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3/07/2019

Zhiva Living Dural Pty Ltd ATF The Zhiva Living Dural Trust

Attn: Christo Winters

3 Quarry Road and 4 Vineys Road, Dural - Amended Site Compatibility Certificate Application - Acoustics

This letter provides our response to the request for an amended Site Compatibility Certification to be lodged to the Department of Planning for the proposed development at 3 Quarry Road and 4 Vineys Road, Dural.

On behalf of Acoustic Logic Consultancy I have been involved in providing a noise impact assessment, was involved in issuing a joint report with the council's acoustic consultant and provided evidence in court during the Land Environment Court Case of Zhiva Living Dural Pty Ltd v Hornsby Shire Council (Case number 2018/292092).

It is Acoustic Logic's understanding that the amended Site Compatibility Certification will reflect the outcomes of the latest noise impact assessment and joint report as well as the outcomes from the Land Environment Court case (Case number 2018/292092).

It is my understanding that any outstanding contentions as part of the joint report were either amended or agreed upon during the LEC case and have been provided with this letter.

Outstanding contentions agreed upon during the LEC case include:

- Agreed that land zoning to establish amenity noise criteria to be classed as "suburban"
- Project Criteria for assessment of noise impacts to and from the site. were agreed upon and provided
- Measured operational noise from market gardens to the site for day, evening and night were agreed upon (We note that the pump on the land of the Dural Farms Florist was not measured and that measurements were agreed to take place during detailed design stage once CC is provided)
- Closing of windows and mechanical ventilation required to mitigate daytime noise intrusion from adjoining market garden activities was agreed upon and mark ups provided for locations
- Barrier attenuation to control external noise from market garden activities was agreed upon and predictions provided during LEC.

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- Upgraded building facades, roof/ceilings and glazing, mechanical ventilation and closed windows required to mitigated Quarry Road traffic noise was agreed upon and provided (as per the NIA dated April 2019). Note that finalisation of construction to building facades, roof/ceilings and glazing will take place during design stage, once pump noise has been measured from Dural Farms Florist from the west.

Provided with this letter to be used as part of the amended Site Compatibility Certification is the following:

- Joint Report provided to the LEC for Case number 2018/292092 dated 16 April 2019 (which is inclusive of the latest Noise Impact Assessment (ref dated 20180361.1/0904A/R4/GC dated 9/04/2019)
- Additional information provided during the LEC case including which are not provided in Noise Impact Assessment or Joint Report:
 - Truck Noise Predictions to project site provided during LEC
 - Sleep disturbance assessment and predictions to all buildings provided during LEC
 - Mark ups of windows open and windows closed to affected residences provided during LEC
 - Logging data for all locations requested during LEC
 - Summary of agreed upon EPA Noise Impact criteria and measurements to date provided during LEC

We note that the attached documents provided are part of the final agreed upon outcomes from the Joint Reporting and LEC case 2018/292092.

To conclude, it is my understanding that any outstanding contentions as part of the joint report were either amended or agreed upon during the LEC case. It is also my understanding the amended Site Compatibility Certification will reflect the outcomes of the latest noise impact assessment and joint report as well as the outcomes from the Land Environment Court case (Case number 2018/292092).

For these reasons, the request for an amended Site Compatibility Certification to be lodged to the Department of Planning for the proposed development at 3 Quarry Road and 4 Vineys Road, Dural should be acoustically acceptable.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,



Acoustic Logic Consultancy Pty Ltd
Glen Campbell

Joint Report of the Acoustics

Zhiva Living Dural Pty Ltd

v

Hornsby Shire Council

LEC Case Number 2018/292092

16 April 2019

1.0 Introduction

1. We have been briefed in the matter of Zhiva Living Dural Pty Ltd v Hornsby Shire Council in the Land and Environment Court case number 2018/292092 in respect of the potential noise impacts arising from activities associated with the construction of a Residential Age Care Facility at 3 Quarry Road and 4 Vineys Road, Dural.
2. The proposal comprises a Residential Aged Care Facility and retirement village with 8 buildings overall. Key elements of the development with respect to acoustics are:
 - The development contains 7 buildings with independent living units as well as one building containing aged care facility
 - The development contains an underground basement car park at the southern end of the site (entry is adjacent to 5 Quarry Road) and at the northern end of the site (entry is adjacent to 6 Vineys St).
 - The southern car park has spaces for 188 parking spaces whilst the northern carpark has 42 car park spaces
 - The development also has a loading dock with entry at Quarry Road side of the development
3. Acoustic treatments and management requirements recommended in the Acoustic Logic Report dated 9 April 2019 have been incorporated to mitigate noise impacts and noise emissions, include:
 - Accommodation Buildings – Upgraded acoustic rated window/door glazing, masonry walls and multi layer insulated ceilings to reduce internal room and areas from road noise and existing operational noise from adjacent rural (Market Gardens) premises to the west and east of the development site.
 - Air conditioning and building ventilation to provide for closed windows/doors
 - Car Park Entry and Loading Dock - Noise screening to the adjacent residential premises.
 - .Management and restrictions for deliveries and pickup during daytime hours, only
4. Pursuant to the Uniform Civil Procedure Rules the experts are required to include the expert's qualifications.
5. Council's Consultant - Graham Atkins is the Managing Director of Atkins Acoustics and Associates Pty Ltd. He was awarded a B.Eng (Mech) (Hons) and has practice as a Consulting Engineer in Acoustics for over 38 years. His curriculum vitae is annexed hereto in Attachment 2
6. The Applicants Consultant – Glen Campbell (M DeSc (Audio and Acoustics)) is a Senior Engineer of Acoustic Logic and has worked as an acoustic consultant for 9 years. His curriculum vitae is annexed hereto in Attachment 1.

7. The joint conference has been prepared on the basis of the following plans and reports:
- Amended Statement of Facts and Contentions dated 2 April 2019.
 - Architectural drawings Issue X dated 4/3/2019 by Marchese Partners Architect.
 - Revised and updated *Environmental Noise Impact Assessment* prepared by Acoustic Logic (Revision 4, dated 9/4/2019). The revised acoustic report incorporated additional site attended noise measurements, identification of noise from fans operating during evening hours, revised noise modelling, reduction in noise attenuation claimed for boundary fences, introduction of the Housing for Seniors or People with Disabilities SEPP (2014), deletion of referenced noise sources, additional reference figures, recommendations for alternative ventilation and closing of window/doors to control noise intrusion, reduction in day and evening peak hour traffic from 146 to 94 and calculations for assessing traffic noise accessing Viney Street.
8. In addition to the Council Policy/Development Control Plans identified in the Statement of Facts and Contentions, the experts have had regard to:
- NSW EPA Noise Policy for Industry 2017.
 - SEPP (Housing for Seniors or People with a Disability) 2004
 - Australian Standard 2107 – 2016 “Recommended Design Sound Levels and Reverberation Times for Building Interiors” and Australian Standard AS3671-1989 “Road Traffic noise Intrusion - Building siting and construction”.
9. The experts consider that the following are fundamental outstanding acoustic issues:
- Rural ‘Market Garden’ operation noise impacts on the proposed development in particular the site location being bound to the west by the Dural Farms Florist located at 835 Old Northern Road, Dural makes the proposed development ‘Unacceptable’.
 - Rural ‘Market Garden’ operational noise impacts on the proposed development, in particular the site location being bound to the east by the Green Gallery Wholesale Plant Nursery located at 5 Quarry Road, Dural makes the proposed development ‘Unacceptable’.
 - Noise generation from the proposed development, in particular:
 - a. The noise generated from the car park entry and exposure for 835 Old Northern Road, 6 Vineys St and 7 Vineys St.
 - b. The noise generated from the car park entry and exposure for 1 Quarry Road.

10. The contentions raised by Council and responses are presented below:

The following section presents brief summary acoustic issues agreed and disagreed;

- Land Zoning to establish amenity noise criteria – Disagree
- Project criteria for assessing noise impacts – Disagree
- Measured operational noise:
 - Day -Agreed
 - Evening - Disagree
 - Night - Disagree
- Closing of windows and mechanical ventilation required to mitigate daytime noise intrusion from adjoining Market Garden activities – Agreed
- Barrier attenuation to control external noise from Market Garden activities Disagree
- Upgraded building facades, roof/ceilings and glazing, mechanical ventilation and closed windows required to mitigated Quarry Road traffic noise – Agreed
- It is understood there are no restrictions imposed on the adjoining properties with respect to operating hours and noise during day, evening and night hours..The proposed development in terms of noise exposure would restrict the existing and future expansion of the Market Garden activities..

	Contentions	Discussion	Agree/Disagree
a)	There are a number of typographical and reference errors in the Noise Impact Assessment of 5 March (NIA) that should be corrected. For example, Section 5.4 'Dural Farm Florists' should read 'Green Gallery Wholesale Plant Nursery'. Hydraulic plant uses (ie watering devices and the like) is not correct as town water Services the site. Section 5.4.5 references to 'Dural Farm Florist' and 'Green Gallery Wholesale Plant Nursery' should be reviewed.	ALC response: - Have amended typographical error in section 5.4 paragraph 3 from Dural Farm to Green Gallery and reviewed remaining document for errors - Have amended the measurement references to be less general and more specific to measurements taken during site visits.	Agreed
b)	NIA (Section 5.3.4) refers to noise levels from the adjacent industrial sites measured at the western boundary of the site and reports a daytime level of $L_{Aeq\ 15\ min}$ 54. Measurement Locations should be clarified as NIA Figure 1 indicates that the measurement locations were on the eastern boundaries and the industrial site identified	ALC response: - Have amended report by adding site map of measurement and source locations to Figure 2 in section 5.3.1 - Amended location in Table 7 to be more detailed and reference figure 2.	Disagree GA The adjoining sites are not classified as 'Industrial'. They are developed and operate as 'Market Gardens' supplying flowers to markets, distributors and retailers It is understood that there are no restrictions on the adjoining 'Market Garden' sites with respect to operating hours, vehicle access or noise. GC ALC has surveyed the site during evening between 7.30pm to 10.30pm and found no noise activity on site. Regardless, as per the updated noise impact assessment and based on noise levels measured from attended measurements and unattended noise monitoring of existing noise levels along the western boundary, the building façade, glazing, roof/ceiling

			and mechanical ventilation has been upgraded as such to allow for a reasonable internal amenity within the habitable spaces with windows/doors closed.
c)	NIA (Section 5.3.4 Table 13) refers to tractor, trucks, hydraulics and general activities. To assist with understanding noise exposure from the sources identified, a schedule of plant/equipment and source locations identified during the audits should be provided by NIA.	ALC response: • Have updated Table 9 with more detailed plant and locations • NIA includes incorporation of detailed locations from figure 2	The ALC assessment assumed that the adjoining Market Garden' sites only operate during daytime hours. ALC has not addressed all operational noise emissions from the 'Market Garden' premises during evening and nighttime hours (other than reported in the updated report (Table 12) and identified as green house fans (49dBA)). Other potential sources include irrigation pumps, fans and trucks. ALC provides no comments or assessment of likely restrictions for the Market Garden premises with respect to noise impacts on the proposed development, GC: I have visited during evening and early night time hours (7.30pm to 10.30pm) to observe potential noise activities. As stated, the NIA is updated with the measured fan noise along a portion of the eastern boundary at 49 dB(A) as per table 12 of report. No other noise activities were observed. Regardless, as per the updated noise impact assessment and based on

			noise levels measured from attended measurements and unattended noise monitoring of existing noise levels along the eastern boundary over a week, the building façade, glazing, roof/ceiling and mechanical ventilation has been upgraded as such to allow for a reasonable internal amenity within the habitable spaces with windows/doors closed.
d)	NIA (Section 5.4.4) appears to repeat Section 5.3.4 with the same results, finding and conclusions. To assist with understanding noise exposure from the sources identified, a schedule of plant/equipment and source locations identified during the audits should be provided by NIA	ALC response: • Results were as measured during the site audit. • Have amended report by adding site map of measurement and source locations to Figure 2 in section 5.41 • Have updated Table 12 with more detailed plant and locations. • Have Included incorporation of detailed locations from figure 3 now added to section 5.4.1	Disagree GA Refer to (c) GA above GC Refer to (c) GC above

e)	From discussions with the Dural Farm florist operator it is understood that a diesel water pump servicing the dam located on the western boundary of the property operates intermittently during day/evening/night hours, there are no restrictions for truck movements during day/evening/night hours and expansion/development of the site could extend to the western boundary of the property. NIA has not discussed impacts form possible expansion of the Dural Farm Florist property	ALC response: • A site visit during evening hours showed Dural Farm was closed for business with no reported activity on site between the visited hours of 7.30pm to 10.30pm on 3rd April 2019. • Attended site visit during evening hours also observed no noise activity from vehicles or plant from the Dural Farm florist between 7.30pm to 10.30pm on 3rd April 2019. • During site visits on 30/1/19 between 6.30am and 11.00am and 3/4/19 between 7.30pm and 10.30pm and attended measurement audits, the diesel pump was never observed to be operational. Acoustic Logic will require access to measure the diesel pump whilst in operation. This will require the Dural Farm Florist to turn on the pump so testing can be completed. • In regards to expansion, as per Section 6.1 of the EPA Noise policy for Industry 2017 applications for existing premises often provide an opportunity to redress issues that relate to the whole site. Any future expansion would need to	Disagree GA Refer to (c) above Referenced to Dot Point 4 (Column 2) there are no restrictions on the 'Market Garden' premises with respect to operating hours, vehicle access or noise. With the development of the residential proposal within the Rural Zone occupants of the development would be exposed to existing operational noise impacts and possible future expansion of the adjoining properties. In my opinion it is unreasonable to expect that as a result of approving a non-compatible land use development in terms of noise exposure unacceptable restrictions could be imposed on existing approved land uses GC As per section 6.1 of the EPA NPfl: <i>There is no 'one-size-fits-all' approach to determine the impact from an existing industry. The following governing principles should be applied when determining the project noise trigger levels and/or assessment requirements for existing industry:</i> • <i>The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.</i>
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		consider a noise impact assessment be provided by the Dural Farm Florist to Council to ensure compliance with the NSW EPA NPfl 2017.	• <i>Where an existing industry has been in operation for more than 10 years and existing site operations exceed the project amenity noise level, the project amenity noise level may be adopted as the project noise trigger level to assess existing, and existing plus proposed site operations, as relevant.</i> Based on the above, any future expansion of the adjacent 'market gardens' will require an assessment based on the amenity criteria as recommended by the EPA NPfl
f)	From discussions with the Green gallery Nursery operators, it is understood that air recirculation fans operate during day/evening/night hours, there are no restrictions for truck movements during day/evening/night hours and expansion/development could extend to the eastern and southern boundaries of the property. NIA has not discussed impacts form possible expansion of the Green Gallery Nursery	ALC response: • A site visit during evening hours showed Dural Farm was closed for business with no reported activity on site between the visited hours of 7.30pm to 10.30pm on 3rd April 2019. • Attended site during evening hours also observed no noise activity from vehicles from the Green Gallery Wholesale Nursery between 7.30pm to 10.30pm on 3rd April 2019. • Air recirculation fans were measured along a portion of the eastern boundary between the hours of 7.30pm and 10.30pm on the 3rd April 2019. These have been included in section 5.4 of the Noise Impact Assessment. • Regardless, as per Section 6.1 of the EPA Noise policy	Disagree GA Refer to (c) GA above GC Refer to (c) GC above

		for Industry 2017, applications for existing premises often provide an opportunity to redress issues that relate to the whole site. Any future expansion would need to consider a noise impact assessment be provided by the Green Gallery Wholesale Nursery to Council to ensure compliance with the NSW EPA NPfl 2017.	
g)	The area is zoned RU2 Rural Landscape NIA (Section 5.1.5) refers to and adopts amenity noise criterion referenced as 'Suburban'. The NPfl daytime amenity criterion for 'RU2 Rural' land is 5 dB(A) lower than recommended for 'Suburban'. The daytime assessment criteria recommended in NIA (Table 6) $L_{Aeq\ 15\ min}$ 53 should be corrected to reflect the NPfl amenity criteria $L_{Aeq\ 15min}$ 48	ALC response: • ALC believe that the subject site should be regarded as a suburban site based on the following: ○ Column 4 of Table 2.3 of the NSW EPA NPfl 2017 states that "an area that has local traffic with characteristically intermittent traffic flow or with light commerce or industry. The area also has the following characteristic: evening ambient noise levels defined by the natural environment and human activity." ○ This site is representative of all of these qualities due to the nature of the	Disagree GA Referring to the NPfl (Section 2.4) <i>the recommended amenity noise levels have been selectively scaled to reflect the perceived differential expectation and ambient noise environments of rural, suburban and urban communities for residential receivers. They are based on protecting the majority of the community (90%) from being highly annoyed by industrial noise'</i> NPfl Table 2.3 refers to Rural residential and Suburban residential categories. Planning zoning categories for Rural residential land include RU1, RU2, RU4 R5 and E4,.For Suburban planning zones include RU5 'Village' and RU6 'transition' In my opinion the subject development land is not located in 'village or transition' zones. Accordingly the 'Amenity noise

		proposed type of development (i.e those with car park, loading dock café, gym, residential apartments etc) ○ Column 3 of Table 2.3 also states that a typical daytime RBL for a Rural site is <40 dB(A) and notes that “where background noise levels are higher than those presented in column 3 due to existing industry or intensive argricultural activities, the selection of a higher noise amenity area should be considered” ○ In regards to section 5.1.6 and section 4.4 of the Noise impact Assessment the day time background noise level is 45 dB(A) and is more indiciative of the surburban residential receiver category RBL, so a higher amenity should be considered.	criteria’ appropriate for the study area is Rural not Suburban. To ensure that industrial type noise sources remain within the NPfI recommended amenity noise limits for an area, the recommended project amenity noise level is the recommended level (Table 2.2) minus 5dBA. The Table below presents a summary of the recommended adjusted amenity levels. <table><tr><th>Noise Amenity Area</th><th>Time of Day</th><th>Recommended Amenity Level LAeq period</th></tr><tr><td rowspan="3">Rural</td><td>Day</td><td>45</td></tr><tr><td>Evening</td><td>40</td></tr><tr><td>Night</td><td>35</td></tr></table> Appendix 4 presents a summary of the assumptions to determine the following project noise criteria for proposed development <table><tr><th>Time of Day</th><th>Project Noise Criteria LAeq 15min</th></tr><tr><td>Day</td><td>48</td></tr><tr><td>Evening</td><td>43</td></tr><tr><td>Night</td><td>35</td></tr></table> GC: ○ Column 3 of Table 2.3 also states that a typical daytime RBL for a Rural site is <40 dB(A) and notes that “where background noise levels are higher than those presented in column 3 due to existing industry or intensive argricultural activities, the selection of a higher noise	Noise Amenity Area	Time of Day	Recommended Amenity Level LAeq period	Rural	Day	45	Evening	40	Night	35	Time of Day	Project Noise Criteria LAeq 15min	Day	48	Evening	43	Night	35
Noise Amenity Area	Time of Day	Recommended Amenity Level LAeq period																			
Rural	Day	45																			
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Day	48																				
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Night	35																				

			amenity area should be considered” ○ In regards to section 5.1.6 and section 4.4 of the Noise impact Assessment the day time background noise level is 45 dB(A) and is more indicative of the suburban residential receiver category RBL, so a higher amenity should be considered. For these reasons above I believe the Noise emission criteria should be: <table><tr><th>Time of Day</th><th>Project Noise Criteria LAeq 15min</th></tr><tr><td>Day</td><td>53</td></tr><tr><td>Evening</td><td>43</td></tr><tr><td>Night</td><td>35</td></tr></table> It is noted that there is only 5 dB(A) difference between GC and GA opinion for day time levels. All other time periods are agreed upon.	Time of Day	Project Noise Criteria LAeq 15min	Day	53	Evening	43	Night	35
Time of Day	Project Noise Criteria LAeq 15min										
Day	53										
Evening	43										
Night	35										

h)	Referring to measurements reported NIA concludes that noise from Dural Farm Florist ($L_{Aeq\ 15\ min}$ 54) and Green Gallery Nursery ($L_{Aeq\ 15min}$ 54) exceed the NIA recommended assessment criteria ($L_{Aeq\ 15min}$ 50) by 4 dBA. Adopting the correct zoning (R2 Rural)and amenity criteria ($L_{Aeq\ 15min}$ 48) the reported measured NIA levels for the eastern and western boundaries of the development site exceed the assessment criteria by 6 dB(A)	ALC response: - Adoption of the suburban amenity criteria should be considered as per the reasoning of our response to contention no13 (g) above - During the site audit ,the 4 dB(A) non-compliance was from found to be the worst case noise activity measured at the boundary of the site (which was truck noise). Closest measured at. 25 metres from western boundary and 10 metres from eastern boundary. - Considering that there is a non habitable service roadway and the closest façade is set back to 8m from the boundary the noise attenuation of the source was also calculated to the closest affected facing façades. - This is the reported resultant worst case noise level of <47 dB(A) at the ground level facades with 5 dB(A) barrier affect attenuation.. - This shows compliance with the EPA daytime amenity level of 48 dB(A) for suburban residential. Regardless, the impacts identified	Disagree GA The results in the Table below present a summary of noise levels reported by ALC from the Market Garden Premises and show a 6dBA exceedance of the recommended daytime criteria.. <table><tr><th>Time of Day</th><th>Criteria $L_{Aeq\ 15m}$</th><th>ALC Measured Level</th></tr><tr><td>Day</td><td>48</td><td>54</td></tr><tr><td>Evening</td><td>43</td><td>-</td></tr><tr><td>Night</td><td>35</td><td>-</td></tr></table> The ALC levels presented in Column 2 refer to a predicted façade level at ground level of less than 47dBA, with a 5dB allowance for attenuation from a timber fence. For the upper levels of the development the facade level would be in the order of 53dBA, and exceed the daytime criteria (48dBA) by 5dBA. To mitigate the noise exceedances ALC recommends additional design changes be incorporated into the development and closing windows/doors. I understand that the proposed recommendations have not been incorporated into the Architectural Plans Agreed To achieve the recommended internal noise levels for daytime periods it is agreed that the façade window glazing is upgraded and	Time of Day	Criteria $L_{Aeq\ 15m}$	ALC Measured Level	Day	48	54	Evening	43	-	Night	35	-
Time of Day	Criteria $L_{Aeq\ 15m}$	ALC Measured Level													
Day	48	54													
Evening	43	-													
Night	35	-													

		can be adequately mitigated by: • Planning the residences so sensitive spaces and external spaces face away from the industrial premises, or separated by common spaces, etc, thereby screening these spaces from noise. • Where there is residual impact providing acoustically treated balconies and terraces,. For example, external terraces could have openable facades with sound absorptive linings. When quiet conditions are desired, the façade can be partially closed. • Acoustically treating facades using sound rated glazing so that internal noise levels are acceptable, and providing, alternative systems for ventilation and thermal comfort	windows closed. ALC has not provided a full assessment of noise impacts during evening and night hours albeit it would be expected that the upgraded and closed windows condition would mitigate the noise and alternative ventilation required to satisfy BCA requirements. ALC has not fully assessed external noise exposure levels for evening and night hours. Potential noise sources include fans, irrigation pumps and sprays and trucks It is agreed that there is potential for the Market Garden properties to expand and encroach on the proposed development. It is understood that there are no restrictions of the Market Garden properties with respect to operating hours, truck movements or noise. GC The internal noise criteria for the proposed development for the closing of windows/doors with mechanical ventilation has been agreed during the joint conference on 12/4/2019. Detailed agreed internal noise limit are below:
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			<table border="1"> <tr> <th rowspan="2">Space/ Activity Type</th><th rowspan="2">Time of Day</th><th colspan="2">Noise Level dB(A)$L_{eq}(1 \text{ hour})$</th></tr> <tr> <th>Satisfactory</th><th>Maximum</th></tr> <tr> <td>Living Areas</td><td>Day (7am to 10pm)</td><td>30</td><td>40</td></tr> <tr> <td>Sleeping Areas</td><td>Night (10pm to 7am)</td><td>30</td><td>35</td></tr> </table> It is also agreed the above criteria is achievable by upgraded façade, glazing, roof/ceiling and mechanical ventilation system . Detailed design will be carried out at CC stage, including additional noise measurements for operational noise from 'market gardens' during evening and night.	Space/ Activity Type	Time of Day	Noise Level dB(A) $L_{eq}(1 \text{ hour})$		Satisfactory	Maximum	Living Areas	Day (7am to 10pm)	30	40	Sleeping Areas	Night (10pm to 7am)	30	35
Space/ Activity Type	Time of Day	Noise Level dB(A) $L_{eq}(1 \text{ hour})$															
		Satisfactory	Maximum														
Living Areas	Day (7am to 10pm)	30	40														
Sleeping Areas	Night (10pm to 7am)	30	35														
i)	NIA (Sections 5.3.5 and 5.4.5) refer to the free field boundary noise measurements, 8 metre building façade setbacks and a calculated external noise level of $L_{Aeq \ 15min}$ 47. NIA provides no modelling or reasoning to support the predicted external façade level $L_{Aeq \ 15min}$ 47	ALC response: As presented above, the loudest noise source at the boundary which was a truck at 25 metres on the western boundary and a truck at 10 metres on the eastern boundary side, which was used to calculate the worst case noise source to the facades a further 8 metres back from the boundary. This is the reported	GA Refer to (h) GA above Agreed The results reported in ALC do not represent all site activities or potential noise impacts from the Market Garden properties. The noise mitigation options discussed in the ALC report have not been accepted by the Applicant or documented on the Architectural Plans														

		resultant worst case noise level of <47 dB(A) at the ground facades with a 5 dB(A) barrier affect attenuation. - Regardless, any non-compliances from noise impacts to the 1st floor façade of the building from existing industrial noise on the eastern and western boundaries can be avoided and mitigated by means such as modifying locations, acoustic screening between the properties or design and constructions that provide acceptable indoor noise amenity. This is as per section 2.4.3 of the NSW EPA NPfI. Regardless, the impacts identified can be adequately mitigated by: - Planning the residences so sensitive spaces and external spaces face away from the industrial premises, or separated by common spaces, etc, thereby screening these spaces from noise. - Where there is residual impact providing acoustically treated balconies and terraces,. For example, external terraces could have openable facades with sound absorptive linings. When quiet conditions are desired, the façade can be partially closed. - Acoustically treating facades using sound rated glazing so that internal noise levels are acceptable, and providing, alternative systems for ventilation and thermal comfort .	GC: Long term and short term noise measurements have been carried out by this office. However, operational information of diesel pump, irrigation pumps etc is unknown to this office at this stage. It is noted that during two site visits the diesel pump and irrigation were not operational It is recommended that coordination between the market garden and ALC is required to measure the operational noise form the diesel pump, irrigation pump etc at CC stage. The measurement results will be included in the design of the façade, glazing and roof/ceiling and ventilation system.
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j)	NIA (section 5.3.5 and 5.4.5) claim that a 1.8 high barrier will reduce noise from the adjoining sites by up to approximately 10dBA. NIA provides no modelling to support the noise reduction claimed or identify the extent of the subject property that benefits from the 10dBA reduction.	ALC Response: Our assessment is based on ASHRAE calculations dependant on barrier calculation factors for 1.8 m high barrier affect achieved typically between minimum 5-10 dB(A) attenuation to the ground level facades facing the adjacent premises from truck noise GA The revised ALC report relies on a 5dB noise attenuation for the 1.8m timber fence compared to the original report submitted with DA of 10dB. Barrier attenuation calculations provided by GC (Attachment 6) show noise reductions for a 1.8m fence of 6-7dBA referenced to ground floor receptors..The calculations are based on specific source locations and sound power levels ranging between 82-94dBA...	Disagree From the GC calculations a 1.8m high fence provides some benefit for outdoor areas and ground floor level of the proposal. However the effectiveness of the fence is dependent on site topography finished ground levels, source location and the noise level emitted from the activity. Referring to the GC calculations (Attachment 6) the reported sound power levels for trucks range between 82-94dAB, calculated from SPL 54@ 10m.and SPL 53@45m, Adopting the 94dBA the adjusted predicted sound pressure levels for the ground level building facades range between 47dBA and 59dBA. The predicted levels exceed the GA recommended day, evening and night criteria (48/43/35). The proposed 1.8m high boundary fence would provide minimal noise reduction benefit to building façade above ground level GC Site investigation indicates that the Dural Farm (western boundary)is open land and truck movements are generally faster and generate more noise The trucks on the eastern boundary (green Gallery side) where trucks are limited in space as they are driving between the aisles at lower speed thus generating less sound.
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			Based on measurements the loudest sound power level from the truck movements on the western side are 94 dB(A) and the loudest sound power level on the eastern side will be 82 dB(A) Considering topography of project side and the adjacent land, the predicted noise level to the western facade will be less than 47 dB(A)(assuming typical truck movements is assumed 45 metres to the boundary with a setback of 11 metres to the facade). Site observations of the Dural Farm that the truck movements typically would be more than approx. 25 metres away from boundary fence. Considering topography of project side and adjacent land the predicted noise level to the eastern facade will be less than 39 dB(A) to ground level with 1.8m high barrier and 49 dB(A) to remaining levels (assuming typical truck movements is assumed 10 metres to the boundary with 20 metre setback to the facade) Regardless of the difference between predicted noise levels between GC and GA, the façade and glazing and ventilation of the ground level space will be designed to comply with the agreed internal noise criteria detailed in GC (h) above
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k)	NIA (sections 5.3.5 and 5.4.5) refer to AS2107-2016 and internal criteria for assessing noise from Dural Farm Florist and Green Gallery Nursery. NIA (Section 5.5) refers to building constructions and upgraded glazing requirements. Clarification is required to confirm the internal levels NIA adopted to determine the recommended building noise controls. To achieve the recommended internal noise levels it is assumed the external windows/doors are closed. NIA provides no assessment of internal noise levels with the windows/doors open.	ALC Response: - AS2107 internal noise criteria adopted from recommendations provide by SEPP 2004 (Housing for seniors or People with Disability). Has been added to report. Section 5.1.2 - As there is no open window criteria for AS2107 will adopt the open window criteria as per the SEPP and presented in the 'Interim guideline for development near rail corridor and busy roads' . . will assess and present in report. If internal levels - As per Interim guideline for development near rail corridor and busy roads', "if internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia."	Agreed Compliance with the recommended internal noise criteria is reliant on closed windows, upgrade glazing and mechanical ventilation.
l)	NIA Appendix 1 provides 24 hour dB/time graphs from unmanned noise. Referring to NPfI reporting procedures the L_{A1} and L_{Amax} levels should be provided on the graphs.	ALC Response: Have been provided with new version of NIA	Agreed

m)	NIA Appendix 1 results reported for Green Gallery Nursery at about 2000 hours show that the background (LA90) levels increases from about 37/38 dBA to about 45/46 dBA. A similar pattern is observed from measurements reported for the Dural Farm Florist Boundary. NIA has not identified or addressed the source of noise contributing to the increase or potential impacts on the subject development. NIA (Section 5.1.6) states “that as the adjacent industrial sites are only open during the day time hours, evening and night time hours have not been assessed”. Clarification is required to identify the industrial site.	ALC Response: • A visit on the night of 3rd April between 7.30pm to 10.30pm was performed to observe any activities associated with the noise level increase and perform noise measurements. • No additional noise activity from vehicles or plant from the Dural Farm florist between these hours as there was no activity on site. • Fan noise activity along a portion of the eastern boundary was observed from the green gallery premises. No additional noise from vehicles or plant from the Green gallery between these hours was observed as the premises was closed. • Based on our site observation the increase to the logger data at 2000 is associated to fan noise. • The fan noise and observations have been added to the NIA as per the request in section 5.4	Agreed Site audits reported by ALC confirmed that ventilation fans operate during evening and nighttime hours. Other likely noise sources evening and nighttime source include water irrigation pumps and sprays, and trucks
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n)	NIA Section 5 refers to 'significant external noise sources in the vicinity of the site' including 'traffic noise on Quarry Road, Green Gallery Wholesale Plant Nursery and Dural Farm Florists and states that 'Noise intrusion should comply with Council DCP, AS2107, AS 3671 and the EPA Noise Policy for Industry 2017'	ALC Response: No contention mentioned as yet.	Agreed ALC reports that noise from Quarry Road, Green Gallery Wholesale Plant Nursery and Dural Farm Florists are significant noise sources
o)	NIA Section 5.2.4 (Table 7) refers to measured daytime ($L_{ea, 1 \text{ Hour}} 59$) and night ($L_{ea, 1 \text{ hour}} 55$) Levels from Quarry Road. It is noted that the NIA text refers to Table 6 and Table 7.	ALC Response; Have amended in report	Agreed
p)	NIA provides no modelling or assessment to address noise exposure and building mitigation options for controlling traffic noise from Quarry Road or Vineys Road. From the reported measurements for Quarry Road it would be expected that exposed windows and doors would be closed to achieve the recommended internal sound pressure levels. Noting that the proposed development is a 'Retirement Village' consideration should be given to addressing traffic noise levels for occupied bedrooms during daytime hours 0700 hours to 2200 hours.	ALC Response; - There is no requirement detailed in the SEPP, 'Interim guideline for development near rail corridor and busy roads' - or- AS2107 for daytime levels to bedrooms in Aged Care. Daytime internal criteria has been assessed to the residential spaces criteria and are typical for this type of development.	Agreed
q)	NIA Section 6 provides an assessment of noise from the proposed development. Noise sources identified include on site traffic, plant/equipment and loading docks.	ALC Response: No contention mentioned as yet.	Agreed

r)	NIA (Section 6.2.1) reports findings from noise modelling for the car park entry referenced to Receiver 1 (Quarry Road) without any supporting assumptions and calculations. Additional information is requested to support the reported predicted noise levels. NIA provides no assessment for onsite vehicles referenced to Receiver 3 (Vineys Road). It is noted that Vineys Road Provides for access to the basement car park	ALC Response: - Assumptions in section 6.2.1 are as per a typical car park assessment for this type of development. modelling used to predict noise to receiver. - Section 6.2.2 assesses the Viney St Receivers from car park entry - Most predicted noise levels on Viney st side are significantly lower than criteria	Agreed
s)	NIA Section 6.2.3.2 refers to a 2 metre barrier on the eastern boundary between the closest residential receivers on Vineys Road. NIA (Section 6.3) Recommends a 1.8m fence on parts of the eastern and western boundaries. NIA provides no modelling to support the recommendations.	ALC Response: The current design shows 1.8 metre high fence based on car park entry assessment.	Agreed
t)	The sound Power Level descriptors presented in NIA (Section 6.2.1 and Table 27) should be referenced as LAeq 15 min or SEL levels.	ALC Response: Amended in report	Agreed
u)	NIA (Table 24) refers to noise emission criteria (Western Boundary Facing Botany Road). Clarification is requested to identify the referenced location.	ALC Response: Amended table accordingly in report	Agreed

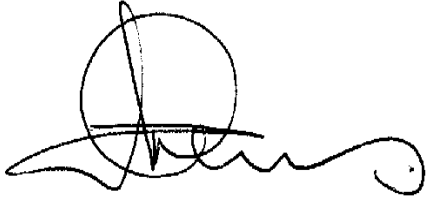
v)	NIA (Section 6.1.5) provides no criteria for assessing noise exposure for residents on Vineys Road. These Properties are some 270m from Quarry Road and the ambient background noise levels would be expected to be lower than adjacent Quarry Road	ALC Response: • Attended Measurements were taken in conjunction with the logging presented in report. • Attended measurements were then adjusted for distance attenuation and time and found to be representative of the background noise logging. • The measured night time RBL of 30 dB(A) is already equal to the recommended minimum noise level by the EPA NPfl •	Agreed
w)	NIA (Table 24) refers to amenity criteria referenced to 'suburban' areas, as discussed above the area is zoned 'RU2 Rural'. The NPfl daytime criterion for RU2 Rural areas is 5 dBA lower than 'suburban' areas.	ALC Response: • ALC believe that the subject site should be regarded as a suburban site based on the following: ○ Column 4 of Table 2.3 of the NSW EPA NPfl 2017 states that "an area that has local traffic with characteristically intermittent traffic flow or with light commerce or industry. The area also has the following characteristic: evening ambient noise levels defined by the natural environment and human activity.' ○ This site is	GA Refer to (g) above. In my opinion the appropriate zoning for assessing noise is Rural GC Refer to GC (g) above. In my opinion the appropriate zoning for assessing noise is Suburban

		representative of all of these qualities due to the nature of the proposed type of development ○ Column 3 of Table 2.3 also states that a typical daytime RBL for a Rural site is <40 dB(A) and notes that “where background noise levels are higher than those presented in column 3 due to existing industry or intensive agricultural activities, the selection of a higher noise amenity area should be considered”. The measured RBL for daytime is 5 dBA greater than the typical RBL in EPA NPfl. ○ It is also noted that the evening measured RBL is also 5 dBA greater than the typical RBL in the EPA NPfl ○ In regards to section 5.1.6 and section 4.4 of the Noise impact Assessment the day time background noise level is 45 dB(A) and is more indicative of the suburban residential receiver category RBL, so a higher amenity should be considered.	
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x)	NIA provides limited discussion regarding provision air-conditioning and no discussion referenced to exhaust systems and basement ventilation. Additionally details should be provided to identify possible locations and acoustic treatments for plant/equipment and plant rooms.	ALC Response: - This sort of detailed design of mechanical plant is assessed at CC stage once the construction drawings are finalised and mechanical selections are made are locations are finalised. - If required for this report can we be provided with indicative mechanical drawings and plant selections of typical plant with locations .	Disagree GA: In my opinion details of typical plant selections and locations are required. The information is required to allow an assessment of suitable areas for the installations and to assess noise impacts. GC: Detailed mechanical noise emission assessment to be performed at CC stage when mechanical engineer is on board.
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List of attachments:

- Attachment 1: CV – Glen Campbell
- Attachment 2: CV – Graham Atkins
- Attachment 3: Rating Background Noise Level and Noise Emission Goals
- Attachment 4: Rating Background Noise Level and Noise Emission Goals
- Attachment 5: DA Stage Environmental Noise Impact Assessment (Acoustic Logic, Revision 4)
- Attachment 6: Barrier Noise Calculations

Signed:	Signed:
	
Glen Campbell	Graham Atkins

Appendix 1 – CV – Glen Campbell

GLEN CAMPBELL

SENIOR PROJECT ACOUSTIC CONSULTANT

Qualifications

Master of Design Science (Audio & Acoustics) Sydney University 2009

July 2010 – September 2017

Project Engineer, Acoustic Logic Consultancy

September 2017 -February 2019

Senior Project Engineer, Acoustic Logic Consultancy

February 2019 - Current

Senior Engineer, Acoustic Logic Consultancy

Outline of Experience

Glen is an senior project acoustic engineer with experience in the building sector, including experienced gained during his degree. He has been involved in many acoustic research projects at Sydney University. Since commencing work in the acoustic industry he has been responsible for noise assessments for many projects.

Projects involved all aspects of acoustic design including room modelling investigations of traffic, train and aircraft noise, design of relevant building systems for compliance with BCA and Council requirements, the assessment of mechanical plant, providing the appropriate treatment for compliance. Other relevant areas included vibration isolation for hard floor systems and railway vibration.

Glen's areas of expertise include:

- Building acoustics and building services noise control;
- Review of external noise impacts (traffic, rail helicopters/helipads and aircraft noise);
- Testing and assessment of walls/floors/glazing/building services;
- Acoustic control of mechanical systems (ventilation systems, air-conditioning etc);
- Spatial planning of development (room layouts, wall design etc);
- Office of Liquor, Gaming and Racing Noise assessments for licensed premises

Project Experience

University of Canberra Public Hospital, Bruce, ACT
St George Hospital Acute Services Building Redevelopment, Kogarah, NSW
Liverpool Hospital Milestone 2, Liverpool, NSW
Star Hotel Project, Star City Casino, Pyrmont, NSW
Orange Hospital Development, Orange, NSW
RACF Seven Hills Road, Baulkham Hills, NSW
Lot 11, 1-5 Pine Ave, Little Bay, NSW
Child Care Centre, Top Ryde Shopping Centre, Ryde, NSW
UWS Bankstown Campus Teaching Facility, Milperra, NSW
20 Gadigal Avenue, Zetland
Dominion, Forbes Street, Darlinghurst
34 Walker Street, Rhodes, NSW
Wilara, Easty St, Woden Green, Phillip, ACT
1-7 Second Avenue, Blacktown, NSW
Lakes Neighbourhood Centre, The Ponds, NSW
Henley Square Stage 2 , Henley Beach, SA
Eclipse Apartments, Braybrooke St, Bruce ACT
14-18 Boondah Road, Warriewood, NSW
Mobbs Lane, Epping Park, NSW
137-141 Bayswater Road, Rushcutters Bay, NSW
8 Bourke Street, Mascot, NSW
4-10 Campbell Street, Haymarket, NSW

Appendix 2 – CV – Graham Atkins

Graham Atkins



Graham Atkins is a Senior Acoustical Engineer and Director of Atkins Acoustics with more than 28 years experience in the field of acoustics. Initially employed by ANI Corporation Limited gaining extensive experience in manufacturing, environmental issues, research and development. Graham left ANI and joined James Madden and Associates in 1980. In January 1982 James Madden and Associates was restructure, and James Madden Cooper Atkins was formed, with Graham being appointed as a Partner. James Madden Cooper Atkins ceased trading as a Consulting Group in April 1995.

In the drive for professional leadership, Atkins Acoustics was formed by Graham as Managing Director.

Graham's particular areas of acoustical experience include major infrastructure projects involving road traffic noise/vibration measurement, prediction/modelling, assessment, control design and post construction evaluations.

Atkins Acoustics

Senior Engineer
Director

QUALIFICATIONS

Bachelor of Engineering (Mech) Hons. NSW University of Technology

PROFESSIONAL MEMBERSHIP

Member Institution of Engineering Australia
Chartered Professional Engineer
Member Australian Acoustical Society
Member Institute of Noise Control Engineering

Specialisation

Road Infrastructure Projects

Specific Road Project Experience

Baulkham Hills Ring Road Assessment
Newcastle Container Wharf Road, Transport Study
Grain Handling Authority, Newcastle Terminal, Road Transport Study
Sydney Harbour Tunnel, Noise Study
Coalex Coal Road Freight Noise Study, Lithgow
Airly Coal Mine, Road Noise Investigations
Warringah Transport Truck Terminal, Terrey Hills
Pennant Hills Road Widening Investigation, Noise Assessment
M4 Motorway, Traffic Noise and Noise Control Barriers
Pacific Highway Noise Assessment, Coffs Harbour
National Highway Extension, Noise Impact Study
Princess Highway, Kiama Bypass, Noise Impact Study
The Great Western Highway, Warrimoo, Noise Impact Assessment
Pacific Highway, Bulladelah NSW, Noise Impact Study
M6 Traffic Noise Assessment, Dapto
RTA Traffic Relief Route, Armidale
RTA Inner City Relief Route, Gosford
Old Windsor Road, Traffic Noise Assessment
Pacific Highway, Ballina
Pacific Highway, Ourimbah
Pacific Highway, Ulmarra
Pacific Highway, Coopernook

Graham Atkins

Raymond Terrace Bypass
Pacific Highway, Mooreland
Pacific Highway, Karuah
Princess Highway, Bega
Princess Highway, Pambula
South Windsor Flood Evacuation Route
F3 – Branxton Link. New England Highway
Pacific Highway, Nabad

Environmental:

Tomago Aluminium Smelter, Tomago;
Alumina Port Facilities, Newcastle Harbour;
Kooragang Island Coal Loader, Stages I and II;
SRA and SPCC Coal Rail Freight Noise Studies;
Ford Australia Pty Ltd, Homebush;
Alcan (Australia) Limited, Aluminium Smelter, Kurri Kurri;
Kellogg's (Australia) Limited, Botany;
Grain Handling Authority, Port Kembla Grain Terminal;
Narrabeen Lagoon Dredging Assessment, Warringah Shire Council;
BHP Mini Steel Mill Assessment, Rooty Hill;
McDonalds Restaurants, NSW, VIC, QLD and NT;
Shell NSW, Service Stations;
BP Oil, Service Stations;
Woolworths, Mayfield and Carlingford;
Pizza Hut Restaurants;
Castrol Australia;
City Rail, East Hills Railway Line Upgrade and Quadruplication;
Parkes International Freight Airport;
Chullora Rail Freight Terminal;
Naval Base Redevelopment, Darwin;
Ampol/ Caltex Oil;
Sewage Treatment Plant (REF), Cronulla;
Glendell Open Cut Mine, Glendell;
Paddy's River Quarry, Paddy's River;
Eastern Creek, International Karting Venue;
The Northside Storage Tunnel, Sydney Water;
Chullora Intermodal Rail Freight Terminal;
Cumulative Noise Impact Assessment, Hunter Valley Coal Mine.

Railway Traffic Noise

SRA/Dubbo Council, Dubbo West Rail Bridge;
Kooragang Island, Rail Bridge Noise Study;
Airly Coal Mine, Rail Noise Investigations;
Cityrail, East Hills Rail Line Upgrade and Quadruplication;
Chullora Intermodal Rail Freight Terminal.

Aircraft Noise

Ansett Aircraft Hangar, Sydney Airport;
International Upgrade, Sydney Airport;
Sydney Western Airport,
Sub-Region Study; Parkes International Freight Airport; Darwin
Airport Noise Study;
Williamstown Airbase Noise Assessment.

Commercial/ Retail

Commonwealth Bank Head Office,
Sydney; TAB Head Office & Computer Centre,
Sydney; Park Royal Hotel, Parramatta;
Commonwealth Bank Computer Centre,
Burwood; State Bank, Ashfield;
Kent & Market St, Commercial Project, Sydney;
Telecom, Resource Management Centre, North Sydney;

Graham Atkins

	McDonalds Restaurant H/O, Thornleigh; Intercontinental Hotel, Sydney; McDonalds Training Centre, Thornleigh; Telecom Telephone Exchange, Chatswood; Macquarie University, North Ryde; TAB Computer Centre,
Residential	Alma Court, Anzac Parade, Maroubra; Museum Towers, Castlereagh Street, Sydney; The Oscar on Hollywood, Hollywood Ave, Bondi Junction; The Darlington, Darling Harbour, Sydney; The Bellevue, Forest Road, Hurstville; Royal Palms, Herbert Street, St Leonards; Jubilee Towers, Pacific Highway, Hornsby; Blackwattle Bay, Residential Development.
Planning	Austlink Corporate, Forestville; RTA. Residential Sub-division Planning; Pioneer Homes, Sub-division Planning; Land Commission Housing Estate, Erskine Park; Stocklands Housing Estate, Erskine Park; Minchinbury Housing Estate, Blacktown; Department of Housing, Dapto; Mulgoa Rd, Penrith; Penrith Lakes Environs Study; South West Sydney Sub-region Planning Study; Glenmore Park Residential Sub-division; Figtree Residential Sub-division.
Universities, Technical Colleges, Churches and School Projects :	Conservatorium of Music Studies, Sydney; Technical College Food School, Newcastle; Calwell High School, Canberra; Macquarie University, Early Childhood Studies; Shalvey High School, Shalvey; Conservatorium of Music, Music Classroom; Gardeners Road Public School, Traffic Noise; Minda Remand Centre, Multi Purpose Hall; Parramatta Diocesan School, Parramatta; RAAF Airbase, Williamstown; University of Western Sydney (Nepean).
Industrial Projects	Alcan Australia Ltd, Kurri Kurri Works; Caroma Industries, Chatswood; Tomago Aluminium Smelter, Tomago; Kooragang Island, Alumina Port Facilities, Newcastle; Cottees Schweppes Foods, Liverpool; Brambles Australia; Kellogg's Australia, Botany; CSR Shipping.
Machine- Structure Vibration:	MWS & DB Emu Plains Water Pumping Station; DB Action; Kelloggs (Aust) Limited, Botany; Bayswater Power Station, Muswellbrook; GE Medical Systems, Magnetic Imaging, (Sydney, Melbourne, Gold Coast); Duxton Hotel, Milsons Point.
Ground Vibration:	Minchinbury Housing Estate, Blacktown; BHP Rail Freight, Induced Ground Vibrations, Newcastle;

Graham Atkins

Commonwealth Bank Computer Centre, Burwood;
Odeon Theatre, Demolition Site, Manly;
DB Action, Alexandria;
ACI Site, Rosebery;
Hard Rock Quarry, Kiama;
Landfill and Quarry, Coffs Harbour;
Glendell Coal, Glendell;
Glennies Creek Coal Mine;
Blackhill Quarry, Black Hill;
Northside Storage Tunnel, Sydney Water;
Chullora Intermodal Rail Freight Terminal.

Sport & Recreational:

Mount Panorama Racing Circuit;
Drag Boat Racing, Hawkesbury River;
Squash Courts, Bayview;
Castle Hill Squash Centre;
Warringah Basketball Centre;
International Karting Circuit/ Venue, Eastern Creek.

Legal Assignments :

Narrabeen Lagoon Dredging, Warringah Shire Council;
BHP Mini Steel Mill, Rooty Hill;
McDonalds Restaurants NSW;
Shell NSW;
BP Oil Service Stations;
Burmah Fuels Service Stations;
Pizza Hut Restaurants;
Chullora Intermodal Rail Freight Terminal;
Princess Highway Kiama Bypass;
Brambles Australia;
CSR Shipping;
Blue Mountains City Council; Botany Municipal Council; Council of the Municipality of Burwood; Council of the Municipality of Kiama;
Randwick City Council; Warringah Shire Council.

Appendix 3 – GC Rating Background Noise Levels and Noise Emission Goals

Time of day	Measured Background Noise Level dB(A) $L_{90(15\text{minutes})}$	Amenity Criteria dB(A) $L_{eq(\text{period})}$	Intrusiveness Criteria Background + 5 dB(A) $L_{eq(15\text{minutes})}$	EPA Criteria for Residential Condensers	EPA Criteria for Sleep Arousal – dB (A)
Day	45	53	50	N/A	N/A
Evening	41	43	46	N/A	N/A
Night	30	38	35	Inaudible within neighbouring premises	40dB(A) $L_{eq(15\text{min})}$ 52dB(A) $L_{Max, F}$

Appendix 4 – GA Rating Background Noise Levels and Noise Emission Goals

Time of day	Measured Background Noise Level	Amenity Criteria (<i>NPf1</i>)	Amenity Criteria +3dBA	Intrusiveness Criteria Background + 5 dB(A)	Project Noise Criteria	EPA Criteria for Residential Condensers	EPA Criteria for Sleep Arousal
	RBL	$L_{eq}(\text{Period})$	$L_{eq}(15\text{min})$	$L_{eq}(15\text{minutes})$	$L_{eq}(15\text{minutes})$		dB(A)
Day	45	45	48	50	48	N/A	N/A
Evening	41	40	43	46	43	N/A	N/A
Night	30	35	38	35	35	Inaudible within neighbouring premises	40dB(A) $L_{eq}(15\text{min})$ 52dB(A) $L_{Max, F}$

Appendix 5 – DA Stage Noise Impact Assessment Report (Acoustic Logic, Revision 4)

3 Quarry Road and 4 Vineys Road, Dural

Environmental Noise Impact Assessment

SYDNEY
A: 9 Sarah St
MASCOT 2020
T: (02) 8339 8000

SYDNEY MELBOURNE BRISBANE CANBERRA
LONDON DUBAI SINGAPORE GREECE

ABN: 11 068 954 343

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DOCUMENT CONTROL REGISTER

Project Number	20180361.1
Project Name	3 Quarry Road and 4 Vineys Road, Dural
Document Title	Environmental Noise Impact Assessment
Document Reference	20180361.1/0904A/R4/GC
Issue Type	Email
Attention To	Sunglow RV One Unit Trust

Revision	Date	Document Reference	Prepared By	Checked By	Approved By
0	28/03/2018	20180361.1/2803A/R0/GC	GC		BW
1	1/06/2018	20180361.1/0106A/R1/GC	GC		BW
2	13/02/2019	20180361.1/1302A/R2/GC	GC		GW
3	5/03/2019	20180361.1/0503A/R3/GC	GC		GW
4	9/04/2019	20180361.1/0904A/R4/GC	GC	GW	GW

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1 INTRODUCTION

This report presents an analysis of acoustic impacts associated with the proposed aged care facility at 3 Quarry Road and 4 Vineys Road, Dural.

In this report we will:

- Conduct an external noise impact assessment (primarily traffic noise) and recommend acoustic treatments to ensure that a reasonable level of amenity is achieved for future tenants.
- Identify potential noise sources generated by the site, and determine noise emission goals for the development to meet Council and NSW EPA acoustic requirements to ensure that nearby developments are not adversely impacted.

Traffic noise and noise from adjacent commercial properties at the site have been measured and assessed in accordance with Hornsby Shire council DCP and Australian Standard AS2107:2016 and AS3671:1989. Noise intrusion from the adjacent industrial sites has been measured and assessed in accordance with the requirements of the NSW EPA Noise Policy for Industry 2017.

The environmental noise emission criteria will be assessed in accordance with the requirements of NSW EPA Noise Policy for Industry 2017.

The assessment is based on architectural drawings presented in the table below.

Table 1 – Referenced Drawings

Consultant	Drawing Number	Revision	Date
Marchese Partners (Job no. 16033)	DA 0.00	X	1/3/2019
	DA 0.01	X	1/3/2019
	DA 1.01	X	1/3/2019
	DA 1.02	X	1/3/2019
	DA 1.03	X	1/3/2019
	DA 1.04	X	1/3/2019
	DA 1.05	X	1/3/2019
	DA 2.01	X	1/3/2019
	DA 2.02	X	1/3/2019
	DA 2.03	X	1/3/2019
	DA 2.04	X	1/3/2019
	DA 2.05	X	1/3/2019
	DA 2.06	X	1/3/2019
	DA 2.07	X	1/3/2019
	DA 4.01	X	1/3/2019
	DA 4.02	X	1/3/2019
	DA 4.03	X	1/3/2019

2 SITE DESCRIPTION

The proposed development consists of a multi-storey aged care facility located between Quarry Road and Vineys Road, Dural. The southern façade faces Quarry Road which is a two lane road with low to medium traffic volumes. The northern façade faces Vineys Road which is primarily used for local residential access while remaining facades are bounded by the existing residential and commercial buildings.

Noise potentially generated by the site will consist primarily of noise from mechanical plant;

The nearest potentially affected noise receivers are:

- Receiver 1 - Residences and commercial properties bounding the site to the north west;
- Receiver 2 - Residences and commercial properties bounding the site to the south west;
- Receiver 3 - Residences properties bounding the site to the north east;
- Receiver 4 - Commercial properties bounding the site to the south east;
- Receiver 5 - Residences on the northern side of Vineys Road;

Refer to Figure 1 below, which is an aerial photo of the existing development.



Figure 1 – Site Map

- | | |
|---|--|
|  | Approximate Site Location |
|  | Unattended Noise Monitoring (Traffic) |
|  | Unattended Noise Monitoring (Background) |
|  | Unattended Noise Monitoring (5 Quarry Road) |
|  | Unattended Noise Monitoring (Dural Farm Florist) |
|  | Attended Noise Monitoring (Traffic) |
|  | Attended Noise Monitoring (Dural Farm Location 1) |
|  | Attended Noise Monitoring (Dural Farm Location 2) |
|  | Attended Noise Monitoring (5 Quarry Rd Location 1) |
|  | Attended Noise Monitoring (5 Quarry Rd Location 2) |



3 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of environmental noise three principle measurement parameters are used, namely L_{10} , L_{90} and L_{eq} .

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement interval.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of traffic noise.

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the L_{90} parameter is not used to assess traffic noise intrusion.

4 BACKGROUND NOISE MONITORING

Long term background noise monitoring was undertaken to establish noise emission criteria in accordance with the guidelines within the NSW EPA Noise Policy for Industry 2017.

4.1 MEASUREMENT LOCATIONS

The unattended monitor measurement location is indicated in Figure 1. The monitor was setup at a location close to receiver 1.

4.2 EQUIPMENT USED

Background noise was recorded using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the unmanned monitoring period. The equipment was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. All measurements were taken on A-weighted fast response mode.

4.3 MEASUREMENT TIME PERIOD

Unattended measurements were conducted between the 13th March 2018 till the 20th March 2018.

4.4 MEASURED RATING BACKGROUND NOISE LEVEL

The measured background noise levels (dB(A) L_{90}) for day, evening and night time periods are shown in the table below.

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm; and
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

The rating background noise levels calculated in accordance with the guidelines contained in the EPA Noise Policy for Industry 2017 are summarised in Table 2.

Table 2– Rating Background Noise Levels

Location	Time	RBL L_{90} dB(A)
Unattended noise monitor along western boundary of the site	Day	45
	Evening	41
	Night	30

5 EXTERNAL NOISE INTRUSION ASSESSMENT

Significant external noise sources in the vicinity of the site are as follows:

- Traffic noise from Quarry Road, on the southern property boundary, which carries medium to high traffic flows.
- The Green Gallery wholesale plant nursery at 5 Quarry Road, Dural;
- The Dural Farm Florist at 835 Old Northern Road which abuts 4 Vineys Road, Dural.

Noise intrusion should comply with the requirements of Hornsby Shire Council DCP and Australian Standard AS2107:2016 and AS3671:1989 as well as the NSW EPA Noise Policy for Industry 2017.

5.1 ACOUSTIC OBJECTIVES

The determination of an acceptable level of noise intrusion within the residential spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities

As sleep is the activity most affected by noise intrusion, bedrooms are the most sensitive rooms. Higher levels of noise are acceptable in living areas without interfering with activities such as reading, listening to television, etc. Noise levels in utility spaces such as kitchens, bathrooms, laundries, etc can be higher.

Traffic noise will be assessed to the following criteria for this project:

- Hornsby Shire Council DCP;
- the State Environment Planning Policy (Housing for Seniors or People with a Disability) 2004;
- Australian Standard AS2107:2016 & AS3671:1989;
- NSW EPA Noise Policy for Industry 2017.

5.1.1 Hornsby Shire council DCP

Hornsby Shire council has no relevant acoustic controls for traffic noise impacts affecting aged care centres. In absence of relevant acoustic controls, the Australian Standard AS2107:2016 & AS3671:1989 and the NSW EPA Noise Policy for Industry 2017 will be used for this assessment.

5.1.2 State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004

The State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004 sets out internal noise levels for developments with the potential to be impacted by external noise. The policy states that:

“32 Visual and acoustic privacy

The proposed development should consider the visual and acoustic privacy of neighbours in the vicinity and residents by:

(a) appropriate site planning, the location and design of windows and balconies, the use of screening devices and landscaping, and

(b) ensuring acceptable noise levels in bedrooms of new dwellings by locating them away from driveways, parking areas and paths.

Note. *The Australian and New Zealand Standard entitled AS/NZS 2107–2000, Acoustics—Recommended design sound levels and reverberation times for building interiors and the Australian Standard entitled AS 3671—1989, Acoustics—Road traffic noise intrusion—Building siting and construction, published by Standards Australia, should be referred to in establishing acceptable noise levels.”*

5.1.3 Australian Standards Criteria

The Australian Standards recommend maximum design sound levels for different areas of occupancy in the residential development while AS 3671 -1989 “Road Traffic Noise Intrusion - Building Siting and Construction” recommends that an appropriate L_{eq} for traffic noise descriptor be used for the occupancy being assessed.

Based on AS2107-2016 and AS 3671-1989 the following assessment criteria would apply to the proposed development based on developments near minor roads.

Table 3 - AS2107:2016 Internal Traffic Noise Criteria

Space/ Activity Type	Time of Day	Noise Level dB(A) $L_{eq}(1 \text{ hour})$	
		Satisfactory	Maximum
Living Areas	Day (7am to 10pm)	30	40
Sleeping Areas	Night (10pm to 7am)	30	35
Public Lobby	Anytime	50	55
Restaurant	Anytime	40	50
Bar	Anytime	-	<50
Office	Anytime	35	40
Boardroom	Anytime	30	40

5.1.4 Requirements by NSW EPA Noise Policy for Industry 2017

The NPfI 2017 provides guidelines for assessing noise impacts from developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The NPfI has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion.

We note that as the adjacent industrial sites are only open during day time hours, evening and night time hours have not been assessed.

5.1.5 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Section 4.4. Noise emissions to the site should comply with the noise levels presented below when measured within the property boundary.

Table 4– Allowable Intrusive Noise Levels

Location	Intrusiveness Noise Goals dB(A) $L_{eq}(15 \text{ minutes})$
	Daytime (7am – 6pm)
All Boundaries	50

5.1.6 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The NSW EPA Noise Policy for Industry sets out acceptable noise levels for various localities. Table 2.2 on page 11 of the policy indicates 3 categories to distinguish different residential areas. They are rural, suburban, urban. This site is categorised by suburban receivers.

For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;

The project amenity noise level is calculated by taking the recommended amenity noise level (as presented in table 2.2 of the policy), subtracting 5dB(A) and then adding 3dB(A) to convert from $L_{Aeq, \text{period}}$ to a $L_{Aeq, 15 \text{ minute}}$ descriptor. The project amenity noise level criteria are presented in the table below.

Table 5 – NPfl Project Amenity Criteria

Location	Period/Time	Project Amenity Noise Level Criteria dB(A) $L_{eq}(15min)$
Within the property boundary - Suburban Receiver	Day (7am-6pm)	53

5.1.7 Summary of Noise Emission Objectives

Based on the requirements stated in the sections above, Table 6 provides a summary of the assessment criteria applicable to the from the commercial sites surrounding the project site. The assessment criteria are also based on the background noise monitoring conducted at the site.

Table 6 – Environmental Noise Emission Criteria

Receivers	Time Period	Background Noise Level dB(A)L_{90}	Amenity Criteria dB(A) $L_{eq}(15min)$	Intrusiveness Criteria Background + 5 dB(A) $L_{eq}(15min)$
All Boundaries	Day	45	53	50

The operation noise generated by the industrial sites adjacent to the proposed site should comply with the above noise emission criteria.

We note that as the adjacent industrial sites are only open during day time hours, evening and night time hours have not been assessed.

5.2 TRAFFIC NOISE MEASUREMENT

As part of this investigation, traffic noise from the surrounding perimeter roadways has been measured. The results of this measurement will be used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Measurements included attended and unattended noise levels measurements conducted at the locations as detailed in Figure 1 above. Measurements were performed generally in accordance with the Australian Standard AS 1055 - "Description and measurement of environmental noise - General Procedures".

5.2.1 Measurement Location

Traffic noise measurement locations are detailed above in Figure 1.

5.2.2 Attended Measurements

Measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded. Measurements were on the 20th March 2018 between 4:30pm and 5:30pm. There were no periods of adverse weather during the measurement.

5.2.3 Unattended Measurements

Unattended noise measurements were obtained using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noise monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator. No significant drift was detected. All measurements were taken on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period. The logger was on site from the 13th March 2018 till the 20th March 2018. Refer to Appendix 1 for unmanned noise monitoring data.

5.2.4 Results of Traffic Noise Level Measurements

The results of measured traffic noise levels at the locations around the site as detailed in Figure 1 above are detailed in the Table 6 below.

Table 6 – Measured Traffic Noise Levels

Location	Time	Traffic Noise Level
Approx. 4m from curb at boundary (on Quarry Road side of property)	Day (7am – 10pm)	59 dB(A) _{L_{Aeq}} (1 hour)
	Night (10pm – 7am)	55 dB(A) _{L_{Aeq}} (1 hour)

5.3 DURAL FARM FLORIST NURSERY MEASUREMENTS – 835 OLD NORTHERN ROAD

As part of this investigation, noise from the surrounding perimeter agricultural land uses has been measured from the Dural Farm Florist at 835 Old Northern Road which abuts 4 Vineys Road, Dural. The results of this measurement will be used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Measurements included attended and unattended noise levels measurements conducted at the locations as detailed in Figure 1 above. Measurements were performed generally in accordance with the Australian Standard AS 1055 - "Description and measurement of environmental noise - General Procedures".

It is noted that the Dural Farm Florist operation hours are 8.30am to 5pm Monday to Friday, 8.30am to 5pm Saturday and Closed on Sunday

Measurements include those of the following from typical use of the agricultural land sites:

- Trucks moving around the site
- Sprinklers and watering devices in various locations observed during measurements

It is noted that the main activities on the farm are performed from approximately 50 metres from the project site. However, there is a shed approximately 20 metres from the site that stores motor vehicles for use on the farm.

5.3.1 Measurement Locations



Figure 2 – Measurement Locations

-  Attended Noise Monitoring (along the western boundary facing Dural Farm Location 1)
-  Attended Noise Monitoring (along the western boundary facing Dural Farm Location 2)
-  Unattended Noise Monitoring (on the western boundary facing the Dural Farm Florist)
-  Approximate location of closest truck activity observed
-  Approximate location of closest sprinkler and watering device activity observed

5.3.2 Attended Measurements

Measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded.

Measurements were conducted during the day on the 30th January 2019 between 6:30am and 11:00am.

Measurements were conducted during the evening on the 3rd April 2019 between 7:30pm and 10:30pm.

There were no periods of adverse weather during the measurement.

5.3.3 Unattended Measurements

Unattended noise measurements were obtained using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noise monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator. No significant drift was detected. All measurements were taken on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period. The logger was on site from the 23rd January to the 30th January 2019. Refer to Appendix 1 for unmanned noise monitoring data.

5.3.4 Results of Noise Level Measurements

The results of measured noise levels from the adjacent industrial sites to the locations around the site as detailed in Figure 2 above are detailed in the Table 7, 8 and 9 below.

Table 7 – Unattended Noise Monitoring Noise Levels to Façade (based on AS2107:2016 Criteria)

Location	Time	Measured Noise Level
Western boundary of the proposed site (with full view of the 835 Old Northern Road site to the west) – See Figure 2 above for detailed location of noise monitor.	Day (7am – 10pm)	54 dB(A) _{L_{Aeq}} (1 hour)
	Night (10pm – 7am)	52 dB(A) _{L_{Aeq}} (1 hour)

Table 8– Unattended Noise Monitoring Noise Levels to Boundary (Based on NSW EPA NPfi Criteria)

Location	Measured Noise Level dB(A) $L_{eq}(15 \text{ minutes})$
	Daytime (7am – 6pm)
Western boundary of the proposed site (with full view of the 835 Old Northern Road site to the west) – See Figure 2 above for detailed location of noise monitor.	54

Table 9 – Attended Noise Measurement Levels

Location	Activity	Measured Noise Level
Western boundary of the proposed site (with full view of the 835 Old Northern Road site to the west) Location 1 – See figure 2 above	Truck driving. approximately 45 metres away (closest distance to measurement location)	53 dB(A) L_{Aeq}^*
	Sprinklers and watering devices servicing crops. The closest being approximately 40 metres away	52 dB(A) L_{Aeq}^*
Western boundary of the proposed site (with full view of the 835 Old Northern Road site to the west) Location 2 - See figure 2 above	Truck driving. approximately 25 metres away (closest distance to measurement location)	54 dB(A) L_{Aeq}
	Sprinklers and watering devices servicing crops. The closest being approximately 50 metres away	50 dB(A) L_{Aeq}

*Note – These represent the measured worst case noise activity and will be the basis of this assessment.

It is noted that any mechanical plant or activities that were operational along the western side of the Dural Farm Florist property were not audible or were masked by the measured mechanical plant and truck noise activities along the eastern side of the Dural Farm Florist site.

It is noted that during the evening attended noise measurements on 3rd April 2019 no noise activity from the Dural Farm Florists site was observed.

5.3.5 Assessment of Noise Measurements from Dural Farm Florist

Our assessment of noise impacts from the Dural Farm Florist found the following results:

- Based on unattended noise monitoring, operational noise from the Dural Farm Florist to the site exceeds the NSW EPA NPfI 2017 criteria by 4 dB(A) when measured at the boundary of the project site during day time hours (which is typically during the operational hours of the Dural Farm Florist).
- Attended measurements found that the worst case measured noise activity from the Dural Farm Florist to the Proposed site is typically truck noise from a distance of approximately 25 metres at the boundary
- The external façade set back for the closest building facing the Dural Farm Florist is approximately 8 metres from the boundary as there is a non-habitable service roadway that separates the boundary line from the closest buildings.
- Predicted noise levels of attenuation from the measured worst case noise activities (i.e trucks at approximately 25 metres) to the ground level of external façade of the closest facing building a further 8 metres away during daytime hours will be less than 47 dB(A)_{L_{eq}(15 minutes)} and will comply with the NSW EPA NPfI guidelines.
- We note that construction of a 1.8 metre high barrier is to be proposed along the boundary separating the nursery from the proposed site. Any use of a barrier will further reduce the noise level of the noise activities from the commercial site by up to approximately 5 dB(A). This noise reduction is under proviso the barrier is imperforate in construction (can be constructed from lapped and capped timber, glazing, Perspex or any combination of these elements).
- Regardless, noise intrusion to the internal amenity of habitable spaces of the project based on the SEPP and 2004AS2107-2016 criteria has been assessed and presented below with construction recommendations presented in section 5.5
- As the Dural Farm Florist is only open during daytime hours, evening and night time hours have not been assessed.
-

5.4 GREEN GALLERY WHOLESALE PLANT NURSERY MEASUREMENTS – 5 QUARRY ROAD

As part of this investigation, noise from the surrounding perimeter agricultural land uses has been measured from the Green Gallery Wholesale Plant nursery at 5 Quarry Road, Dural. The results of this measurement will be used to determine the treatments required to reduce noise levels to within the project acoustic objectives.

Measurements included attended and unattended noise levels measurements conducted at the locations as detailed in Figure 1 above. Measurements were performed generally in accordance with the Australian Standard AS 1055 - "Description and measurement of environmental noise - General Procedures".

It is noted that the Green Gallery Wholesale Plant Nursery operation hours are 8.00am to 5pm Monday to Friday and Closed on Saturday and Sunday

Measurements include those of the following from typical use of the agricultural land site:

- Trucks moving around the site
- Sprinklers and watering devices in various locations observed during measurements

5.4.1 Measurement Locations

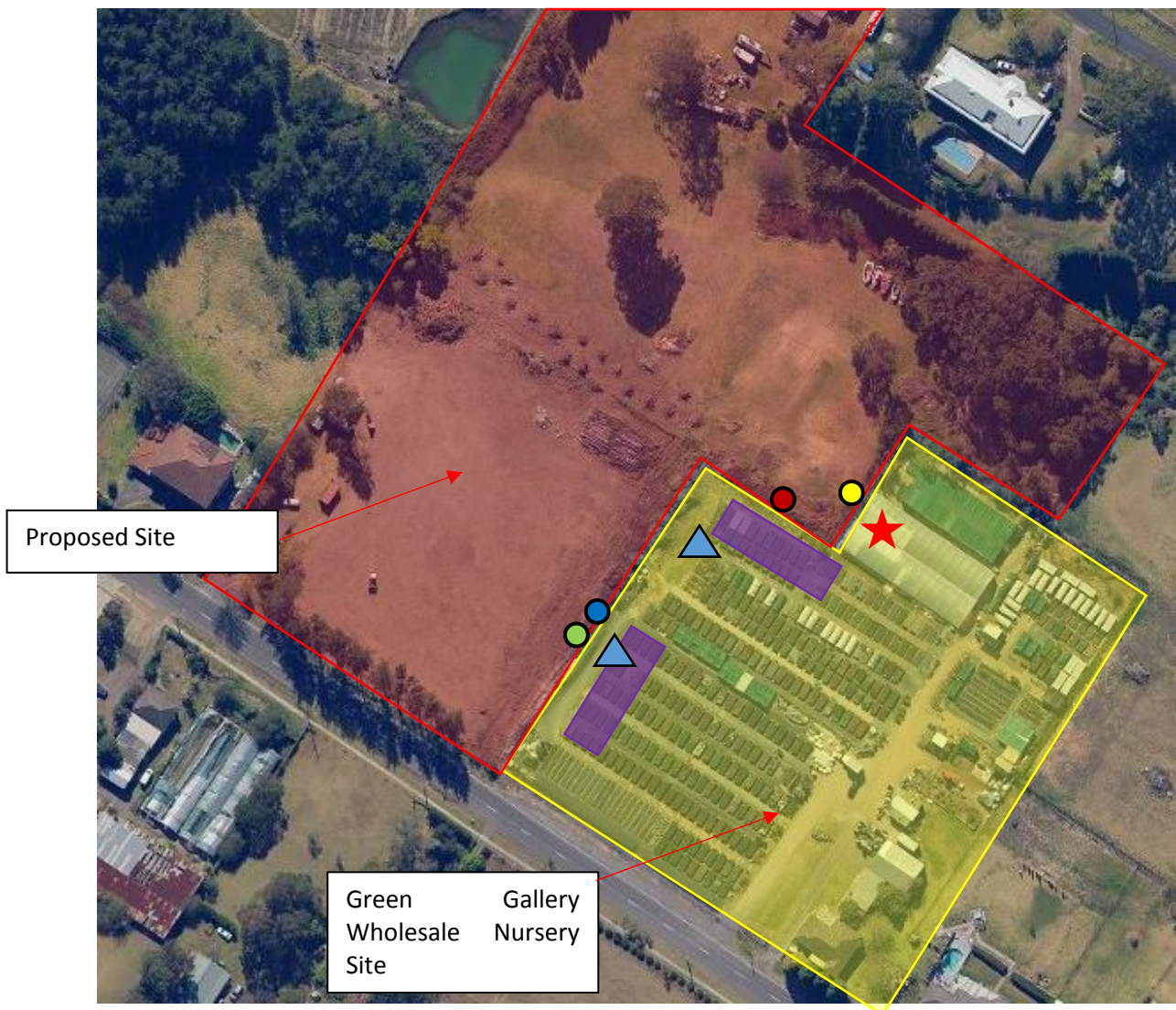


Figure 3 – Measurement Locations

- Attended Noise Monitoring (along the eastern boundary facing Green Gallery - Location 1)
- Attended Noise Monitoring (along the eastern boundary facing Green Gallery Location 2)
- Attended Noise Monitoring (along the eastern boundary facing Green Gallery Location 3)
- Unattended Noise Monitoring (along the eastern boundary facing Green Gallery)
- △ Approximate location of closest truck activity observed
- Approximate location of closest sprinkler and watering device activity observed.
- ★ Approximate location of mechanical circulation fans activity observed (within green houses)

5.4.2 Attended Measurements

Measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded.

Measurements were conducted during the day on the 30th January 2019 between 6:30am and 11:00am.

Measurements were conducted during the evening on the 3rd April 2019 between 7:30pm and 10:30pm.

There were no periods of adverse weather during the measurements.

5.4.3 Unattended Measurements

Unattended noise measurements were obtained using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noise monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator. No significant drift was detected. All measurements were taken on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period. The logger was on site from the 23rd January to the 30th January 2019. Refer to Appendix 1 for unmanned noise monitoring data.

5.4.4 Results of Noise Level Measurements

The results of measured noise levels at the locations around the site as detailed in Figure 1 above are detailed in the Table 10, 11 and 12 below.

Table 10 – Unattended Noise Monitoring Noise Levels to Façade (based on AS2107:2016 Criteria)

Location	Time	Measured Noise Level
Eastern boundary of the proposed site (with full view of the 5 Quarry Road site to the east)	Day (7am – 10pm)	51 dB(A) _{L_{Aeq}} (1 hour)
	Night (10pm – 7am)	48 dB(A) _{L_{Aeq}} (1 hour)

Table 11– Unattended Noise Monitoring Noise Levels to Boundary (Based on NSW EPA NPfI Criteria)

Location	Measured Noise Level dB(A) _{L_{eq}} (15 minutes)
	Daytime (7am – 6pm)
Eastern boundary of the proposed site (with full view of the 5 Quarry Road site to the east)	54

Table 12 – Attended Noise Measurement Levels

Location	Time of Measurement	Activity	Measured Noise Level
Eastern boundary of the proposed site (with full view of the 5 Quarry Road site to the east) Location 1	6.30am – 11.00am	Truck driving around site approximately 10 metres away	54 dB(A) L_{Aeq}
		Table top sprinklers/watering device approximately 10 metres away	50 dB(A) L_{Aeq}
Southern facing boundary of the site (with full view of the 5 Quarry Rd site to the south) Location 2	6.30am – 11.00am	Truck pass by approximately 15 metres away.	53 dB(A) L_{Aeq}
		Table top sprinklers/watering device approximately 15 metres away	49 dB(A) L_{Aeq}
Eastern facing boundary of the site (with full view of the 5 Quarry Rd site to the south) Location 3	7.30pm-10.30pm	Green houses with mechanical air circulation fans inside . Approximately 7 metres away	49 dB(A) L_{Aeq}

The measured noise above should be deemed as a worst case noise activity. It is noted that any other mechanical plant or activities that were operational along the eastern side of the Green Gallery property were not audible or were masked by the measured mechanical plant and truck noise activities along the western side of the Green Gallery site.

The measured noise levels above will be deemed as a worst case noise activity and will be the basis of this assessment.

This office notes that during the evening attended measurements taken on the 3rd April 2019 that there were no other observed noise activities apart from those presented in Table 12 above.

5.4.5 Assessment of Noise Measurements From Green Gallery Wholesale Plant Nursery

Our assessment of noise impacts from the Green Gallery Wholesale Plant Nursery found the following results:

- Based on unattended noise monitoring, operational noise from the Green Gallery Wholesale Plant Nursery to the site exceeds the NSW EPA NPfI 2017 criteria by 4 dB(A) when measured at the boundary of the project site during day time hours (which is typically also during the operational hours of the Green Gallery Nursery).
- This non-exceedance is based on the worst case measured noise activity from the Green Gallery Wholesale Plant Nursery to the Proposed site which is typically truck noise from approximately 10 metres away.
- Regardless, the external façade set back for the closest building facing the Green Gallery Wholesale Plant Nursery is approximately 8 metres from the boundary as there is a non-habitable service roadway that separates the boundary line from the closest buildings.
- Predicted noise levels of noise attenuation from the measured worst case noise activities (i.e trucks at approximately 25 metres) to the external ground level façade of the closest facing building a further 8 metres away during daytime hours will be less than 47 dB(A)_{Leq(15 minutes)} and will comply with the NSW EPA NPfI guidelines.
- We note that construction of a 1.8 metre high barrier is to be proposed along the boundary separating the nursery from the proposed site. Any use of a barrier will further reduce the noise level of the noise activities from the commercial site by up to approximately 5 dB(A). This noise reduction is under proviso the barrier is imperforate in construction (can be constructed from lapped and capped timber, glazing, Perspex or any combination of these elements).
- Noise intrusion to the internal amenity of habitable spaces of the project based on the AS2107-2016 criteria has been assessed and presented below with construction recommendations presented in section 5.5
- As the Green Gallery Wholesale Plant Nursery is only open during daytime hours, evening and night time hours have not been assessed.
-

5.5 RECOMMENDATIONS

Traffic noise intrusion and noise intrusion from the adjacent industrial sites into the proposed development was assessed using the measured external noise levels reported above as a basis.

Calculations were performed taking into account the orientation of windows, the total area of glazing, facade transmission loss, roof, barrier effects (where applicable) and room sound absorption characteristics. In this way the likely interior noise levels can be predicted. Acoustic treatment required to ensure compliance with the assessment criteria are detailed in this section.

Internal noise levels will primarily be as a result of noise transfer through the windows and doors as these are relatively light building elements that offer less resistance to the transmission of sound. Noise transfer through the masonry elements will not be significant and need not be considered further.

The constructions necessary to achieve the noise levels are detailed below. The predicted noise levels have been based on the expected level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

5.5.1 Glazed Windows and Doors

The following constructions are recommended to comply with the noise objectives stated in Section 5.1, Aluminium framed/sliding glass doors and windows will be satisfactory provided they meet the following criteria listed below.

Table 13 - Recommended Glazing (Building A and D)

Façade	Floor	Room	Glazing	Seals
Southern (Facing Quarry Road)	Ground	Board Room	10.38mm Laminated	Yes
		Office	6.38mm Laminated	Yes
		Restaurant	6mm Toughened	Yes
		Bar	6mm Toughened	Yes
		Lobby	6mm Toughened	Yes
	All floors	Living Area	6.38mm Laminated	Yes
		Bedroom	6.38mm Laminated	Yes
Eastern	All Floors (Building D) – Facing 5 Quarry Road	Bedroom	6.38mm Laminated	Yes
		Living Area	6.38mm Laminated	Yes
	All Floors (Building A)	Bedroom	6mm Toughened	Yes
		Living Area	6mm Toughened	Yes
Western	All Floors	Dining	6mm Toughened	Yes
		Bedroom	6mm Toughened	Yes
Northern	All Floors (Building D)	Dining	6mm Toughened	Yes
		Bedroom	6mm toughened	Yes
	All Floors (Building A)	Bedroom	4mm Toughened	Yes
		Living Area	4mm Toughened	Yes
Remaining (inward Facing)	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes

Table 14 - Recommended Glazing (Building B, C and RAC)

Façade	Floor	Room	Glazing	Seals
Southern	All floors	Living Area	6mm Toughened	Yes
		Bedroom	6mm toughened	Yes
Eastern	All Floors	Bedroom	4mm Toughened	Yes
		Living Area	4mm toughened	Yes
Western	All Floors – Facing 835 Old northern Road	Dining	6.38mm Laminated	Yes
		Bedroom	6.38mm Laminated	Yes
Northern	All Floors	Dining	6mm Toughened	Yes
		Bedroom	6mm toughened	Yes
Remaining (inward Facing)	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes

Table 15 - Recommended Glazing (Building E and G)

Façade	Floor	Room	Glazing	Seals
Southern	All Floors – Building E	Living Area	6mm Toughened	Yes
		Bedroom	6mm toughened	Yes
	All Floors – Building G - Facing 5 Quarry Road	Dining	6.38mm Laminated	Yes
		Bedroom	6.38mm Laminated	Yes
Eastern	All Floors – Building E - Facing 5 Quarry Road	Dining	6.38mm Laminated	Yes
		Bedroom	6.38mm Laminated	Yes
	All Floors – Building G - Facing 5 Quarry Road	Dining	6.38mm Laminated	Yes
		Bedroom	6.38mm Laminated	Yes
Western	All Floors – Building E	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes
	All Floors – Building G	Dining	6mm Toughened	Yes
		Bedroom	6mm toughened	Yes
Northern	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes
Remaining (inward Facing)	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes

Table 16 - Recommended Glazing (Building F and Remaining)

Façade	Floor	Room	Glazing	Seals
Southern	All floors	Living Area	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes
Eastern	All Floors	Bedroom	4mm Toughened	Yes
		Living Area	4mm toughened	Yes
Western	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes
Northern	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes
Remaining (inward Facing	All Floors	Dining	4mm Toughened	Yes
		Bedroom	4mm toughened	Yes

In addition to meeting the minimum glazing thickness requirements given, the design of the window mullions, perimeter seals and the installation of the windows/doors in the building openings shall not reduce the STC rating of the glazing assembly below the values nominated in the Table 4 and 5 above. Note that mohair type seals will not be acceptable for the windows requiring acoustic seals.

The window/door suppliers should provide evidence that the systems proposed have been tested in a registered laboratory with the recommended glass thicknesses and comply with the minimum listed STC requirements. Also, the glazing installer should certify that the window/doors have been constructed and installed in a manner equivalent to the tested samples.

Table 17 – Minimum STC of Glazing

Glazing Assembly	Minimum STC of Installed Window	Acoustic Seals
4mm toughened	27	Yes
6mm toughened	29	Yes
6.38mm laminated	31	Yes
10.38mm laminated	35	Yes

5.6 EXTERNAL WALLS

External walls composed of concrete or masonry elements will not require acoustic treatment. Any penetrations in the skin of the wall should be acoustically sealed.

5.7 EXTERNAL ENTRY DOORS

It is recommended that full perimeter acoustic seals are used for all external entry doors. Timber doors shall be a minimum of 40mm solid core timber with Raven RP10 to the top and sides, and Raven RP38 to the underside of the door.

Glazed doors shall have glazing thicknesses equal to those recommended in Table 3 and are to have Raven RP10 to the top and sides, and Raven RP38 to the underside of the door.

5.8 ROOF/ CEILING CONSTRUCTIONS

The recommended roof/ceiling construction is shown below in Figure 2 below:

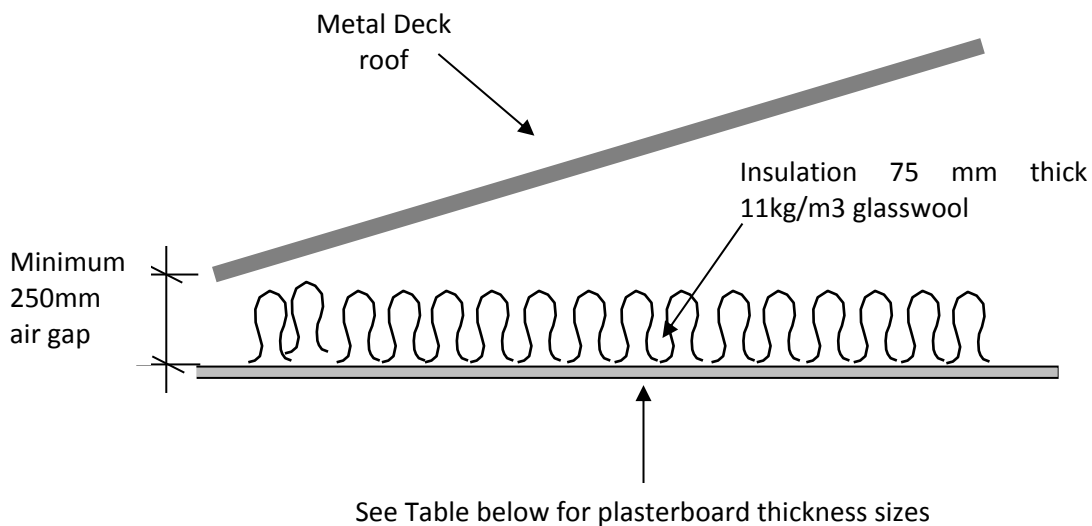


Figure 2 - Roof / Ceiling Construction

Table 18 – Ceiling Plasterboard Thickness

Building	Façade	Room	Thickness
A and D	Southern	All	1 Layers of 16mm Thick Plasterboard Sheeting
	Eastern – Building A only	All	1 Layer of 16mm Thick Plasterboard Sheeting
	Remaining	All	1 Layer of 13mm Thick Plasterboard Sheeting
B, C and RAC	Western	All	1 Layer of 16mm Thick Plasterboard Sheeting
	Remaining	All	1 Layer of 13mm Thick Plasterboard Sheeting
Building E	Eastern	All	1 Layer of 16mm Thick Plasterboard Sheeting
	Remaining	All	1 Layer of 13mm Thick Plasterboard Sheeting
Building G	Eastern and Southern	All	1 Layer of 16mm Thick Plasterboard Sheeting
	Remaining	All	1 Layer of 13mm Thick Plasterboard Sheeting
Building F and Remaining	All	All	1 Layer of 13mm Thick Plasterboard Sheeting

Penetrations in ceilings (such as for light fittings etc.) must be sealed gap free with a flexible sealant. Any ventilation openings in the ceilings would need to be acoustically treated to maintain the acoustic performance of the ceiling construction.

5.8.1 Plasterboard Corner Details

The recommended plasterboard ceiling/wall corner construction options over the top floor rooms are shown in Figure 3.

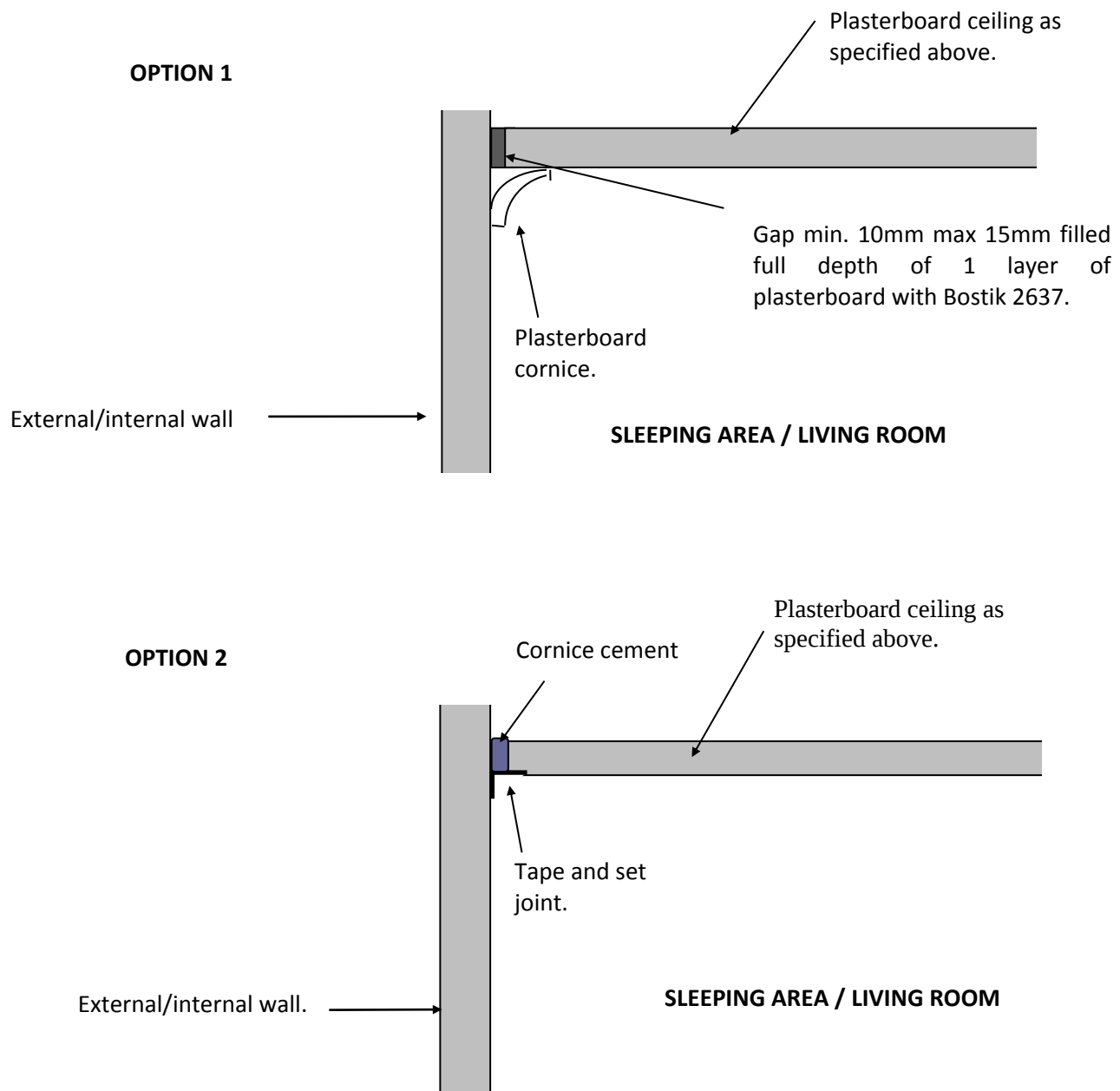


Figure 3- Plasterboard Corner Details

5.9 VENTILATION

5.9.1 PROPOSED INTERNAL and EXTERNAL CRITERIA

The screening assessment indicates that emissions from the Dural Farm Florist and Green Gallery Wholesale Plant nursery are likely to adversely impact the proposed development. The impacts identified can be adequately mitigated by:

- Planning the sensitive spaces and external spaces face away from the Dural Farm Florist and Green Gallery Wholesale Plant nursery, or separated by common spaces, etc, thereby screening these spaces from noise.
- Where there is residual impact providing acoustically treated balconies and terraces, or alternative common recreation spaces. For example, external terraces could have openable facades with sound absorptive linings. When quiet conditions are desired, the façade can be partially closed.
- Acoustically treating facades using sound rated glazing so that internal noise levels are acceptable, and providing, alternative systems for ventilation and thermal comfort.

In this assessment it is assumed that any further mitigation will need to occur through treating external spaces and facades to limit sound penetration into the buildings.

The following criteria are proposed as a minimum standard for the future occupants. When making these recommendations, reference has been made to the criteria proposed in The NSW Infrastructure SEPP, INP and AS 2107.

Living Areas (living rooms, studies, dining rooms, etc)

- 40 dB(A) L_{eq} (based on typical worst 15 minute noise level between 7am and 10pm)

Sleeping Areas

- 40 dB(A) L_{eq} (based on typical worst 15 minute noise level) between 7am and 10pm, and
- 35 dB(A) L_{eq} (based on typical worst 15 minute noise level) 10pm to 7am, and

As the recommended internal noise levels cannot be achieved with windows open within sleeping areas on the western façade facing 835 Old Northern Road and the eastern façade facing 5 Quarry Road, an alternative outside air supply system or air conditioning will be required (be it through mechanical ventilation or a passive ventilation system).

All proposed tenancies are required to be provided with an alternative ventilation or air conditioning system to maintain adequate ventilation with the windows closed.

Any alternative ventilation system that is installed should be acoustically designed to ensure that the acoustic performance of the recommended constructions is not reduced and does not exceed Council criteria for noise emission to nearby properties.

The remaining facades will not require an alternative outside air supply system or air conditioning as they are not excessively affected by industrial noise.

6 EXTERNAL NOISE EMISSION ASSESSMENT

6.1 NOISE EMISSION OBJECTIVES

The following documents are used to establish the noise emission criteria for the development site:

- Hornsby Shire Council DCP
- EPA Noise Policy for Industry 2017
- Protection of Environmental Operation Act Regulation

6.1.1 Requirements by Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development

Hornsby Shire Council Policy and Guidelines for Noise and Vibration Generating Development (Acoustic Guideline V.5. 2000) does not provide specific noise criteria for aged care facilities.

6.1.2 NSW EPA Industrial Noise Policy for Industry 2017

The NSW EPA Noise Policy for Industry 2017, has two criteria which need to be satisfied; namely the Intrusiveness noise level criteria and the Project amenity noise level criteria. The project noise trigger level is then established based on the lower of the intrusiveness and project amenity levels.

Noise levels are to be assessed at the property boundary or nearby dwelling, or at the balcony or façade of an apartment.

6.1.2.1 Intrusiveness Noise Level Criteria

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor do not exceed the background noise level by more than 5dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

Background noise levels adopted are presented in Section 4. Noise emissions from the site should comply with the noise levels presented below when measured at nearby property boundary.

Table 19– Allowable Intrusive Noise Levels

Location	Intrusiveness Noise Goals dB(A) $L_{eq}(15 \text{ minutes})$		
	Daytime (7am – 6pm)	Evening (6pm – 10pm)	Night-time (10pm – 7am)
All Boundaries	50	46	35

6.1.2.2 Project Amenity Noise Level Criteria

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The NSW EPA Industrial noise policy sets out acceptable noise levels for various localities. Table 2.2 on page 11 of the policy indicates 3 categories to distinguish different residential areas. They are rural, suburban, urban. This site is categorised by suburban receivers.

For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm.
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.

The project amenity noise level is calculated by taking the recommended amenity noise level (as presented in table 2.2 of the policy), subtracting 5dB(A) and then adding 3dB(A) to convert from $L_{Aeq, period}$ to a $L_{Aeq, 15 minute}$ descriptor. The project amenity noise level criteria are presented in the table below.

Table 20 – Project Amenity Noise Level Criteria

Location	Period/Time	Project Amenity Noise Level Criteria dB(A) $L_{eq(15min)}$
Nearby Residences – Urban Receiver	Day (7am-6pm)	53
	Evening(6pm-10pm)	43
	Night(10pm-7am)	38
Commercial Receiver	When in use	63

6.1.2.3 Project Noise Emission Limit

The project noise emission limit (as outlined in section 2.1 of the policy) is the lower of the intrusiveness and project amenity noise levels. The project noise emission limits are presented in the table below.

Table 21 – Project Noise Emission Limit Criteria

Location	Period/Time	Project Noise Trigger Level Criteria dB(A) $L_{eq(15min)}$
All Remaining Boundaries	Day (7am-6pm)	50
	Evening(6pm-10pm)	43
	Night(10pm-7am)	35
Commercial	When in use	63

6.1.3 Sleep Arousal Criteria

Potential sleep arousal impacts should be considered for noise generated before 7am or after 10pm.

Short duration, intermittent noise events (such as cars driving by) are typically assessed for potential sleep disturbance.

Potential impacts are assessed using the recommended procedure in the NSW EPA Noise Policy for Industry.

- An assessment should be conducted to determine if noise levels at a residential location during the night time period (10pm-7am) exceed:
 - $L_{Aeq, 15min}$ 40dB(A) or the prevailing RBL (rating background noise level) plus 5 dB, whichever is greater, and/or
 - L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB, whichever is greater.

The policy does not explicitly state where noise impacts should be assessed within the residential location. For the purposes of this assessment, noise impacts will be assessed at the location immediately outside a resident's bedroom window. If the noise events are compliant with this criteria, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The criteria is set out below.

Table 22 – Sleep Arousal Criteria

Location	Background Noise Level (10pm-7am)	Sleep Arousal Criteria dB(A)
All Remaining Boundaries	30dB(A) L_{90}	40 dB(A) $L_{eq(15min)}$ 52dB(A) $L_{Max, F}$

6.1.4 Protection of the Environmental Operation Act Regulation

Protection of the Environmental Operations regulation limits the noise levels associated within the operation of domestic air conditioning criteria during night time periods which is presented below:

Protection of the Environmental Operations (Noise Control) Regulation 2000-Sect 52

52 Air Conditioners

(1) A person must not cause or permit an air conditioner to be used on residential premises in such a manner that it emits noise that can be heard within a habitable room in any other residential premises (regardless of whether any door or window to that room is open):

- (a) before 8 am or after 10 pm on any Saturday, Sunday or public holiday, or*
- (b) before 7 am or after 10 pm on any other day.*

6.1.5 Summary of Noise Emission Objectives

Based on the requirements stated in the sections above, the Table 19 and 20 below provides a summary of the assessment criteria applicable to the future residential development at the project site. The assessment criteria are also based on the ambient noise monitoring conducted at the site.

Table 23 – Environmental Noise Emission Criteria – All Boundaries

Time of day	Measured Background Noise Level dB(A) L ₉₀ (15minutes)	Amenity Criteria dB(A) L _{eq} (period)	Intrusiveness Criteria Background + 5 dB(A) L _{eq} (15minutes)	EPA Criteria for Residential Condensers	EPA Criteria for Sleep Arousal – dB (A)
Day	45	53	50	N/A	N/A
Evening	41	43	46	N/A	N/A
Night	30	38	35	Inaudible within neighbouring premises	40dB(A)L _{eq} (15min) 52dB(A)L _{Max, F}

Table 24 - Noise Objectives for Commercial Receivers Near Proposed Development

Type of Receiver	Time of Day	Recommended Acceptable Noise Level dB(A) L _{eq}
Commercial	When In Use	63

6.2 NOISE EMISSION ASSESSMENT

The nearest potentially affected noise receivers are:

- Receiver 1 - Residences and commercial properties bounding the site to the north west;
- Receiver 2 - Residences and commercial properties bounding the site to the south west;
- Receiver 3 - Residences properties bounding the site to the east;
- Receiver 4 - Commercial properties bounding the site to the east;
- Receiver 5 - Residences on the northern side of Vineys Road;

Refer to Figure 1 for locations of the affected receivers.

Noise potentially generated by the site will consist primarily of noise from:

- Noise emission from the proposed plant service project building.
- Noise impact from the proposed carpark entry driveway to Receiver 1.
- Noise emission from the operation of the proposed northern loading dock entry to Receiver 3.
- Noise emission from the operation of the proposed southern loading dock entry to Receiver 1.

6.2.1 Noise Generated by the Carpark Entry (Quarry Road Side)

A noise assessment of the basement car park entry to Quarry Road has been carried out based on assumptions below:

- Day Time and Evening Peak hour - 94 trips (approximate 50% of carpark capacity).
- Night time car movement of 15 trips per hour.
- Vehicles drive in/out at 10km/hour speed with typical sound power level of 84dB(A) as measured by this office.
- Recommendations in Section 8 are implemented.

The predicted noise levels at the nearby receivers are presented in the table below:

Table 25- Predicted Noise Levels from Car Park Entry – Quarry Road

Noise at Affected Receivers (External Boundary)	Predicted Noise Level	Criteria $L_{eq, 15min}$ dB(A)	Complies
Receiver 1 (1 Quarry Road) –5m from western boundary (Quarry Road side) Approximately 80 metres away from car park entry	Peak Hour-45	Day-50 Evening -46	Yes
	Night -33	Night 35	Yes

6.2.2 Noise Generated by the Carpark Entry (Viney Street Side)

A noise assessment of the basement car park entry has been carried out based on assumptions below:

- Peak hour - 21 trips (approximate 50% of carpark capacity).
- Night time 5 trips per hour.
- Vehicles drive in/out at 10km/hour speed with typical sound power level 84dB(A) measured by this office.
- Recommendations in Section 8 are implemented.

The predicted noise levels at the nearby receivers are presented in the table below:

Table 26- Predicted Noise Levels from Car Park Entry – Viney street

Noise at Affected Receivers (External Boundary)	Predicted Noise Level	Criteria $L_{eq, 15min}$ dB(A)	Complies
Receiver 3 (6 Vineys St) –5m from eastern boundary (Viney St side) –Building Approximately 20 metres from car park entry	Peak Hour-38	Day-50 Evening -46	Yes
	Night -32	Night 35	Yes
Receiver 2(385 Old Northern road) –5m from western boundary (Viney St side) – Building Approximately 60 metres from car park entry	Peak Hour-36	Day-50 Evening -46	Yes
	Night -30	Night 35	Yes
Receiver 5 (7 Vineys St)– on northern side of Vineys St (Viney St side) Building Approximately 40 metres form car park entry	Peak Hour-40	Day-50 Evening -46	Yes
	Night -34	Night 35	Yes

6.2.3 Noise Generated by Loading Dock

This office has been advised that the basement loading dock will be primarily used for garbage truck and truck movements will be typically once per day during day time only.

6.2.3.1 Noise Sources

The potential noise sources associated with the loading dock are listed in table below along with the noise emission levels. The emission levels have been obtained from noise monitoring carried out at similar retail loading dock facilities. Noise measurements were obtained using a Norsonics SA 110 with (serial number 24692) or CEL-593 Type 1 sound level analysers (serial number C1. T 116962), set to fast response. The sound level analysers were calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was recorded.

Assessment has been based on rigid trucks up to 8.8m in length and the loading dock operation during day and evening only.

Table 27 -Loading Dock Noise Data

Noise Source	Sound Power Level dB(A) L_{eq}	Type of Noise Source
Truck Idle	99	Quasi-Steady
Trucks Manoeuvring	103	Intermittent

6.2.3.2 Predicted Noise Levels- Day Time Only

The nearest residential noise receivers of the proposed loading docks are below:

- Residential dwellings located along western boundary (Receiver 1 and Receiver 2).
- Residential dwelling located at north eastern corner (Receiver 3).

The noise levels to those receivers were calculated based on the noise emission levels provided in Table 13 above. These levels were corrected for:

- Distance between the noise source and receiver, barrier or directivity effects (when present) and topography.
- Losses from a 1.8 metre barrier to be installed on the eastern boundary between the Aged Care Facility and the closest residential receivers on Vineys Road.

A worst case 15 minute noise level based on the following for the receivers near the loading area entry doors:

- One Long Rigid Truck arrives during a 15 minute period.
- Long Rigid Truck idling for 20 seconds upon arrival or departure.

The predicted boundary of the nearest noise receiver is summarised below:

Table 28 -Predicted Noise Levels from Loading Docks (dB(A)_{Leq, 15min})

Receiver Location	Predicted Noise Level dB(A) _{Leq, 15min}	Criteria dB(A) _{Leq}	Comply?
Residential dwelling along south western boundary (Receiver 1)	41	50	Yes
Residential dwelling along north western boundary (Receiver 2)	41	50	Yes
Residential dwelling located north eastern corner (Receiver 3)	47	50	Yes
Residential dwelling located north of site (Receiver 5)	44	50	Yes

6.2.4 Plant Noise Emission

As mechanical plant has not yet been selected at this stage, a complete assessment of mechanical noise emissions can not be conducted at this time. Generally, this is undertaken at CC stage, once the plant selections have been undertaken. Notwithstanding, compliance with the mechanical noise emission criteria presented in section 5.2.4 is both practical and reasonable with the use of one or more of (but not limited to) the following:

- Acoustic Barriers/Screens;
- Internally lined ductwork;
- External Lagging;
- Silencers etc.

6.2.4.1 Noise – Air-conditioners

As air conditioning plant has not yet been selected, a complete assessment of air-conditioning noise emissions can not be conducted at this time. Generally, this is undertaken at CC stage, once the plant selections have been undertaken. Notwithstanding, compliance with the air conditioning noise emission criteria presented in section 5.2.4 is both practical and reasonable with the use of one or more of (but not limited to) the following acoustic treatments:

- Acoustic Barriers/Screens;
- Internally lined ductwork;
- External Lagging;
- Silencers etc.

6.3 RECOMMENDATION

The following building and management controls are recommended to ensure no adverse noise impact onto neighbouring receivers:

- Loading dock shall be used during day time only.
- Install 1.8 metre fence on the western boundary between the Aged Care Facility and the closest residential receiver on Vineys Road. The fence can be constructed by colorbond or equal with all penetrations and junctions acoustically sealed. (maximum 50mm gap at the bottom of the fence to allow water flow). See figure 4 below for location.
- Install imperforate barrier to be constructed along eastern boundary between the Aged Care Facility and the closest residential receiver. Barrier shall be minimum 1.8 high from natural ground, the structure of fence can be lapped and capped timber or colorbond or equal. See figure 4 below for location.

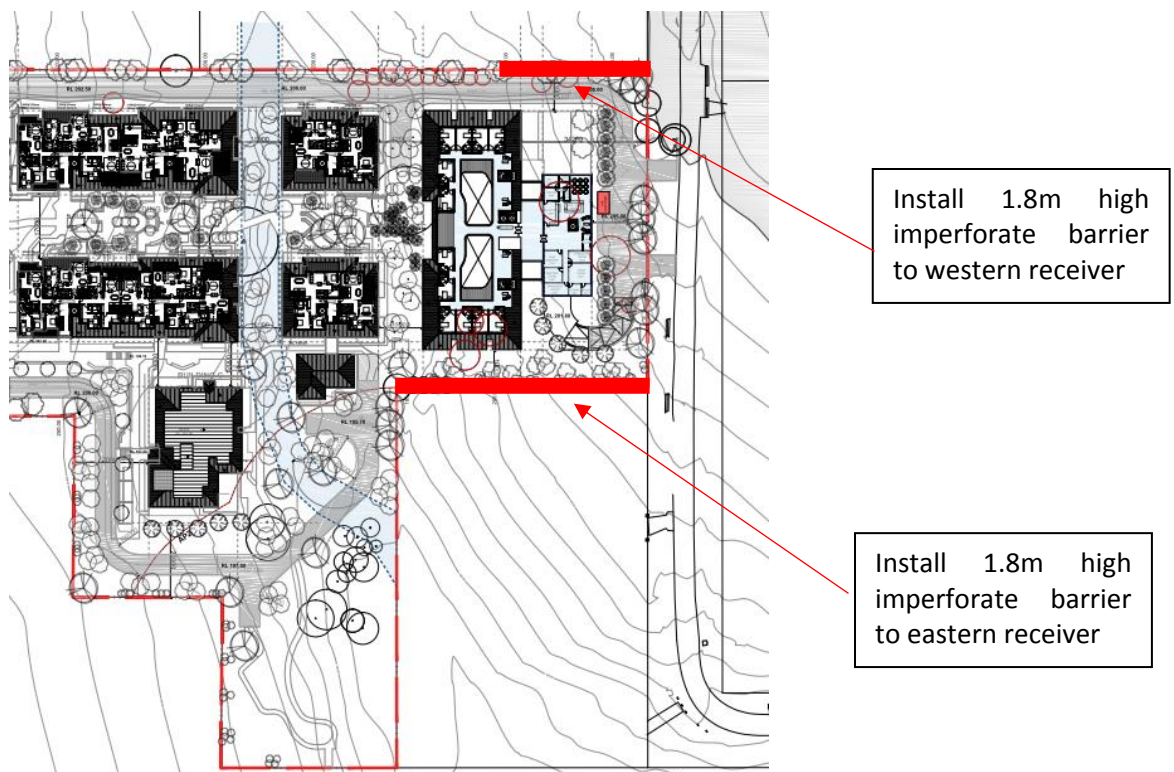


Figure 4 – Location of Barrier

- Carpark entry door: shall be vibration isolated and Vibration from the operation of automatic doors shall be vibration isolated from the building structure to prevent door operation from being audible within occupied spaces. Doors shall be panel lift. Roller doors are not permitted. In addition, as a minimum suitable rubber isolating element equal to Embelton NRD mounts shall be used where the motors are fixed to the structure and Teflon guides install in all rails. Ensure that door panels do not rattle, and the smooth operation of any door guides, rollers, etc is smooth. Door motors shall be fitted with a soft start/stop controller to minimise noise while the door shall be stopped approximately 5 mm from the slab/ground to ensure the base of the door does not contact the concrete surface.
- Plant noise shall be acoustically designed to comply with NSW EPA Criteria presented in section 6.1.5 at CC stage.

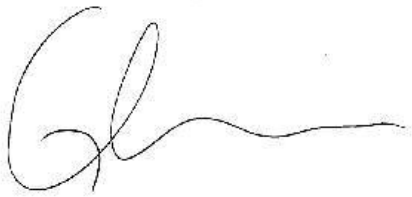
7 CONCLUSION

This report presents an analysis of acoustic impacts associated with the proposed aged care facility at 3 Quarry Road and 4 Vineys Road, Dural.

- Noise intrusion impact from traffic noise and surrounding industrial sites onto the future occupants of the development has been assessed in accordance with Hornsby Shire Council DCP, SEPP 2004 and Australian Standard AS2107:2016 and AS3671:1989 as well as the NSW EPA Noise Policy for Industry. The acoustic treatments in principle necessary to achieve these guidelines have been set out in Section 5.
- Noise emission criteria for the development site have been determined based on the site noise logging, the NSW EPA Noise Policy for Industry 2017 and Protection of the Environment Operation Act Regulation. These requirements have been presented in Section 6.1 with recommendations presented in Section 6.3 of this report.

We trust this information is satisfactory. Please contact us should you have any further queries.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Glen Campbell', with a long horizontal flourish extending to the right.

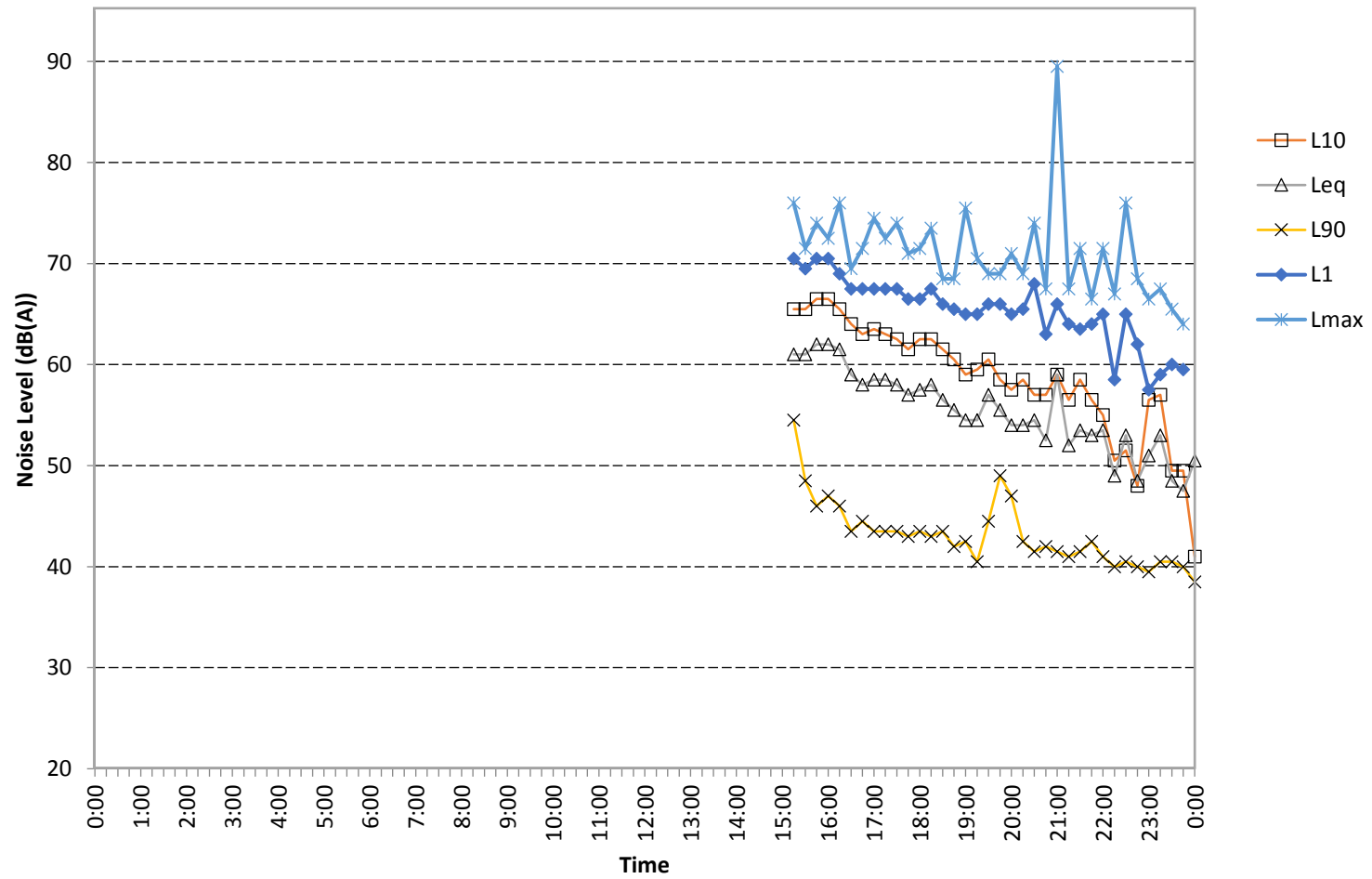
Glen Campbell

APPENDIX 1

Unattended Noise Monitoring Data

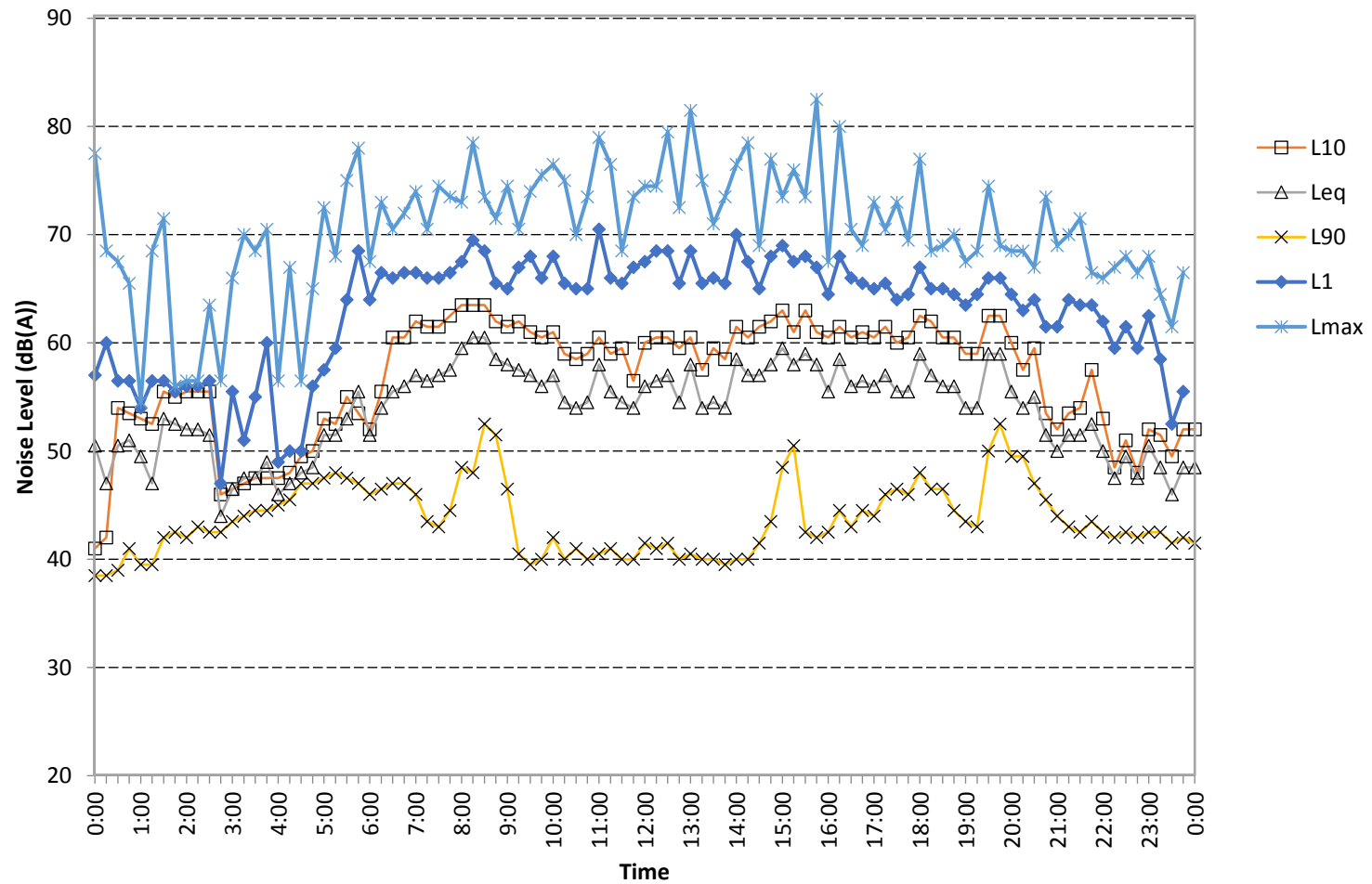
Quarry Road, Dural (Traffic Noise)

Tuesday March 13, 2018



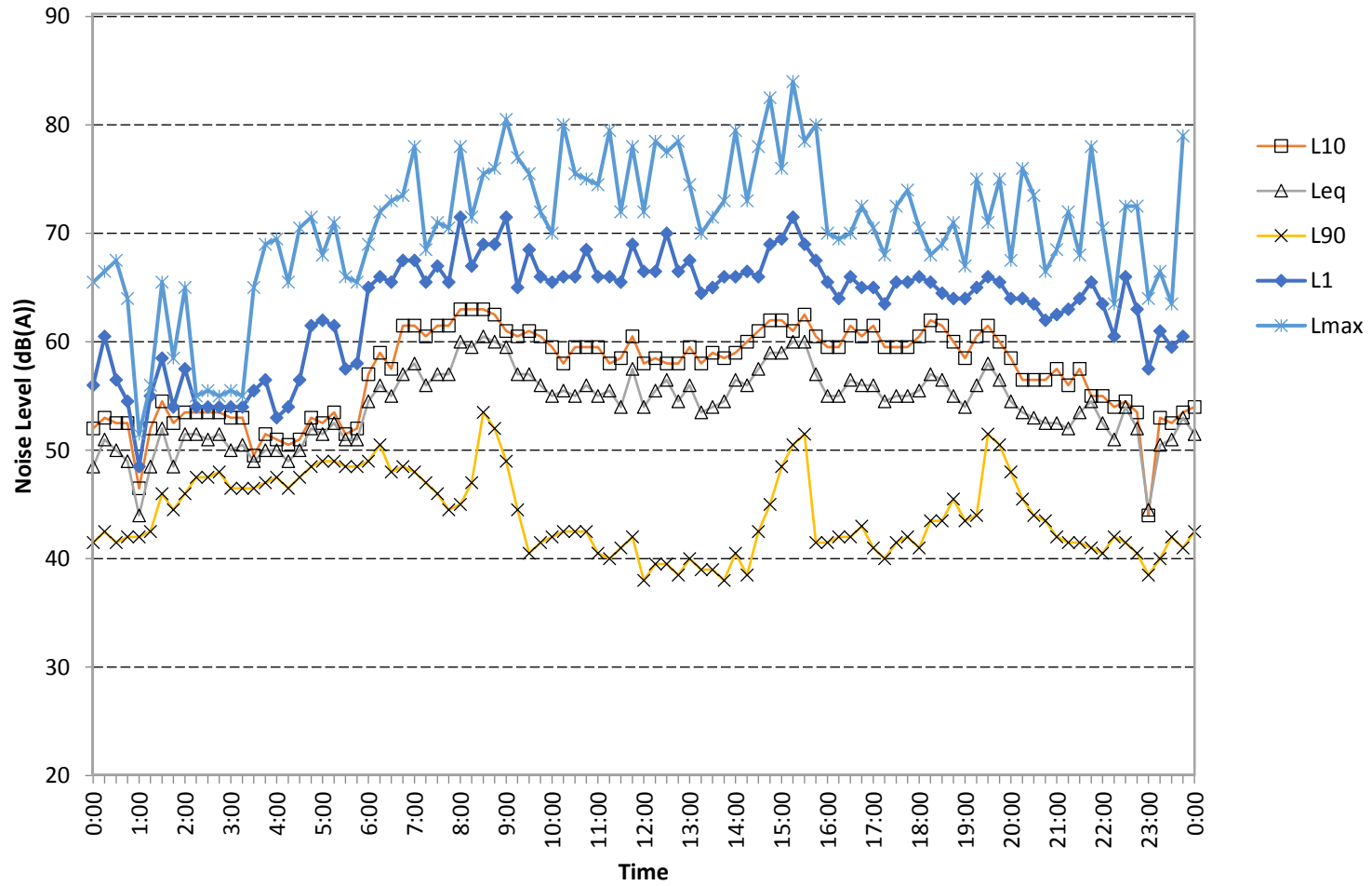
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Wednesday March 14, 2018



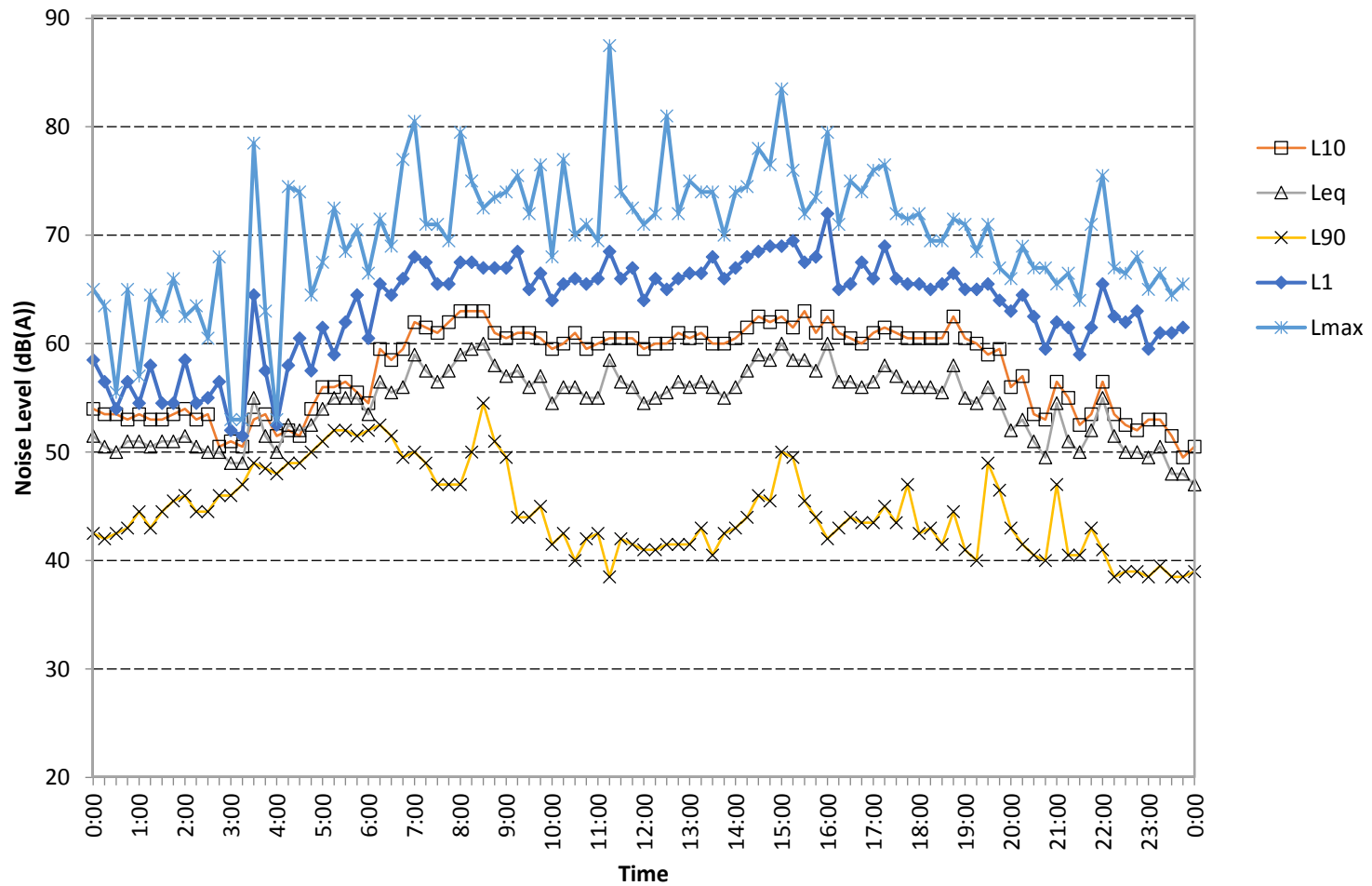
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Thursday March 15, 2018



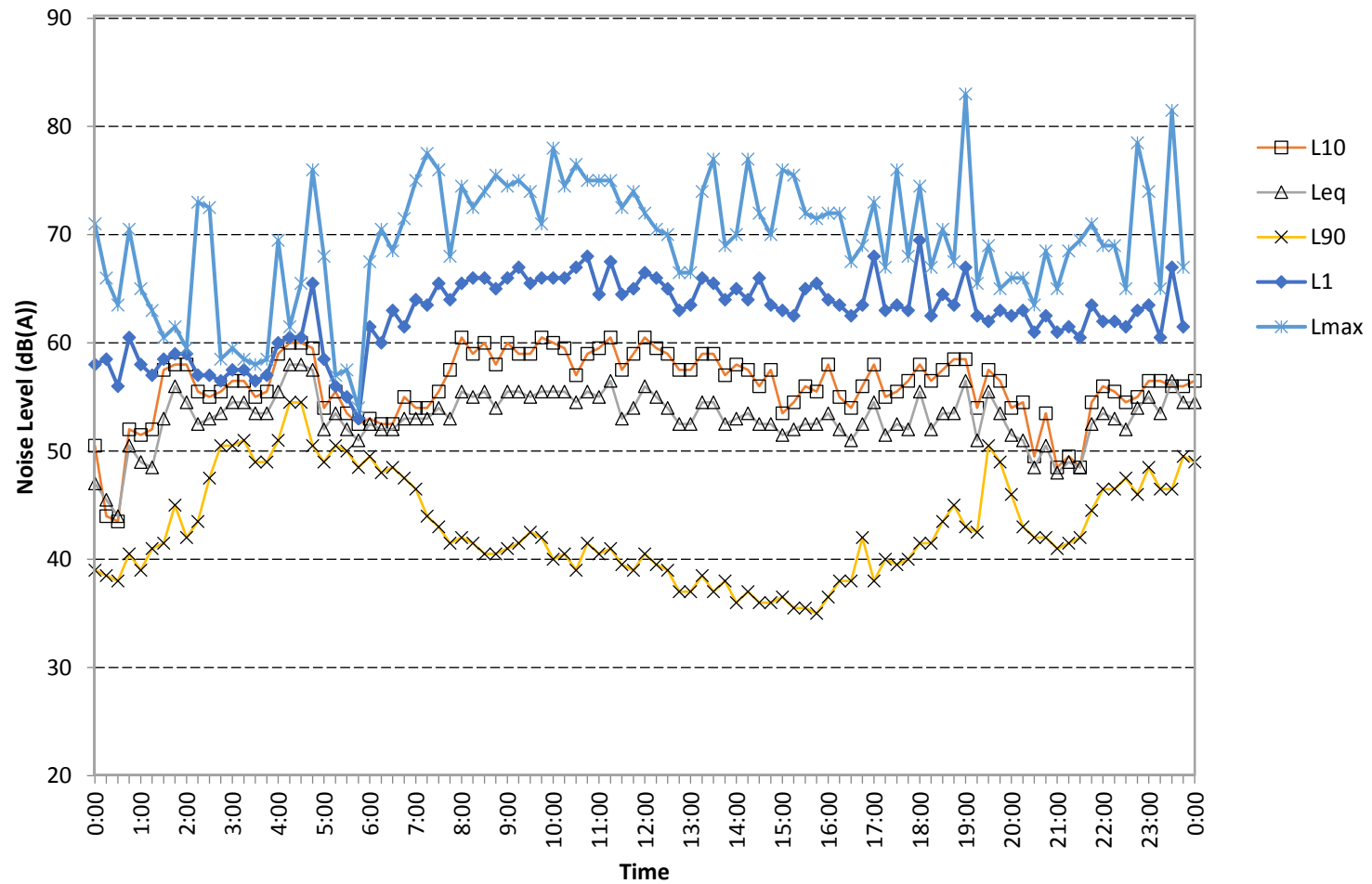
Quarry Road, Dural (Traffic Noise)

Friday March 16, 2018



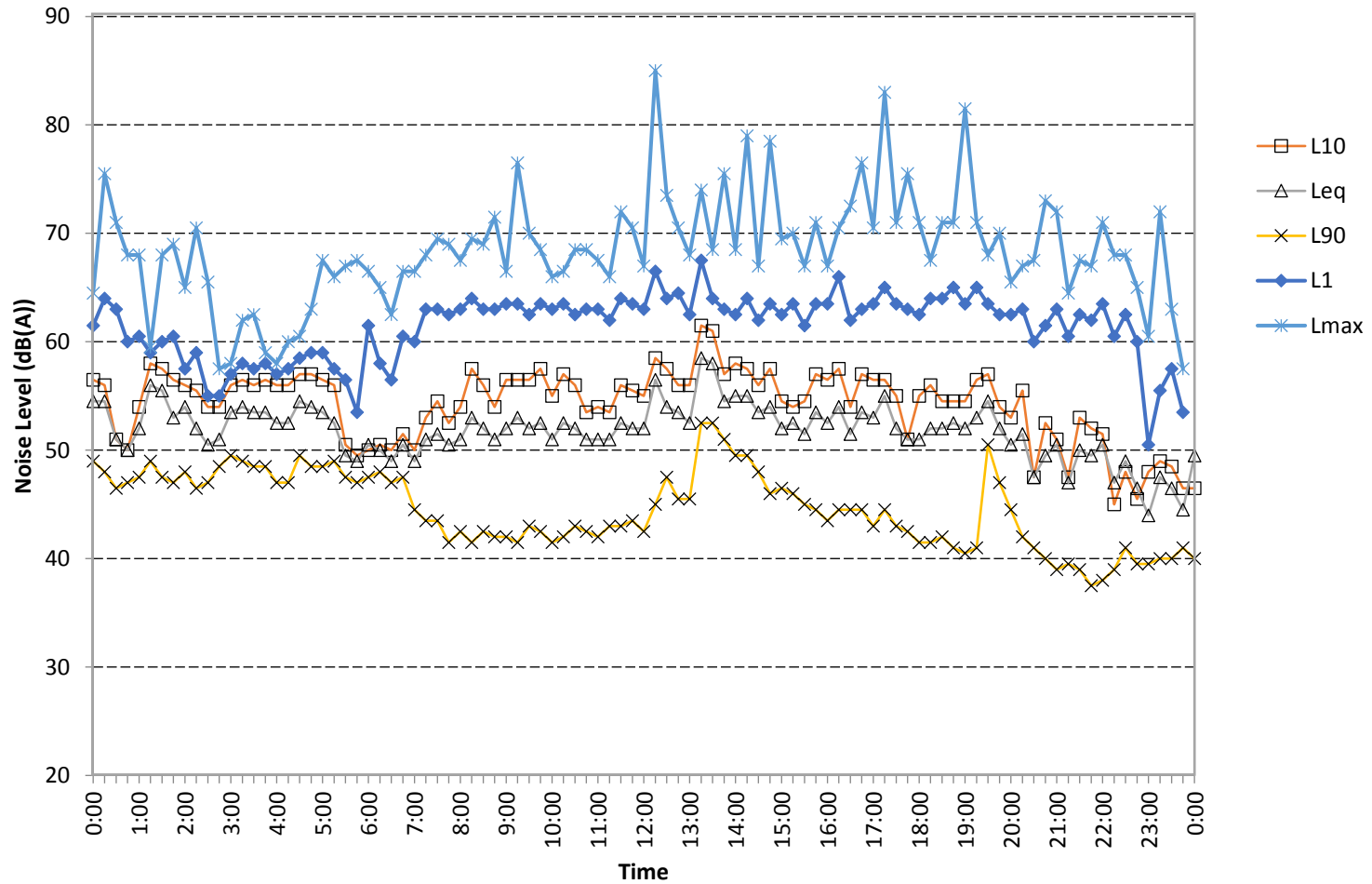
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Saturday March 17, 2018



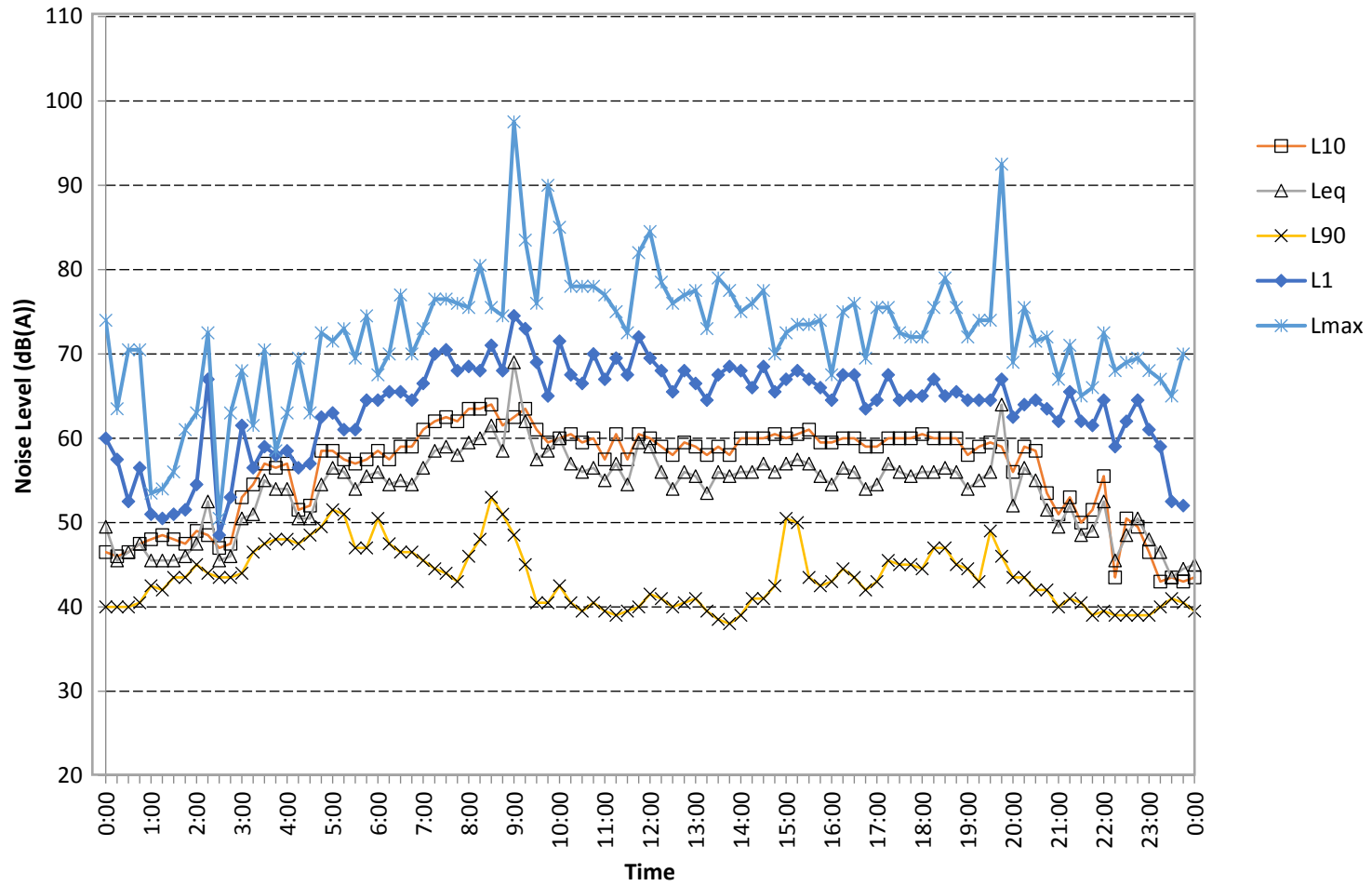
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Sunday March 18, 2018



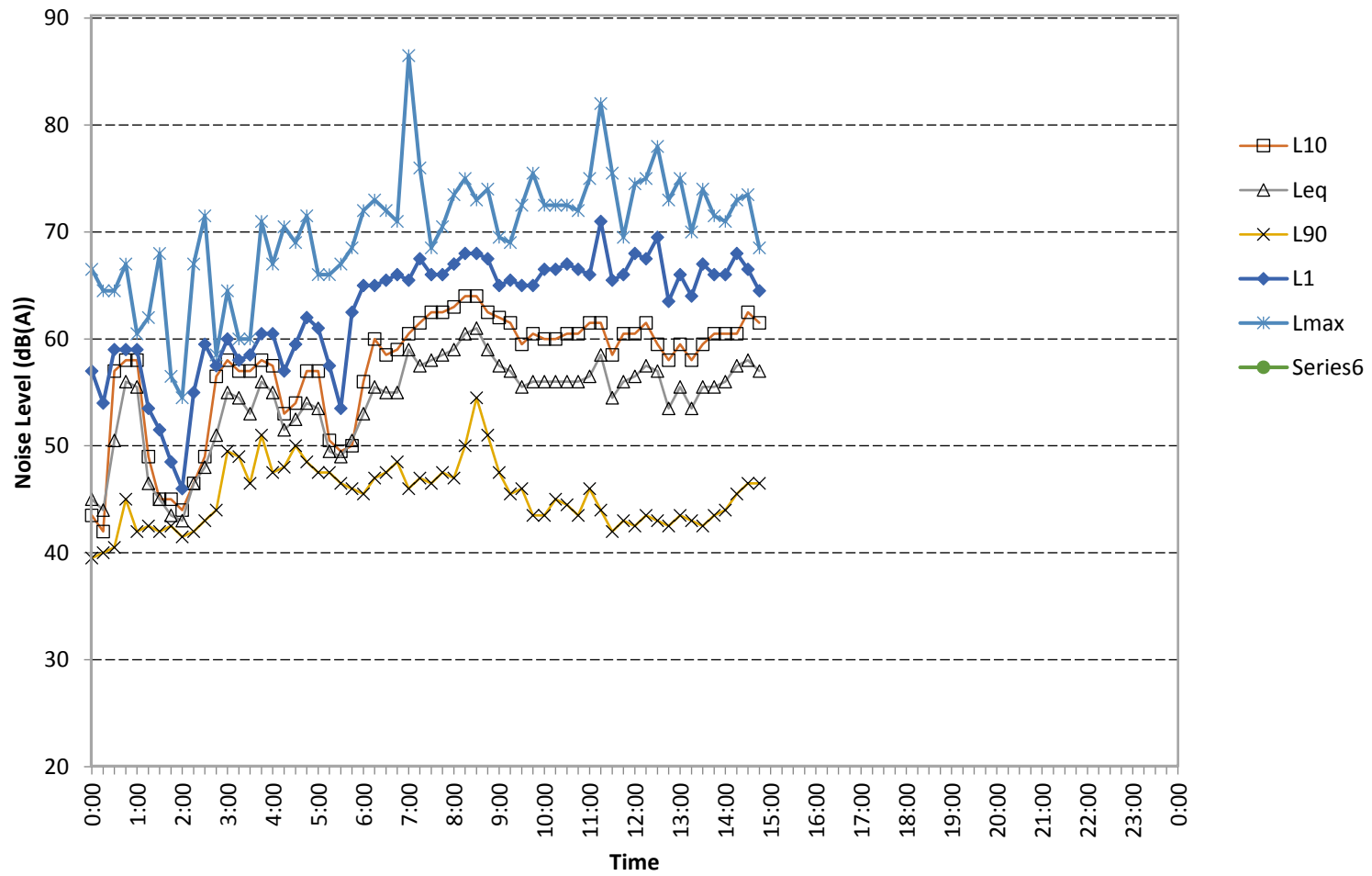
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Monday March 19, 2018



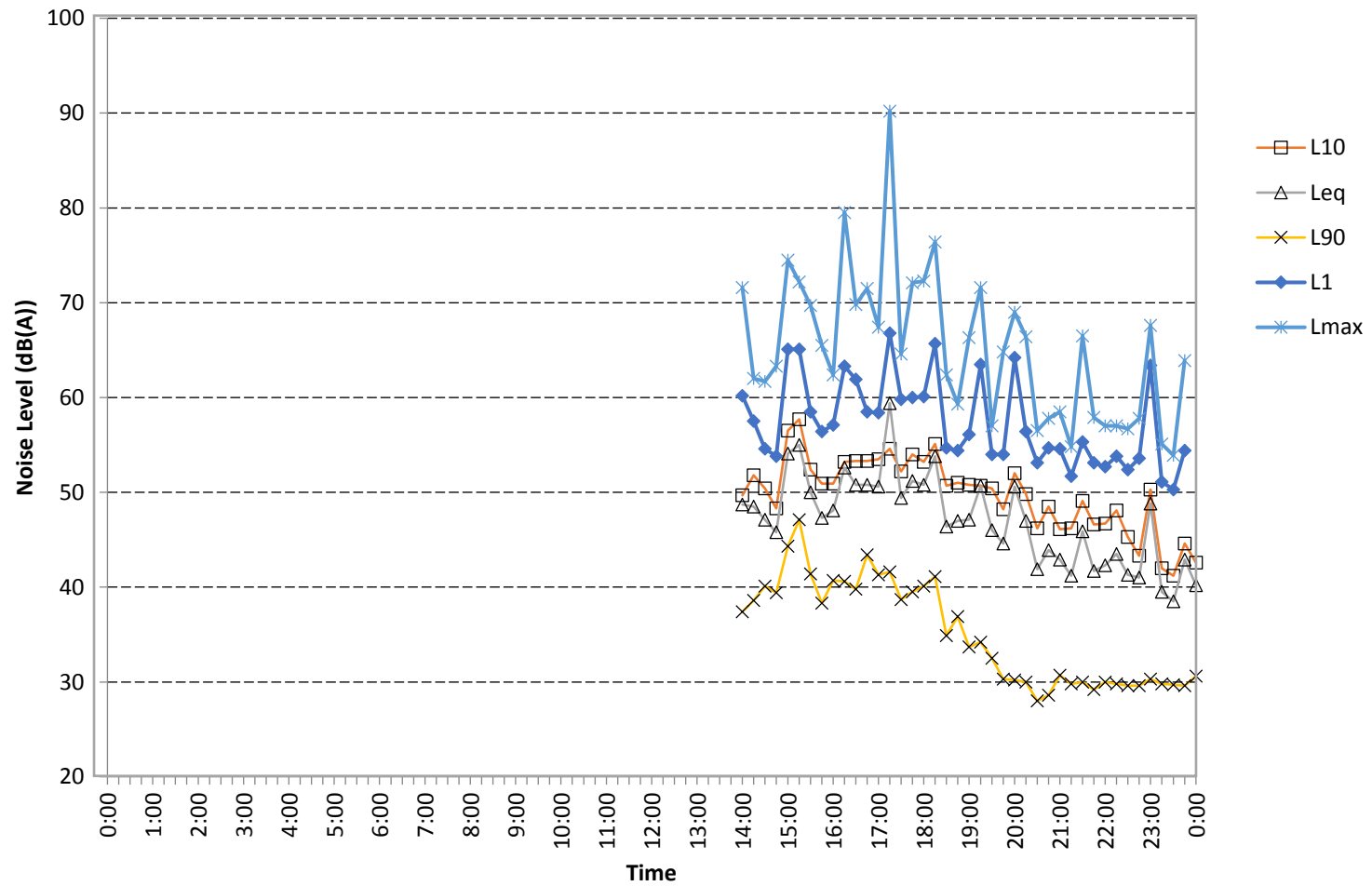
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Tuesday March 20, 2018



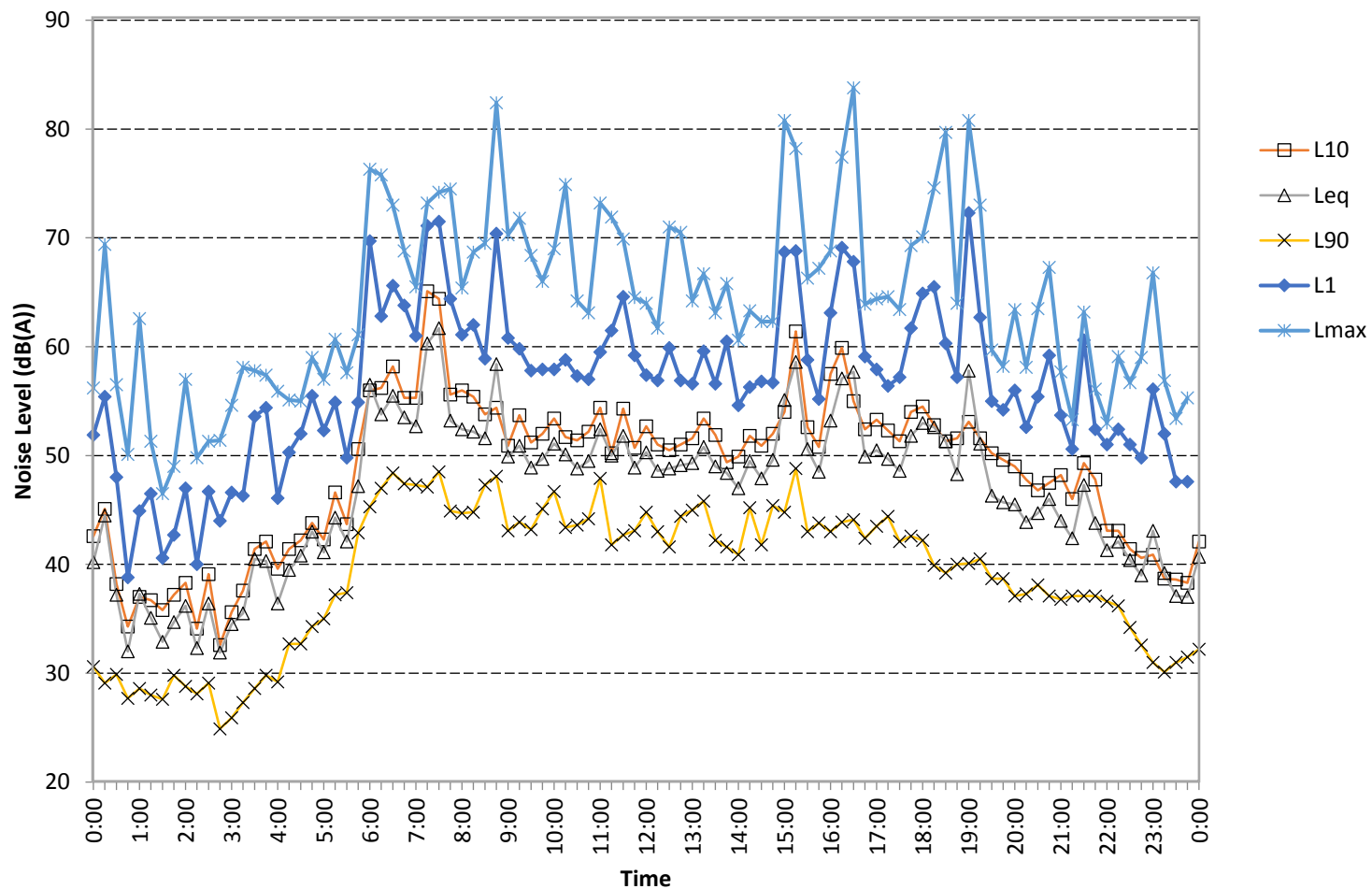
Quarry Road, Dural (Background Noise Monitor)

Tuesday March 13, 2018



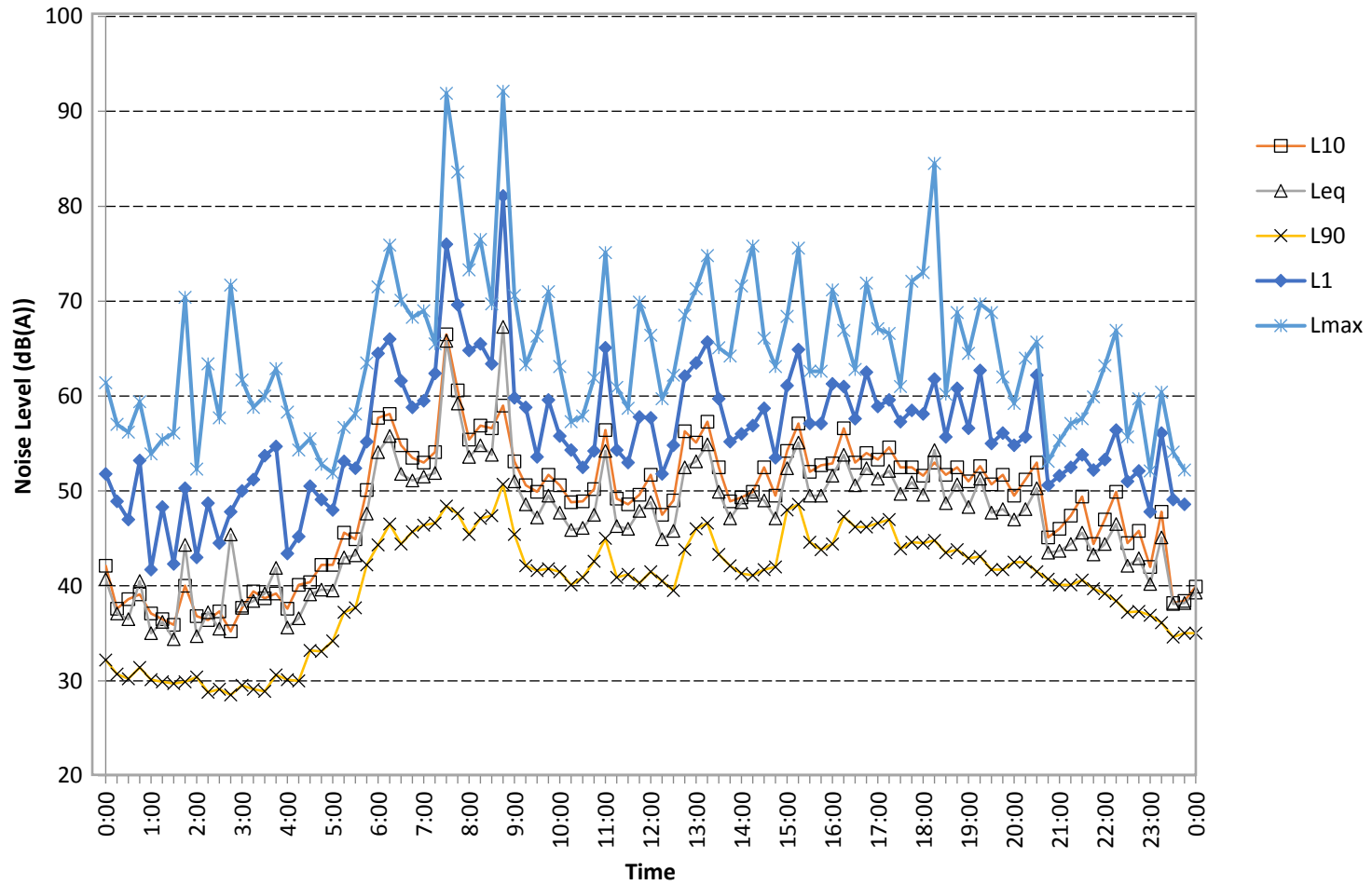
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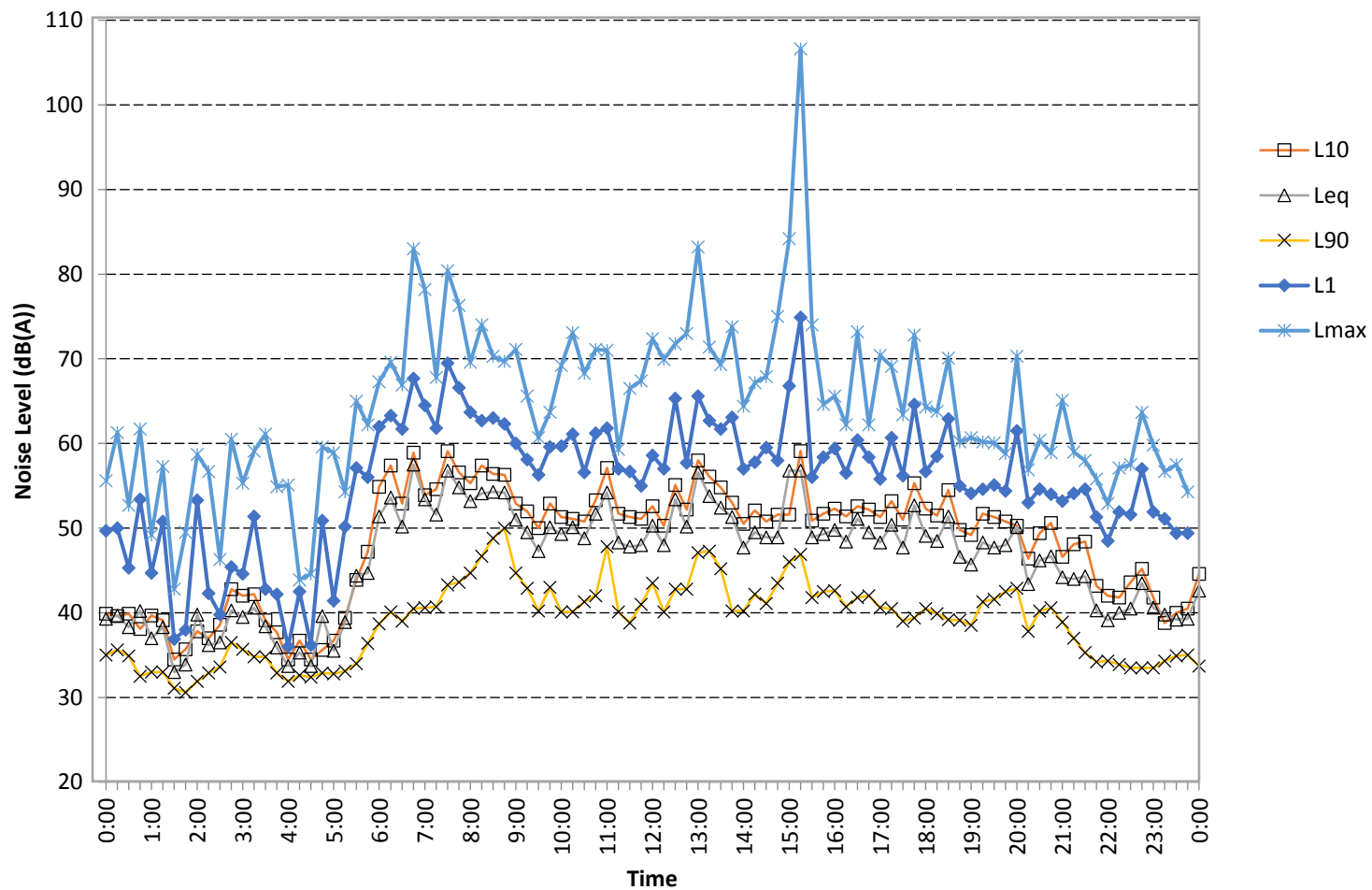
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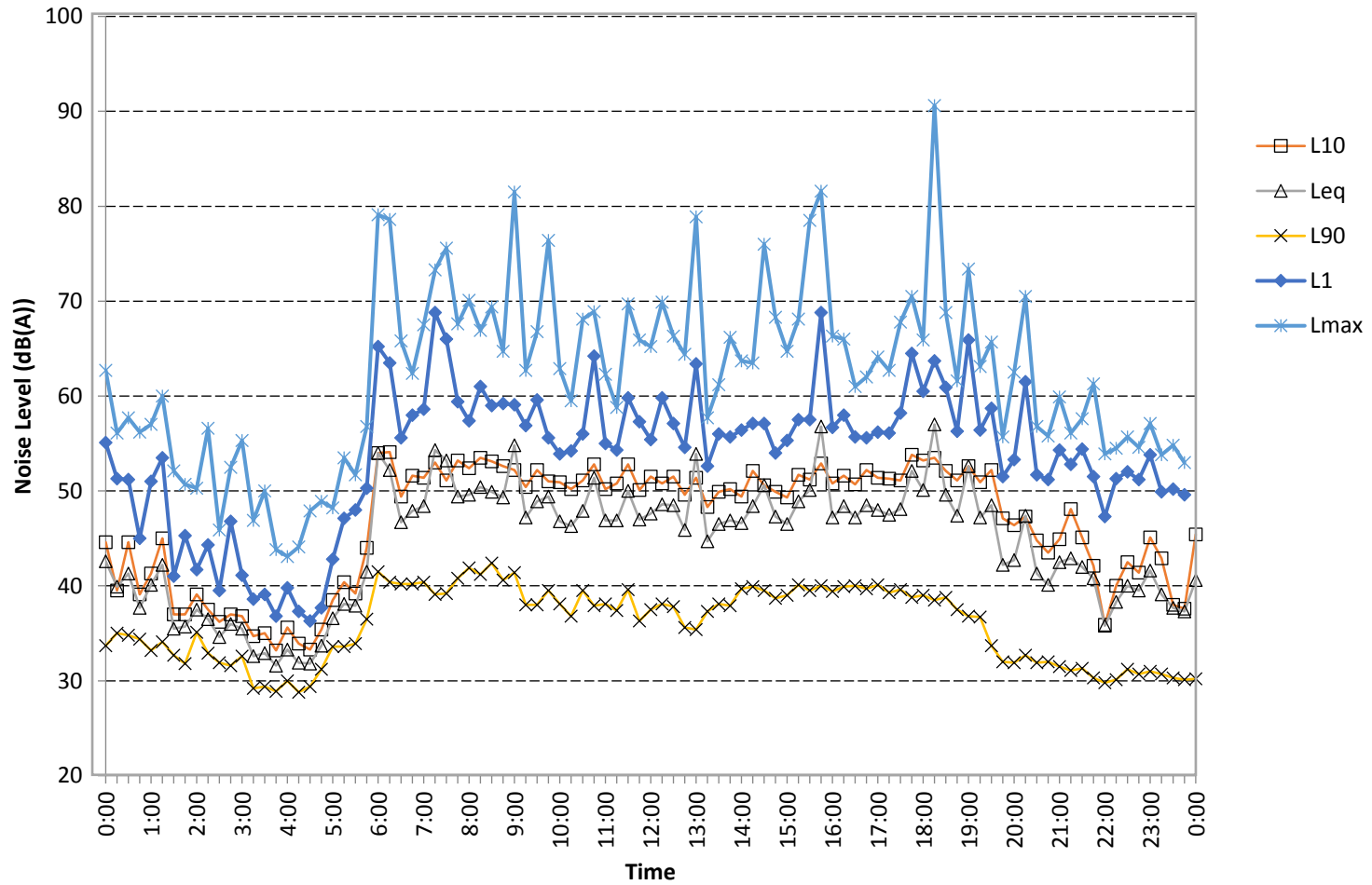
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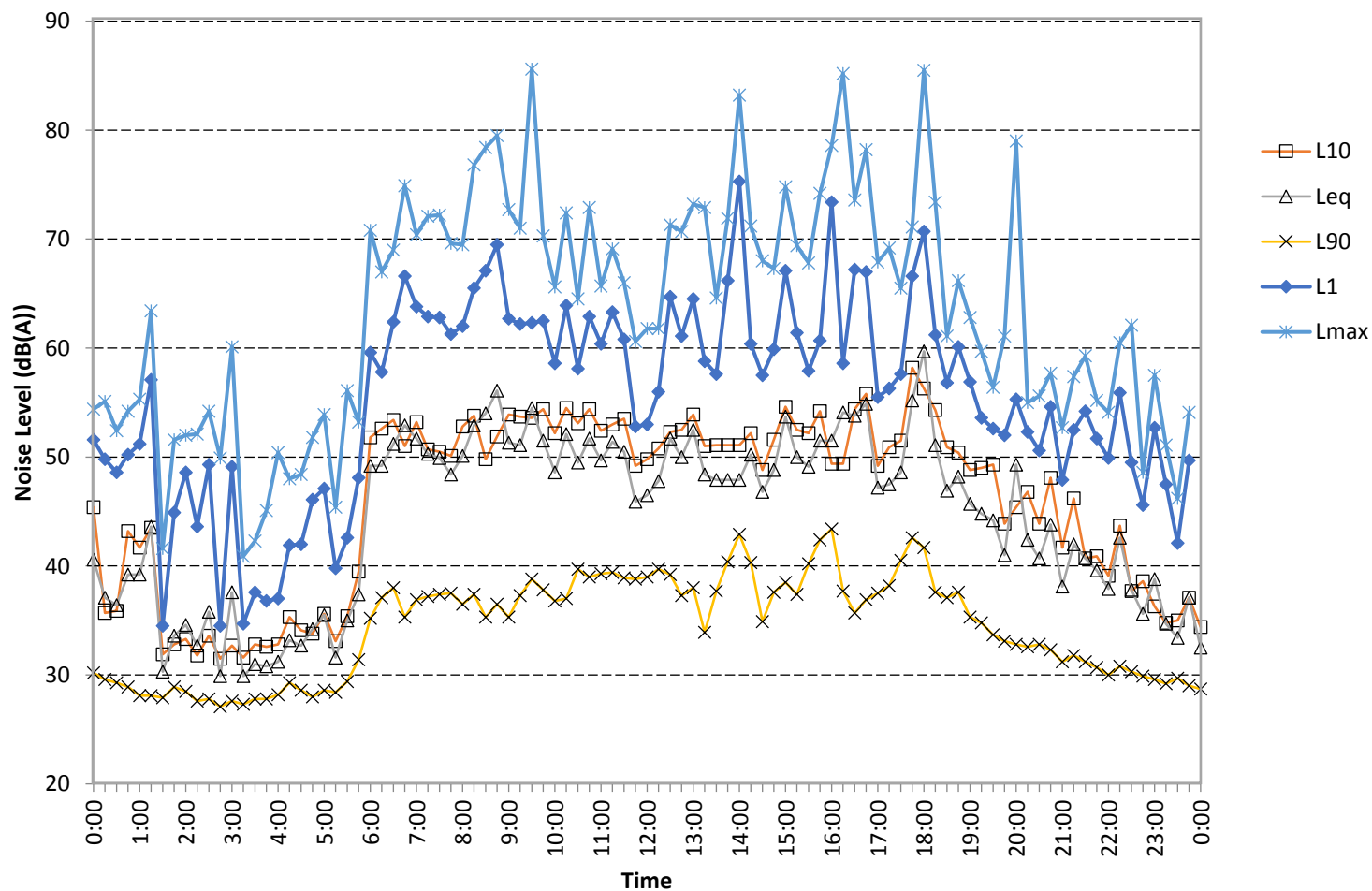
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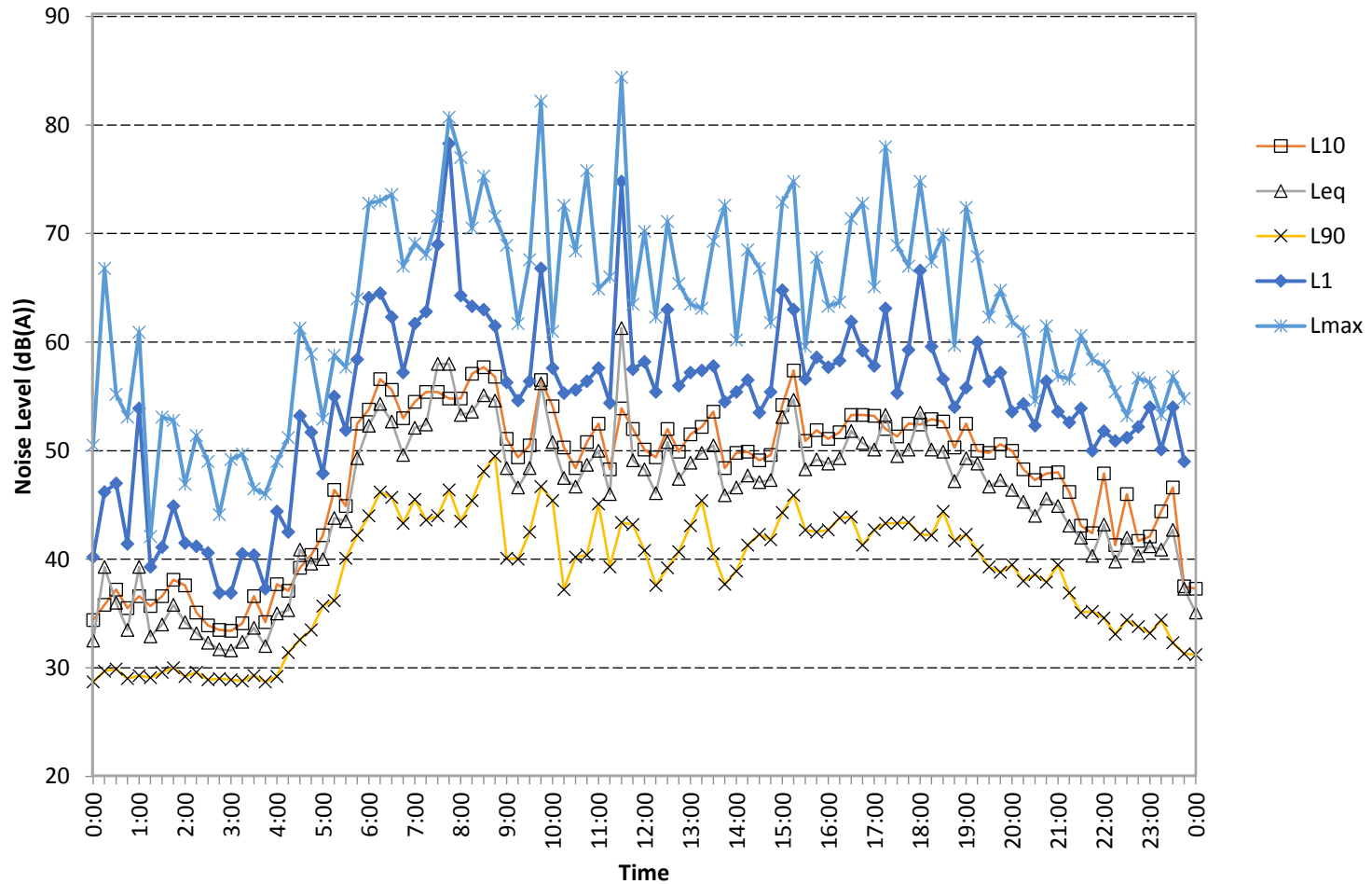
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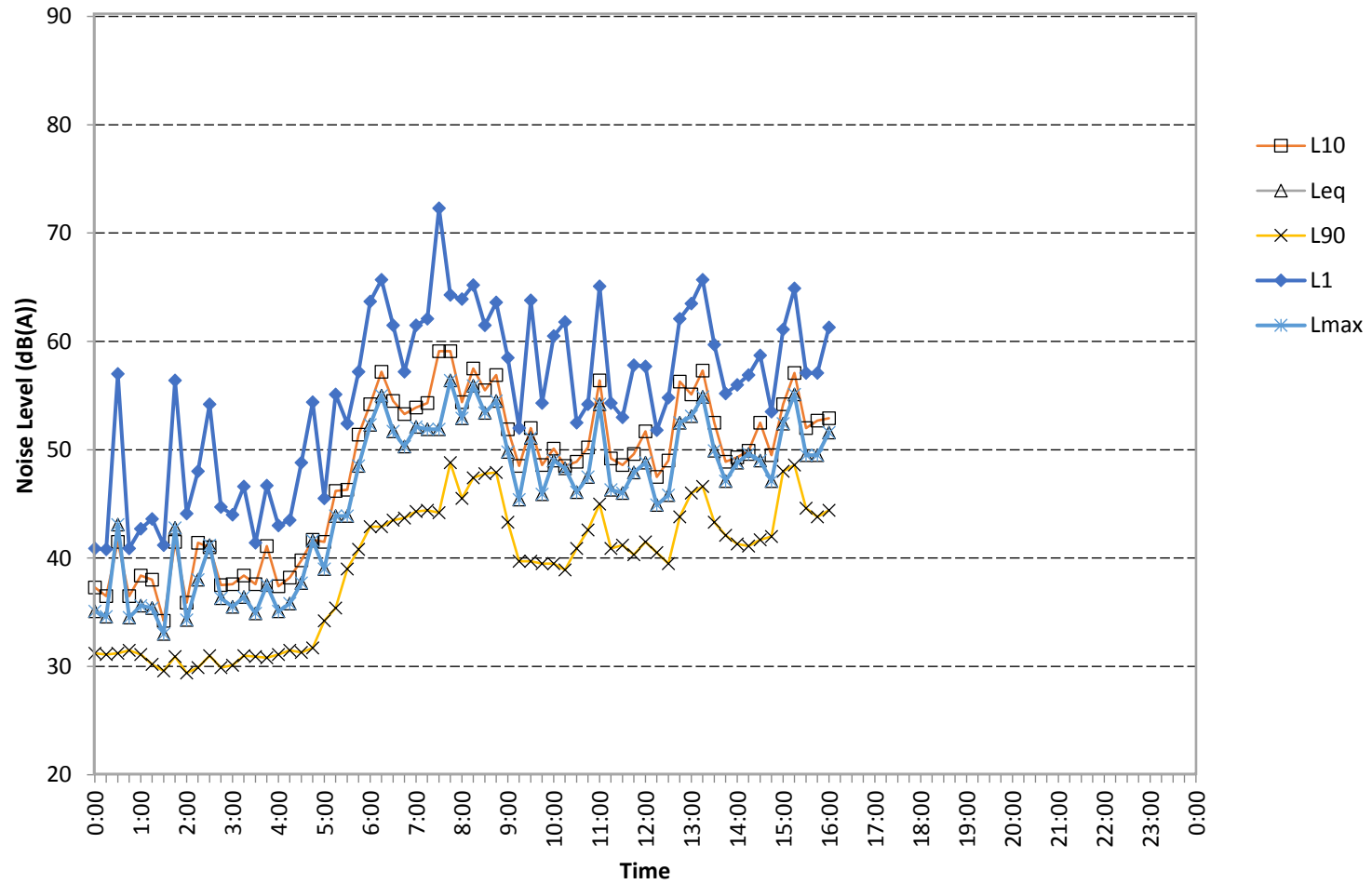
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Monday March 19, 2018



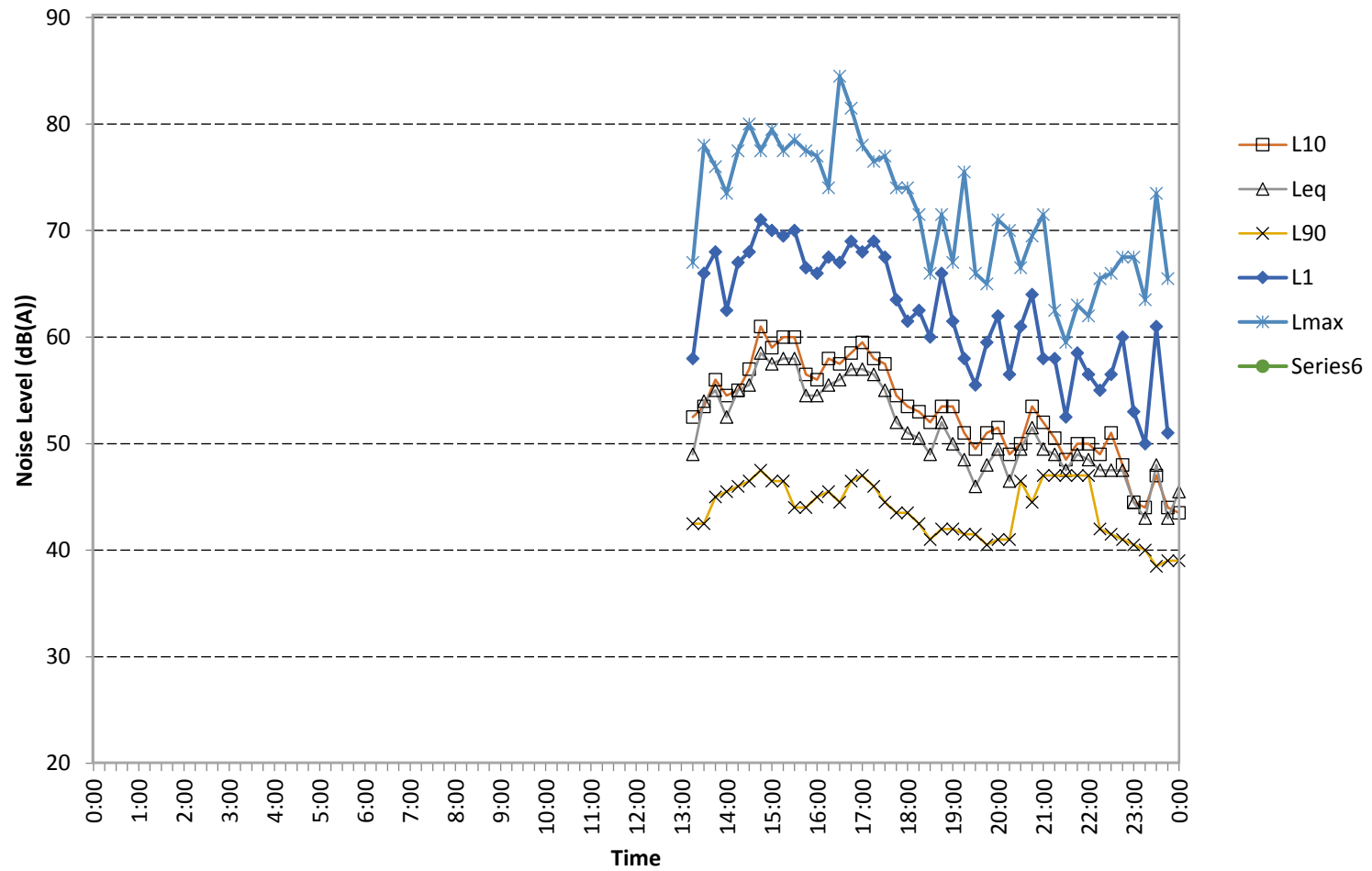
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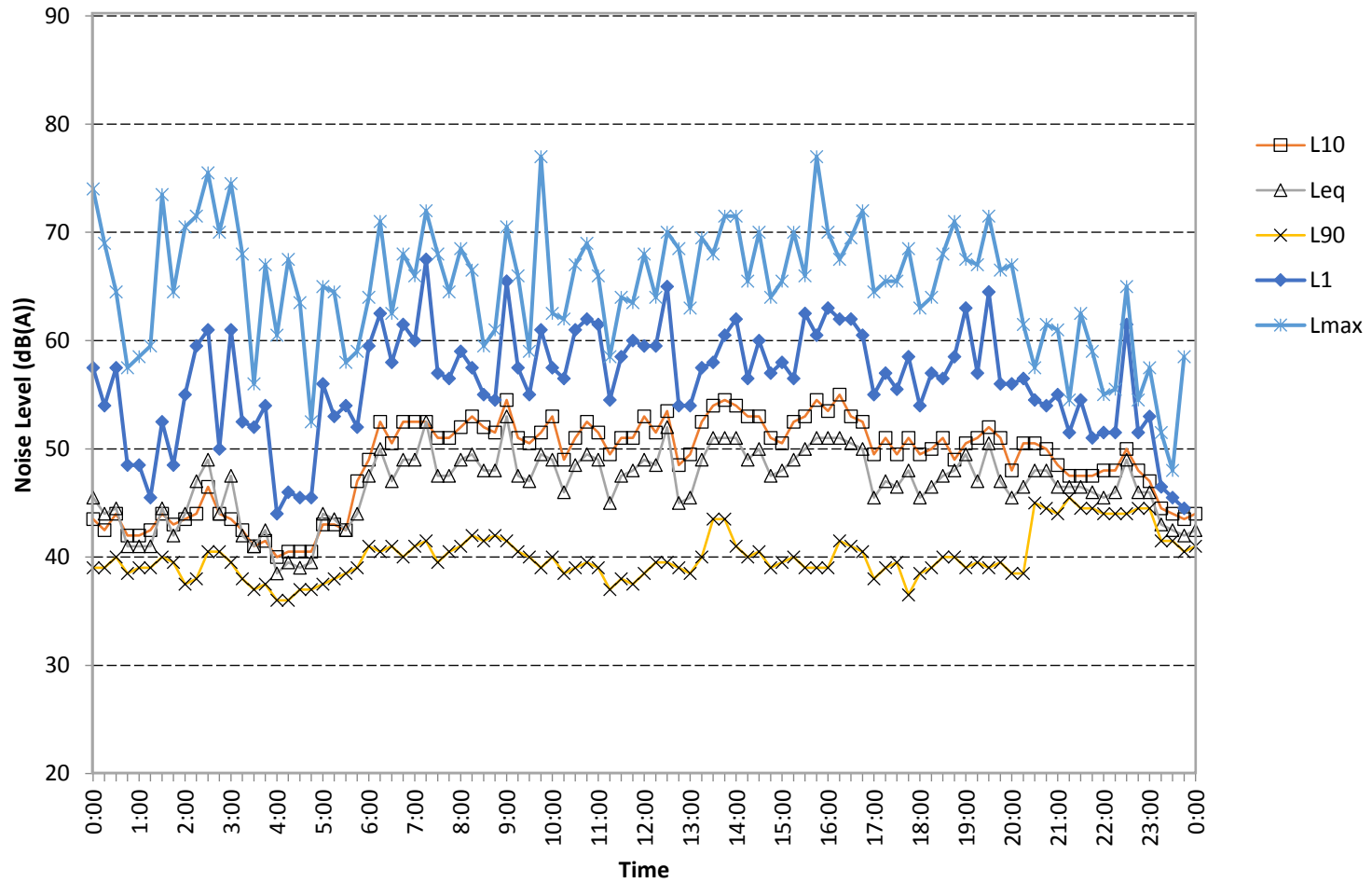
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Tuesday January 23, 2018



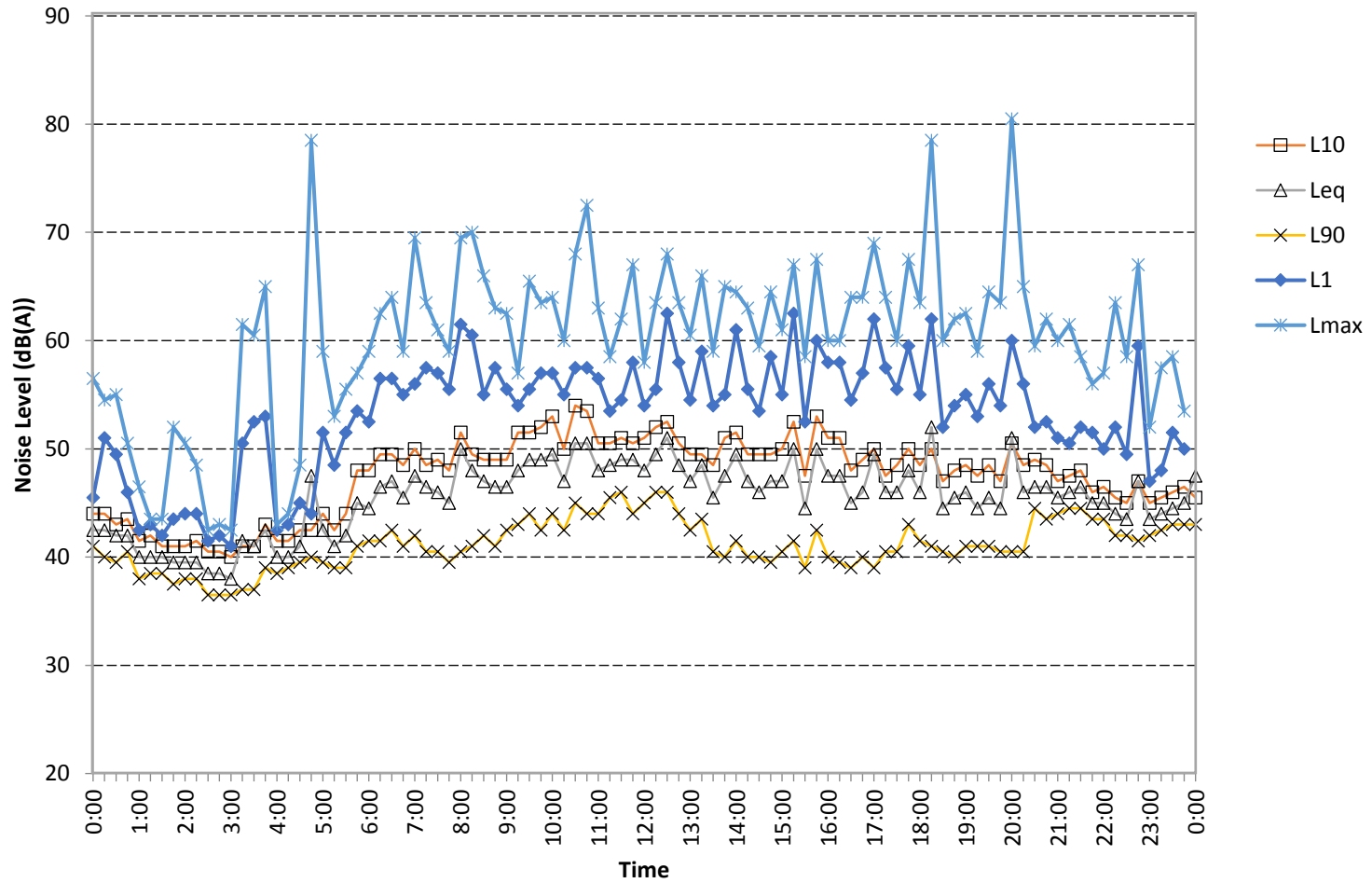
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Wednesday January 24, 2018



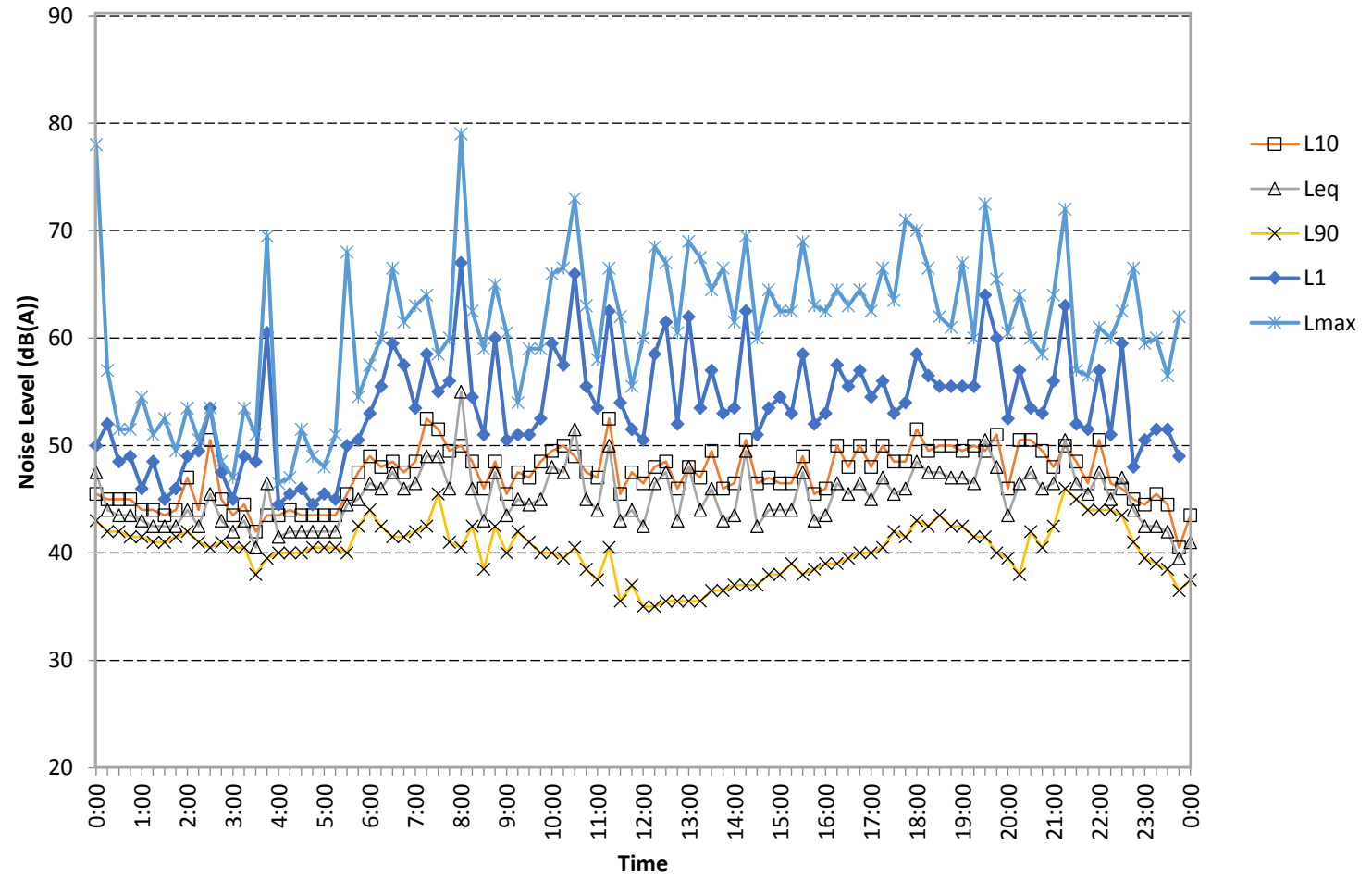
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Thursday January 25, 2018



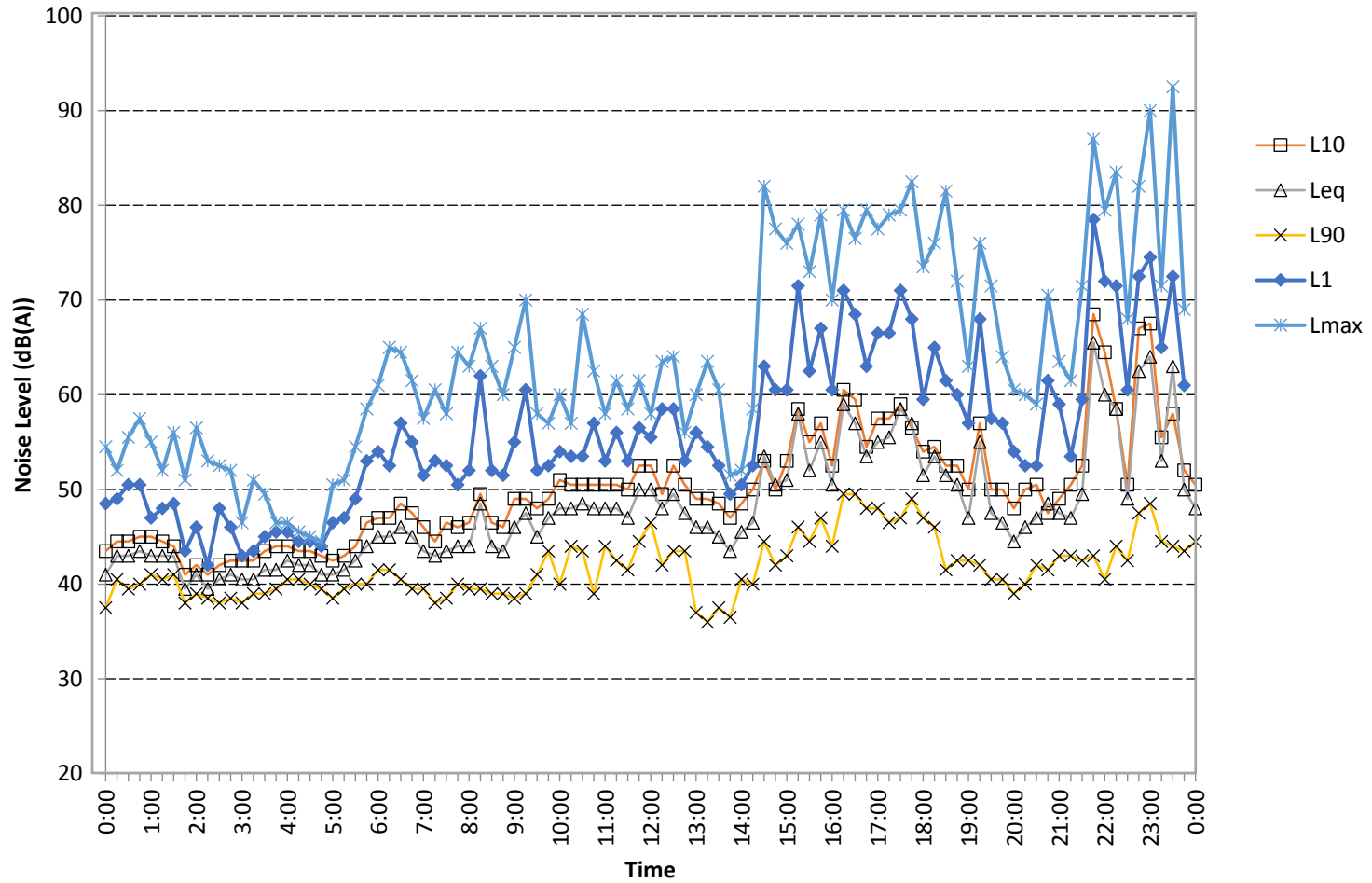
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Friday January 26,2018



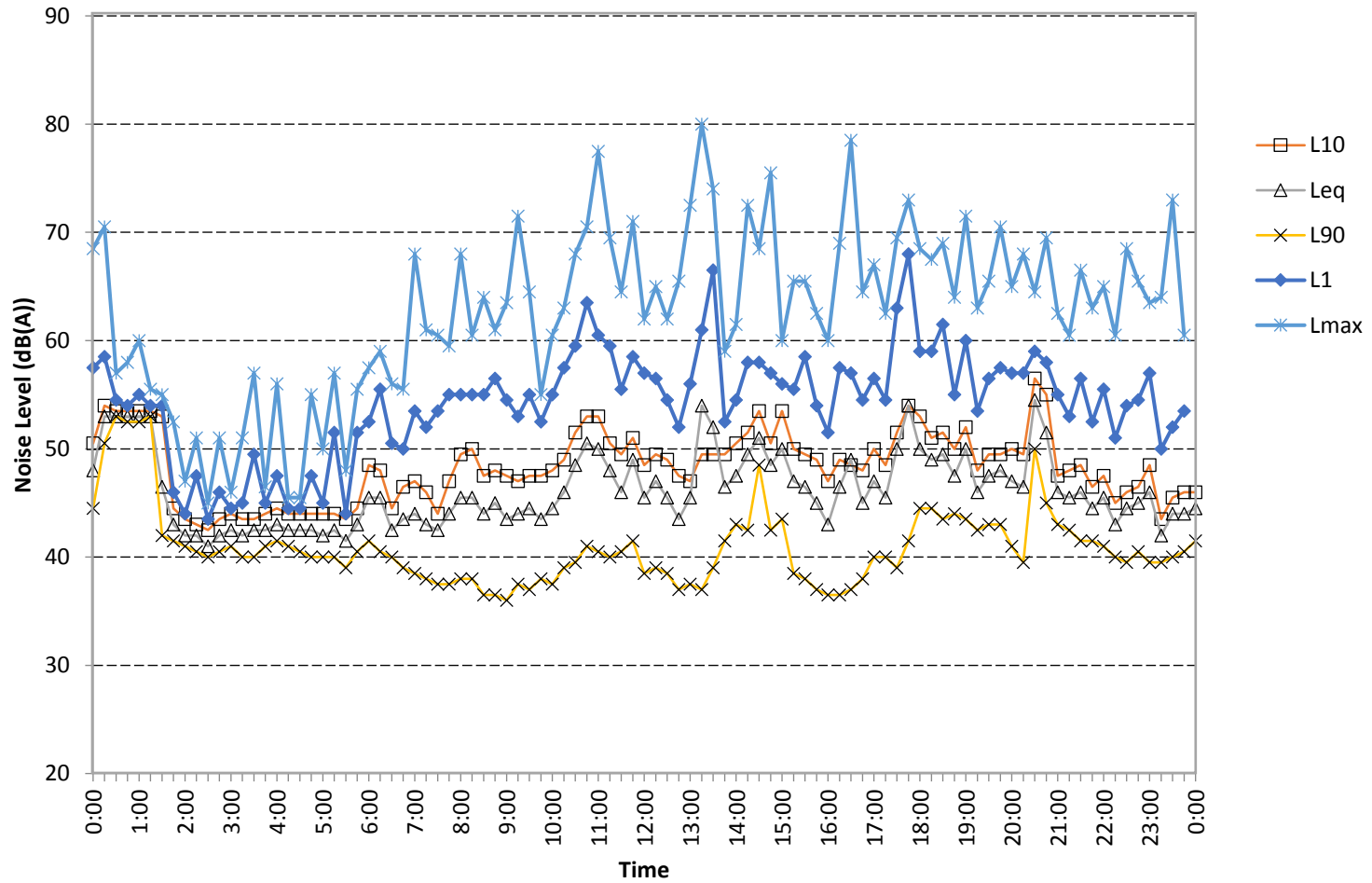
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Saturday January 27,2018



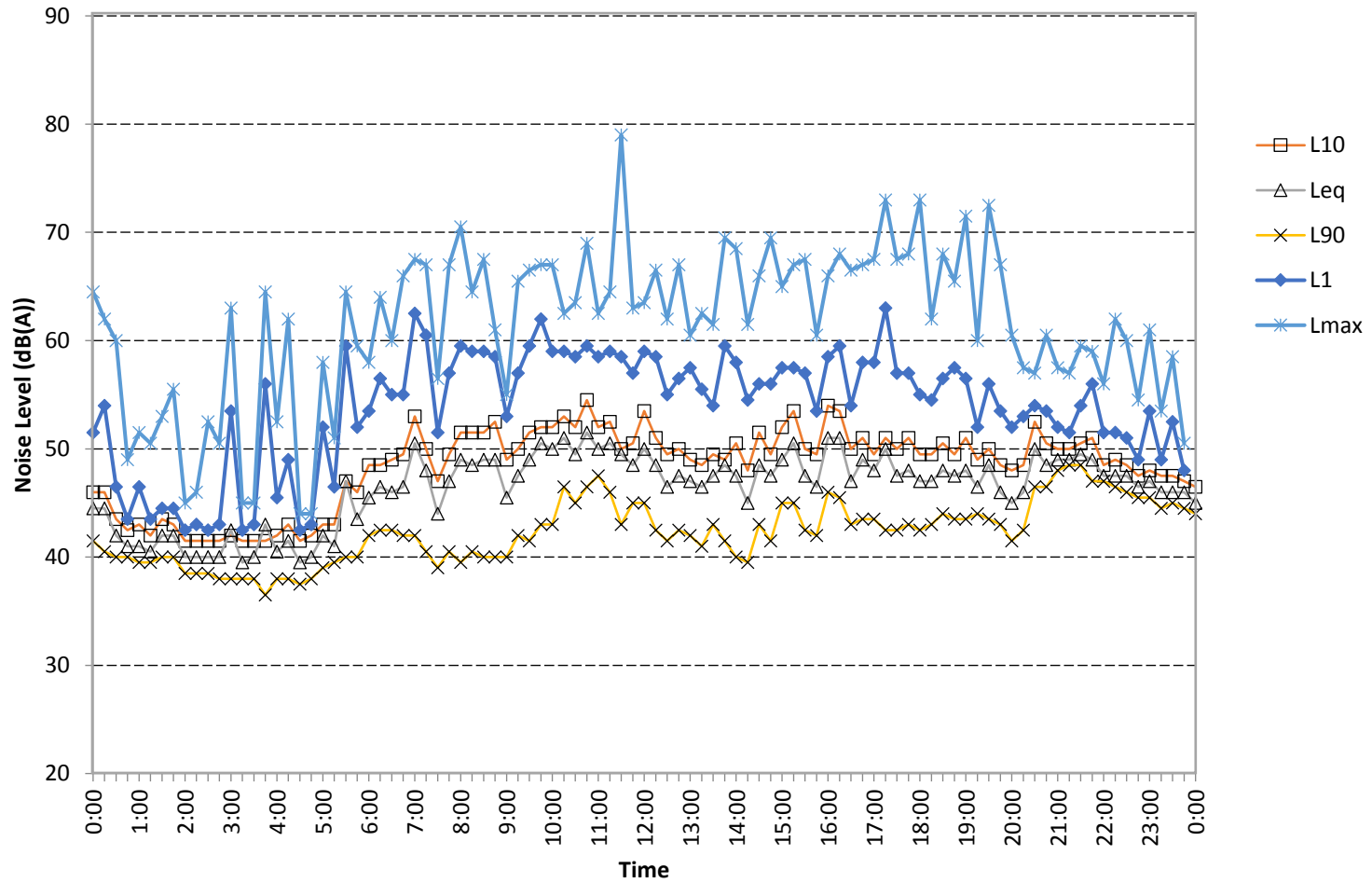
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Sunday January 28,2018



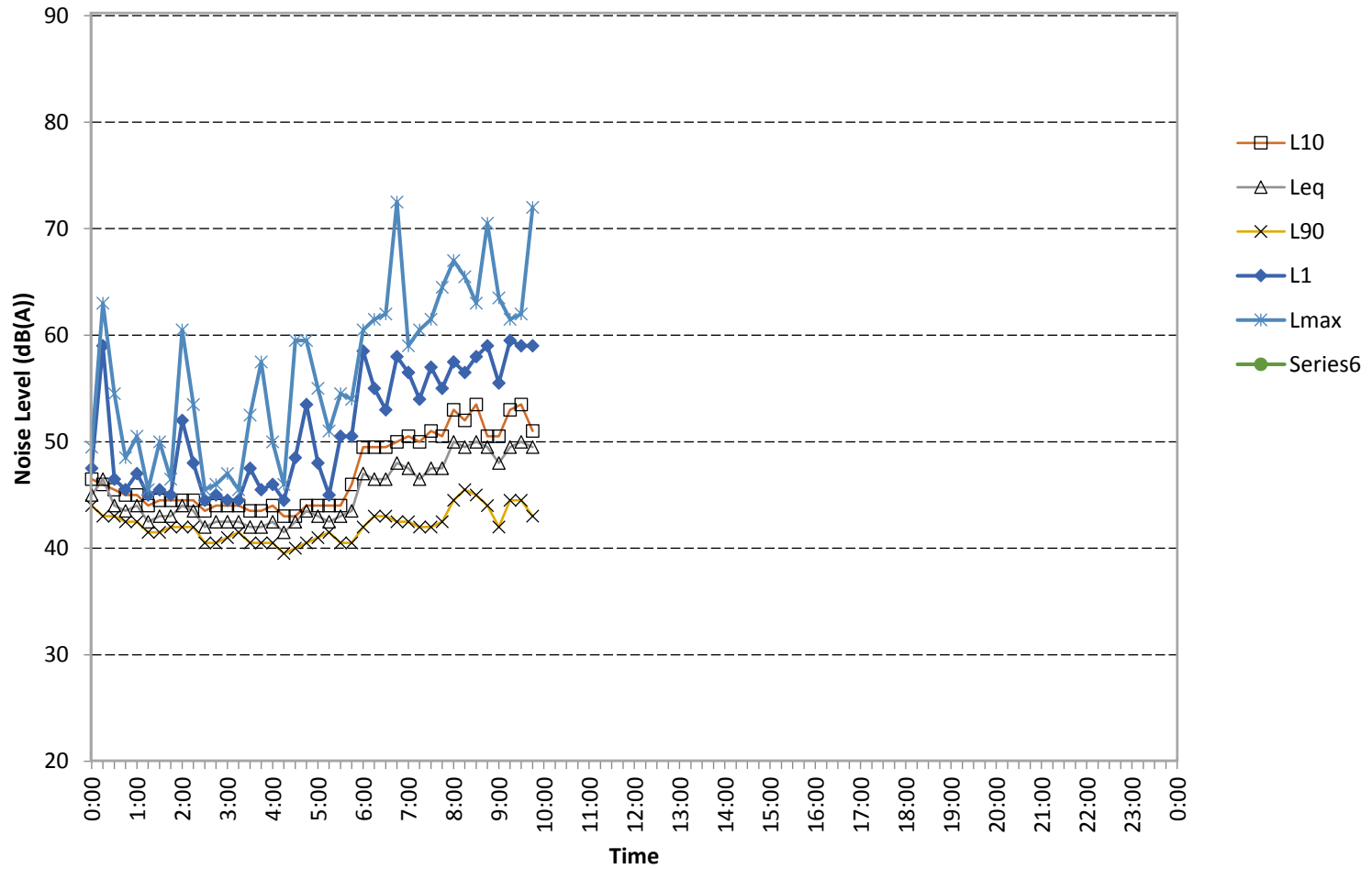
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Monday January 29, 2018



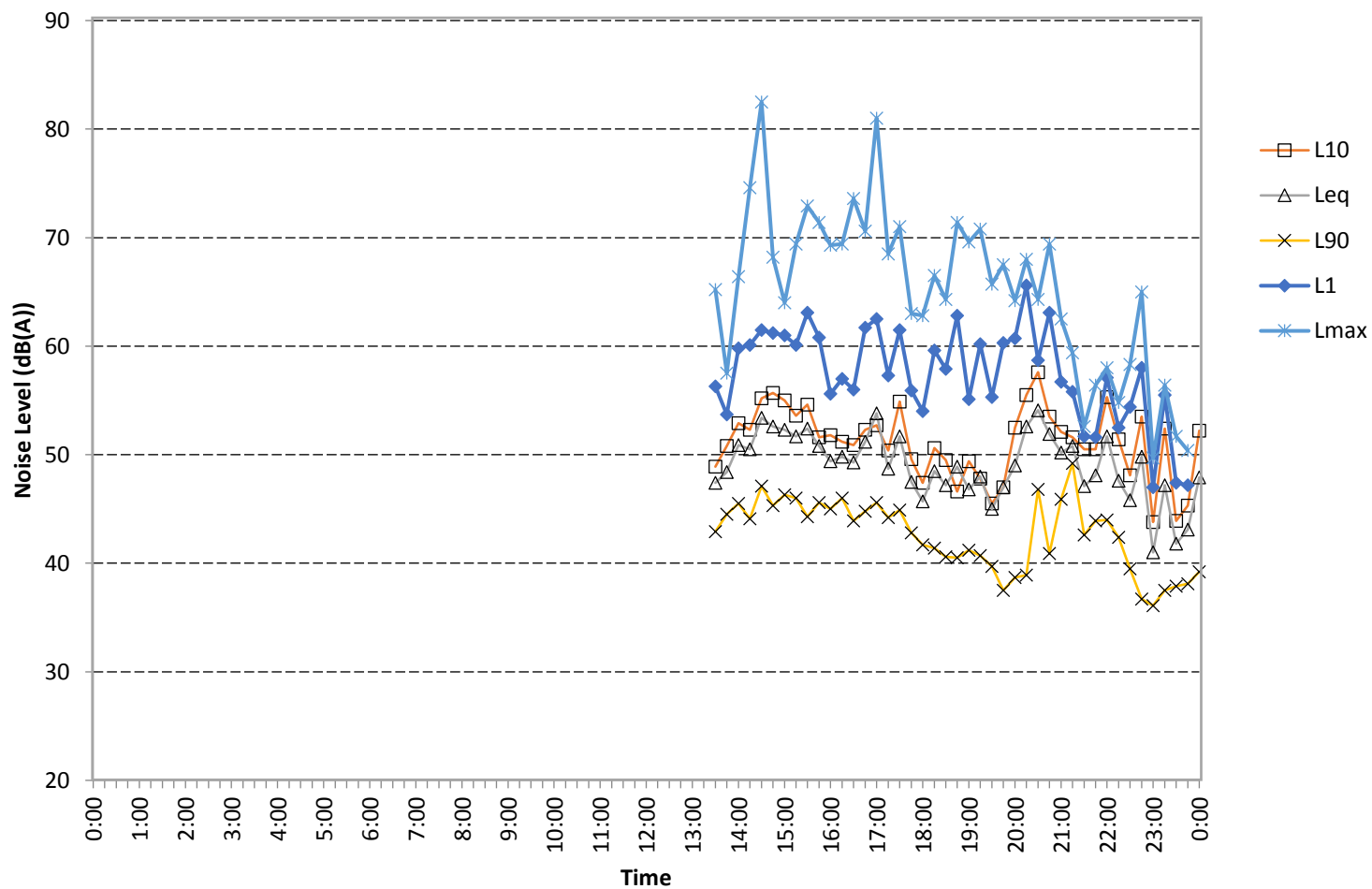
Eastern Boundary (Facing Green Gallery - 5 Quarry Road)

Tuesday January 30,2018



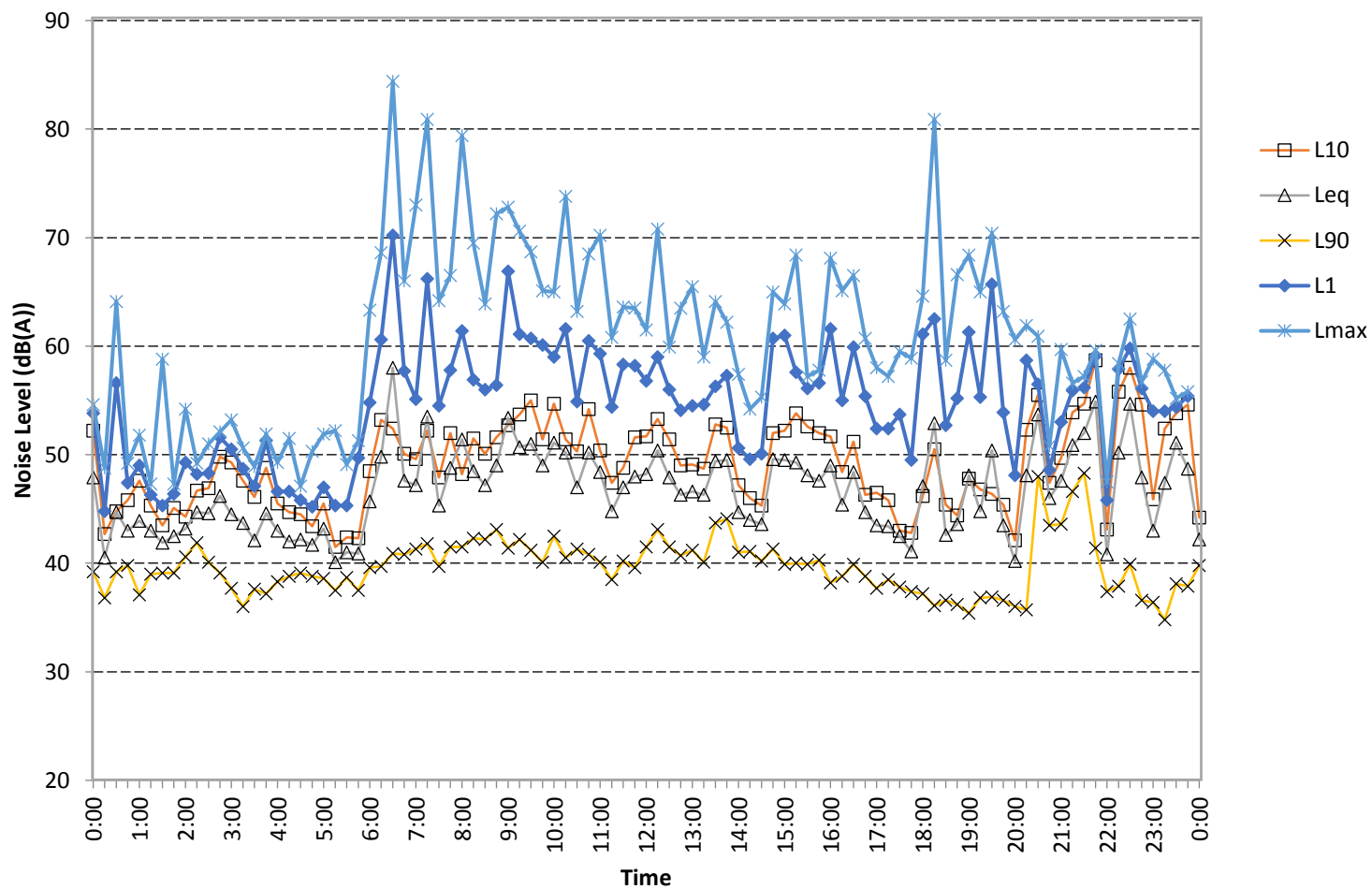
Western boundary (Facing Dural Farm Florist)

Wednesday January 23, 2019



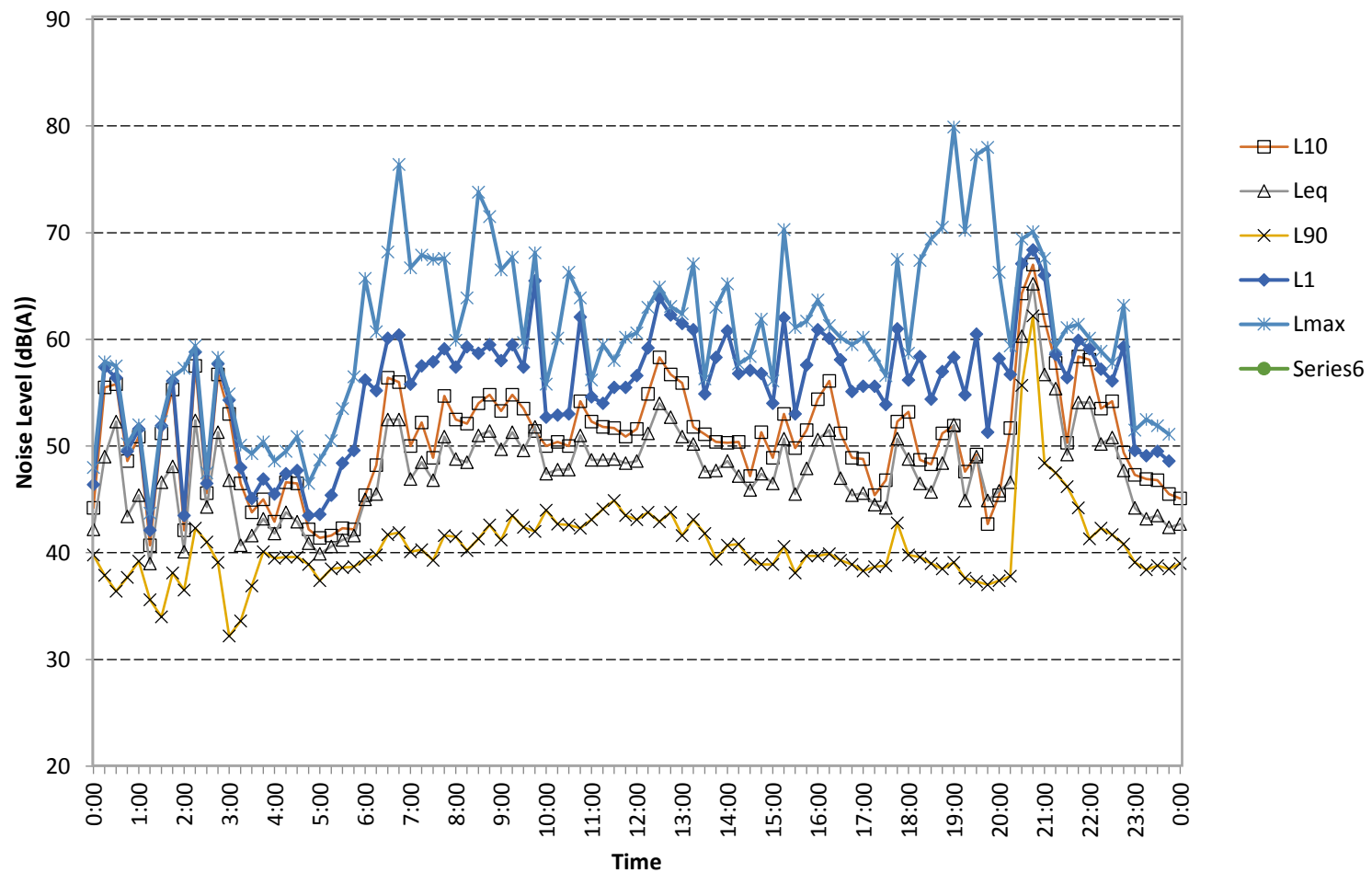
Western boundary (Facing Dural Farm Florist)

Thursday January 24, 2019



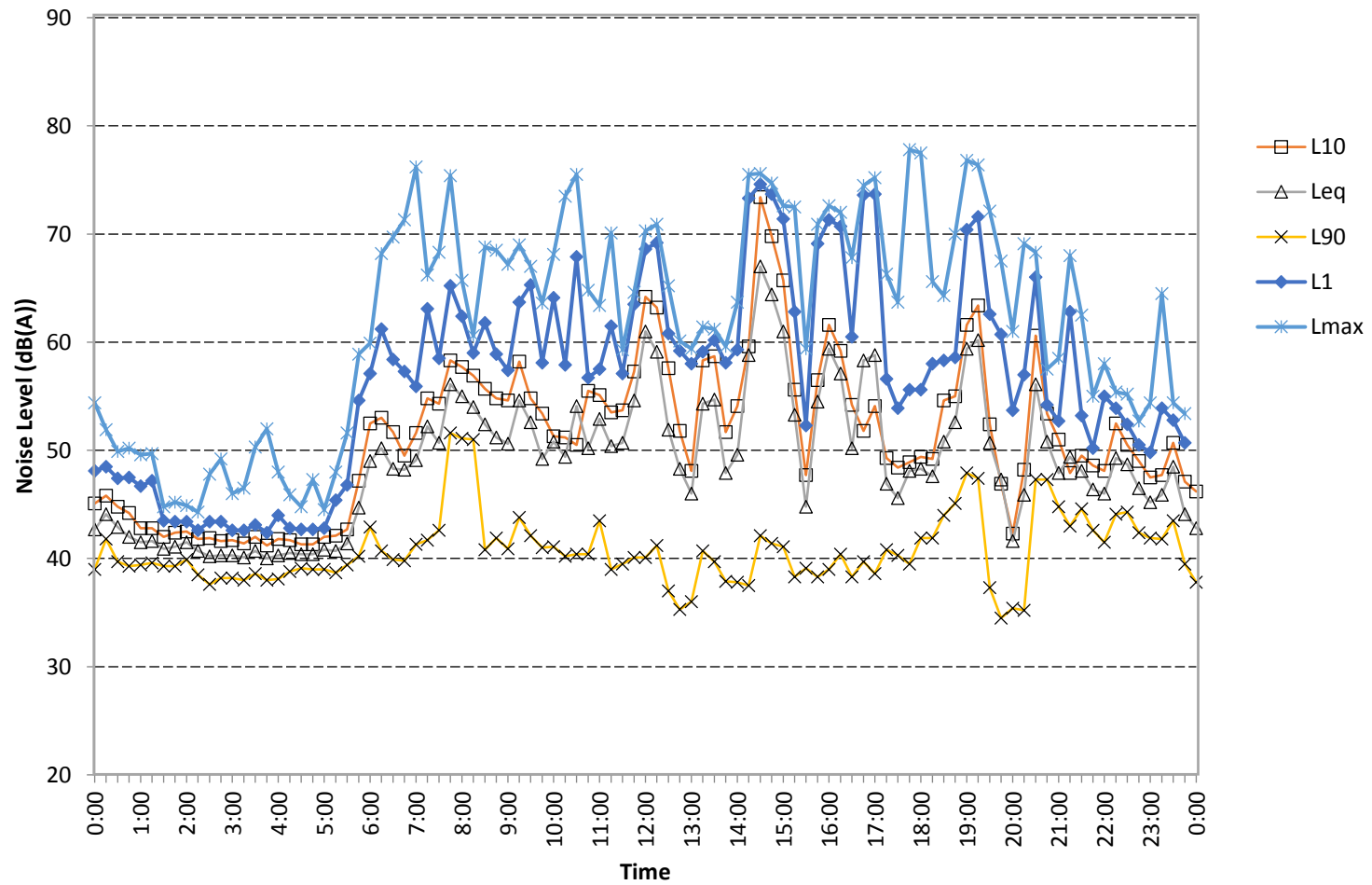
Western boundary (Facing Dural Farm Florist)

Friday January 25, 2019



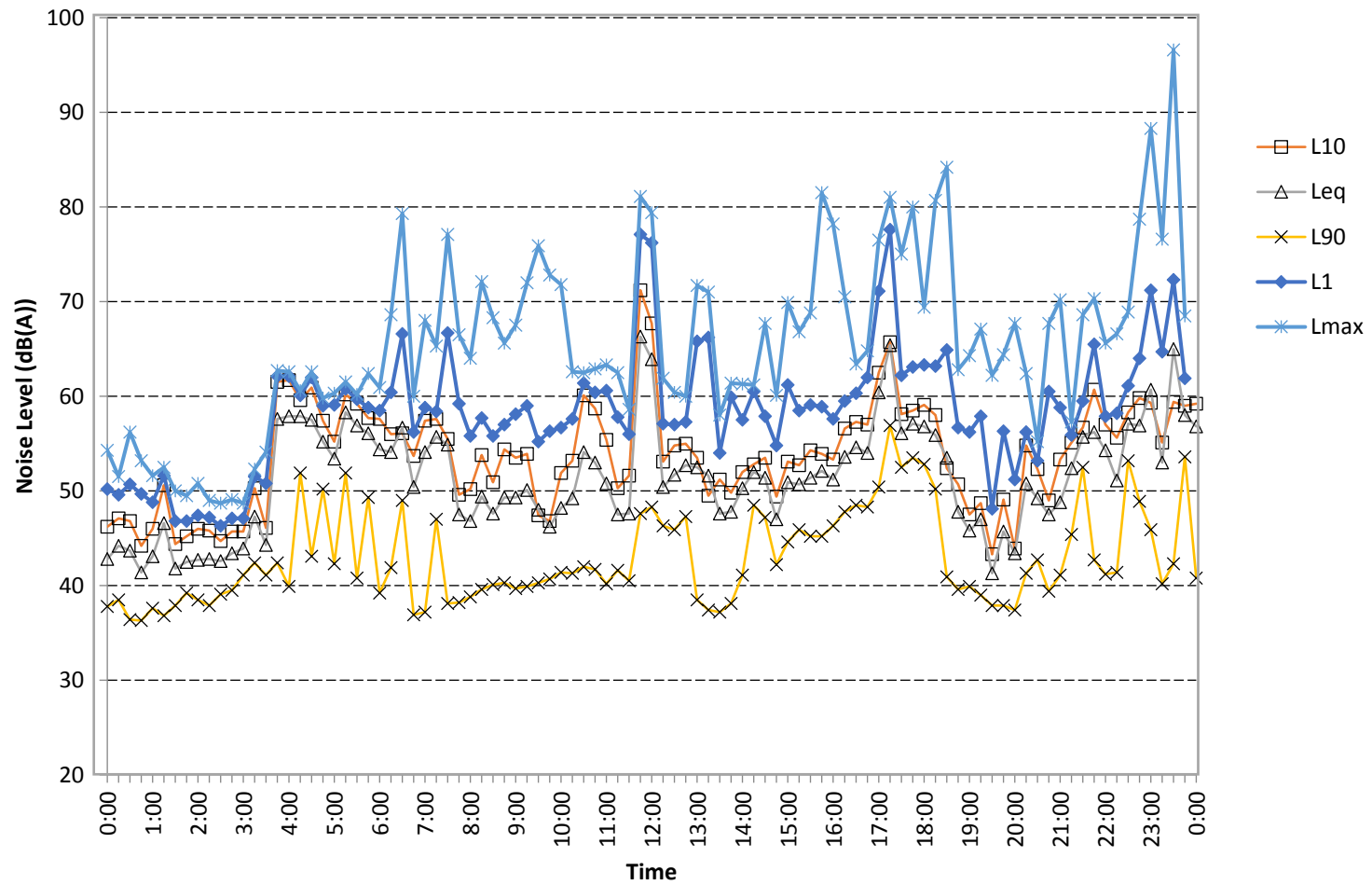
Western boundary (Facing Dural Farm Florist)

Saturday January 26, 2019



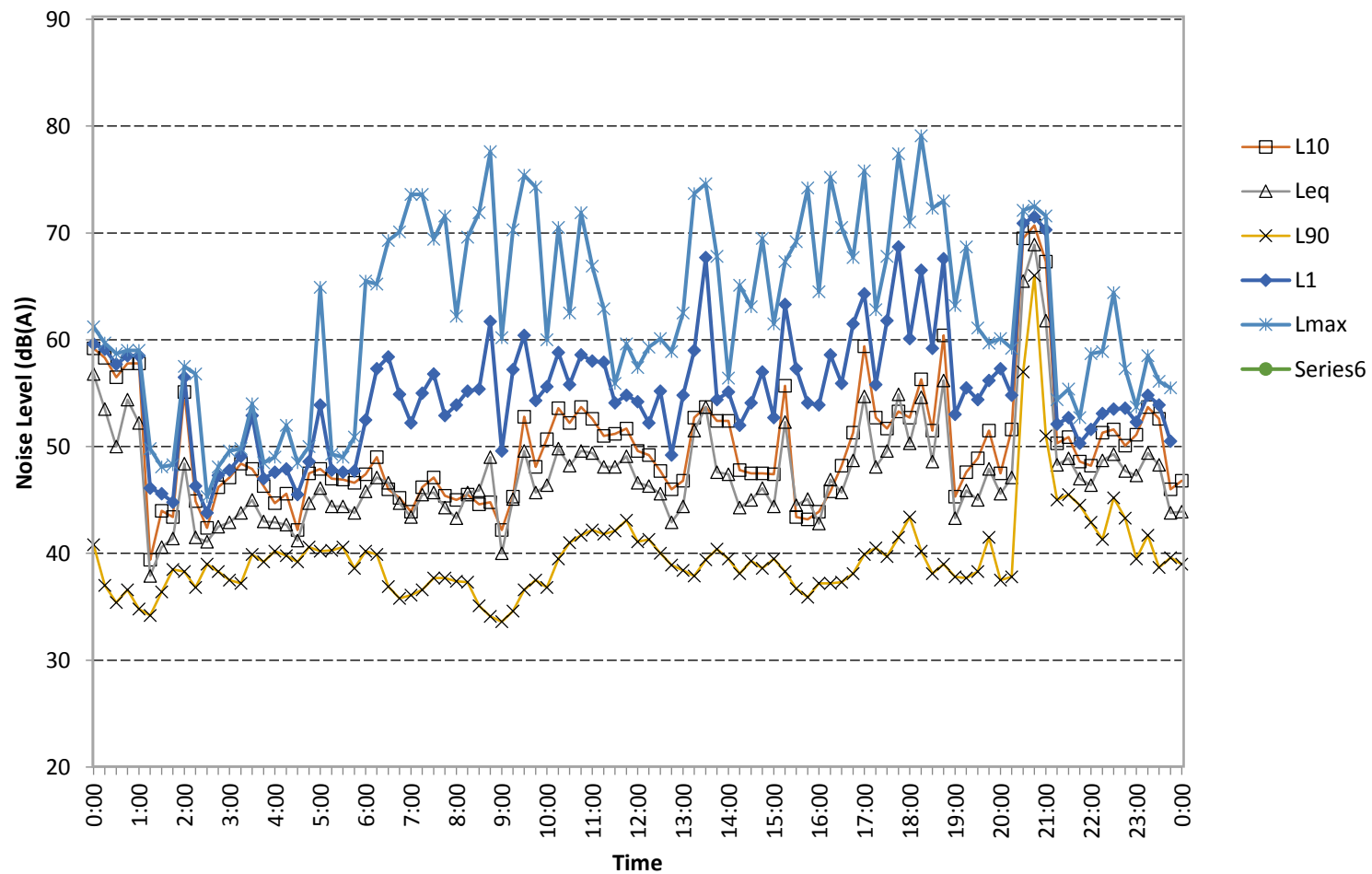
Western boundary (Facing Dural Farm Florist)

Sunday January 27, 2019



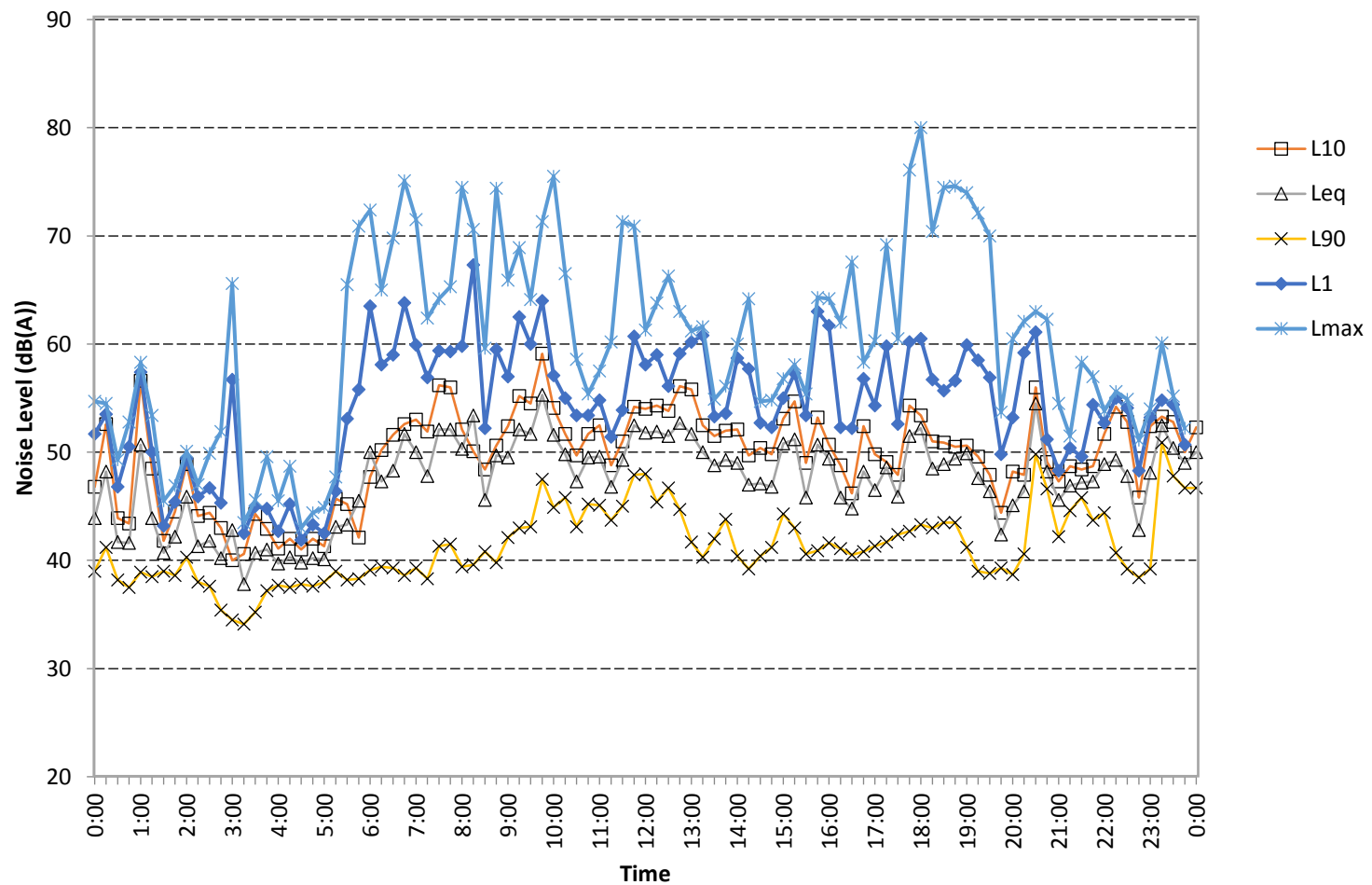
Western boundary (Facing Dural Farm Florist)

Monday January 28, 2019



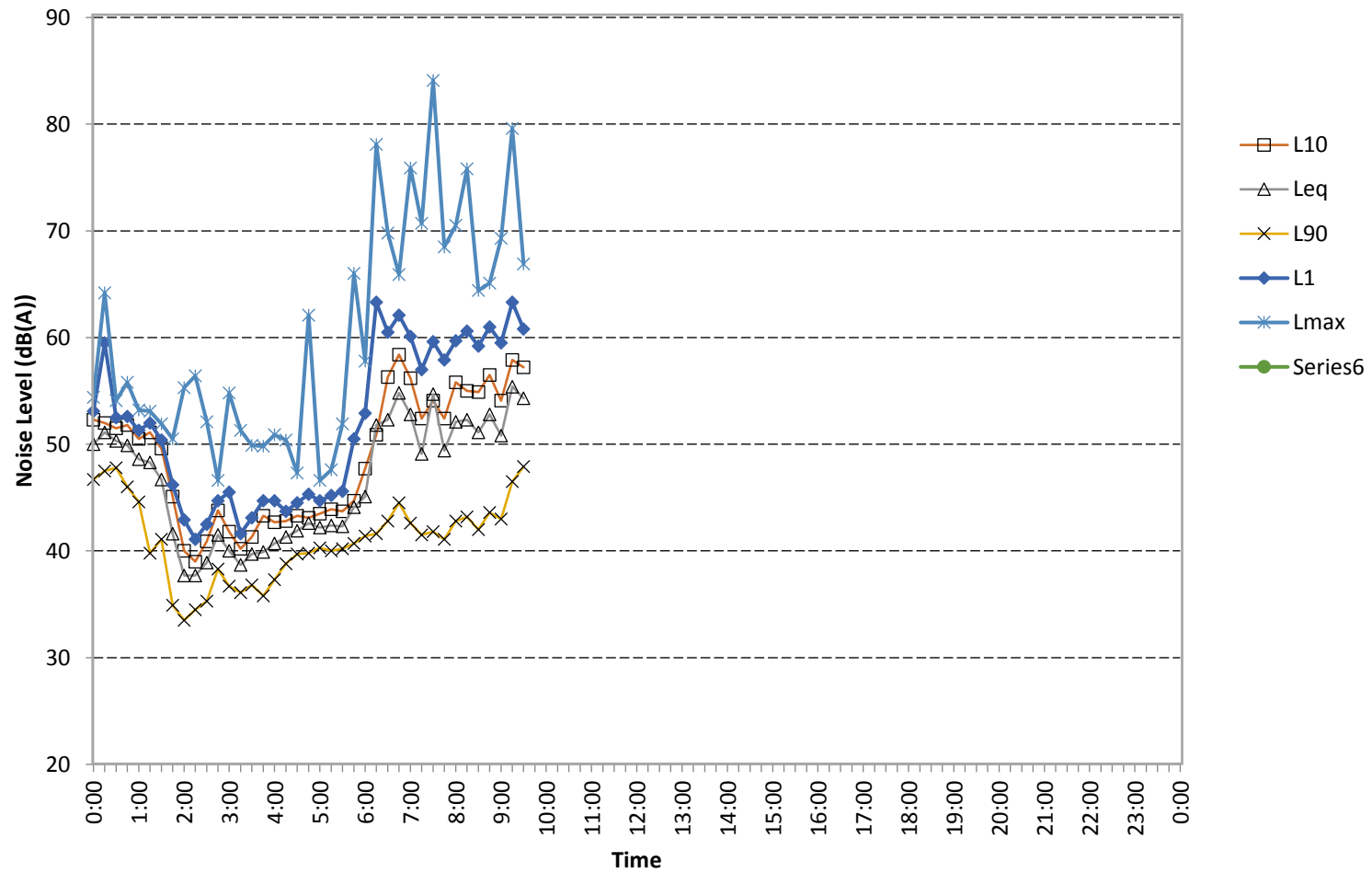
Western boundary (Facing Dural Farm Florist)

Tuesday January 29, 2019



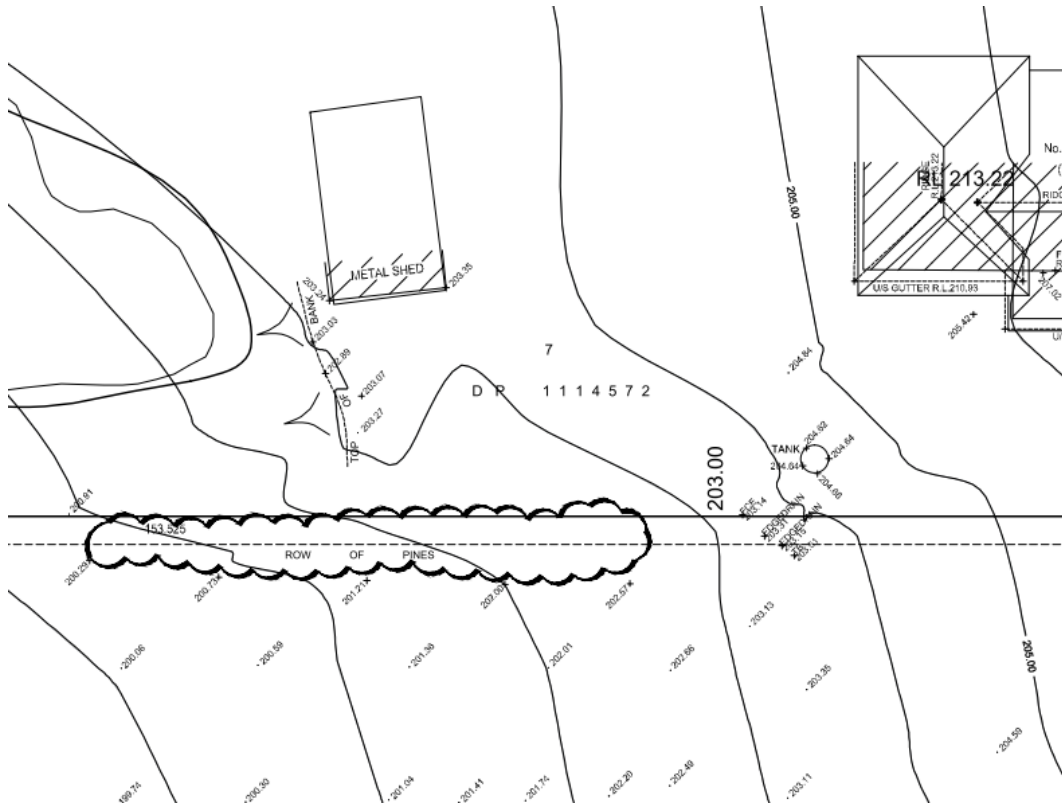
Western boundary (Facing Dural Farm Florist)

Wednesday January 30, 2019

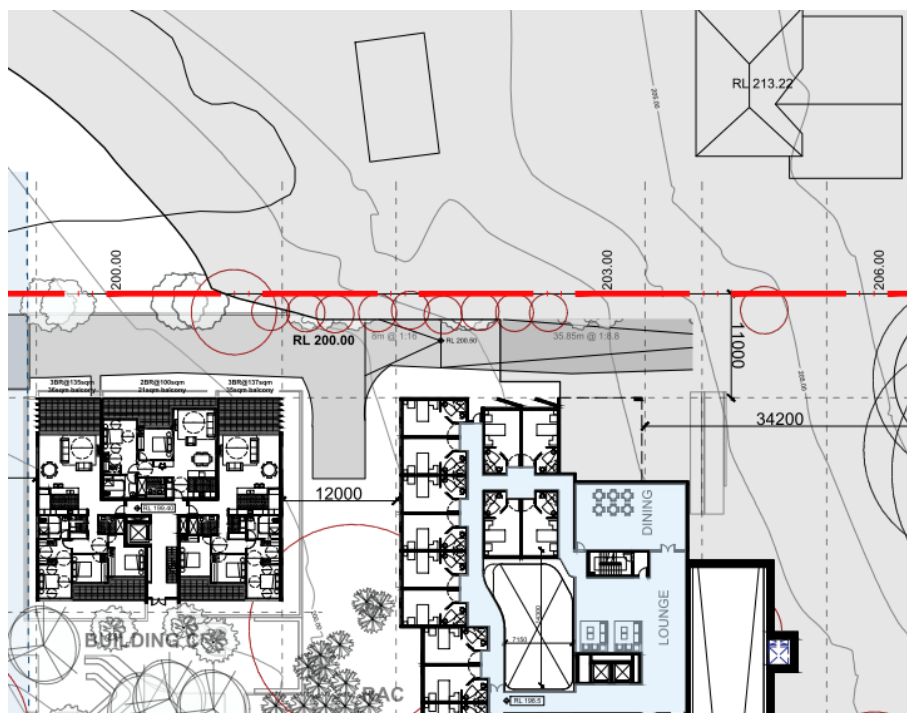


Appendix 6 – Barrier Noise Calculations

Based on RL 203.00 at boundary and RL 203.35 at source (using RL at shed as guide)



Based on ground level RACF bld on level 199 being at an RL 198.50



Barrier Calculation from truck to ground level façade

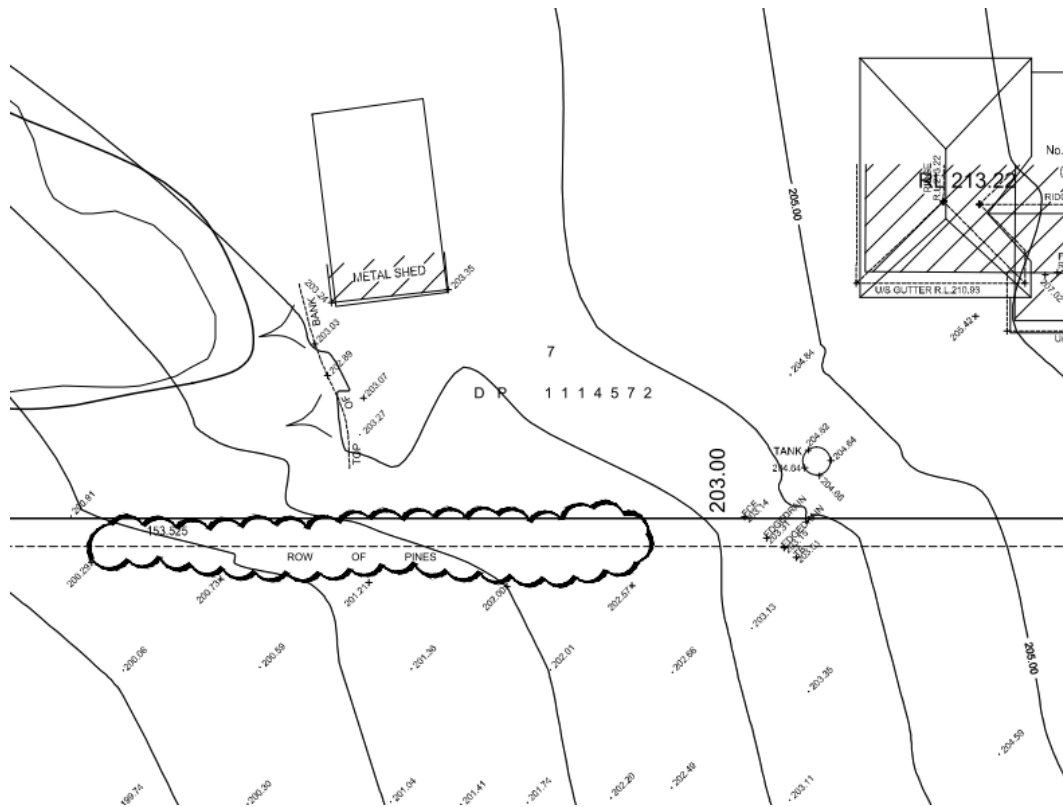
Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 25 metres (dural Farm)	204.55	0.00	203.00	1.80	204.80	25.00	200.00	36.00	36.29	25.00	12.00	0.717

Noise emission calculation with barrier to ground level façade with setback at 11 metres from the boundary

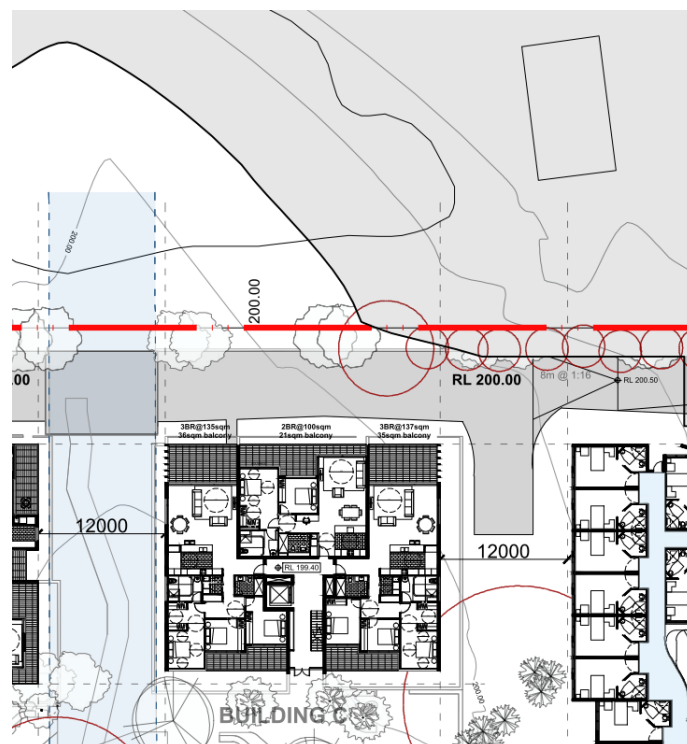
Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 25 metres	67.3	56.7	53.9	51.0	47.5	46.9	39.5	35.5	54.0
Correction – for distance	36	36	36	36	36	36	36	36	-
Barrier Correction path difference (b = 0.5)	-9	-10	-12	-15	-18	-20	-23	-26	-
Correction for Distance (25m + 11m = 36m)	-39.1	-39.1	-39.1	-39.1	-39.1	-39.1	-39.1	-39.1	-
Predicted Noise Level at Residences ground level facade	55.1	43.5	38.8	32.8	26.4	23.7	13.4	6.3	36.1

Refer to drawings DA 1.02, DA 2.03 attached for RL

Based on RL 200.00 at boundary and RL 203.35 at source (using RL at shed as guide)



Based on ground level residence on level 199 being at an RL 199.40



Barrier Calculation from truck to ground level façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 45 metres (dural farm)	204.55	0.00	200.00	1.80	201.80	45.00	200.90	56.00	56.12	45.08	11.04	0.002

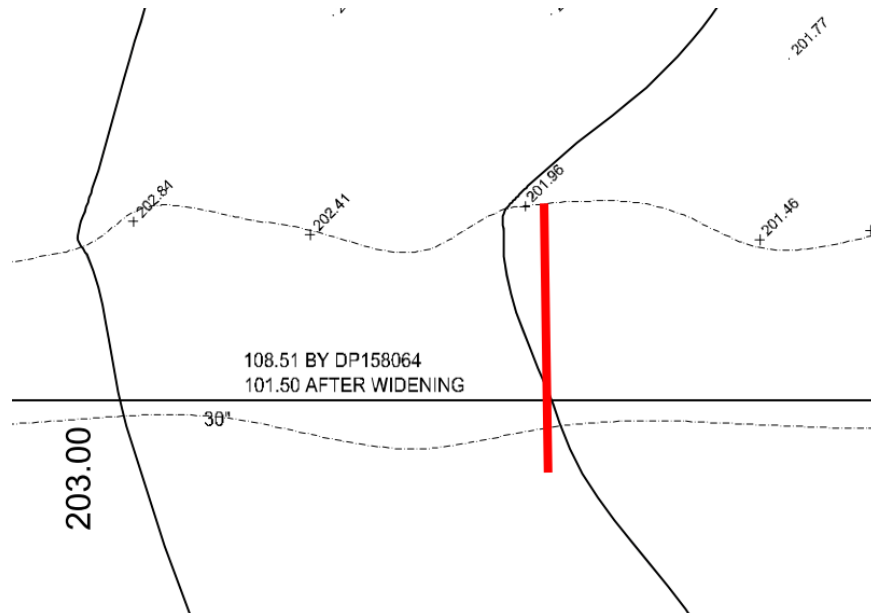
Noise emission calculation with barrier to ground level facade

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 45 metres	62.6	58.2	48.8	48.3	47.8	46.7	40.5	32.7	53.0
Correction – for distance	41.1	41.1	41.1	41.1	41.1	41.1	41.1	41.1	-
Barrier Correction path difference (b = 0)	-5	-5	-5	-5	-5	-5	-5	-5	-
Correction for Distance (45m + 11m = 56m)	-43.0	-43.0	-43.0	-43.0	-43.0	-43.0	-43.0	-43.0	-
Predicted Noise Level at Residences ground level facade	55.7	51.3	41.9	41.4	40.9	39.8	33.6	25.8	46.1

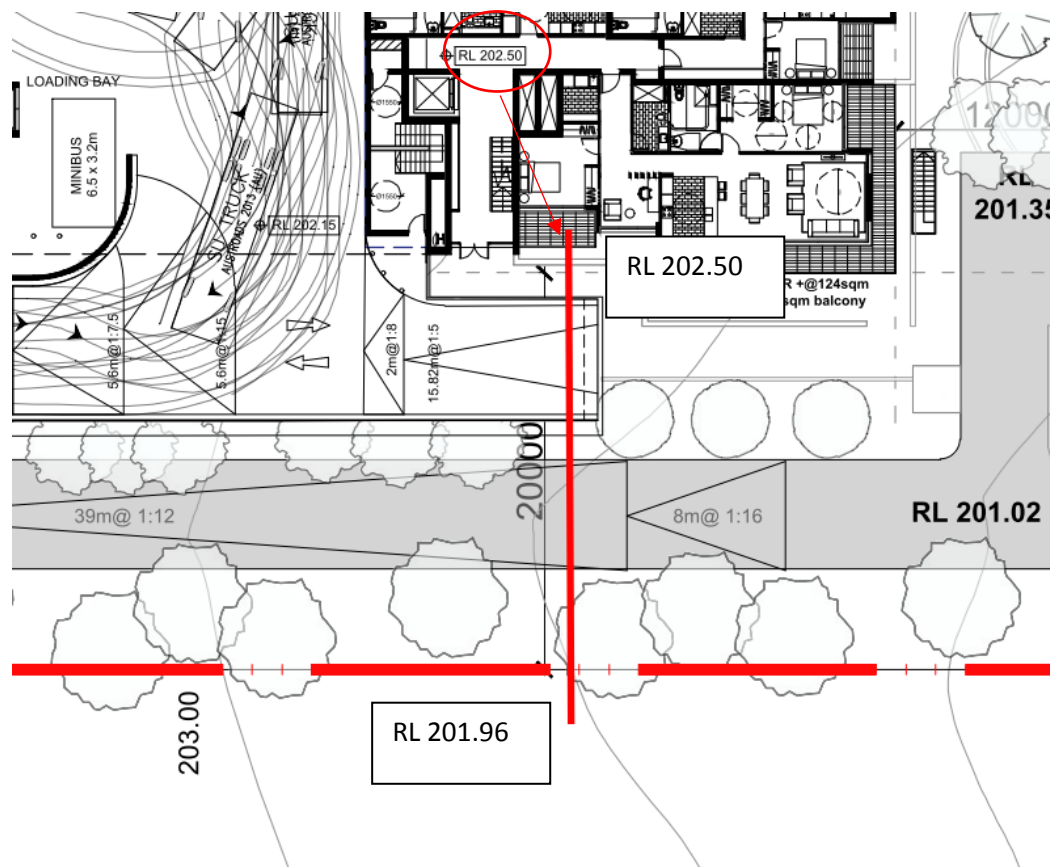
Refer to drawings DA 1.02, DA 2.03 attached for RL

Noise Emission Calculation – Green Gallery Truck – 54 db(A) at 10 Metres from Boundary

Based on RL 201.96 at boundary and RL 201.96 at source



Based on level residence on level 203 being at an RL 202.50



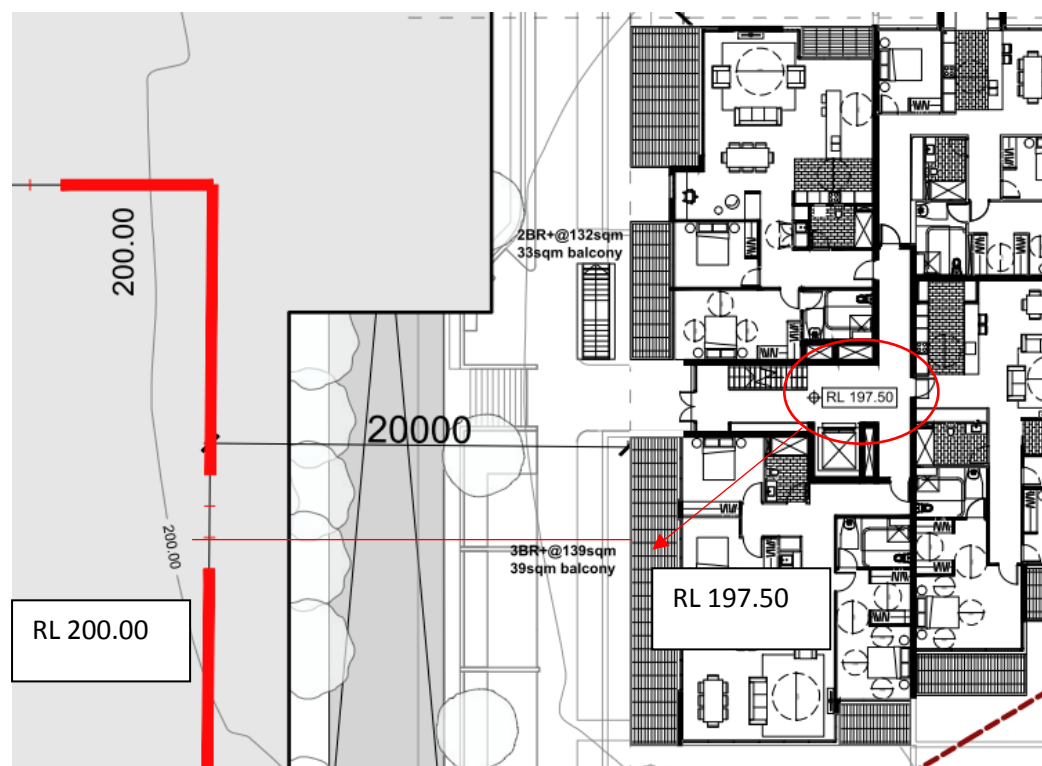
Barrier Calculation from truck to ground level façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 10 metres (green Gallery)	203.16	0.00	201.96	1.80	203.76	10.00	204.00	30.00	30.01	10.02	20.00	0.008

Noise emission calculation with barrier to ground level façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 10 metres	59.0	52.6	50.1	50.8	49.7	45.8	42.6	39.1	54.0
Correction – for distance	28	28	28	28	28	28	28	28	-
Barrier Correction path difference (b = 0)	-5	-5	-5	-5	-5	-5	-5	-5	-
Correction for Distance (10m+20m = 30m)	-37.5	-37.5	-37.5	-37.5	-37.5	-37.5	-37.5	-37.5	-
Predicted Noise Level at Residences ground level facade	44.5	38.1	35.6	36.2	35.1	31.3	28.1	24.6	39.4

Refer to drawings DA 1.02 & DA 2.04 attached for RL



Barrier Calculation from truck to ground level façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 15 metres (green Gallery)	202.24	0.00	200.00	1.80	201.80	10.00	199.00	35.00	35.15	10.01	25.16	0.016

Noise emission calculation with barrier to ground level façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 15 metres	66.2	55.6	52.8	49.9	46.4	45.8	38.4	34.4	52.9
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = 0.01)	-5	-5	-6	-6	7-	-8	-9	-10	-
Correction for Distance (15m+20m = 35m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences ground level facade	53.8	43.3	39.5	36.6	32.1	30.4	22.1	17.0	38.9

Refer to drawings DA 1.02 & DA 2.02 attached for RL

Noise Emission Calculation – Green Gallery Truck – 53 db(A) at 15 Metres from Boundary

Based on RL 199.87 (barrier RL 201.67) and RL 199.89 (Barrier RL 201.69) at boundary and RL 201.04 at source

Barrier Calculation from truck to ground level façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 15 metres (Green Gallery) to 197.50	202.24	0.00	199.87	1.80	201.67	15.00	199.00	35.00	35.15	15.01	20.18	0.039
truck at 15 metres (Green Gallery) to 200.60	202.24	0.00	199.87	1.80	201.67	15.00	202.10	35.00	35.00	15.01	20.00	-0.015
truck at 15 metres (Green Gallery) to 197.50	202.24	0.00	199.89	1.80	201.69	15.00	199.00	35.00	35.15	15.01	20.18	0.041
truck at 15 metres (Green Gallery) to 200.60	202.24	0.00	199.89	1.80	201.69	15.00	202.10	35.00	35.00	15.01	20.00	-0.014

**Based on ground level bld G on level 197 being at an RL 197.50
(+1.5m for receiver)**

Noise emission calculation with barrier to façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 15 metres	66.2	55.6	52.8	49.9	46.4	45.8	38.4	34.4	52.9
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = 0.05)	-7	-7	-8	-9	-10	-12	-13	-14	-
Correction for Distance (15m+20m = 35m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences facade	51.8	41.3	37.5	33.6	29.1	26.4	18.1	13.0	36

**Based on ground level bld G on level 200 being at an RL 200.60
(+1.5m for receiver)**

Noise emission calculation with barrier to façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 15 metres	66.2	55.6	52.8	49.9	46.4	45.8	38.4	34.4	52.9
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = -0.01)	-4	-4	-4	-3	-3	-2	-1	0	-
Correction for Distance (15m+20m = 35m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences facade	54.8	44.3	41.5	39.6	36.1	36.4	30.1	27.0	42.8

Noise Emission Calculation – Green Gallery Truck – 53 db(A) at 15 Metres from Boundary

Based on RL 199.87 (barrier RL 201.67) and RL 199.89 (Barrier RL 201.69) at boundary and RL 200 at source

Barrier Calculation from truck to ground level façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 15 metres (Green Gallery) to 197.50	201.20	0.00	199.87	1.80	201.67	15.00	199.00	35.00	35.07	15.01	20.18	0.116
truck at 15 metres (Green Gallery) to 200.60	201.20	0.00	199.87	1.80	201.67	15.00	202.10	35.00	35.01	15.01	20.00	0.000
truck at 15 metres (Green Gallery) to 197.50	201.20	0.00	199.89	1.80	201.69	15.00	199.00	35.00	35.07	15.01	20.18	0.119
truck at 15 metres (Green Gallery) to 200.60	201.20	0.00	199.89	1.80	201.69	15.00	202.10	35.00	35.01	15.01	20.00	0.001

**Based on ground level bld G on level 197 being at an RL 197.50
(+1.5m for receiver)**

Noise emission calculation with barrier to façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 15 metres	66.2	55.6	52.8	49.9	46.4	45.8	38.4	34.4	52.9
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = 0.1)	-7	-8	-9	-10	-11	-14	-16	-18	-
Correction for Distance (15m+20m = 35m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences facade	51.8	40.3	36.5	32.6	28.1	24.4	15.1	9.0	35.0

**Based on ground level bld G on level 200 being at an RL 200.60
(+1.5m for receiver)**

Noise emission calculation with barrier to façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 15 metres	66.2	55.6	52.8	49.9	46.4	45.8	38.4	34.4	52.9
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = 0)	-5	-5	-5	-5	-5	-5	-5	-5	-
Correction for Distance (15m+20m = 35m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences facade	53.8	43.3	40.5	37.6	34.1	33.4	26.1	22.0	40.6

Noise Emission Calculation – Green Gallery Truck – 54 db(A) at 10 Metres from Boundary

Based on RL 200.50 (barrier RL 202.30) at boundary and RL 200.50 at source

Based on ground level bld E on level 199 being at an RL 201.20 (+1.5m for receiver)

Barrier Calculation from truck to façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 10 metres (Green Gallery)	201.70	0.00	200.50	1.80	202.30	10.00	202.70	30.00	30.02	10.02	20.00	0.005

Noise emission calculation with barrier to façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 10 metres	59.0	52.6	50.1	50.8	49.7	45.8	42.6	39.1	54.0
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = 0)	-5	-5	-5	-5	-5	-5	-5	-5	-
Correction for Distance (10m+20m = 30m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences facade	44.5	38.1	35.6	36.2	35.1	31.3	28.1	24.6	39.4

Noise Emission Calculation – Green Gallery Truck – 54 db(A) at 10 Metres from Boundary

Based on RL 203 (barrier RL 204.80) at boundary and RL 203 at source

Based on ground level bld D on level 207 being at an RL 207.50 (+1.5m for receiver)

Barrier Calculation from truck to façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 10 metres (Green Gallery)	204.20	0.00	203.00	1.80	204.80	10.00	208.60	30.00	30.32	10.02	20.36	-0.055

Noise emission calculation with barrier to façade with setback at 20 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 10 metres	59.0	52.6	50.1	50.8	49.7	45.8	42.6	39.1	54.0
Correction – for distance	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-
Barrier Correction path difference (b = -0.05)	-3	-3	-2	-1	-0	-0	-0	-0	-
Correction for Distance (15m+20m = 35m)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-
Predicted Noise Level at Residences ground level facade	46.5	40.1	38.6	40.2	40.1	36.3	33.1	29.6	44.1

Noise Emission Calculation – Dural Farm Truck – 53 db(A) at 45 Metres from Boundary

Based on RL 200.16 (barrier RL 201.96) at boundary and RL 204 at source

Based on ground level bld C on level 199 being at an RL 199.40 (+1.5m for receiver)

Barrier Calculation from truck to façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 45 metres (Dural farm)	205.20	0.00	200.16	1.80	201.96	45.00	200.90	56.00	56.16	45.12	11.05	0.003

Noise emission calculation with barrier to façade with setback at 11 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 45 metres	62.6	58.2	48.8	48.3	47.8	46.7	40.5	32.7	53.0
Correction – for distance	41.1	41.1	41.1	41.1	41.1	41.1	41.1	41.1	-
Barrier Correction path difference (b = -0)	-5	-5	-5	-5	-5	-5	-5	-5	-
Correction for Distance (45m+11m = 56m)	-43.0	-43.0	-43.0	-43.0	-43.0	-43.0	-43.0	-43.0	-
Predicted Noise Level at Residences facade	55.7	51.3	41.9	41.4	40.9	39.8	33.6	25.8	46.1

Noise Emission Calculation – Dural Farm Truck – 53 db(A) at 45 Metres from Boundary

Based on RL 202 (barrier RL 203.80) at boundary and RL 204 at source

Based on ground level bld B on level 203 being at an RL 202.50 (+1.5m for receiver)

Barrier Calculation from truck to façade

Description	Source RL	Source Distance	Ground Under Barrier	Barrier Height	Barrier RL	Barrier Distance	Receiver RL	Receiver Distance	Direct	Source to Barrier	Barrier to Receiver	Path Difference
truck at 45 metres (Dural farm)	205.20	0.00	202.00	1.80	203.80	45.00	204.00	75.00	75.01	45.02	30.00	-0.013

Noise emission calculation with barrier to façade with setback at 11 metres from the boundary

Noise Source/Correction	Noise level dB(A) – Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	A-wt
Sound Pressure Level of - truck at 45 metres	62.6	58.2	48.8	48.3	47.8	46.7	40.5	32.7	53.0
Correction – for distance	41.1	41.1	41.1	41.1	41.1	41.1	41.1	41.1	-
Barrier Correction path difference (b = -0.01)	-4	-4	-4	-3	-3	-2	-1	0	-
Correction for Distance (75m total)	-45.5	-45.5	-45.5	-45.5	-45.5	-45.5	-45.5	-45.5	-
Predicted Noise Level at Residences facade	54.2	49.8	40.4	40.9	40.4	40.3	35.0	28.3	46

Predicted Noise Levels from Green Gallery to Building A and B Eastern facade – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Green Gallery – Truck at 10 metres	54 dB(A) Leq @ 10 metres	Building A East – All levels -	36.1 dB(A) _{Leq(15min)} 42.1 dB(A) _{L_{Max}, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{L_{Max}, F}
	60 dB(A) Lmax @ 10 metres	Building B East– All Levels	36.1 dB(A) _{Leq(15min)} 42.1 dB(A) _{L_{Max}, F}	

Predicted Noise Levels from Green Gallery to Building D facade – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Green Gallery – Truck at 10 metres	54 dB(A) Leq @ 10 metres 60 dB(A) Lmax @ 10 metres	Building D East – Level 203 - Ground (RL 202.50)	44.1 dB(A) _{Leq(15min)} 49.1 dB(A) _{L_{Max}, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{L_{Max}, F}
		Building D East– upper Levels – 206 to 209	44.4 dB(A) _{Leq(15min)} 50.4 dB(A) _{L_{Max}, F}	
		Building D North East – Level 203 - Ground (RL 202.50)	39 dB(A) _{Leq(15min)} 45 dB(A) _{L_{Max}, F}	
		Building D North East– upper Levels – 206 to 209	42.4 dB(A) _{Leq(15min)} 44.4 dB(A) _{L_{Max}, F}	
		Building D North West – Level 203 - Ground (RL 202.50)	36.6 dB(A) _{Leq(15min)} 42.6 dB(A) _{L_{Max}, F}	
		Building D North West– upper Levels – 206 to 209	40 dB(A) _{Leq(15min)} 42 dB(A) _{L_{Max}, F}	

Note: All remaining facades will comply

Predicted Noise Levels from Green Gallery to Building E facade – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Green Gallery – Truck at 10 metres	54 dB(A) Leq @ 10 metres 60 dB(A) Lmax @ 10 metres	Building E East (southern) – Level 199 - Ground	39.4 dB(A) _{Leq(15min)} 44.4 dB(A) _{L_{Max}, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{L_{Max}, F}
		Building E East (southern)– upper Levels – 203 to 209	44.4 dB(A) _{Leq(15min)} 50.4 dB(A) _{L_{Max}, F}	
		Building E East (northern) – Level 199 - Ground	36.9 dB(A) _{Leq(15min)} 42.9 dB(A) _{L_{Max}, F}	
		Building E East (northern)– upper Levels – 203 to 209	41.9 dB(A) _{Leq(15min)} 47.9 dB(A) _{L_{Max}, F}	
		Building E south (eastern) – Level 199 - Ground	39 dB(A) _{Leq(15min)} 45 dB(A) _{L_{Max}, F}	
		Building D south (eastern)– upper Levels – 203 to 209	42.4 dB(A) _{Leq(15min)} 44.4 dB(A) _{L_{Max}, F}	
		Building E south (western) – Level 199 - Ground	36.6 dB(A) _{Leq(15min)} 42.6 dB(A) _{L_{Max}, F}	
		Building D south (western)– upper Levels – 203 to 209	40 dB(A) _{Leq(15min)} 42 dB(A) _{L_{Max}, F}	

Note: All remaining facades will comply

Predicted Noise Levels from Green Gallery to Building G facade – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Green Gallery – Truck at 10 metres	53 dB(A) Leq @ 15 metres 59 dB(A) Lmax @ 15 metres	Building G South – Level 197 - Ground	36 dB(A) _{Leq(15min)} 41.5 dB(A) _{L_{Max}, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{L_{Max}, F}
		Building G South – Level 199 – Level 1	42.8 dB(A) _{Leq(15min)} 49.1 dB(A) _{L_{Max}, F}	
		Building G South – Upper Levels - 203	45.6 dB(A) _{Leq(15min)} 51.6 dB(A) _{L_{Max}, F}	
		Building G West – Level 197 - Ground	33 dB(A) _{Leq(15min)} 38.5 dB(A) _{L_{Max}, F}	
		Building G West (Northern) – Level 199 – Level 1	39.8 dB(A) _{Leq(15min)} 46.1 dB(A) _{L_{Max}, F}	
		Building G West– Upper Levels - 203	42.6 dB(A) _{Leq(15min)} 51.6 dB(A) _{L_{Max}, F}	
		Building G East– Level 197 - Ground	33 dB(A) _{Leq(15min)} 38.5 dB(A) _{L_{Max}, F}	
		Building G East – Level 199 – Level 1	39.8 dB(A) _{Leq(15min)} 46.1 dB(A) _{L_{Max}, F}	
		Building G East– Upper Levels - 203	42.6 dB(A) _{Leq(15min)} 51.6 dB(A) _{L_{Max}, F}	

Note: All remaining facades will comply

Predicted Noise Levels from Dural Farm to Building B facade – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Dural Farm – Truck at 45 metres	53 dB(A) Leq @ 45 metres 62 dB(A) Lmax @ 45 metres	Building B West– Level 199 - Ground	46 dB(A) _{Leq(15min)} 55 dB(A) _{LMax, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{LMax, F}
		Building B North (western) Level 199 - Ground	45.4 dB(A) _{Leq(15min)} 54.4 dB(A) _{LMax, F}	
		Building B North (eastern) Level 199 - Ground	39.4 dB(A) _{Leq(15min)} 48.4 dB(A) _{LMax, F}	
		Building B West (northern) – Upper Levels – 203 to 206	48.6 dB(A) _{Leq(15min)} 57.6 dB(A) _{LMax, F}	
		Building B West (southern) – Upper Levels – 203 to 206	38.8 dB(A) _{Leq(15min)} 47.8 dB(A) _{LMax, F}	
		Building B North (eastern) Level Upper Levels	42 dB(A) _{Leq(15min)} 51 dB(A) _{LMax, F}	

Note: All remaining facades will comply

Predicted Noise Levels from Dural Farm to Building C facade – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Dural Farm – Truck at 45 metres	53 dB(A) Leq @ 45 metres 62 dB(A) Lmax @ 45 metres	Building C West – Level 197 - Ground	46.1 dB(A) _{Leq(15min)} 55.1 dB(A) _{LMax, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{LMax, F}
		Building C West – Upper Levels	51 dB(A) _{Leq(15min)} 60 dB(A) _{LMax, F}	
		Building C North – Level 197 - Ground	42.8 dB(A) _{Leq(15min)} 51.8 dB(A) _{LMax, F}	
		Building C North – Upper Levels	47.8 dB(A) _{Leq(15min)} 56.8 dB(A) _{LMax, F}	
		Building C South – Level 197 - Ground	42.8 dB(A) _{Leq(15min)} 51.8 dB(A) _{LMax, F}	
		Building C South – Upper Levels	47.8 dB(A) _{Leq(15min)} 56.8 dB(A) _{LMax, F}	

Note: All remaining facades will comply

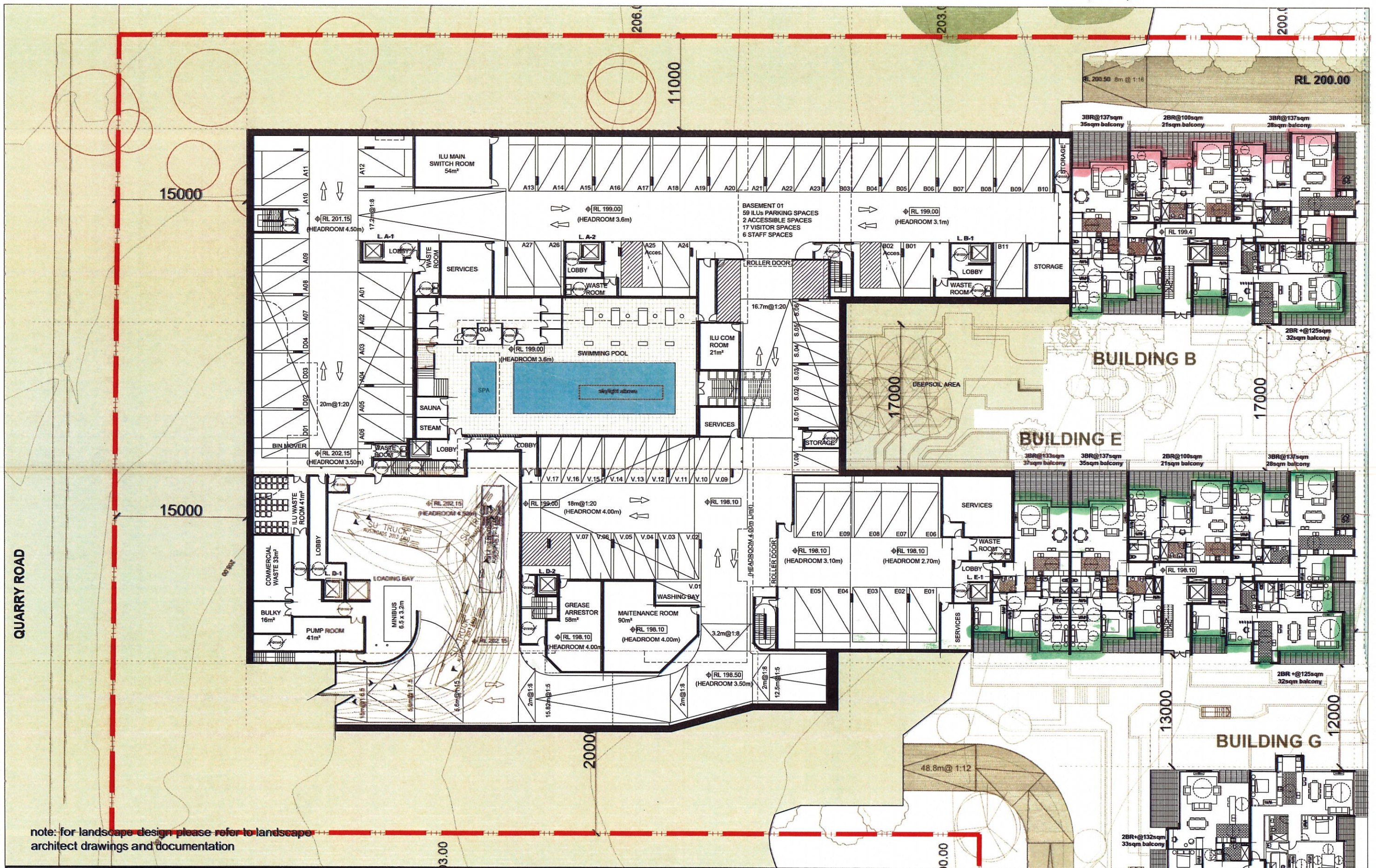
Predicted Noise Levels from Green Gallery and Dural Farm to Building F facades – Sleep Disturbance Criteria

Location/Noise Source	Measured/Distance	Receiver Location	Predicted Noise Level	Criteria
Green Gallery – Truck at 10 metres	54 dB(A) Leq @ 15 metres 59 dB(A) Lmax @ 15 metres	Building F South – All levels -	27.1 dB(A) _{Leq(15min)} 35.7 dB(A) _{LMax, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{LMax, F}
Dural Farm – Truck at 45 metres	53 dB(A) Leq @ 45 metres 62 dB(A) Lmax @ 45 metres	Building F West – All levels -	35.8 dB(A) _{Leq(15min)} 45.4 dB(A) _{LMax, F}	40 dB(A) _{Leq(15min)} 52dB(A) _{LMax, F}

Note: All remaining facades will comply

WINDOWS OPEN / WINDOWS CLOSED - MARK UP

CL 8/5/19



note: for landscape design please refer to landscape architect drawings and documentation

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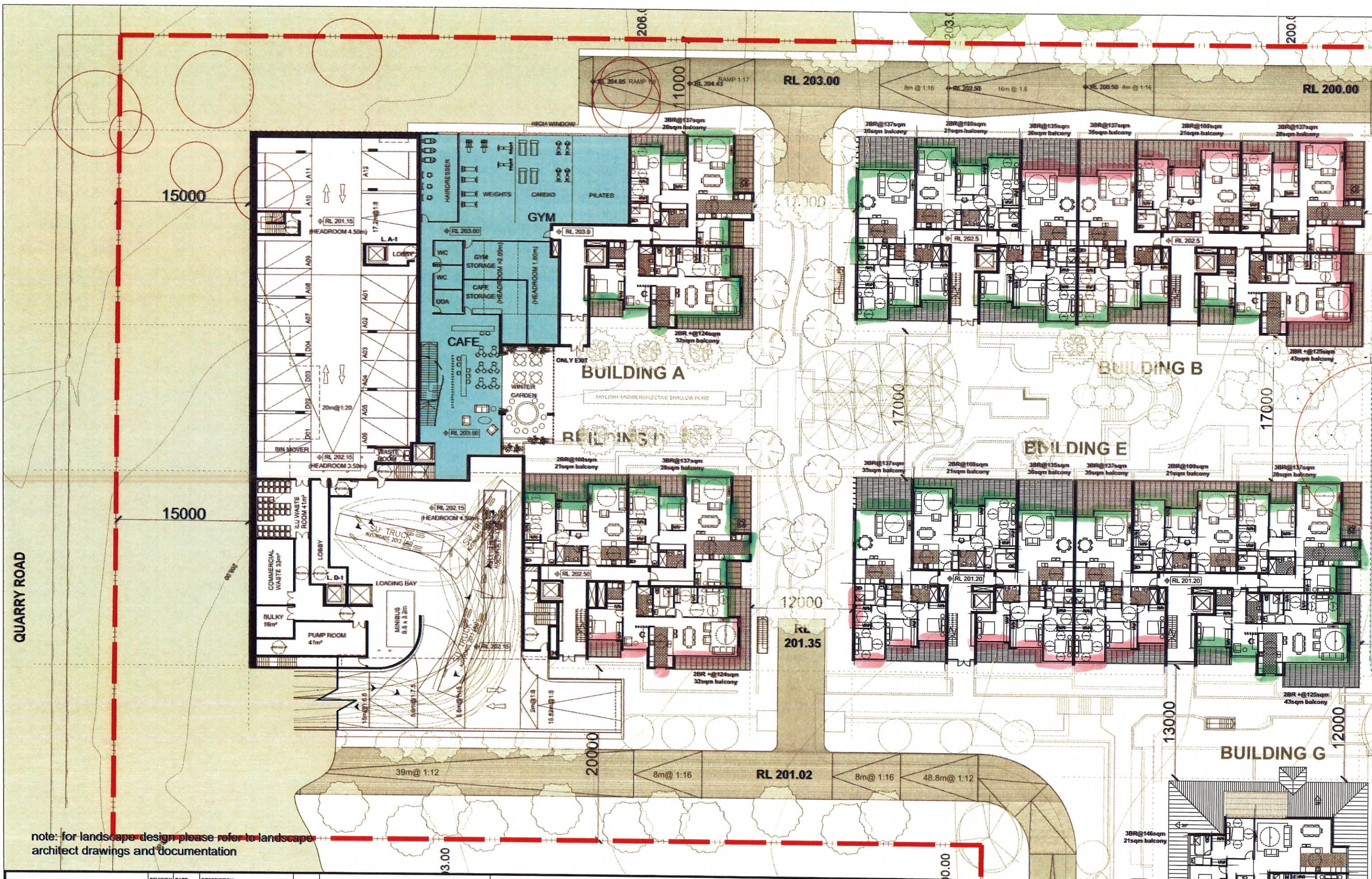
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3 Quarry Rd, Dural

DRAWING TITLE			
ZONE 1 LEVEL 199			
SCALE	DATE	DRAWN	CHECKED
1:200 @ A1 1:400 @ A3	04.03.2019	NC	EB
JOB	DRAWING	REVISION	
16033	DA2.23	X	



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PRELIMINARY NOT FOR CONSTRUCTION			

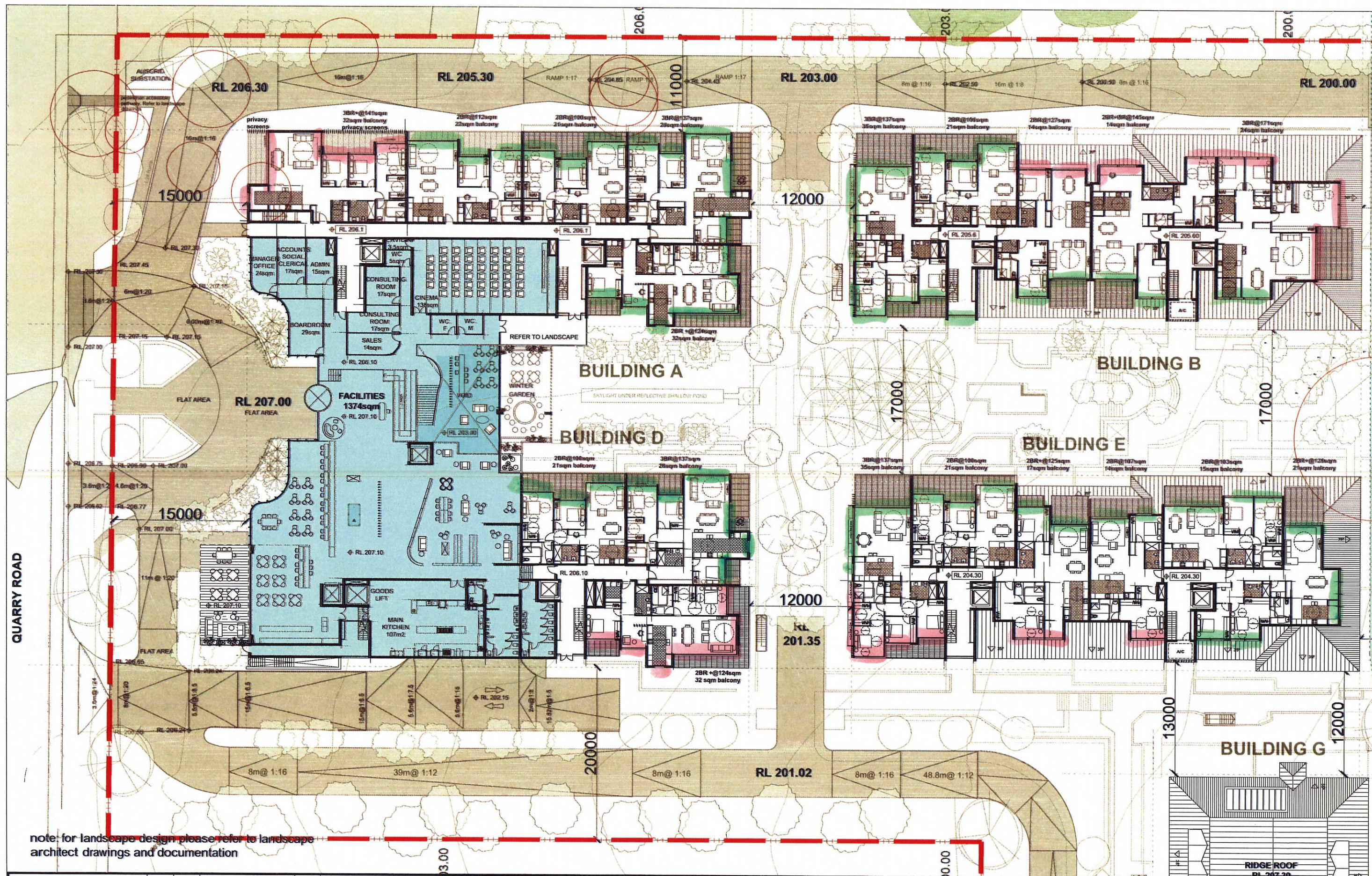
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PROJECT
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DRAWING TITLE			
ZONE 1 LEVEL 203			
SCALE 1:200 @ A1 1:400 @ A3	DATE 04.03.2019	DRAWN NC	CHECKED EB
JOB 16033	DRAWING DA2.24	REVISION X	



note: for landscape design please refer to landscape architect drawings and documentation

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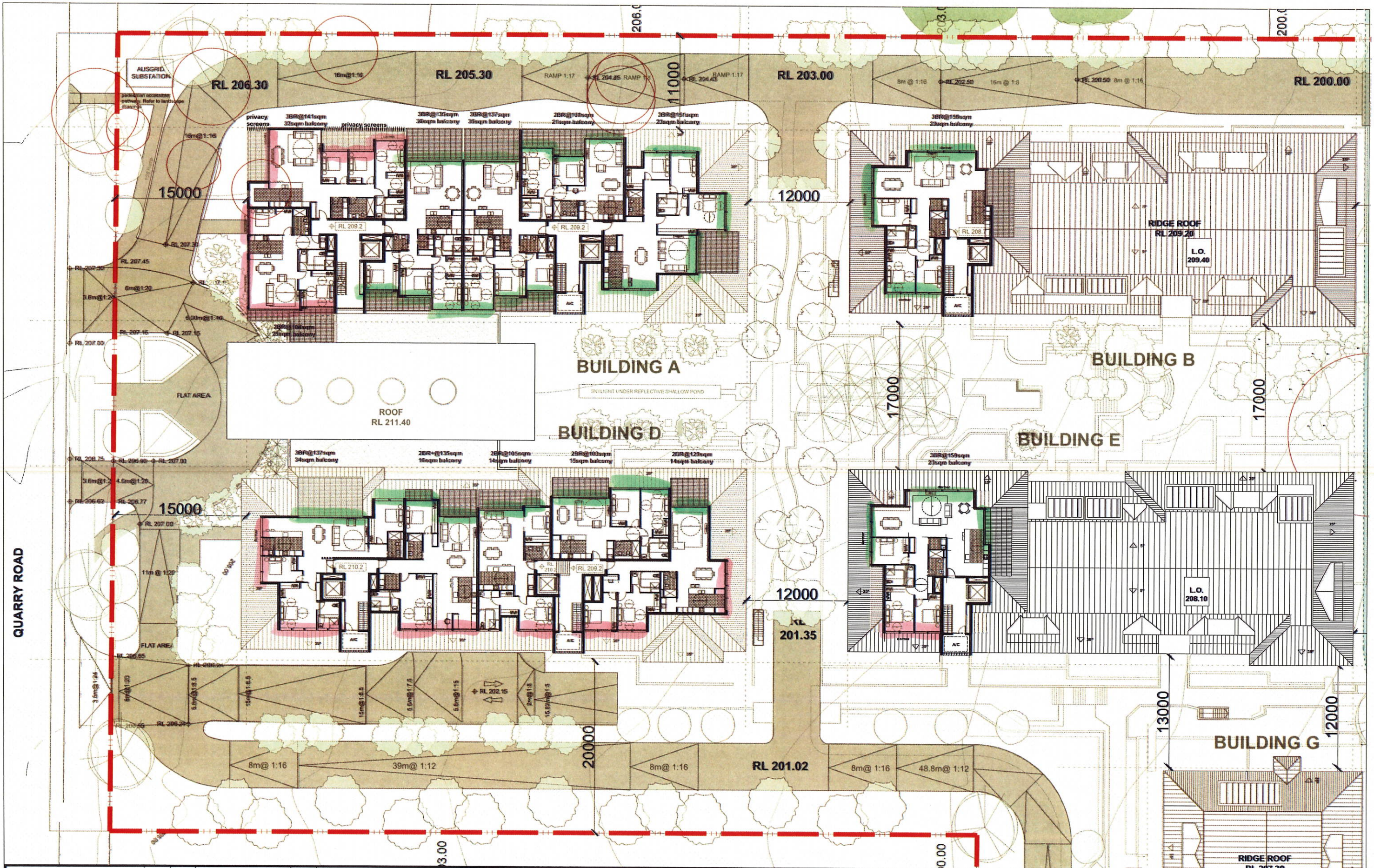


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PROJECT
3 Quarry Rd, Dural

DRAWING TITLE
ZONE 1 LEVEL 206

SCALE 1:200 @ A1 1:400 @ A3	DATE 04.03.2019	DRAWN NC	CHECKED EB
JOB 16033	DRAWING DA2.25	REVISION X	



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WINDOWS OPEN COMPLIES

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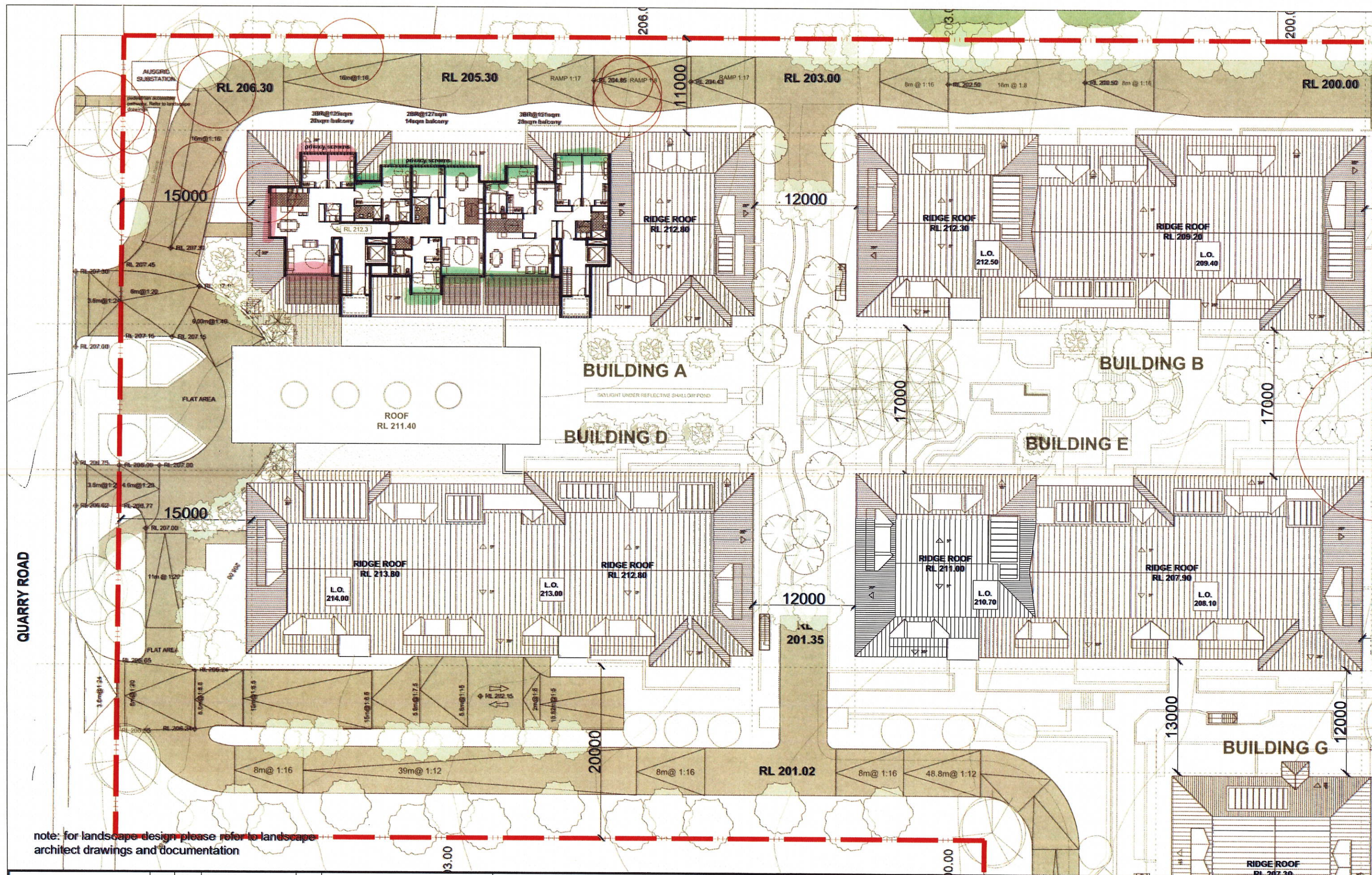
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PROJECT
3 Quarry Rd, Dural

DRAWING TITLE
ZONE 1 LEVEL 209

SCALE	DATE	DRAWN	CHECKED
1:200 @ A1 1:400 @ A3	04.03.2019	NC	EB
JOB	DRAWING	REVISION	
16033	DA2.26	X	



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PROJECT
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DRAWING TITLE			
ZONE 1 LEVEL 212			
SCALE	DATE	DRAWN	CHECKED
1:200 @ A1 1:400 @ A3	04.03.2019	NC	EB
JOB	DRAWING	REVISION	
16033	DA2.27	X	



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X	01.03.2019	FOR LODGEMENT WITH COURT	EB

WINDOWS CLOSED

WINDOWS OPEN COMPLIES

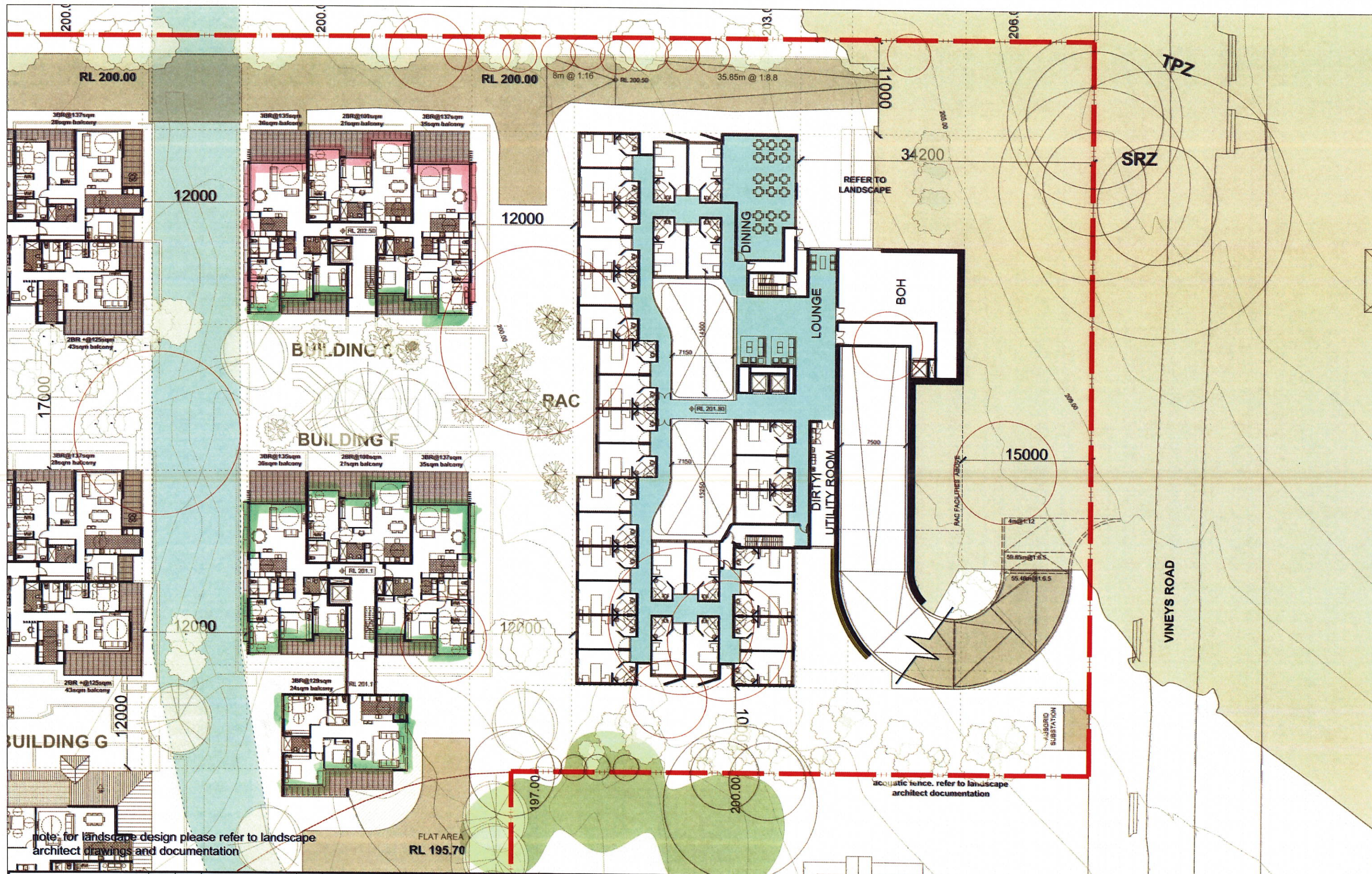
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PROJECT
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DRAWING TITLE ZONE 2 LEVEL 199	
SCALE 1:200 @ A1 1:400 @ A3	DATE 04.03.2019
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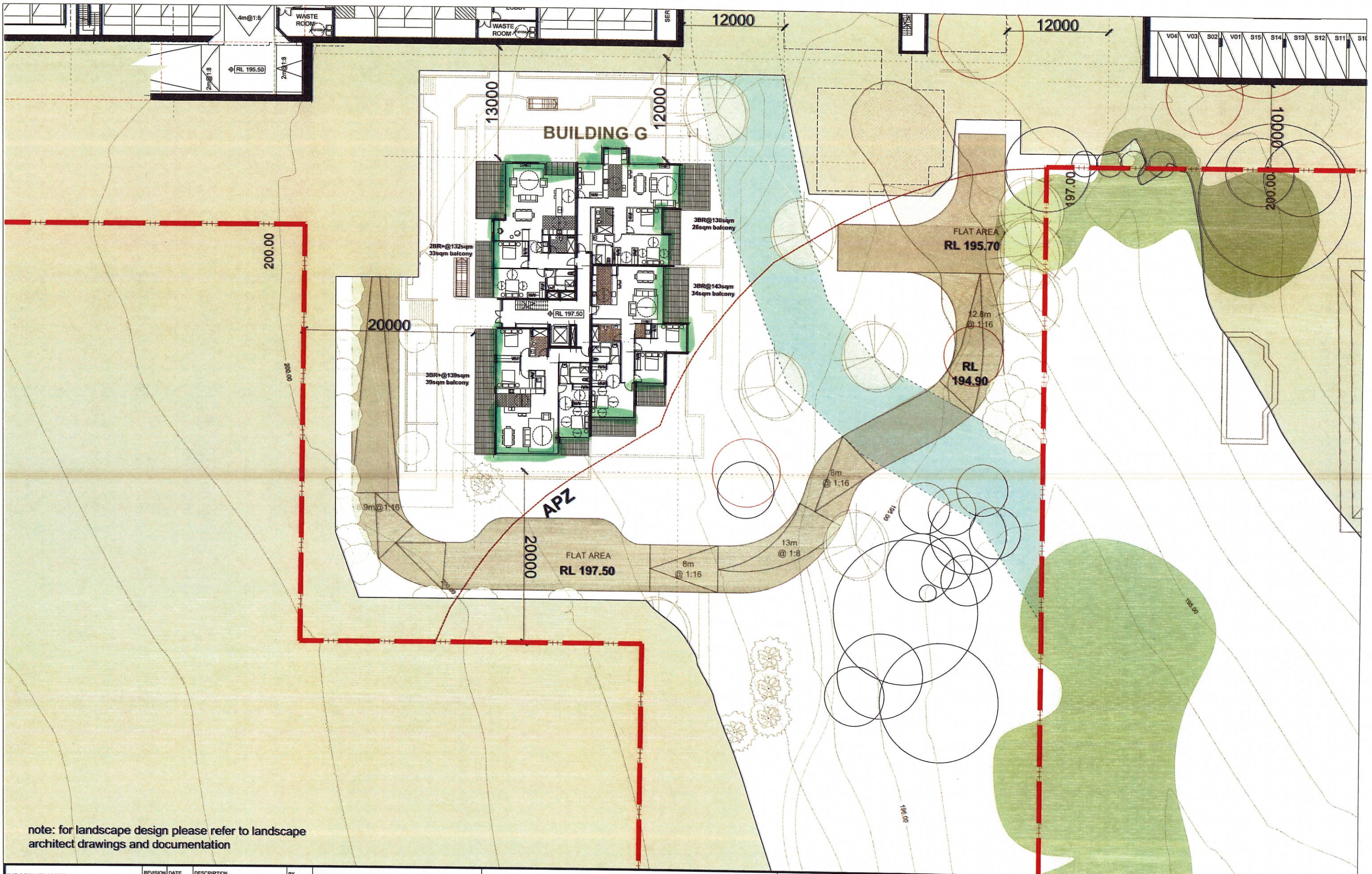


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PROJECT
3 Quarry Rd, Dural

DRAWING TITLE
ZONE 2 LEVEL 203

SCALE	DATE	DRAWN	CHECKED
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JOB	DRAWING	REVISION	
16033	DA2.32	X	



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COMPLETES

WINDOWS
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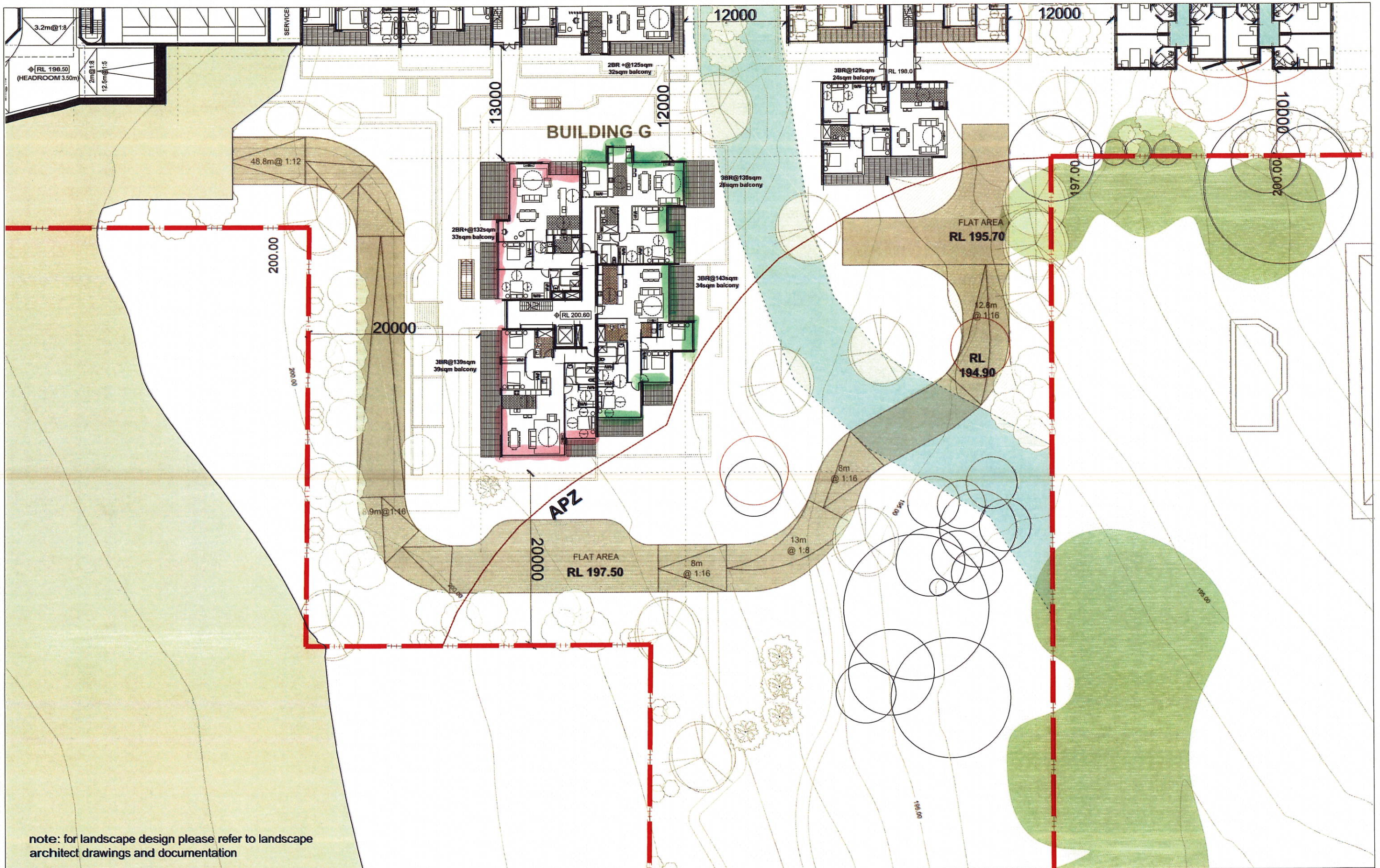
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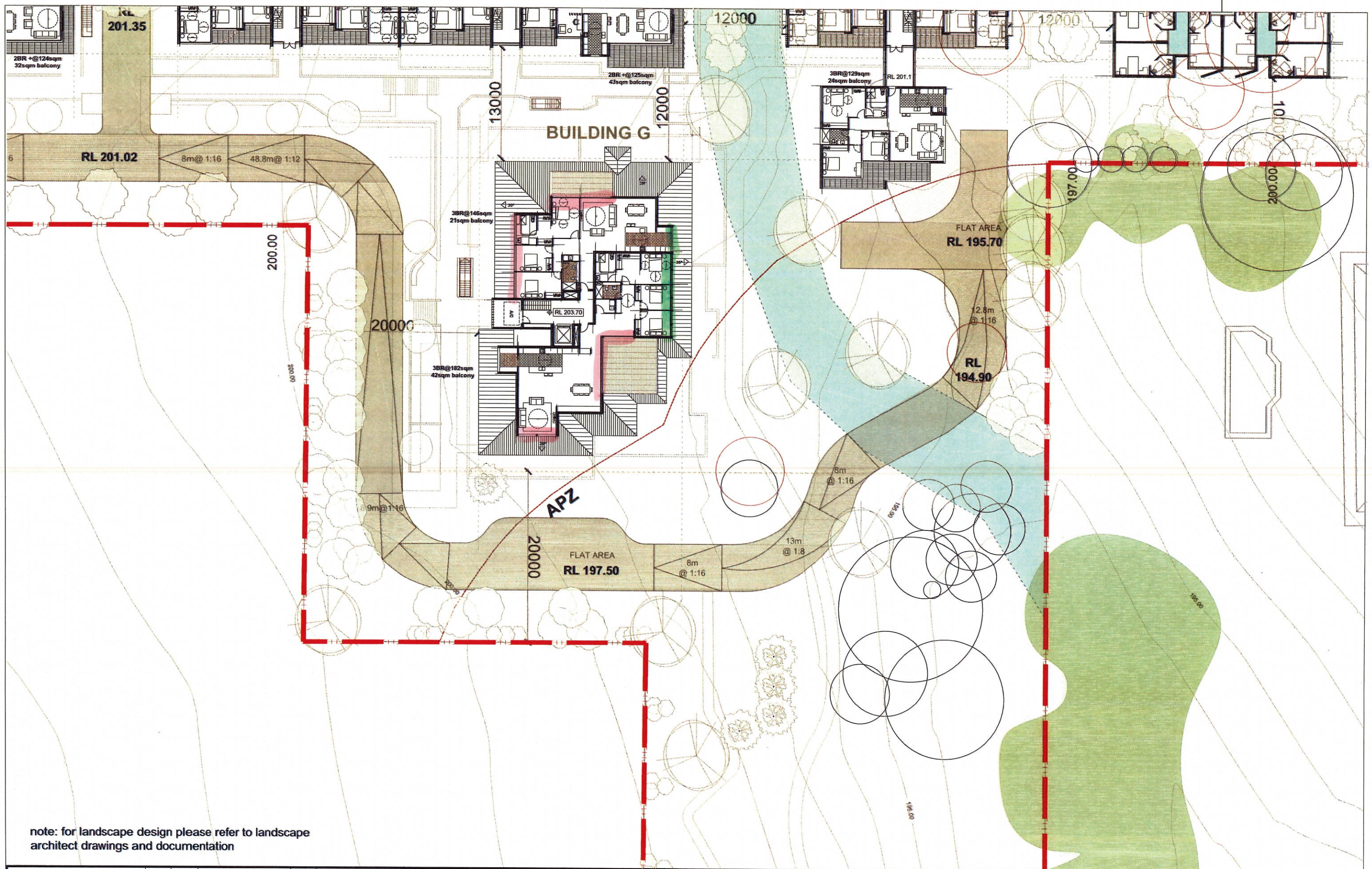
DRAWING TITLE
ZONE 3 LEVEL 197

SCALE	DATE	DRAWN	CHECKED
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JOB 16033	DRAWING DA2.36	REVISION X	



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	PROJECT 3 Quarry Rd, Dural		SCALE 1:200 @ A1 1:400 @ A3	DATE 04.03.2019			DRAWN NC	CHECKED EB				
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JOB	DRAWING		REVISION																																													
16033	DA2.38		X																																													

Logging Data

Traffic Logger - Quarry Road @ 4 metres from curb (southern side)

RBL

Date	Measured Rating Background Noise Level dB(A) _{L₉₀}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 13 March 2018	43.5	41	39.5
Wednesday 14 March 2018	42	42.75	42
Thursday 15 March 2018	41.8	41.25	41.25
Friday 16 March 2018	41.15	40.25	38.5
Saturday 17 March 2018	42.1	41.5	46.5
Sunday 18 March 2018	41.65	38.5	40
Monday 19 March 2018	42.8	39.75	39.25
Tuesday 20 March 2018	42.5		
RBL	42	41	40

LEQ

Date	Measured Noise Level dB(A) _{L_{eq}}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 13 March 2018	61.6	57.1	53.5
Wednesday 14 March 2018	58.8	57.3	53.1
Thursday 15 March 2018	59.4	56.2	54.9
Friday 16 March 2018	58.8	56.3	55.7
Saturday 17 March 2018	55.3	54.4	54.8
Sunday 18 March 2018	55.1	52.9	55.2
Monday 19 March 2018	60.0	59.4	54.5
Tuesday 20 March 2018	59.1		
Ambient LAeq	59	56.3	55

Background Noise Logger

RBL Background (As per table 2 of report)

Date	Measured Rating Background Noise Level dB(A) _{L₉₀}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 13 March 2018	44.0	34.9	28.7
Wednesday 14 March 2018	47.4	43.0	30.1
Thursday 15 March 2018	46.4	45.9	33.2
Friday 16 March 2018	45.6	40.8	30.4
Saturday 17 March 2018	42.8	36.7	28.7
Sunday 18 March 2018	41.4	37.0	29.9
Monday 19 March 2018	44.7	41.2	31.0
Tuesday 20 March 2018	45.1		
RBL	45	41	30

LEQ

Date	Measured Noise Level dB(A) _{L_{eq}}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 13 March 2018	54.8	50.9	52.0
Wednesday 14 March 2018	56.3	53.5	51.0
Thursday 15 March 2018	61.1	51.4	48.7
Friday 16 March 2018	54.5	49.6	48.9
Saturday 17 March 2018	52.1	53.2	45.0
Sunday 18 March 2018	53.7	55.1	50.1
Monday 19 March 2018	56.2	53.2	48.0
Tuesday 20 March 2018	52.4		
Ambient LAeq	54.6	53.2	48.9

Green Gallery Noise Logger (eastern boundary)

RBL

Date	Measured Rating Background Noise Level dB(A) _{L₉₀}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 23 January 2018	43.4	47.0	37.0
Wednesday 24 January 2018	38.1	44.8	37.0
Thursday 25 January 2018	39.5	44.5	40.0
Friday 26 January 2018	35.5	44.5	38.0
Saturday 27 January 2018	38.5	43.0	40.0
Sunday 28 January 2018	36.6	44.8	38.0
Monday 29 January 2018	40.0	48.3	40.5
Tuesday 30 January 2018	42.0		
RBL	39.0	44.8	38.0

LEQ

Date	Measured Noise Level dB(A) _{L_{eq}}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 23 January 2018	57.4	50.8	48.0
Wednesday 24 January 2018	50.5	48.4	46.6
Thursday 25 January 2018	49.3	48.4	45.5
Friday 26 January 2018	48.7	48.0	45.2
Saturday 27 January 2018	56.1	57.8	60.9
Sunday 28 January 2018	50.2	51.1	45.2
Monday 29 January 2018	50.3	49.1	47.2
Tuesday 30 January 2018	49.4		
Ambient LAeq	52	51	48

Dural Farm Noise Logger (western Boundary)

RBL

Date	Measured Rating Background Noise Level dB(A) _{L₉₀}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 23 January 2018	42.9	42.0	37.0
Wednesday 24 January 2018	42.0	40.0	35.2
Thursday 25 January 2018	38.9	45.0	38.2
Friday 26 January 2018	37.8	43.2	37.1
Saturday 27 January 2018	38.3	44.8	36.0
Sunday 28 January 2018	42.5	45.2	36.3
Monday 29 January 2018	40.3	40.3	35.6
Tuesday 30 January 2018	41.7		
RBL	41	43.2	36.3

LEQ

Date	Measured Noise Level dB(A) _{L_{eq}}		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am Next Day)
Tuesday 23 January 2018	52.3	52.1	49.2
Wednesday 24 January 2018	50.6	51.2	50.6
Thursday 25 January 2018	50.9	60.7	49.0
Friday 26 January 2018	59.6	57.3	56.6
Saturday 27 January 2018	61.1	55.5	59.1
Sunday 28 January 2018	50.7	64.8	48.3
Monday 29 January 2018	52.0	50.3	50.3
Tuesday 30 January 2018	53.4		
Ambient LAeq	54	56	52

Description	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
	LAeq 15mi	LAeq 15min	LAeq 15min	Exceedance			Significance of residual noise impacts		
Amenity Criteria				Table 4.1 NPfl					
Rural	48	43	38						
Suburban	53	43	38						
Intrusive Criteria	50	46	35						
Project Criteria (Suburban)	50	43	35	(lower of the amenity and intrusive criteria)					
Measured Truck Noise (ALC Table 12)	53/4	53/4	53/4						
Façade Corrected +2.5dB	56/7	56/7	56/7	6/7	13/14	21/22	Significant	Significant	Significant
Sprinklers (ALC Table 12)	49/50	49/50	49/50						
Façade Corrected +2.5dB	52/53	52/53	52/53	1/2	9/10	17/18	Negligible	Significant	Significant
Fans	49	49	49						
Façade Corrected +2.5dB	52	52	52	2	9	17	Negligible	Significant	Significant
Pump (unknown)									