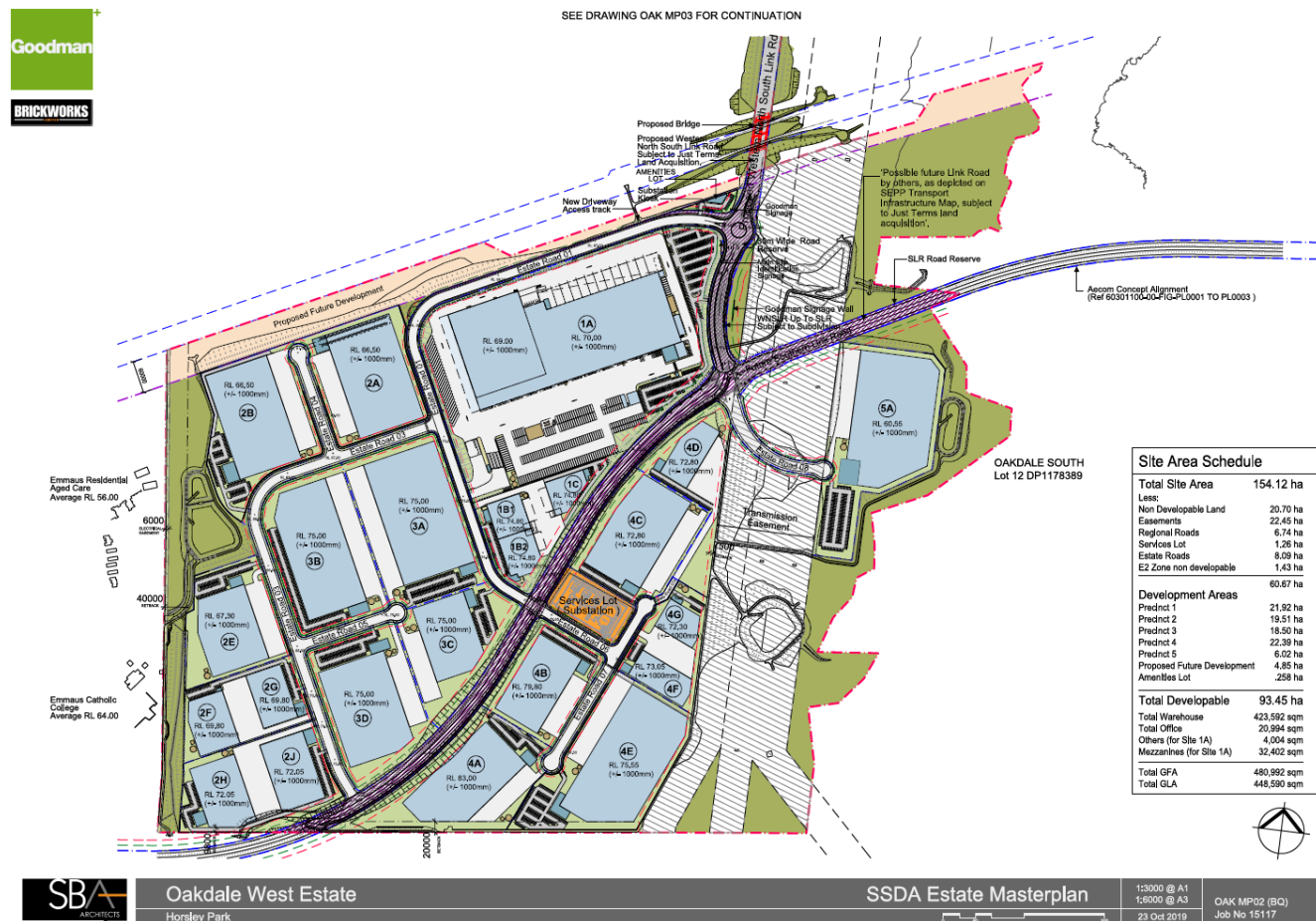
All assumptions in this assessment are consistent with the assumptions for the approved development noise impact assessment, unless stated otherwise.

The approved design is shown in **Figure 1**, and the MOD 2 design is shown in **Figure 2**.

Figure 1 Approved Design Plans



Figure 2 MOD 2 Design Plans



3 Operational Noise Impact Assessment

3.1 Operational Noise Criteria

The operational noise criteria applicable to Oakdale West are specified in Conditions B18 and B19 of the Development Consent SSD 7348. Conditions B18 and B19 are reproduced below:

B18 *The Applicant shall ensure the Development does not exceed the noise limits in Table 3 at the receiver locations N1, N2, N3, N4 and N5 shown on the plan in Appendix 5.*

Table 3: Noise Limits dB(A)

Location	Day	Evening	Night	
	LAeq(15 minute)	LAeq(15 minute)	LAeq(15 minute)	LA1(1 minute)
N1 Emmaus Village Residential	44	43	41	51
N3 Kemps Creek – nearest residential property	39	39	37	47
N4 & N5 Kemps Creek – other residences	39	39	37	47
N2 Emmaus Catholic College (school)	When in use: 35 (internal)			

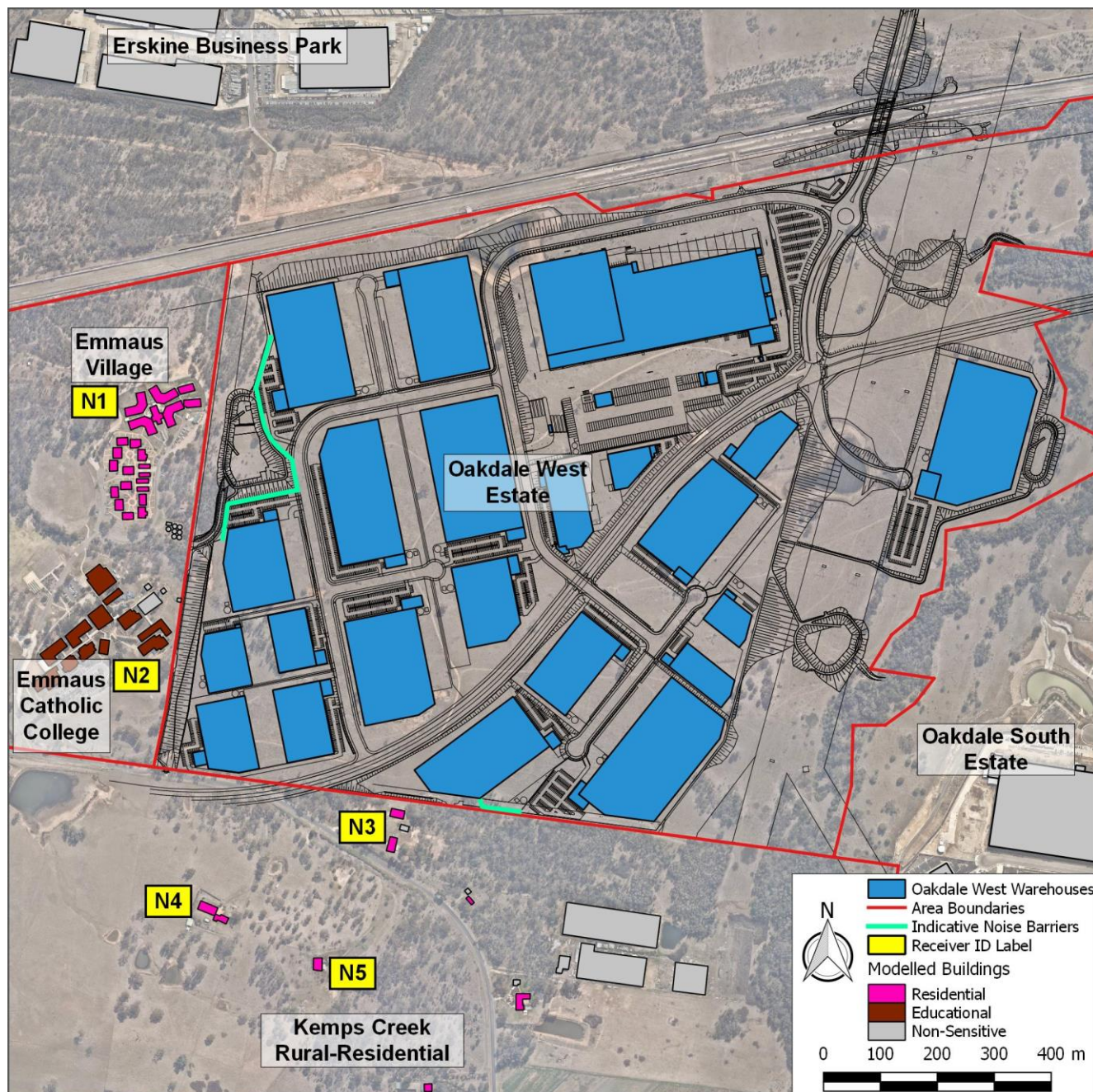
Note: Noise generated by the Development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the Noise Policy for Industry (EPA 2017).

B19 *The noise limits in Table 3 do not apply to receiver N3 if the Applicant has a Noise Agreement with the relevant landowner to exceed the noise limits, and the Applicant has provided written evidence to the Planning Secretary that an agreement is in place.*

It is understood that a Noise Agreement with receiver N3 has been submitted to DPIE. As such, the criteria in Condition B18 of the Development Consent SSD 7348 are not applicable at receiver N3.

The locations of receivers N1, N2, N3, N4 and N5 are shown in Appendix 5 of the Development Consent SSD 7348. These locations are shown in **Figure 3**.

Figure 3 Receiver Locations



3.2 Noise Model Inputs and Assumptions

Operational noise from the development was modelled using the SoundPLAN noise model prepared for the approved development. This model was updated with the MOD 2 design changes as outlined in **Section 2**.

3.2.1 Vehicle Movements

Proposed light and heavy vehicle movements for Lot 1A were provided by Goodman and reflect the requirements of the future customer, including shift times for a standard day, and a peak day which would be expected to occur for around 6 weeks per year. Proposed vehicle movements for Lot 1A are summarised in **Table 2**.

Table 2 Proposed Vehicle Movements – Lot 1A

Period	Proposed Vehicle Movements		
	Light Vehicles	Heavy Vehicles	Total Movements
Standard Day			
24-hour	828	950	1,778
Day/Evening peak 1-hour	302	50	352
Night peak 1-hour	173	50	223
Peak Day (around 6 weeks per year)			
24-hour	1,034	1,188	2,222
Day/Evening peak 1-hour	377	54	431
Night peak 1-hour	216	54	270

Vehicle movements for other lots and precincts in Oakdale West were defined in the approved development noise impact assessment based on the following details:

- 24-hour – around 8,760 vehicles
- Day/evening peak 1-hour – around 750 vehicles
- Night peak 1-hour – around 225 vehicles (30% of day peak)
- Heavy vehicle percentage of around 25% of total movements.

These volumes were split across the lots based on the Gross Floor Area (GFA) of the lots, ie bigger lots have more vehicle movements assigned. Note that the above values included vehicle movements for Lot 1A. As such, the assigned Lot 1A vehicle movements were replaced with those provided by Goodman for a peak day (refer to **Table 2**) in accordance with the Traffic Impact Assessment for MOD 2 (prepared by ASON).

Based on the above assumptions, the peak 1-hour vehicle movements summarised in **Table 3** were modelled to determine noise emissions from the development. These volumes were further broken down into 15-minute volumes to assess against the applicable criteria.

Table 3 Peak 1-Hour Vehicle Volumes

Lot	Proposed Vehicle Volumes			
	Day/Evening Peak 1-Hour		Night Peak 1-Hour	
	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
1A	377	54	216	54
1B/1C	28	10	8	2
2A	31	10	9	3
2B	34	11	10	3
2E	19	6	6	2
2F	9	3	3	1
2G	9	3	3	1
2H	14	5	4	1
2I	14	5	4	1
3A	41	14	12	4
3B	33	11	10	3
3C	18	6	5	2
3D	30	10	9	3
4A	28	9	8	3
4B	22	7	7	2
4C	27	9	8	3
4D	10	3	3	1
4E	32	11	10	3
4F	6	2	2	1
4G	6	2	2	1
5A	43	14	13	4

Sound power levels and speed assumptions for the modelled vehicle movements are shown in **Table 4**.

Table 4 Sound Power Levels for Onsite Vehicle Movements

Noise Source	Sound Power Level (SWL)	Average Speed
Heavy vehicles	103 dBA ¹	25 km/h
Light vehicles	96 dBA	40 km/h
Gas-powered forklifts ²	93 dBA	n/a

Note 1: Based on SLR's noise measurement database, this sound power level is typical of trucks travelling at low speeds, such as within industrial estates.

Note 2: If electric forklifts are utilised instead of gas-powered forklifts, noise emissions from forklifts would be considerably lower.

External forklift movements have been modelled within the at-grade dock areas of the hardstands for each lot. It has been assumed that forklifts would operate continuously during the worst-case 15-minute period of all hardstand areas during the daytime and evening periods. No forklift movements within lots 2F, 2G, 2H, 2J, 3A, 3C, 4A, 4E and 5A have been modelled during the night time period. During later design stages when further information is known of the operations of these future lots, forklift movements would be further investigated should they be proposed during the night-time period on these lots.

In order to assess the possibility of sleep disturbance, in addition to the above noise sources, heavy vehicle brake releases and reverse alarms (non-tonal) have been modelled in the hardstand areas of the development with a sound power level (SWL) of 115 dBA.

3.2.2 Fixed Noise Sources

Proposed mechanical plant for Lot 1A has been provided by Goodman based on the future customers requirements including temperature control for the high bay and low bay warehouse areas. Major items of plant in terms of noise emissions are detailed in **Table 5** along with their manufacturer specified sound power levels. Note that at this stage of the development the proposed models and locations are indicative and must be confirmed during the detailed design of Lot 1A.

Table 5 Proposed Mechanical Plant – Lot 1A

Plant Ref	Plant Model	Location	Number of Units	SWL per Unit
BEF-MO	Fantech AP0806CA9/32Ex	Main office roof	1	83 dBA
GEF-DG	Fantech CHD564Ex	Dangerous goods roof	1	90 dBA
GEF-TR	Fantech HUD636	Trailer workshop roof	1	79 dBA
KEF-MO-R & KSF-MO-R	Fantech AP0714LA9/18	Main office roof	2	92 dBA
OAF-MO-G	Fantech PUE354ER	Main office ground	1	68 dBA
OAF-MO	Fantech PUE404ER	Main office roof	1	73 dBA
TEF-GH	Fantech RIL-1505W(Lo)	Gatehouse roof	1	60 dBA
TEF-MO-G	Fantech MME354/5	Main office ground	1	74 dBA
TEF-MO-R-1	Fantech GUE566V	Main office roof	1	75 dBA
TEF-MO-R-2	Fantech CE224D	Main office roof	1	59 dBA
SSF	Fantech APS1256CA6/30	High bay and low bay warehouse roof	24	100 dBA
PAC-WH	Temperzone OPA2000	Low bay warehouse roof	21	89 dBA
PAC-WH	Temperzone OPA1370	High bay warehouse roof	12	86 dBA
PAC-WH	Temperzone OPA705	Main office roof	1	85 dBA
CRAC-CU	Vertiv Liebert CRV CR035RA	Main office roof	2	76 dBA
CU-MO-1	Mitsubishi PURY-P700YSNW-A(-BS)	Main office roof	1	73 dBA
CU-MO-2	Mitsubishi PURY-P750YSNW-A(-BS)	Main office roof	1	75 dBA
CU-MO-3	Mitsubishi PURY-P850YSNW-A(-BS)	Main office roof	1	76 dBA
CU-MO-4	Mitsubishi PURY-P650YSNW-A(-BS)	Main office roof	1	73 dBA

Note 1: SSF units are smoke exhaust fans and are used only in emergency situations. As such, these have not been included in the noise model.

Acoustic screening has been modelled around each unit on the high bay and low bay warehouse roof, and around the plant areas on the main office roof, as instructed by Goodman. The acoustic screening has been modelled to a height of 0.5 m above the top of the mechanical units. Specifications for the acoustic screening must be confirmed during the detailed design stage for Lot 1A.

As details of specific items of plant are not yet known for the other lots within Oakdale West, an approach has been adopted that assumed fixed noise sources with a cumulative sound power level of 90 dBA per warehouse during the day and evening, which were modelled at rooftop locations around the development. All sources are assumed to operate continuously during the worst-case 15-minute period. This has been modelled throughout the estate with the exception of Lot 1A which has been modelled as noted above in **Table 5**.

A cumulative sound power level of 85 dBA per warehouse has been adopted for the night-time. This has been done to account for the lower mechanical load requirements typically required throughout the night-time period. No rooftop mechanical plant within lots 2E, 2F, 2G, 2H, 2J, 3C, 3D, 4A, 4B and 4E has been modelled during the night-time period. During later design stages when further information is known of the operations of the future lots, management measures regarding mechanical plant would be determined, if applicable. These measures could include selection of quieter plant, locating plant at ground level making use of the warehouse structures as shielding, or use of localised shielding around units to meet the noise limits, for example.

3.2.3 Summary of Operational Noise Mitigation Measures

3.2.3.1 Noise Barrier Extension

Preliminary noise model results for the 'Precinct 1 only' scenario indicated an exceedance of the criteria at N1 to the west, prior to construction of the noise barriers in Precinct 2 in the western area of the development. The noise barriers in Precinct 2 are now proposed to be constructed prior to the commencement of operations in Precinct 1. As such, the noise barriers in Precinct 2 have been included in the model to minimise noise impacts at these receivers prior to the construction of the Precinct 2 warehouses.

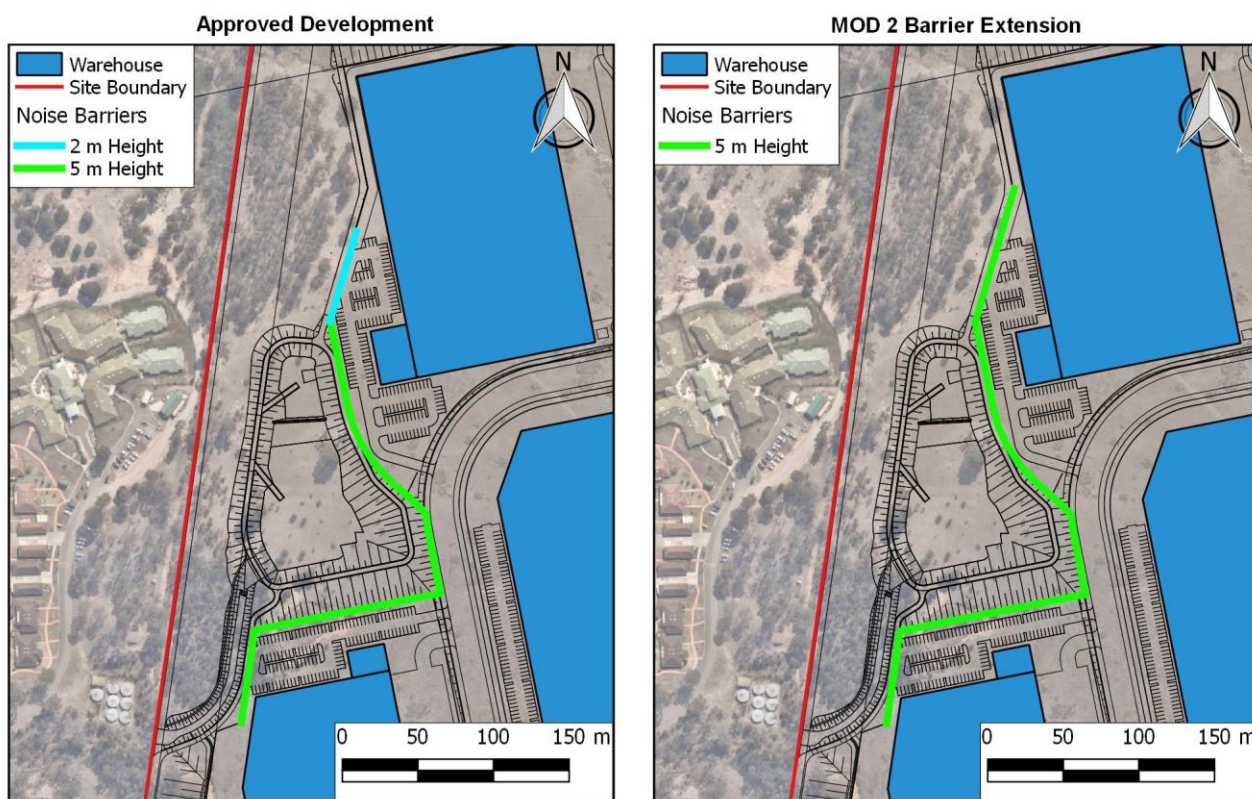
In addition to these barriers being constructed prior to the operation of Precinct 1, the preliminary noise model results found that an extension of the barriers is required to meet the criteria prior to the construction of Warehouse 2B, which is located adjacent to the northern section of the barrier.

Most of the approved noise barriers in Precinct 2 have a height of 5 m (refer to **Figure 4**). No modifications to these sections of barrier are proposed.

At the northern end of the approved barrier, a section approximately 60 m in length has an approved height of 2 m. This section is proposed to be increased to a height of 5 m and extended further to the north (approximately 30 m in additional length). The Precinct 2 noise barriers, including the extension, will be a permanent operational noise mitigation measure and will not be removed following construction of Warehouse 2B.

The approved Precinct 2 noise barriers are compared to the MOD 2 proposed barrier extension in **Figure 4**. Note that all section of the noise barriers in Precinct 2 are located on the warehouse pads, ie at the top of the retaining walls.

Figure 4 Proposed Precinct 2 Noise Barrier Extension



No changes to the height, location or timing of the noise barrier on the southern site boundary in Precinct 4 are proposed (refer to **Figure 3**). The specifications of this barrier will be confirmed during the detailed design of Precinct 4 and constructed during Precinct 4 construction.

3.2.3.2 Lot 1A Rooftop Plant Screening

As detailed in **Section 3.2.2**, acoustic screening is proposed to be installed around each temperature control unit on the high bay and low bay warehouse roof and around the main office rooftop plant area on Lot 1A. The acoustic screening should extend to a height of 0.5 m above the top of the mechanical units.

Specifications and design for the acoustic screens must be confirmed during the detailed design stage for Lot 1A.

Additionally, the proposed plant models and locations for all external fixed plant on Lot 1A, along with any additional mitigation measures such as silencers, must be confirmed during detailed design for Lot 1A.

3.3 Predicted Operational Noise Impacts

The operational noise levels predicted in this section include all noise model assumptions and mitigation measures outlined in **Section 3.2**.

Predicted cumulative noise impacts of all precincts within Oakdale West operating concurrently are detailed in **Section 3.3.1**.

Predicted noise impacts of Precinct 1 in isolation (prior to completion of construction of the other stages of Oakdale West) are detailed in **Section 3.3.2**.

3.3.1 Oakdale West – All Precincts

The predicted operational noise levels for the MOD 2 design are compared to the applicable criteria in **Table 6**. Noise contours are provided for day/evening in **Figure 5** and night-time in **Figure 6**.

Table 6 Predicted Operational Noise Levels – All Precincts

Receiver	Period (weather) ⁵	LAeq(15 minute) Noise Level (dBA)				LA1(1 minute) Noise Level (dBA)			
		Criteria	Predicted	Exceedance	Compliance ³	Criteria	Predicted	Exceedance	Compliance ³
N1 – Emmaus Village Residential	Day (standard)	44	36	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	43	36	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	41	30	-	Yes	51	50	-	Yes
	Night (noise-enhancing)	41	34	-	Yes	51	55	4	No
N2 – Emmaus Catholic College (school)	When in use	45 (external) ¹	39	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
N3 – Kemps Creek – nearest residential property	Day (standard)	39	44	n/a ²	n/a ²	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	39	44	n/a ²	n/a ²	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	37	37	n/a ²	n/a ²	47	56	n/a ²	n/a ²
	Night (noise-enhancing)	37	42	n/a ²	n/a ²	47	60	n/a ²	n/a ²
N4 – Kemps Creek – other residence	Day (standard)	39	39	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	39	39	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	37	31	-	Yes	47	52	5	No
	Night (noise-enhancing)	37	37	-	Yes	47	57	10	No
N5 – Kemps Creek – other residence	Day (standard)	39	38	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	39	38	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	37	31	-	Yes	47	47	-	Yes
	Night (noise-enhancing)	37	37	-	Yes	47	52	5	No

Note 1: Criteria for N2 is specified as an interior noise level. For the purpose of this assessment a conservative inside to outside correction of +10 dBA has been applied to the criteria for N2 in order to assess the external noise predictions against the criteria. An inside to outside correction of +10 dBA is typical of a building with open windows.

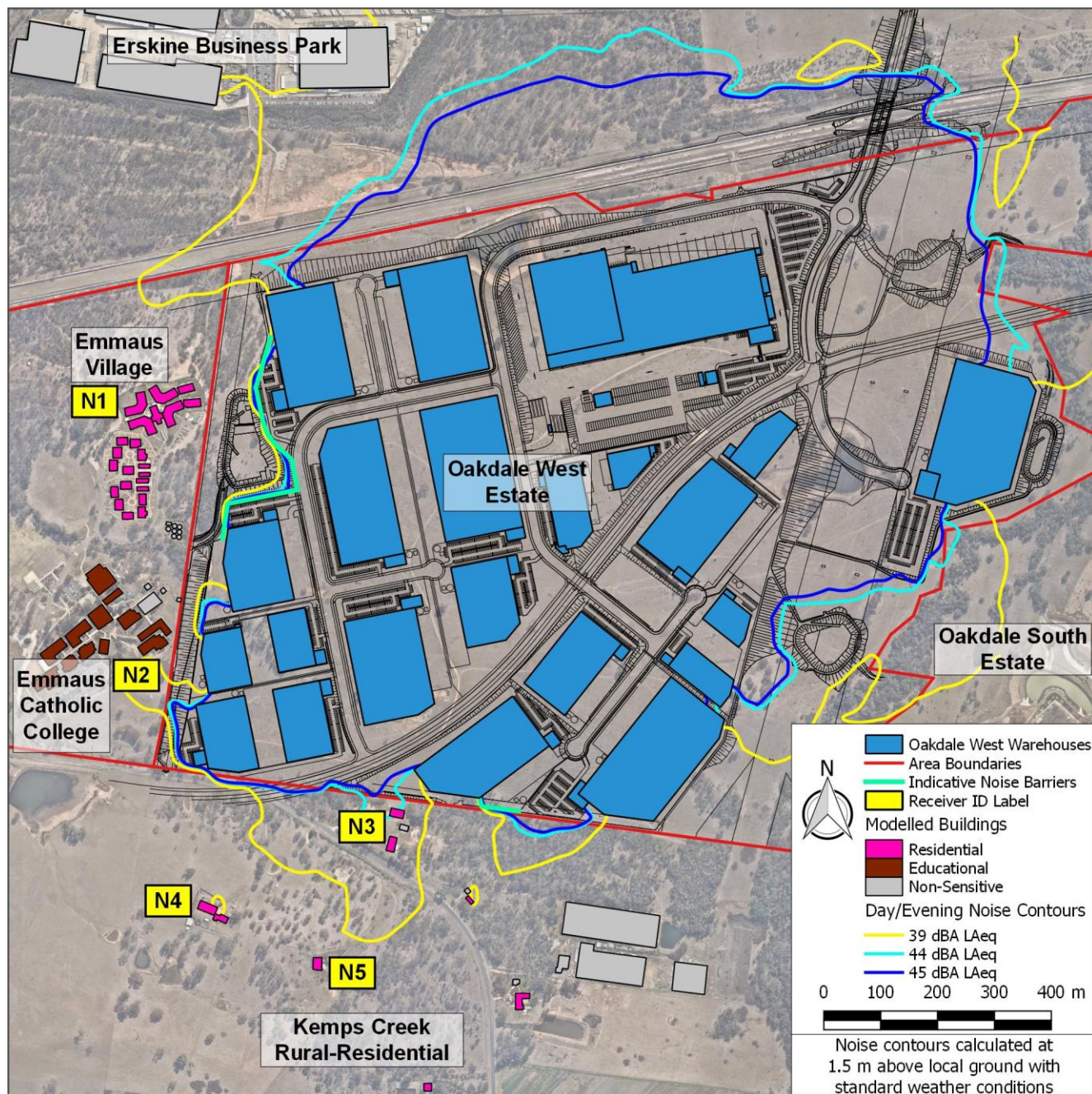
Note 2: As per Condition C19 of the Development Consent SSD 7348, the noise criteria does not apply at N3 (refer to **Section 3**).

Note 3: **Bold** text indicates an exceedance of the criteria.

Note 4: LA1(1minute) criteria is not applicable during this time period and/or to this receiver type.

Note 5: Noise-enhancing weather conditions during the daytime and evening periods have not been included in the assessment as it is not a prevailing feature of the site (refer to SSDA NIA).

Figure 5 Predicted Noise Levels – Daytime/Evening – Standard Weather Conditions – All Precincts

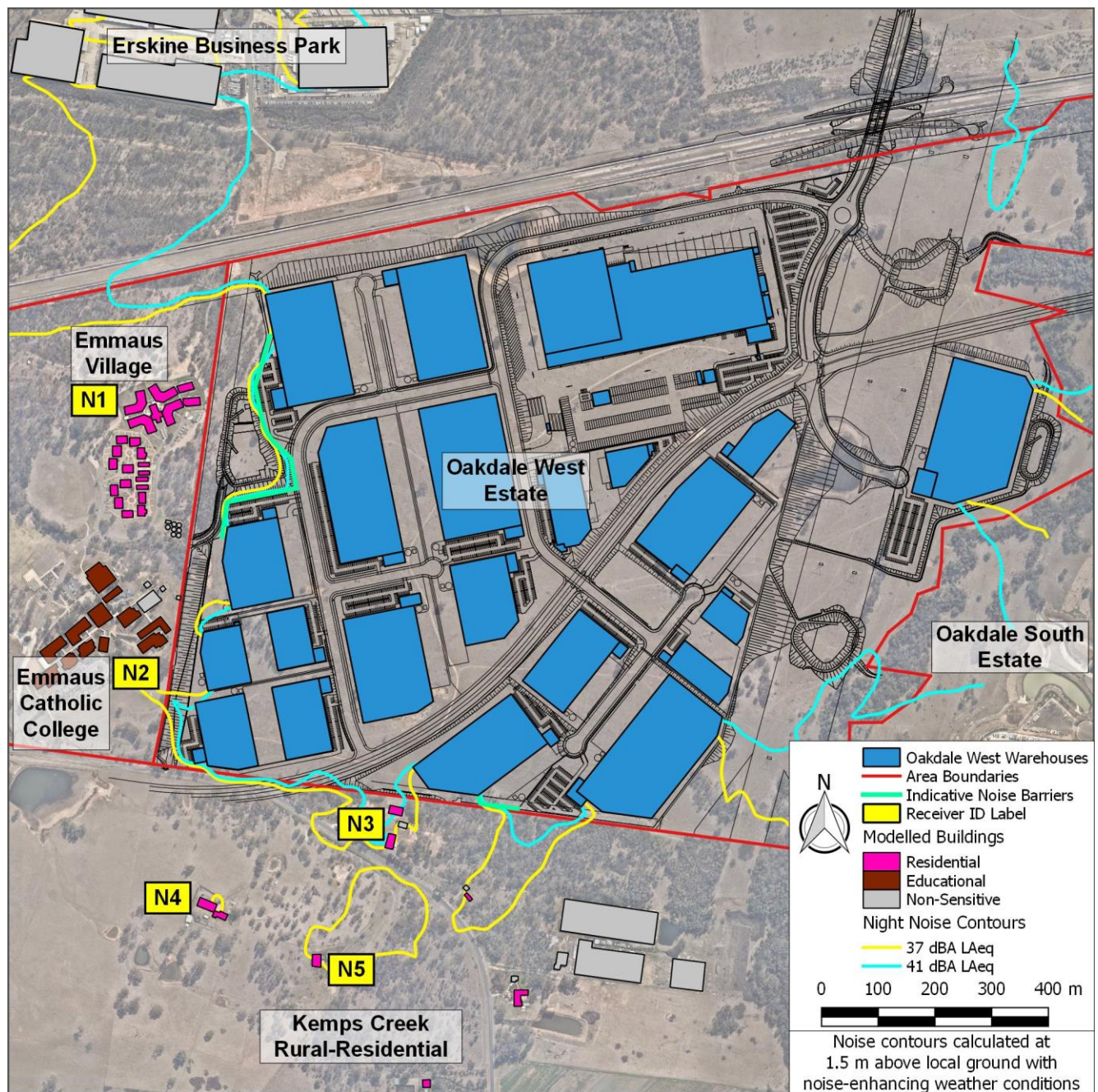


Note 1: 44 dBA LAeq noise contour (light blue) corresponds to the daytime noise criteria for N1 (Emmaus Village residential).

Note 2: 45 dBA LAeq noise contour (dark blue) corresponds to the daytime noise criteria for N2 (Emmaus Catholic College school).

Note 3: 39 dBA LAeq noise contour (yellow) corresponds to the daytime noise criteria for N3, N4 and N5 (Kemps Creek residential).

Figure 6 Predicted Noise Levels – Night-time – Noise-Enhancing Weather Conditions – All Precincts



Note 1: 41 dBA LAeq noise contour (light blue) corresponds to the night-time noise criteria for N1 (Emmaus Village residential).

Note 2: 37 dBA LAeq noise contour (yellow) corresponds to the night-time noise criteria for N3, N4 and N5 (Kemps Creek residential).

3.3.1.1 Peak LAeq Noise Levels

Peak operational noise emissions from the development are predicted to comply with the relevant LAeq criteria at the surrounding sensitive receivers.

Noise levels are predicted to be above the LAeq criteria at N3, which is consistent with the approved development, however as per Condition C19 of the Development Consent SSD 7348, the noise criteria do not apply at this residence (refer to **Section 3**).

Noise levels for the MOD 2 development are generally predicted to be higher than the approved development. Peak operational noise levels during the daytime and evening periods are predicted to be higher by up to 2 dBA at N1 and N2, up to 4 dBA at N3 and N5, and up to 5 dBA at N4. Peak operational noise levels during the night-time period under noise-enhancing weather conditions are typically up to 2 dBA higher for MOD 2 than the approved development.

While the operation of Lot 1A includes increased peak 1-hour heavy and light vehicle movements to that assessed in the approved design, the separation distance between Lot 1A and nearby sensitive receivers, along with the intervening shielding provided by structures and topography in the other lots limits the change in predicted noise levels at nearby receivers.

Overall, the predicted operational noise impacts from the MOD 2 design are generally consistent with the approved design and comply with the relevant LAeq criteria at the surrounding receivers.

3.3.1.2 Maximum Noise Levels

Subsequent to the commencement of the SSDA Noise Impact Assessment for Oakdale West (SSDA NIA) (SLR Report 610.15617-R02-Revision 4) the EPA released the *Noise Policy for Industry* (NPfI) (EPA, 2017) which supersedes the *Industrial Noise Policy* (INP) (EPA, 2000).

The NPfI provides guidance on assessment of the potential for sleep disturbance from maximum noise level events during the night-time period.

The NPfI states that where LAmax noise levels from the development at a residential location exceed 52 dBA or the prevailing RBL plus 15 dB, whichever is greater, a detailed maximum noise event assessment should be undertaken. The detailed assessment should discuss the level of events, the exceedance of the screening level, existing maximum noise levels, and consider guidance from current literature regarding sleep disturbance, such as the EPA's *Road Noise Policy* (RNP) (EPA, 2011).

The LA1(1minute) noise limits specified in the Development Consent SSD 7348 are based on the sleep disturbance screening level of RBL plus 15 dB as detailed in the SSDA NIA.

Worst-case LA1(1minute) noise levels for MOD 2 are predicted to be above the Development Consent LA1(1minute) at N4 under standard weather conditions, and at N1, N4 and N5 under noise-enhancing weather conditions, however, 52 dBA is only exceeded at N1 and N4 under noise-enhancing weather conditions.

The SSDA NIA for the approved development predicted exceedances of the sleep disturbance screening level at the Kemps Creek residences (N4/N5).

The EPA's *Road Noise Policy* (RNP) also provides context in relation to maximum noise levels and potential for sleep disturbance. The RNP concludes that maximum internal noise levels of 50-55 dBA are unlikely to awaken people, and one or two events per night with maximum internal noise levels of 65-70 dBA are not likely to affect health and wellbeing significantly. This results in corresponding external noise levels of 60-65 dBA and 75-80 dBA assuming a 10 dB loss through open windows. The worst-case LA1(1minute) noise levels are predicted to be below the noise levels likely to cause sleep disturbance based on the RNP guidance.

Noise monitoring undertaken at the site during preparation of the SSDA NIA (refer to the noise monitoring results in Appendix B of the SSDA NIA) measured typical existing maximum noise levels during the night-time of around 50-55 dBA near N1 and 50-60 dBA near N3/N4/N5. The highest night-time maximum noise levels at both monitoring locations exceeded 70 dBA numerous times during the monitoring period. The predicted maximum noise levels during the night-time period are similar to the existing typical maximum noise levels, and well below the highest noise levels measured during the monitoring period.

In summary, while the maximum noise levels are predicted to exceed the RBL plus 15 dB criteria, the noise levels are below the levels outlined in the RNP that would be considered to have potential to cause sleep disturbance, and would be similar in level to the existing ambient noise environment.

As the LA1(1minute) noise limits specified in Development Consent SSD 7348 are lower than the sleep disturbance screening level specified in the NPfI, it is recommended that the LA1(1minute) noise limits be modified to be 52 dBA, consistent with the NPfI sleep disturbance screening level. It is noted that the maximum noise levels are predicted to exceed the screening level during the night-time period, however only under noise-enhancing weather conditions. The maximum noise level assessment concludes that the predicted noise levels would be unlikely to result in sleep disturbance.

The recommended modification to the LA1(1minute) noise limits is detailed in **Table 7**.

Table 7 Recommended Modification to LA1(1minute) Noise Limits

Location	Development Consent SSD 7348 Noise Limit – Night LA1(1minute) dBA	Proposed Noise Limit Night LA1(1minute) dBA
N1 Emmaus Village Residential	51	52
N3 Kemps Creek – nearest residential property	47	52
N4 & N5 Kemps Creek – other residences	47	52

Note: No change is proposed to the LAeq(15minute) noise limits specified in the Development Consent SSD 7348.

3.3.2 Oakdale West – Precinct 1 Only

In order to predict the operational noise levels for stage 1 of the development prior to the construction of further stages, noise emissions from Precinct 1 have been modelled with no structures or noise sources in the other precincts, with the exception of the noise barriers in Precinct 2 (refer to **Section 3.2.3.1**).

The predicted operational noise levels for the MOD 2 design of Precinct 1 are compared to the applicable criteria in **Table 8**. Noise contours are provided for day/evening in **Figure 7** and night-time in **Figure 8**.

Table 8 Predicted Operational Noise Levels – Precinct 1 Only

Receiver	Period (weather) ⁵	LAeq(15 minute) Noise Level (dBA)				LA1(1 minute) Noise Level (dBA)			
		Criteria	Predicted	Exceedance	Compliance ³	Criteria	Predicted	Exceedance	Compliance ³
N1 – Emmaus Village Residential	Day (standard)	44	31	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	43	31	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	41	31	-	Yes	51	40	-	Yes
	Night (noise-enhancing)	41	36	-	Yes	51	47	-	Yes
N2 – Emmaus Catholic College (school)	When in use	45 (external) ¹	35	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
N3 – Kemps Creek – nearest residential property	Day (standard)	39	38	n/a ²	n/a ²	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	39	38	n/a ²	n/a ²	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	37	37	n/a ²	n/a ²	47	49	n/a ²	n/a ²
	Night (noise-enhancing)	37	43	n/a ²	n/a ²	47	55	n/a ²	n/a ²
N4 – Kemps Creek – other residence	Day (standard)	39	33	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	39	33	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	37	33	-	Yes	47	44	-	Yes
	Night (noise-enhancing)	37	39	2	No	47	51	4	No
N5 – Kemps Creek – other residence	Day (standard)	39	31	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Evening (standard)	39	31	-	Yes	n/a ⁴	n/a ⁴	n/a ⁴	n/a ⁴
	Night (standard)	37	30	-	Yes	47	41	-	Yes
	Night (noise-enhancing)	37	37	-	Yes	47	48	1	No

Note 1: Criteria for N2 is specified as an interior noise level. For the purpose of this assessment a conservative inside to outside correction of +10 dBA has been applied to the criteria for N2 in order to assess the external noise predictions against the criteria. An inside to outside correction of +10 dBA is typical of a building with open windows.

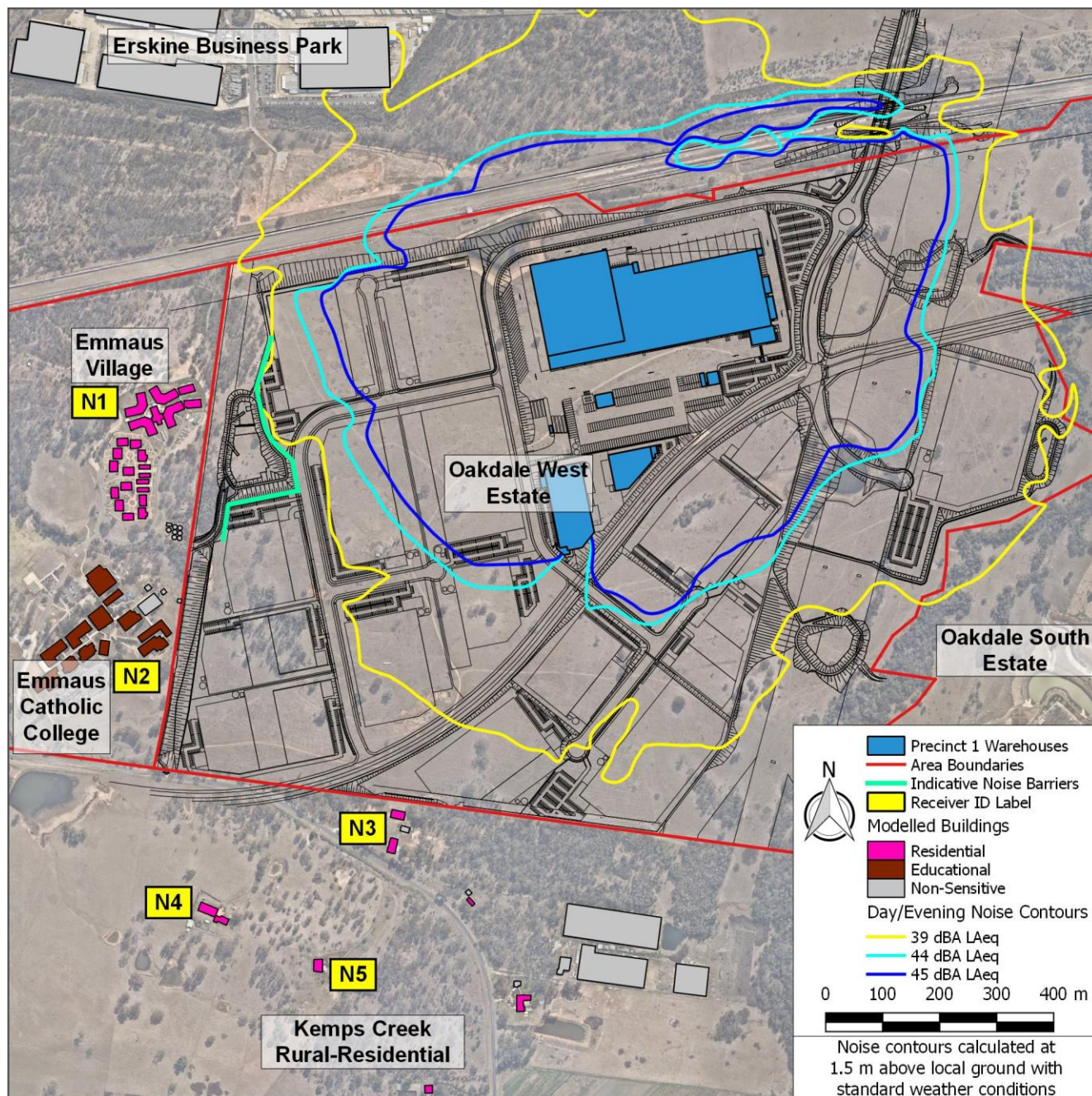
Note 2: As per Condition C19 of the Development Consent SSD 7348, the noise criteria does not apply at N3 (refer to **Section 3**).

Note 3: **Bold** text indicates an exceedance of the criteria.

Note 4: LA1(1 minute) criteria is not applicable during this time period and/or to this receiver type.

Note 5: Noise-enhancing weather conditions during the daytime and evening periods have not been included in the assessment as it is not a prevailing feature of the site (refer to SSDA NIA).

Figure 7 Predicted Noise Levels – Daytime/Evening – Standard Weather Conditions – Precinct 1 Only

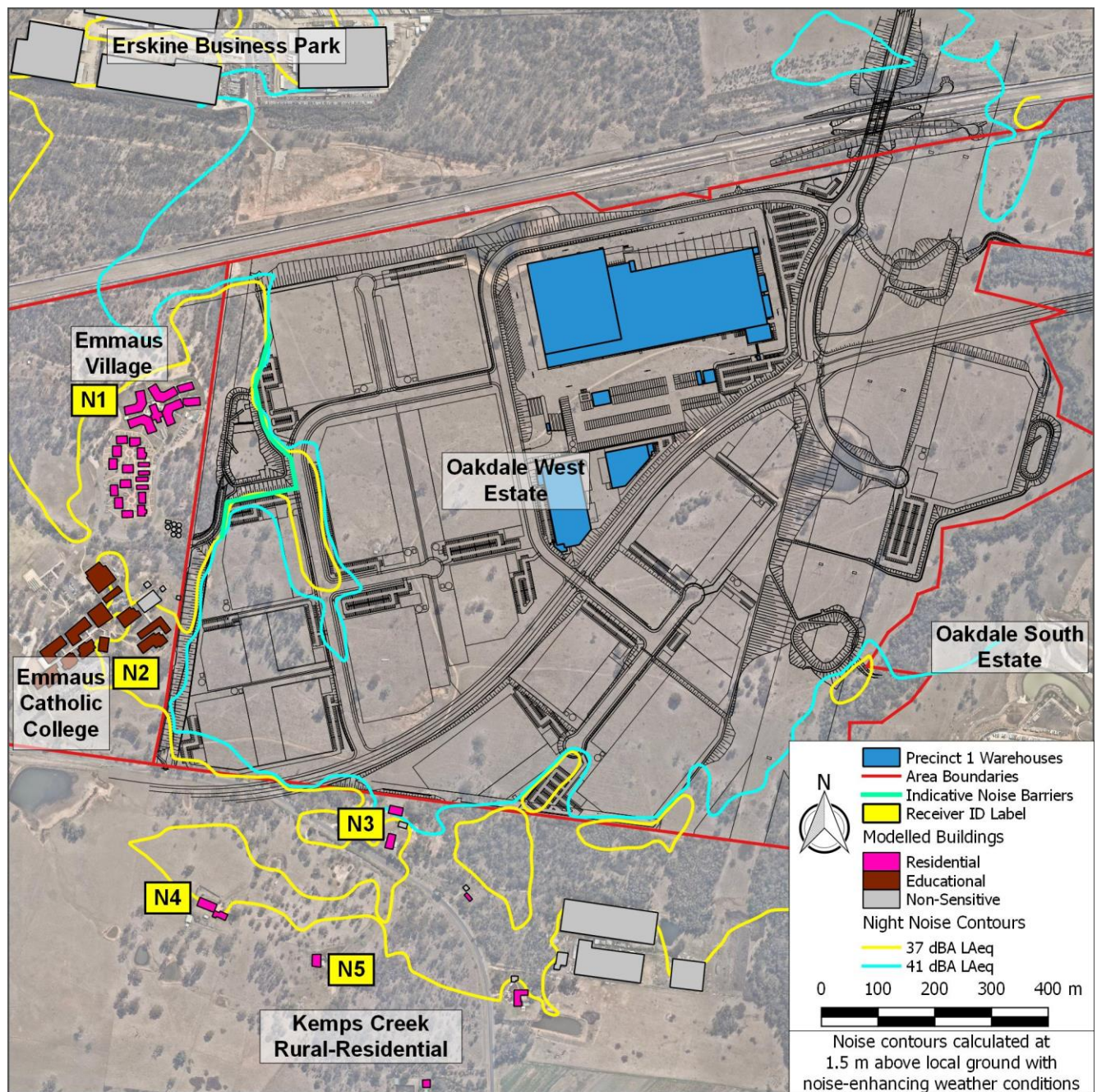


Note 1: 44 dBA LAeq noise contour (light blue) corresponds to the daytime noise criteria for N1 (Emmaus Village residential).

Note 2: 45 dBA LAeq noise contour (dark blue) corresponds to the daytime noise criteria for N2 (Emmaus Catholic College school).

Note 3: 39 dBA LAeq noise contour (yellow) corresponds to the daytime noise criteria for N3, N4 and N5 (Kemps Creek residential).

Figure 8 Predicted Noise Levels – Night-time – Noise-Enhancing Weather Conditions – Precinct 1 Only



Note 1: 41 dBA LAeq noise contour (light blue) corresponds to the night-time noise criteria for N1 (Emmaus Village residential).

Note 2: 37 dBA LAeq noise contour (yellow) corresponds to the night-time noise criteria for N3, N4 and N5 (Kemps Creek residential).

Peak operational noise emissions from Precinct 1 of the development are predicted to comply with the relevant L_{Aeq} criteria at receivers N1, N2 and N5 during all applicable periods.

Under noise-enhancing weather conditions during the night-time period, noise levels are predicted to be above the L_{Aeq} criteria at N3, however as per Condition C19 of the Development Consent SSD 7348, the noise criteria do not apply at this residence (refer to **Section 3**).

Minor exceedance of the L_{Aeq} noise criteria of up to 2 dBA is predicted at N4 during the night-time period under noise-enhancing weather conditions. Noise levels are not predicted to exceed the criteria at N4 under standard weather conditions during the night-time period, or during the daytime or evening periods.

While an exceedance of the night-time L_{Aeq} criteria is predicted at N4 it is noted that this exceedance is minor (up to 2 dBA) and only occurs during noise-enhancing weather conditions. Section 4 of the EPA's *Noise Policy for Industry* (NPfI) discusses the significance of residual noise impacts following implementation of feasible and reasonable noise mitigation. It notes that a residual exceedance of up to 2 dBA is negligible in significance and would not warrant receiver-based treatments or controls.

Worst-case $LA_{1(1minute)}$ noise levels are predicted to be above the relevant criteria at N4 and N5 under noise-enhancing weather conditions. As per the discussion in **Section 3.3.1**, the predicted maximum noise levels are below the levels outlined in the RNP that would be considered to have potential to cause sleep disturbance, and would be similar in level to the existing ambient noise environment. Additionally, the predicted $LA_{1(1minute)}$ noise levels for the 'Precinct 1 Only' scenario are lower than the maximum noise levels predicted for the 'All Precincts' scenario.

This stage 1 development scenario is a temporary situation and noise levels at the surrounding receivers would be lower as additional structures are constructed in the other precincts of Oakdale West between Precinct 1 and these receivers. Goodman currently has advanced enquiries for the intervening lots and anticipates these structures to be constructed soon after completion of Precinct 1.

It is considered that these exceedances are minor and temporary in nature, and as such would be acceptable during construction of the estate.

3.4 Off-site Operational Traffic Noise Impacts

While light and heavy vehicle movements within the Oakdale West are classified as part of the operational site noise, once they move off the site and onto public roads they are assessed under the NSW *Road Noise Policy* (RNP).

The RNP requires noise mitigation to be considered 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 the approved Western North-South Link Road (WNSLR), then the existing arterial road of Lenore Drive.

The off-site operational traffic noise assessment for the approved development referenced the WNSLR noise impact assessment (refer to SLR Report 610.16083-R1) for the forecast daily traffic volumes on Lenore Drive at the opening of the WNSLR. The daily traffic on Lenore drive was forecast to be approximately 28,000 vehicles, including approximately 9,000 vehicles accessing Oakdale West, ie around 19,000 vehicles without Oakdale West traffic.

The Traffic Impact Assessment for MOD 2 (prepared by ASON) details that total daily traffic volumes for Oakdale West with the MOD 2 design would be slightly lower than the approved development (approximately 8,850 daily vehicle movements).

The daily traffic volume from Oakdale West equates to an increase in traffic volumes on Lenore Drive of approximately 47%. Therefore, an increase in traffic noise due to Oakdale West of greater than 2 dB is not considered likely. Consideration of mitigation is not required as a result. This is consistent with the approved development.

4 Construction Noise and Vibration Impacts

Construction noise and vibration impacts for the approved development were assessed at a precinct and estate level in the SSDA NIA. The MOD 2 changes to the layout of Precinct 1 do not affect the assessed general construction activities and locations. As such, the construction noise and vibration impacts are considered to be consistent with those detailed in the SSDA NIA.

Details of monitoring, mitigation and management of construction noise and vibration will be detailed in construction noise and vibration management plans prepared separately to this report.

5 Summary of Proposed Modification to Approved Noise Limits

Guidance is provided in the EPA's *Road Noise Policy* (RNP) and *Noise Policy for Industry* (NPfI) on the potential for maximum noise events to result in sleep disturbance. The maximum noise level assessment concludes that while the maximum noise levels are predicted to exceed the screening level at some receivers under noise-enhancing weather conditions, the predicted noise levels are below the levels outlined in the RNP that would be considered to have potential to cause sleep disturbance, and would be similar in level to the existing ambient noise environment. As such, the predicted maximum noise levels would be unlikely to result in sleep disturbance.

As the LA_{1(1minute)} noise limits specified in Development Consent SSD 7348 are lower than the sleep disturbance screening level specified in the NPfI, it is recommended that the LA_{1(1minute)} noise limits be modified to be 52 dBA, as outlined below, consistent with the NPfI sleep disturbance screening level.

Location	Development Consent SSD 7348 Noise Limit – Night LA _{1(1minute)} dBA	Proposed Noise Limit Night LA _{1(1minute)} dBA
N1 Emmaus Village Residential	51	52
N3 Kemps Creek – nearest residential property	47	52
N4 & N5 Kemps Creek – other residences	47	52

Note: No change is proposed to the LA_{eq(15minute)} noise limits specified in the Development Consent SSD 7348.

I trust that this letter covers your requirements.

Yours sincerely



JOSHUA RIDGWAY
Senior Consultant

Checked/ Authorised by: MR

APPENDIX A

Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2×10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

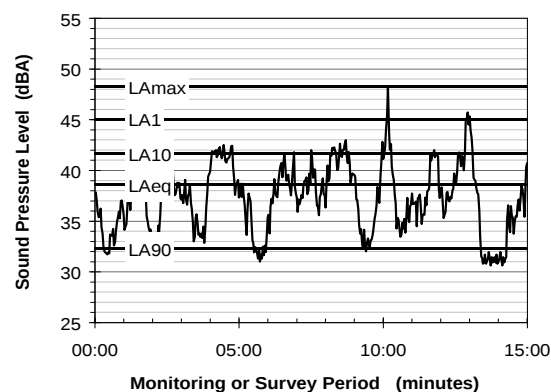
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

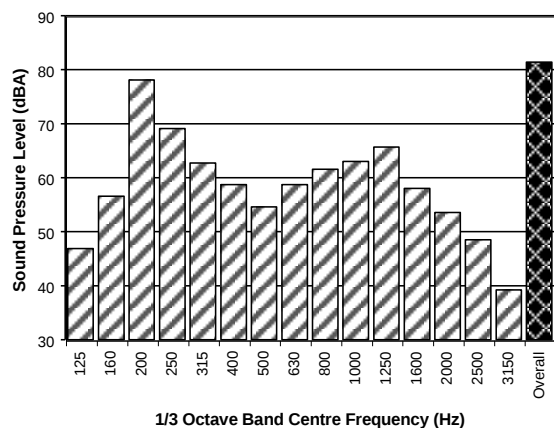
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V , expressed in mm/s can be converted to decibels by the formula $20 \log (V/V_0)$, where V_0 is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

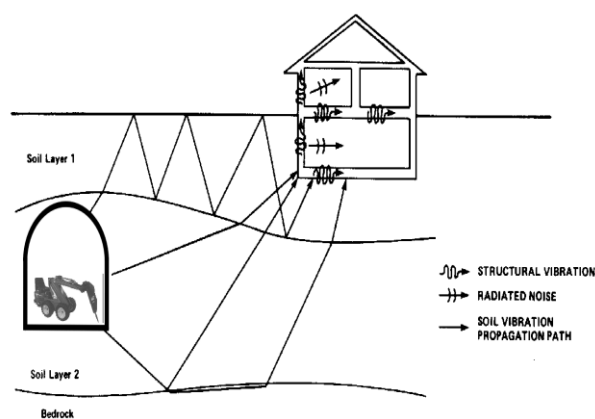
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.