



Firs Hotel

Bedford Road, Hitchin, SG5 2TY

Noise Impact Assessment

5th June 2026

Revision 1



Firs Hotel

Bedford Road, Hitchin, SG5 2TY

Noise Impact Assessment

5th June 2026

Revision 1

Revision History

Version	Comments	Author	Date
First Issue	First issued version of the report	Chris Parker-Jones BSc (Hons) MSc MIOA Director and Acoustic Consultant	11 th February 2026
Revision 1	Revised site plan and addition of 3m northern boundary acoustic fence		5th June 2026

ParkerJones Acoustics Limited

Bristol

11 Bankside Road
Brislington
Bristol
BS4 4LB

London

29 Lincoln's Inn Fields
Holborn
London
WC2A 3EE

Glasgow

126 West Regent Street
Glasgow
G2 2RQ

+44 (0)800 830 3338

+44 (0)117 914 6558

info@parkerjonesacoustics.com

www.parkerjonesacoustics.com

Registered in England and Wales

Company No. 12235614

This document has been prepared using all reasonable skill and care. ParkerJones Acoustics Limited (PJA) accepts no liability or responsibility for any third-party data present in this report. The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in PJA unless the terms of appointment with the Client state otherwise. PJA shall not be liable for the use of or reliance on any information, advice, recommendations, and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only if PJA and the third party have executed a reliance agreement or collateral warranty.

Executive Summary and Conclusions

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment in support of a proposed residential redevelopment at the former Firs Hotel, Bedford Road, Hitchin.

The proposal comprises the demolition of the existing hotel building and the construction of residential dwellings with associated external amenity space. The purpose of this assessment is to evaluate the impact of the existing noise environment, including road traffic along Bedford Road and commercial activity to the north of the site (most notably the adjacent car wash), on the proposed development, and to advise on appropriate façade, ventilation, and plant noise controls to achieve suitable internal and external noise conditions for future occupants.

This revised assessment has subsequently been updated to reflect revisions to the proposed layout and the introduction of a 3 m high acoustic fence along the northern boundary, following discussions with the Local Planning Authority and Environmental Health Officer regarding external amenity noise levels and the influence of the adjacent car wash.

Noise Impact on the Proposed Development (Section 5.0)

In summary, PJA considers that the noise impact on future occupants of the proposed dwelling can be controlled to an acceptable level and should not pose a barrier to planning permission, provided the recommendations in this report are implemented.

External amenity noise levels have been assessed in **Section 5.3.2**. The assessment demonstrates a clear variation in noise exposure across the site. External amenity areas associated with the westernmost residential building are well screened from Bedford Road and from adjacent commercial activity to the north, and are predicted to fall comfortably within the guideline range for outdoor amenity spaces, allowing these areas to be used and enjoyed as intended.

External amenity areas associated with the easternmost residential building were previously predicted to exceed the upper end of the guideline range, primarily due to noise from the adjacent car wash. Following discussions with the Local Planning Authority and Environmental Health Officer, the scheme has been amended to incorporate a 3 m high acoustic barrier along the northern boundary. The updated assessment demonstrates that the barrier provides a meaningful reduction in noise levels within the affected gardens, such that all external amenity areas now contain usable areas at or below 55 dB $L_{Aeq,16hr}$ and therefore fall within the guideline range identified by ProPG, BS 8233:2014 and the WHO Guidelines.

Internal noise levels have been assessed in **Section 5.3.3**. The assessment shows that internal noise criteria cannot be reliably achieved with windows open in all parts of the development, particularly within Exposure 1 and, to a lesser extent, Exposures 2 and 3, where external noise levels are highest. This does not imply that windows would be fixed shut; however, assessment against the Acoustics, Ventilation and Overheating (AVO) Guide (2020) indicates that reliance on open windows as the primary means of ventilation may result in increased noise intrusion and associated behavioural change, particularly at the more exposed façades.

Minimum sound-reduction indices for glazing and passive ventilators have been specified in **Table 5.5 (Section 5.3.3.3)** (corresponding with exposure levels in **Figure 5.1**), providing compliance with internal targets under closed-window conditions while maintaining a passive air path. These requirements are informed by both road traffic noise and commercial noise from the north of the site, including car wash activity. While example constructions are provided in Appendix E, the applicant must ensure that the final products meet or exceed the recommended $R_w + C_{tr}$ and $D_{n,e,w} + C_{tr}$ ratings and be prepared to provide supporting datasheets or schedules to the Local Planning Authority if requested.

As discussed in **Section 5.3.3.4**, consideration also needs to be given to overheating risk and compliance with Approved Document O. It is uncertain whether reliance on acoustically attenuated passive ventilators alone would provide sufficient airflow to maintain thermal comfort during warmer periods. Unless demonstrated otherwise through a separate overheating assessment, it may be beneficial to consider a whole-dwelling mechanical ventilation system and/or comfort-cooling, designed to meet the acoustic criteria and maintain acceptable internal noise levels.

Subject to the implementation of these measures, the proposed development is considered capable of achieving an acceptable internal and external acoustic environment, consistent with the intent of BS 8233:2014, the Professional Practice Guidance on Planning and Noise (2017), and the Acoustics, Ventilation and Overheating Guide (2020).

Operational Plant Noise Impact (Section 6.0)

Detailed fixed plant specifications are not available at this stage. However, based on the conclusions of the noise and ventilation assessment, it is anticipated that the dwellings will incorporate mechanical ventilation (e.g. MVHR) and potentially air-conditioning or comfort-cooling systems.

The plant noise limits identified in **Section 6.2** are not considered unduly restrictive and can be readily achieved through standard good-practice mechanical and acoustic design.

Where MVHR systems are installed, these would typically include in-duct silencers to control breakout and regenerated noise, which are commonplace components and not considered onerous.

Where external plant such as ASHPs or AC condensers is proposed, compliance with the plant noise limits can similarly be achieved through appropriate equipment selection, siting, and, where necessary, modest local acoustic mitigation.

Contents

Executive Summary and Conclusions	3
1.0 Introduction.....	6
2.0 Site and Development Description.....	7
3.0 Relevant Guidelines	14
3.1 The Professional Practice Guidance on Planning and Noise (ProPG).....	14
3.2 BS 8233:2014	16
3.3 World Health Organisation (WHO) Environmental Noise Guidelines.....	17
3.4 Acoustics, Ventilation, and Overheating (AVO) Residential Design Guide.....	18
3.5 BS 4142:2014.....	19
4.0 Noise Survey	20
4.1 Methodology.....	20
4.2 Results	21
5.0 Noise Impact on the Proposed Development	27
5.1 External Noise Levels	28
5.2 Stage 1 - Initial Site Noise Risk Assessment.....	31
5.3 Stage 2 – Full Assessment.....	31
5.4 Summary and Conclusions	42
6.0 Operational Plant Noise Impact	43
6.1 Background Sound Levels.....	44
6.2 Maximum Rating Levels	45
6.3 Design Implications	45
Appendix A – Acoustic Terminology and Concepts.....	46
Appendix B – National Planning Policy.....	47
Appendix C – Survey Methodology	55
Appendix D – Noise Mapping	58
Appendix E – Example Façade Constructions.....	76

1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment in support of a proposed residential redevelopment at Firs Hotel, Bedford Road, Hitchin SG5 2TY.

The site comprises the former Firs Hotel, which is no longer operational, and the proposals form part of a full planning application for residential development. The assessment has been commissioned to address the potential effects of existing environmental noise on the proposed development and to ensure that appropriate acoustic design measures are incorporated at an early stage. The assessment has subsequently been updated to reflect revisions to the proposed layout and the introduction of a 3 m high acoustic fence along the northern boundary, following discussions with the Local Planning Authority and Environmental Health Officer regarding external amenity noise levels and the influence of the adjacent car wash.

This report has been prepared to assess noise ingress from surrounding noise sources, primarily road traffic along Bedford Road, together with commercial noise sources to the north of the site, including a petrol filling station, car wash, and vehicle repair / servicing activities. The assessment is used to inform the specification of the building envelope and any associated ventilation strategy, with the aim of achieving suitable internal noise levels within the proposed dwellings. The assessment also considers external noise levels within proposed external amenity areas, where relevant, and provides recommendations where necessary to achieve appropriate acoustic conditions.

In addition, the report sets indicative plant noise limits, where applicable, to ensure that any future mechanical plant or building services (such as air conditioning, ventilation, or MVHR systems) can be designed to operate without giving rise to adverse noise impacts at nearby noise-sensitive receptors.

The assessment has been undertaken with reference to:

- the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE), and the Planning Practice Guidance on Noise (PPG-N) (summarised in **Appendix B**),
- the *Professional Practice Guidance on Planning and Noise* (ProPG, 2017), which provides guidelines regarding suitable internal ambient noise levels for residential properties;
- BS 8233:2014 – *Guidance on Sound Insulation and Noise Reduction for Buildings*, which “provides guidance on the control of noise in and around buildings” and recommends appropriate criteria and internal noise limits for different situations, including residential developments;
- the *World Health Organization (WHO) Guidelines for Community Noise* (1999) and *Night Noise Guidelines for Europe* (2009), which suggest suitable internal and external noise levels in dwellings that correspond to “moderate” or “serious” annoyance thresholds; and
- the *Acoustics, Ventilation and Overheating Guide* (AVO Guide, 2020), which provides guidance on balancing the acoustic performance of façades with appropriate ventilation and overheating control;
- BS 4142:2014+A1:2019 ‘*Methods for rating and assessing industrial and commercial sound*’, where relevant, in relation to the assessment and control of noise from fixed plant and building services.

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who may not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in **Appendix A**.

2.0 Site and Development Description

The application site comprises the former Firs Hotel on Bedford Road, Hitchin SG5 2TY, together with the associated surface car park to the rear. The site was previously operated as a hotel but is no longer in use and is currently vacant.

As shown in **Figure 2.1**, the site is bounded to the east by Bedford Road (A600), which forms a main route through this part of Hitchin. Beyond Bedford Road, further to the east, is a football pitch associated with Hitchin Town Football Club. To the south-east, a roundabout connects Bedford Road with Fishponds Road (A505) and Maxwell's Path.

Residential properties are located immediately to the south, along Firs Close, and to the west, along Symonds Road, both comprising established residential streets. To the north of the site is a Shell petrol filling station, with an automated car wash located directly along its southern boundary. Adjacent to the petrol station to the north is a Bosch Service Centre vehicle repair workshop, which sits broadly opposite the north-west corner of the application site. A Kwik Fit vehicle service and tyre centre is located further to the north of these commercial uses.

The proposed development involves the demolition of the existing hotel building and associated car park, and the erection of two three-storey residential buildings comprising terraced housing. The western building contains five dwellings, while the building closer to Bedford Road contains four dwellings, giving a total of nine residential units. Car parking is proposed within the central part of the site, between the two buildings.

Each dwelling is provided with a fenced external amenity area, located predominantly on the western sides of the buildings. Windows are proposed only within the western and eastern elevations of both residential blocks. In response to discussions with the Local Planning Authority and Environmental Health Officer regarding external amenity noise levels, the proposals also incorporate a 3 m high acoustic barrier along the northern boundary of the site. The barrier extends from the rear (western) building towards the front of the site and is intended to reduce noise ingress from the adjacent commercial uses, most notably the automated car wash.

The proposed site layout is shown in **Figure 2.2**, with the acoustic barrier highlighted in red for clarity. The proposed ground floor, 1st floor, and 2nd floor layouts are illustrated in **Figures 2.3, 2.4 and 2.5** respectively. **Figure 2.6** presents the proposed street scenes and elevations, illustrating the appearance of the development and the relationship between the proposed buildings, acoustic barrier, and surrounding area.

Figure 2.1 – Aerial views of the site and surrounding area



Figure 2.2 – Proposed site plan

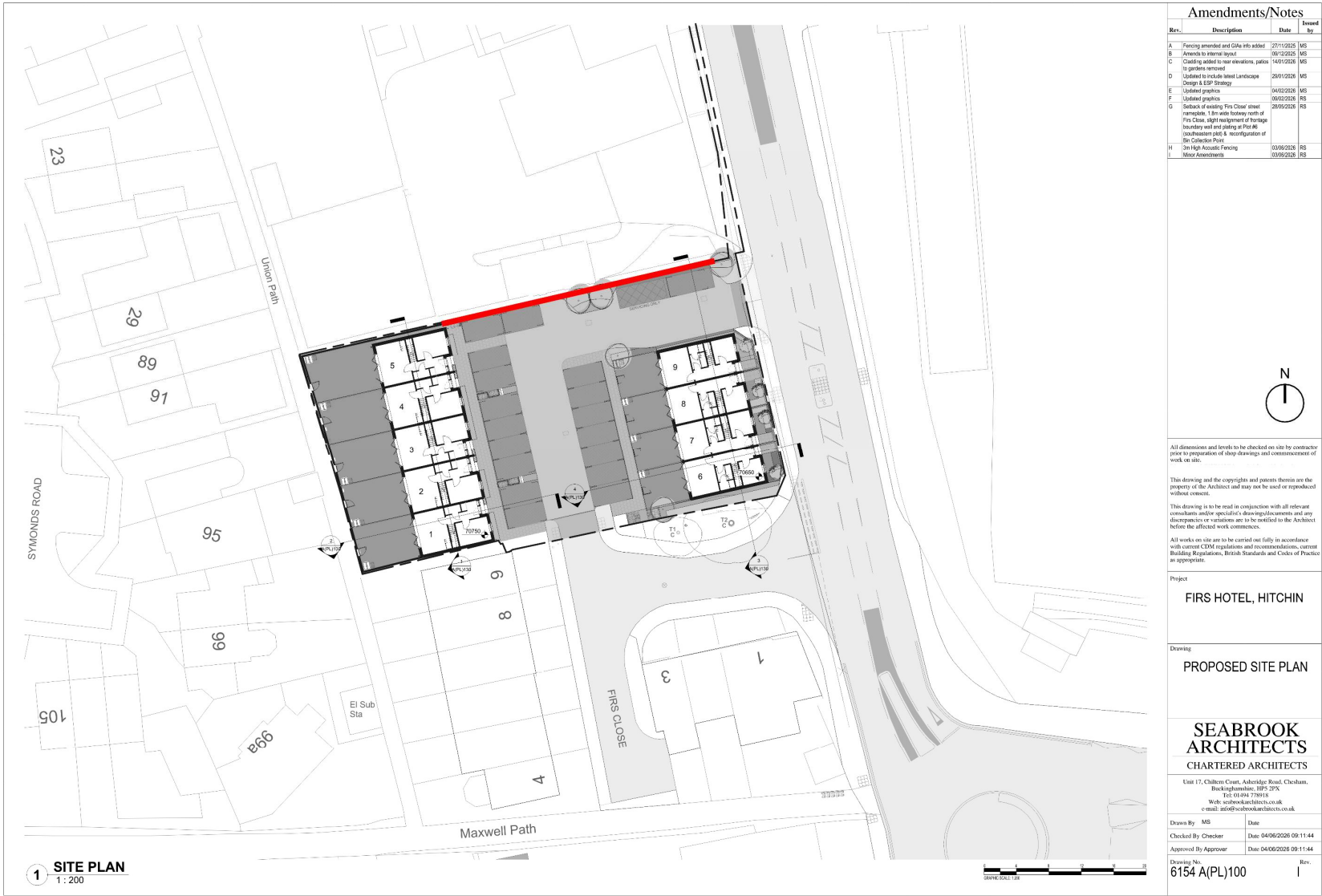


Figure 2.3 – Proposed ground floor plans

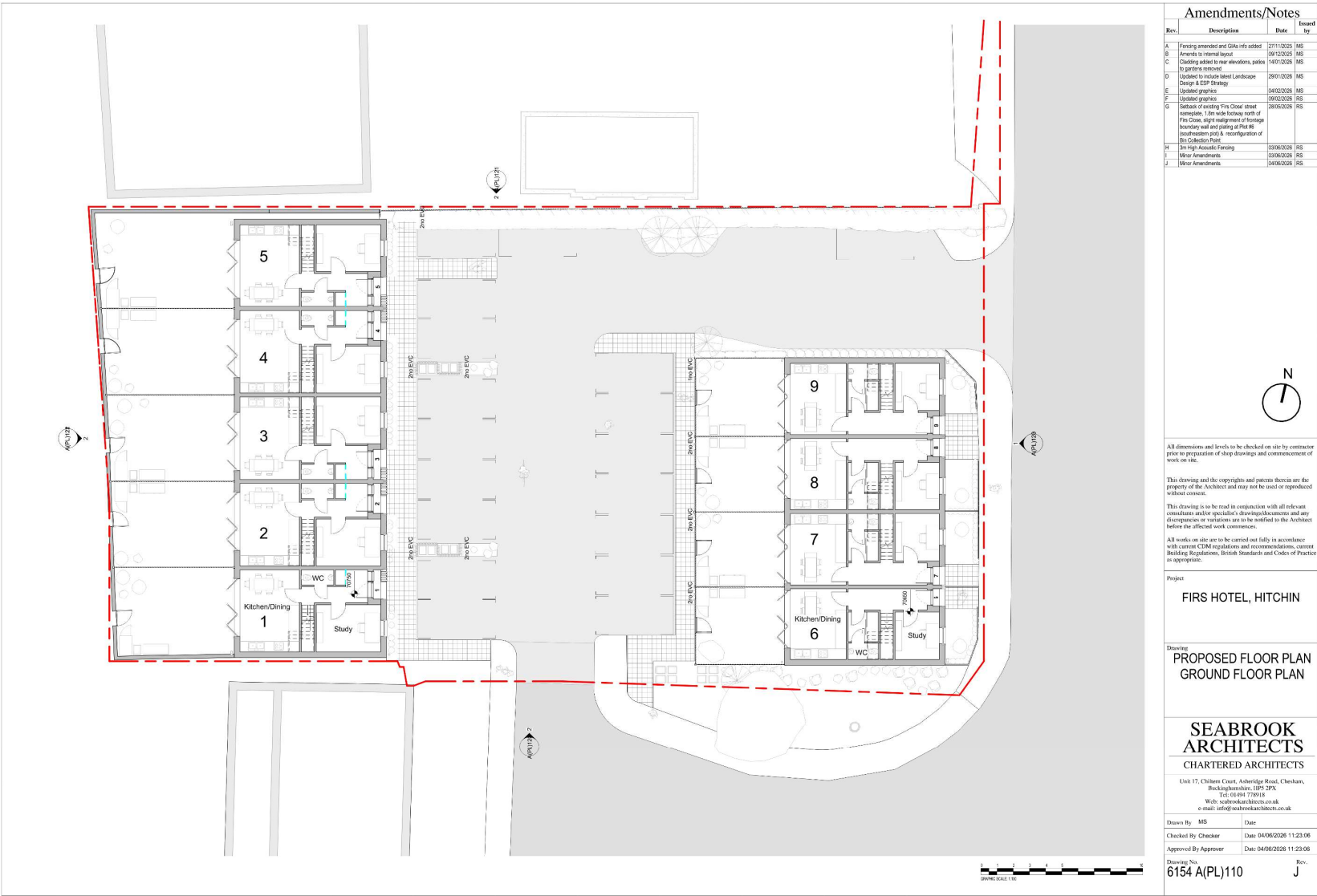


Figure 2.4 – Proposed first floor plans

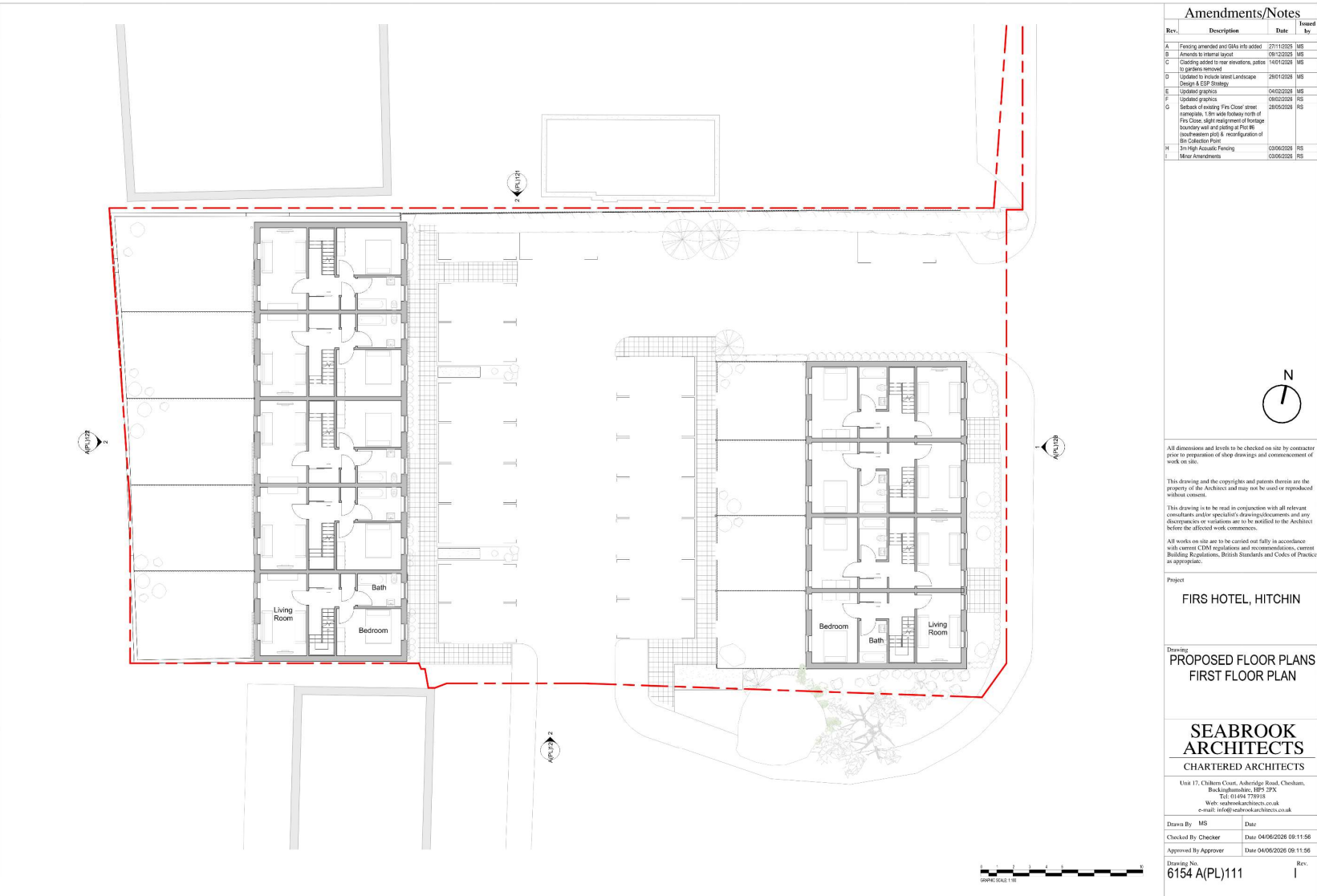


Figure 2.5 – Proposed second floor plans



Figure 2.6 – Proposed street scenes



3.0 Relevant Guidelines

3.1 The Professional Practice Guidance on Planning and Noise (ProPG)

The ProPG, published in 2017, extends on the guidance and numerical targets within BS 8233:2014 and WHO guidelines, providing new and extended recommendations where these standards (frequently used for assessing residential developments throughout the UK) are considered to fall short. Therefore, it is considered to be the most relevant and up-to-date design standard for assessing the noise impact on new residential developments.

A full summary of the standard (including the 'good acoustic design' process) is given in **Appendix B.4**.

3.1.1 Stage 1: Initial Site Noise Risk Assessment

The ProPG recommends that an initial site noise risk assessment should be undertaken based on indicative external noise levels on the existing site, without accounting for the impact of any new or additional mitigation measures that may subsequently be included in development proposals. Figure 1 of the ProPG relates the increasing risk of adverse effects against indicative daytime noise levels ($L_{Aeq,16hr}$) and nighttime noise levels ($L_{Aeq,8hr}$) without noise mitigation. This is recreated in **Table 3.1**.

Table 3.1 – The ProPG initial site noise risk assessment guidelines

Indicative external daytime noise levels $L_{Aeq,16hr}$	Indicative external nighttime noise levels $L_{Aeq,8hr}$	Potential risk of adverse effect without noise mitigation
≤ 50 dB	≤ 40 dB	Negligible / No adverse effect ¹
> 50 dB and ≤ 60 dB	> 40 dB and ≤ 50 dB	Low
> 60 dB and ≤ 70 dB	> 50 dB and ≤ 60 dB	Medium
> 70 dB	> 60 dB	High
NOTES: The noise level limits are an interpretation of Figure 1 in the ProPG, which is presented as a diagram rather than a table and does not explicitly state the limits at which each risk category exists. ¹ An indication that there may be more than 10 noise events at night with $L_{Amax,F} > 60$ dB means the site should not be regarded as a negligible risk.		

3.1.2 Stage 2: Full Assessment

The ProPG, published in 2017, extends on the guidance and numerical targets within BS 8233:2014 and WHO guidelines, new and extended recommendations where these standards are considered to fall short. Therefore, it is considered to be the most relevant and up to date design standard for assessing the noise impact on new residential developments.

3.1.2.1. Internal Ambient Noise Levels

The ProPG provides internal ambient noise level targets based on BS 8233:2014 and WHO guidelines, as shown in the table below. The targets are essentially the same as BS 8233:2014 guidelines but with the addition of an $L_{Amax,F}$ target overnight based on WHO guidelines.

The ProPG indicates that the guidance can be relaxed by up to 5 dB (as does BS 8233:2014) where development is considered necessary or desirable, despite high external noise levels.

Table 3.2 – The ProPG internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)	Nighttime (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}$ ¹
¹ a threshold by which 'good acoustic design' is achieved by not exceeding this threshold more than 10 times a night			

Whilst it is desirable to achieve the recommended IANLs with windows open, an assessment can be made with closed windows and open ventilators (i.e., trickle vents) which provide "*whole dwelling ventilation*" (as defined by Building Regulations Approved Document F).

Closed windows do not mean sealed shut/un-openable windows, as occupants would favour the ability to open the windows (especially during the hotter months of the year) even if the resultant internal acoustic conditions aren't as satisfactory.

3.1.2.2. Outdoor Amenity Noise Levels

The ProPG also provides guidance for outdoor amenity noise levels based on WHO and BS 8233:2014 guidelines. This applies to gardens, balconies, roof terraces, and patio areas.

If outdoor amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended. Noise levels should ideally not be above the range **50 – 55** dB $L_{Aeq,16hr}$.

It does, however, accept that this can't be achieved in all situations, in which the development should be designed to achieve the lowest practicable noise levels in these outdoor amenity spaces. The impact can partially be offset by the residents having access to a:

- relatively quiet alternative outdoor amenity space as part of the property, group of residential properties, or a public space in the nearby area; and/or
- a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e., an enclosed balcony) as part of their dwelling.

3.2 BS 8233:2014

BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' suggests appropriate criteria and limits for different situations. It is primarily intended to guide the design of new buildings, or refurbished buildings undergoing a change of use. This includes internal and external noise criteria for residential developments. The limits with BS 8233:2014 are similar to those in the WHO's 'Guidelines for Community Noise' (1999) and 'Night Noise Guidelines for Europe' (2009) documents.

3.2.1 Internal Ambient Noise Levels

Table 4 of BS 8233:2014 provides 'desirable' internal ambient noise level (IANL) limits for dwellings from "steady external noise sources". BS 8233:2014 also notes that "where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved." These targets are summarised in **Table 3.2** below.

Table 3.3 – BS 8233:2014 internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)		Nighttime (23:00 – 07:00)	
		Desirable conditions	Reasonable conditions	Desirable conditions	Reasonable conditions
Resting	Living Room	35 dB L _{Aeq,16hr}	40 dB L _{Aeq,16hr}	-	-
Dining	Dining Room/Area	40 dB L _{Aeq,16hr}	45 dB L _{Aeq,16hr}	-	-
Sleeping (daytime resting)	Bedroom	35 dB L _{Aeq,16hr}	40 dB L _{Aeq,16hr}	30 dB L _{Aeq,8hr}	35 dB L _{Aeq,8hr}

Annex G.1 of BS 8233:2014 suggests that "if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB".

Whilst it is desirable to achieve the recommended IANLs with windows open, this is not stipulated as a mandatory requirement within the guidance of BS 8233:2014 which states "if relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g., trickle ventilators should be open) during assessment."

3.2.2 Outdoor Amenity Noise Levels

BS 8233:2014 indicates that in external areas used for amenity space, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

Although in many areas, i.e., next to a strategic transport network, a compromise between elevated noise levels and the convenience of living in these locations may be acceptable. In such a case, the development should be designed to 'achieve the lowest practicable levels' in these external amenity spaces but should not be prohibited.

3.3 World Health Organisation (WHO) Environmental Noise Guidelines

The WHO document *Guidelines for Community Noise 1999* has recently been superseded by the *Environmental Noise Guidelines for the European Region*. However, the updated guidance states that 'all WHO guidelines for community noise (CNG) indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid'.

The 1999 document gives the following description of community noise:

*"Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include **road, rail and air traffic**, industries, construction and public work, and the neighbourhood. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music; sport events including motor sports; playgrounds; car parks; and domestic animals such as barking dogs."*

3.3.1 Internal Ambient Noise Levels

For steady continuous noise, the GCN recommends an indoor guideline value for bedrooms of 30 dB $L_{Aeq,8hr}$ and 45 dB L_{AFmax} to prevent sleep disturbance.

3.3.2 Outdoor Amenity Noise Levels

Regarding external noise, the GCN states:

- To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise.
- To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq} .

3.4 Acoustics, Ventilation, and Overheating (AVO) Residential Design Guide

The Acoustics, Ventilation and Overheating Guide ('AVO Guide') recommends an approach for "good acoustic design" which regards the "interdependence of provisions for acoustics, ventilation and overheating".

The AVO Guide gives considerably more detailed guidance than other noise guideline documents regarding the impact of noise ingress when windows are open to reduce overheating. It indicates that slightly elevated internal noise levels over the internal targets of BS 8233:2014 as a result of opening windows may be an acceptable compromise to provide thermal comfort.

The table identifies the relationship between the external noise level and the risk of adverse impact (from the 'Level 1' assessment methodology outlined in the standard.

This reiterates that designing to a limit outside of residential windows of 50 dB L_{Aeq} during the daytime and 45 dB L_{Aeq} should mean a low risk of adverse impact.

Table 3.4 – AVO relationship of internal noise levels with open windows to a risk of adverse impact

External Free-Field Noise Level		Examples of Outcomes	Risk (of Adverse Impact) Category for Level 1 Assessment
Daytime $L_{Aeq,T}$ (07:00 – 23:00)	Nighttime $L_{Aeq,8h}$ (23:00 – 07:00)		
≤ 52 dB	≤ 47 dB	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of the television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Low
> 52 dB and ≤ 62 dB	> 47 dB and ≤ 55 dB	Increasing risk of adverse effect due to impact on reliable speech communication during daytime or sleep disturbance at night. Although noise levels at the lower end of this category will cause changes in behaviour, they may still be considered suitable. Noise levels at the upper end of this category will result in more significant changes in behaviour and are only likely to be considered suitable if they occur for limited periods.	Medium
> 62 dB	> 55 dB	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	High

3.5 BS 4142:2014

BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound*' is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations (i.e., residential windows) within the context of the existing sound environment.

The method is based upon assessing the predicted noise emissions from plant/equipment against the existing background sound levels at NSRs, the latter of which is determined by a noise survey conducted at the site.

The predicted noise emissions are termed as a 'rating level', which is the 'specific sound level' from plant (the actual measurable noise level), plus 'penalties' which account for whether the noise has distinguishing characteristics such as tonality, intermittency, impulsivity, or is generally distinguishable from the ambient noise environment. Such features may attract attention and be considered annoying, hence sounds with these qualities should be penalised over sounds at the same specific noise level which is less intrusive.

BS 4142:2014 states that *"the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact."*

Further explanation of the standard is given in **Appendix B.5**.

4.0 Noise Survey

4.1 Methodology

ParkerJones Acoustics Limited (PJA) attended the site to undertake an environmental noise survey over the course of several days between the afternoon of Thursday 4th December and the early evening of Wednesday 10th December 2025. The results of the survey have been used to quantify the typical residual noise levels incident on the site on a representative day-to-day and night-by-night basis..

Two long-term unattended measurement positions (P1 and P2) were installed at the locations shown in **Figure 2.1** (Section 2.0).

- **Position P1** was located at the north-eastern corner of the existing Firs Hotel building, with the microphone secured to a rainwater downpipe at a height of approximately 3.0 metres above ground level. The microphone was fixed close to the façade purely for security reasons, but was deliberately positioned to provide a clear line of sight to Bedford Road and to the exit of the adjacent automated car wash, such that noise from both road traffic and commercial activity to the north of the site would be appropriately captured.
- **Position P2** was located on the western side of the building, close to the corner of the westernmost elevation and adjacent to the western edge of the existing external green area at the inner edge of the car park. This position was selected to provide a clear line of sight to the rear of the petrol filling station, the intake of the automated car wash, and the rear of the Bosch Service Centre vehicle repair workshop. The microphone was installed at a height of approximately 3.0 metres above ground level and positioned at least 1.5 metres from the nearest vertical reflective surface.

The sound level meters were configured to log noise levels continuously over the survey period, recording 5-minute averaging periods at both positions. The monitoring equipment was left unattended for the duration of the survey, with site attendance limited to setup and collection. The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered a good representation of the average ambient sound level;
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' – i.e., emergency services sirens;
- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – or noise levels from continuous noise sources such as plant; and
- $L_{A10,T}$: The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level' and a good representation of traffic noise contributions.

Appendix C contains further information on the methodology of the survey; including the equipment used; photographs of the site and monitoring positions; and the weather conditions.

4.2 Results

4.2.1 Position P1

A graph of the measured noise levels across the monitoring period at Position P1 is provided in **Figure 4.1**, with a summary of results presented in **Table 4.1**.

The noise climate at P1 was most consistently dominated by road traffic along Bedford Road, which provided a largely continuous noise source throughout the daytime period. A clear diurnal pattern was observed, with noise levels remaining elevated during the day before reducing markedly overnight, when traffic flows became significantly more intermittent.

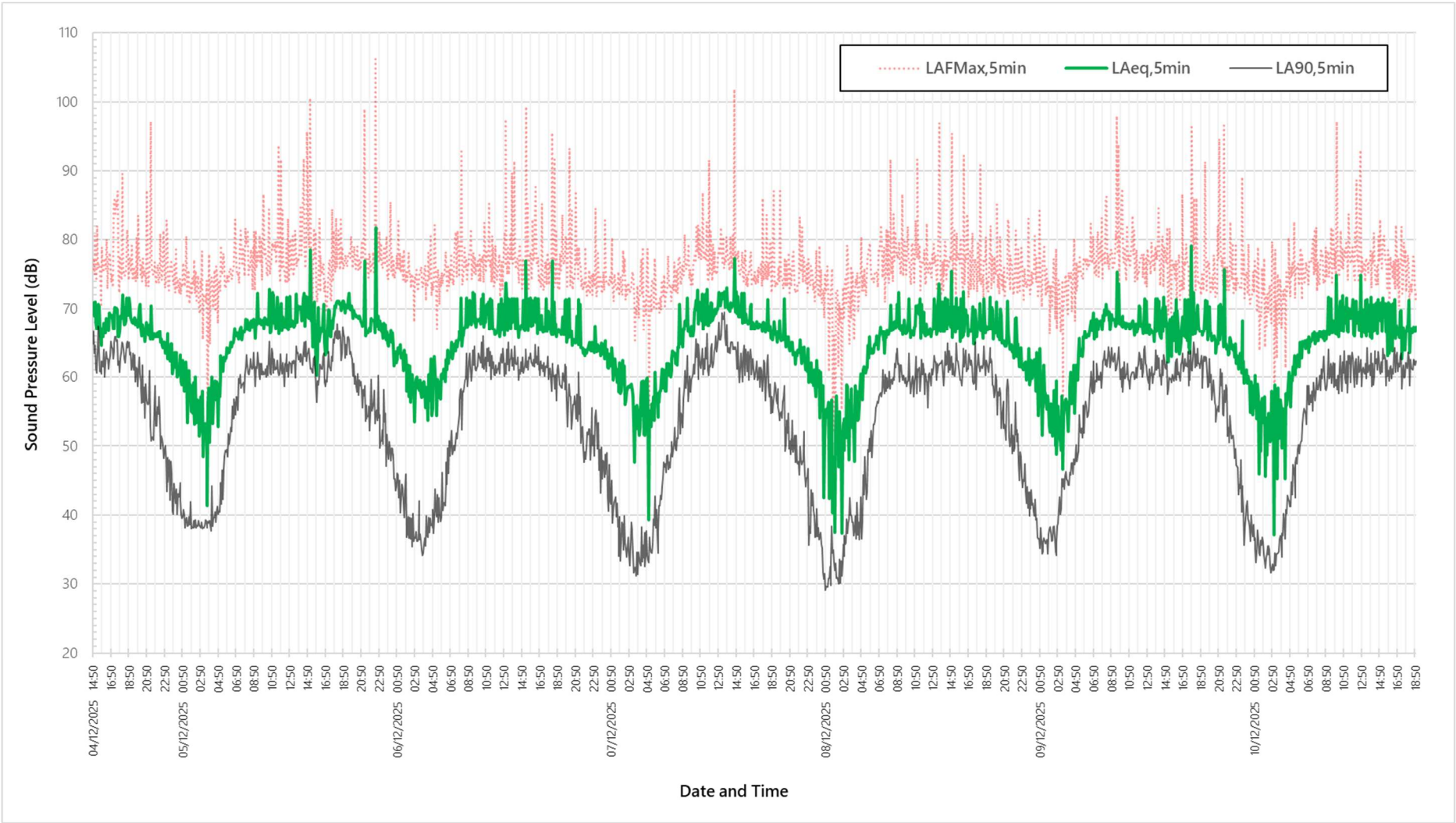
In addition to road traffic, the noise data show regular and consistent daytime peaks, which were observed during the site visit to be associated with activity at the adjacent petrol filling station car wash. During periods when the car wash was in use, $L_{Aeq,5min}$ values frequently increased into the low-70 dB(A) range, reflecting noise emissions from the washing and drying operations. The highest $L_{Aeq,1hr}$ value recorded during the daytime, coinciding with a period of sustained car wash activity, was 73 dB(A). Although screening is present along part of the car wash boundary, the open sides of the structure allow noise to propagate towards the site, and the data indicate that this activity occurred at fairly regular intervals throughout the daytime period.

A small number of short-duration transient peaks were also recorded, most likely attributable to emergency service sirens along Bedford Road. These events resulted in occasional anomalously high L_{AFmax} and $L_{Aeq,5min}$ values and have been treated as unrepresentative short-term events rather than characteristic of the underlying ambient noise climate.

Table 4.1 – Summary of measured noise levels – Position P1

Period	Logarithmic Average L _{Aeq,T} (dB)	10 th Highest L _{AFmax,5min} (dB)	Minimum L _{A90,5min} (dB)	Median L _{A10,5min} (dB)
Daytime (07:00 – 23:00) T = 16-hours				
Thursday 4th December; 14:50 - 23:00	68	84	48	70
Friday 5th December; 07:00 - 23:00	69	86	52	71
Saturday 6th December; 07:00 - 23:00	69	87	48	70
Sunday 7th December; 07:00 - 23:00	68	82	44	71
Monday 8th December; 07:00 - 23:00	68	84	44	70
Tuesday 9th December; 07:00 - 23:00	68	86	47	70
Wednesday 10th December; 07:00 - 19:00	68	82	55	70
Nighttime (23:00 – 07:00) T = 8-hours				
Thursday 4th December / Friday 5th December; 23:00 - 07:00	61	78	38	64
Friday 5th December / Saturday 6th December; 23:00 - 07:00	63	79	34	65
Saturday 6th December / Sunday 7th December; 23:00 - 07:00	61	77	31	63
Sunday 7th December / Monday 8th December; 23:00 - 07:00	60	78	29	60
Monday 8th December / Tuesday 9th December; 23:00 - 07:00	62	78	34	63
Tuesday 9th December / Wednesday 10th December; 23:00 - 07:00	60	78	32	62

Figure 4.1 – Graph of measured noise levels – Position P1



4.2.2 Position P2

A graph of the measured noise levels across the monitoring period at Position P2 is provided in **Figure 4.2**, with a summary of results presented in **Table 4.2**.

The noise climate at P2 was again influenced by road traffic activity along Bedford Road; however, due to the location of this position on the opposite side of the building, together with the increased distance from the road and additional screening provided by the existing structure, traffic noise levels were significantly reduced in comparison with Position P1.

This is reflected in the measured background and ambient noise levels, which were typically around 15 to 18 dB lower overnight at P2 than those recorded at P1. A similar reduction was observed during the daytime period on average, confirming the effectiveness of distance and screening in attenuating road traffic noise at this location.

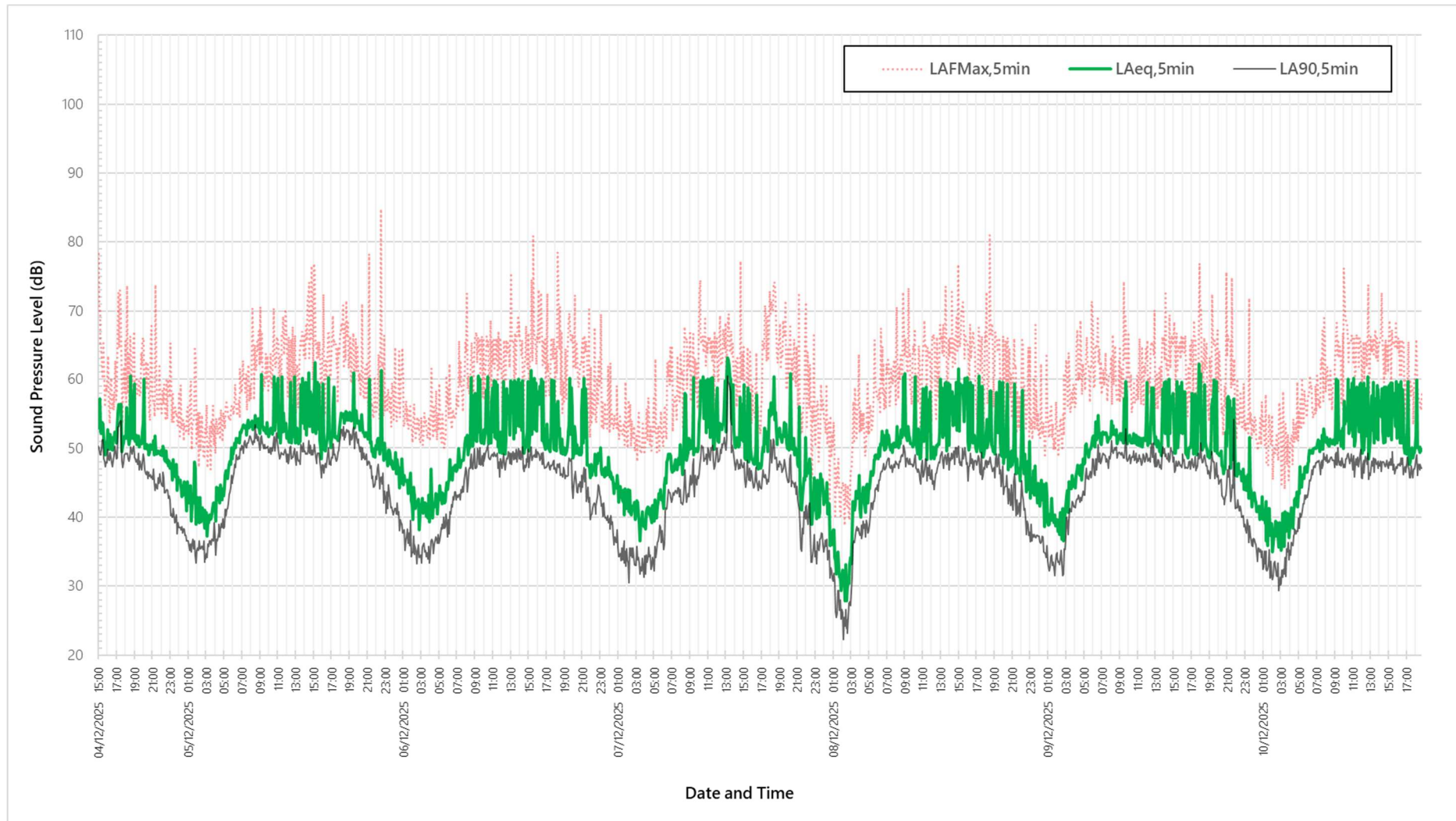
Despite this reduction in road traffic influence, the monitoring data show that activity at the adjacent petrol filling station car wash remained a noticeable contributor to the noise climate during the daytime. Clear and repeatable peaks were observed in the measured noise levels during periods of operation, with $L_{Aeq,5min}$ values typically increasing to around 57 to 60 dB(A) when the car wash was in use. It is evident from the data that the car wash operates only during the daytime, as no corresponding peaks were recorded during the nighttime period.

During a sustained period of regular car wash activity, the highest $L_{Aeq,1hr}$ value measured at Position P2 was 60 dB(A), representing the upper end of the daytime ambient noise levels at this location.

Table 4.2 – Summary of measured noise levels – Position P2

Period	Logarithmic Average L _{Aeq,T} (dB)	10 th Highest L _{AFmax,5min} (dB)	Minimum L _{A90,5min} (dB)	Median L _{A10,5min} (dB)
Daytime (07:00 – 23:00) T = 16-hours				
Thursday 4th December; 15:00 - 23:00	53	67	43	53
Friday 5th December; 07:00 - 23:00	55	72	42	55
Saturday 6th December; 07:00 - 23:00	55	72	40	53
Sunday 7th December; 07:00 - 23:00	54	71	34	53
Monday 8th December; 07:00 - 23:00	55	70	37	53
Tuesday 9th December; 07:00 - 23:00	54	69	39	53
Wednesday 10th December; 07:00 – 18:45	55	68	46	54
Nighttime (23:00 – 07:00) T = 8-hours				
Thursday 4th December / Friday 5th December; 23:00 - 07:00	46	58	33	48
Friday 5th December / Saturday 6th December; 23:00 - 07:00	45	60	33	48
Saturday 6th December / Sunday 7th December; 23:00 - 07:00	44	60	31	47
Sunday 7th December / Monday 8th December; 23:00 - 07:00	45	59	22	45
Monday 8th December / Tuesday 9th December; 23:00 - 07:00	47	65	32	48
Tuesday 9th December / Wednesday 10th December; 23:00 - 07:00	44	58	29	45

Figure 4.2 – Graph of measured noise levels – Position P2



5.0 Noise Impact on the Proposed Development

This section sets out the assessment of the impact of the existing noise environment on the proposed development, including the implications for the ventilation strategy, the construction requirements of the building façades, and the suitability of external amenity areas. The objective is to ensure that internal and external noise levels are controlled to an acceptable standard for future occupants.

The assessment has been undertaken in accordance with the Professional Practice Guidance on Planning and Noise (ProPG, 2017), as summarised in **Section 3.2** and **Appendix B.4**, and applies the internal and external noise criteria defined in BS 8233:2014, ProPG, and the World Health Organization (WHO) Guidelines. The assessment also takes into account the Acoustics, Ventilation and Overheating (AVO) Guide (2020), which provides guidance on balancing acoustic performance, ventilation provision, and overheating risk, particularly where windows are opened for background or purge ventilation.

Following the ProPG framework, the assessment includes a Stage 1 Initial Site Noise Risk Assessment and a Stage 2 Good Acoustic Design Assessment, structured as follows:

- The existing ambient noise environment has been quantified through an environmental noise survey (**Section 4.0**) to establish representative daytime and nighttime noise levels at the site.
- A 3D noise model has been developed and calibrated to the measured data, then updated to include the proposed dwelling layout to predict external noise levels at the façades and within external amenity areas (**Section 5.1** and **Appendix D**).
- A Stage 1 Risk Assessment (**Section 5.2**) identifies the overall level of noise exposure and the associated level of risk to the proposed residential use prior to any mitigation.
- A Stage 2 Good Acoustic Design Assessment (**Section 5.3**) defines the design measures necessary to achieve suitable internal and external noise conditions, including:
 - **Section 5.3.1** – Good Acoustic Design Process, which summarises the consideration of layout, orientation, and boundary treatments in line with ProPG’s good acoustic design principles, identifying opportunities to minimise exposure to external noise through design choices.
 - **Section 5.3.2** – External Amenity Areas, which evaluates predicted noise levels against the guideline values in BS 8233, ProPG, and WHO, and identifies where mitigation devices such as acoustic fencing or screening may be beneficial to reduce noise exposure within gardens or outdoor spaces.
 - **Section 5.3.3** – Internal Noise Levels, which assesses predicted external noise ingress into habitable rooms, provides the necessary sound reduction indices for façade elements (e.g. glazing and trickle ventilators), and considers the implications for ventilation and overheating. This includes commentary on the impact of open-window ventilation, the relevance of the AVO Guide, and whether alternative ventilation strategies, such as mechanical or passive systems, would be advantageous in preventing overheating while maintaining appropriate internal noise levels.

5.1 External Noise Levels

A noise model/map for the existing site and proposed development has been constructed using the CadnaA® software package, a commonly used 3-D noise modelling software that implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The intention of noise modelling/mapping for this assessment is to accurately determine the noise levels across the entire site, at each façade and on each floor of the building(s) associated with the proposed development. This is considered more accurate than simply applying the results from the monitoring position to the whole development, as the different elevations have varying levels of exposure to noise.

Screenshots from the noise model and further information on the model parameters are provided in **Appendix D**.

The model has first been set up to reflect the noise climate at the existing site, based upon the results of the environmental noise survey, by placing receptor points at the survey monitoring positions and adjusting the model parameters to match these results as closely as possible (in terms of the highest $L_{Aeq,16hrs}$ and $L_{Aeq,8hrs}$, and the nighttime $L_{AFmax,5min}$ values which are exceeded 10 times per night. The existing site noise maps therefore represent a calibrated model of current baseline conditions.

For the existing site, noise maps have been produced at a receptor height of 3.0 m, corresponding to the approximate microphone heights used during the survey. The following figures are provided in **Appendix D**:

- **Figure D.1** – shows 3D views of the model setup of the existing site;
- **Figure D.2** – shows the daytime ambient noise level $L_{Aeq,16hr}$ – for the existing site, at a height of 3m (the approximate measurement heights of both monitoring positions).
- **Figure D.3** – shows the nighttime ambient noise level $L_{Aeq,8hr}$ – for the existing site, at a height of 3m.
- **Figure D.4** – shows the 10th highest maximum noise level $L_{AFmax,5min}$ – for the existing site, at a height of 3m.
- **Figure D.5** – shows the $L_{Aeq,1hr}$ noise levels representing worst-case daytime emissions from commercial noise sources to the north of the site, most notably activity associated with the automated car wash, used to illustrate the spatial extent and façade exposure from these sources in isolation.

The proposed development has then been incorporated into the model, and predictions have been undertaken to determine noise exposure levels at all residential façades and within external amenity areas. Predictions have been carried out for the daytime and nighttime periods, including both overall ambient noise levels and, where relevant, commercial noise contributions expressed as $L_{Aeq,1hr}$.

The following figures are provided in **Appendix D** for the proposed development scenario:

- **Figure D.6** – shows 3D views of the model setup with the proposed development in place.
- **Figure D.7** – shows the predicted outdoor amenity noise levels - $L_{Aeq,16hr}$, at a height of 1.5m.
- **Figure D.8** - shows the predicted façade exposure levels during the daytime - $L_{Aeq,16hr}$ – at ground floor level (1.5m).
- **Figure D.9** - shows the predicted façade exposure levels during the daytime - $L_{Aeq,16hr}$ – at 1st floor level (4.5m).

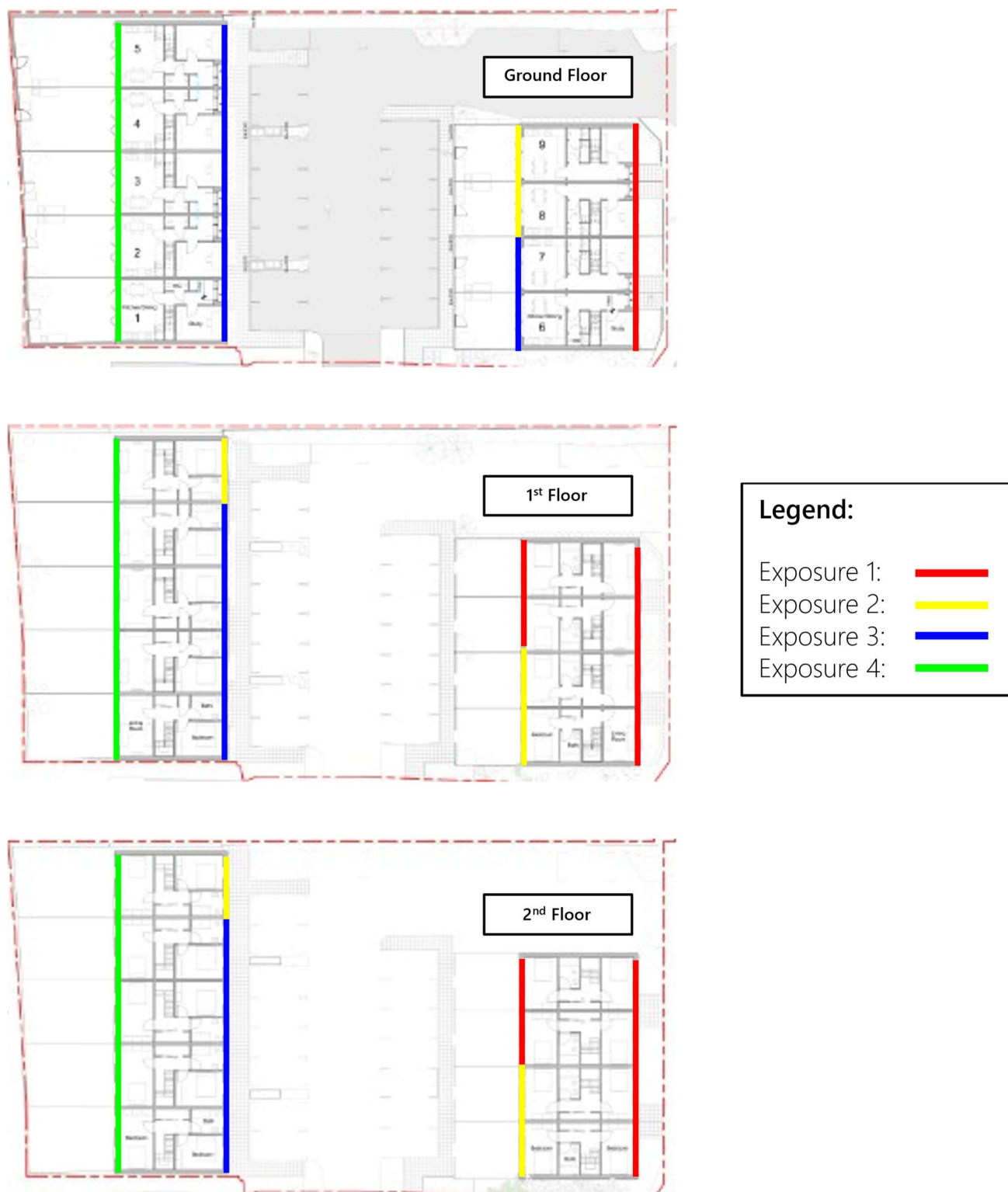
- **Figure D.10** - shows the predicted façade exposure levels during the daytime - $L_{Aeq,16hr}$ – at 2nd floor level (7.5m).
- **Figure D.11** - shows the predicted façade exposure levels during the nighttime - $L_{Aeq,8hr}$ – at 1st floor level (4.5m).
- **Figure D.12** - shows the predicted façade exposure levels during the nighttime - $L_{Aeq,8hr}$ – at 2nd floor level (7.5m).
- **Figure D.13** – shows the predicted façade exposure levels during the nighttime - $L_{AFmax,5min}$ (10th highest) – at 1st floor level (4.5m).
- **Figure D.14** – shows the predicted façade exposure levels during the nighttime - $L_{AFmax,5min}$ (10th highest) – at 2nd floor level (7.5m).
- **Figure D.15** – shows the predicted façade noise levels due to commercial noise sources only, expressed as $L_{Aeq,1hr}$, during the daytime period, during a worst case 1-hour period (sustained car wash usage) - at ground floor level (1.5m).
- **Figure D.16** – shows the predicted façade noise levels due to commercial noise sources only (as per above) - at 1st floor level (4.5m).
- **Figure D.17** – shows the predicted façade noise levels due to commercial noise sources only (as per above) - at 2nd floor level (7.5m).

To assess the required sound reduction performance for the building envelope, façade exposure categories have been defined as shown in **Figure 5.1** overleaf. These are based on the floor-by-floor façade noise levels determined from the noise modelling. **Table 5.1** defines the external façade noise levels for each exposure category.

Table 5.1 – External noise levels of each façade exposure category

Exposure Category	External Noise Level incident on the façade			
	Daytime average (07:00 – 23:00) dB $L_{Aeq,16hr}$	Nighttime average (23:00 – 07:00) dB $L_{Aeq,8hr}$	Nighttime maximum ¹ (23:00 – 07:00) dB L_{AFmax}	Daytime worst-case Commercial Noise (07:00 – 23:00) dB $L_{Aeq,1hr}$
Exposure 1	61 - 71	49 - 67	65 - 83	44 - 71
Exposure 2	52 - 62	47 - 54	63 - 70	59 - 67
Exposure 3	53 - 60	47 - 54	63 - 70	56 - 64
Exposure 4	39 - 50	34 - 44	50 - 60	40 - 51
1 - 10 th highest value per night.				

Figure 5.1 – Façade exposure categories



5.2 Stage 1 – Initial Site Noise Risk Assessment

As described in **Section 3.1.1**, the ProPG states that an initial assessment of the risk of adverse noise impact is made without accounting for the impact of any new or additional mitigation measures that may subsequently be included in development proposals. An overview of the noise risk criteria is provided in **Table 3.1**.

Based on the measured daytime $L_{Aeq,16hr}$ and nighttime $L_{Aeq,8hr}$ levels from **Table 5.1** it is seen that the potential risk of adverse effect without noise mitigation when comparing the levels to those in **Table 3.1** is *High* on Exposure 1, *Low* to *Medium* on Exposures 2 and 3, and *Low* on Exposure 4.

5.3 Stage 2 – Full Assessment

5.3.1 ‘Good’ Acoustic Design Process

ProPG suggests that a ‘good’ acoustic design process should explore other methods of mitigating noise which doesn’t wholly rely on using the building envelope (see **Appendix B.4** of this report). **Table 5.2** analyses the feasibility of the suggested mitigation measures for this site.

Table 5.2 – Analysis of noise mitigation measures as part of a ‘good’ acoustic design process as defined by the ProPG

Mitigation Method	Analysis
Maximising the spatial separation of noise source(s) and receptor(s).	The site is bounded by significant noise sources on multiple sides, including Bedford Road to the east and commercial uses to the north (petrol filling station, car wash, and vehicle repair facilities). Given the constrained urban nature of the site, there is limited scope to materially increase separation distances between noise sources and the proposed dwellings. Repositioning the buildings within the site would not result in any meaningful reduction in noise exposure and could conflict with other design and planning constraints.
Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.	The site is relatively flat and does not benefit from any advantageous topography that would provide natural screening from surrounding noise sources. There are no existing buildings or permanent structures on the site that could be relied upon to provide acoustic screening over the lifetime of the proposed development. As such, this mitigation measure does not offer any meaningful benefit in this instance.
Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.	The use of noise barriers forms an important part of the mitigation strategy for the proposed development. A 3 m high acoustic barrier is proposed along the northern boundary adjacent to the petrol filling station and car wash, specifically to reduce noise levels within the external amenity areas associated with the easternmost dwellings. Whilst the barrier is not expected to provide significant reductions to road traffic noise affecting the upper-floor façades, it is capable of reducing direct noise ingress from the adjacent commercial uses, most notably the automated car wash, and has been incorporated into the scheme following discussions with the Local Planning Authority and Environmental Health Officer. The barrier therefore provides a meaningful acoustic benefit and contributes towards achieving suitable external amenity noise levels across the development.

Mitigation Method	Analysis
Using the layout of the scheme to reduce noise propagation across the site.	The proposed layout places the primary external amenity spaces on the western side of the development, which represents the quieter part of the site. The westernmost residential block provides a degree of screening to these gardens from noise sources to the east, particularly Bedford Road. As a result, noise levels within these external amenity areas are significantly reduced compared to the road-facing side of the development, and in some locations noise level targets may be achievable with windows open. The layout therefore makes effective use of building mass to reduce noise propagation across the site.
Investigating the necessity and feasibility of reducing existing noise levels and relocating existing sources.	The dominant noise sources affecting the site, including road traffic along Bedford Road and established commercial activities to the north, are external to the site and beyond the control of the Applicant. It is not feasible to reduce noise emissions at source or to relocate these activities. Mitigation must therefore focus on managing noise exposure at the receptor.
Using the orientation of buildings to reduce the noise exposure of noise-sensitive rooms.	Due to the nature of the residential layout and the form of the proposed dwellings, noise-sensitive habitable rooms are inevitably located on multiple façades, including those exposed to higher noise levels. While some opportunities exist to favour quieter façades where practicable, building orientation alone is insufficient to adequately control noise exposure, and additional mitigation measures are required.
Using the building envelope to mitigate noise to acceptable levels.	The primary means of mitigation is therefore through appropriate specification of the building envelope, including glazing and ventilation elements, to ensure suitable internal noise levels are achieved within habitable rooms. This approach is consistent with good acoustic design principles and is discussed in detail in Section 5.3.3 .

5.3.2 Outdoor Amenity Area Noise Levels

The Professional Practice Guidance on Planning and Noise (ProPG), BS 8233:2014, and the World Health Organization (WHO) Guidelines indicate that noise levels within outdoor amenity areas should ideally not exceed 50 – 55 dB $L_{Aeq,16hr}$ in order for such spaces to be comfortably used and enjoyed.

Predicted daytime noise levels within the proposed external amenity areas have been derived from the calibrated noise model, with results presented in **Figure D.7 (Appendix D)**.

For the westernmost residential building, predicted garden noise levels are typically in the order of 40 – 42 dB $L_{Aeq,16hr}$, which is comfortably below the guideline range for outdoor amenity areas. These low levels arise due to a combination of factors, including effective screening from Bedford Road by the building itself, increased distance from road traffic, and substantial screening from commercial noise sources to the north. In particular, the rear elevation of the adjacent Bosch Service Centre comprises a largely solid façade facing the site, with operational access located on the opposite (northern) side of the building. Noise from the automated car wash is also substantially attenuated at this location due to the intervening building mass. As a result, the external amenity areas associated with the western building are considered acoustically suitable without the need for additional mitigation.

For the easternmost residential building, predicted daytime noise levels within the external amenity areas would previously have exceeded the upper end of the 50 – 55 dB guideline range, primarily due to commercial noise associated with the adjacent petrol filling station car wash rather than road traffic alone.

Following discussions with the Local Planning Authority and Environmental Health Officer, the scheme has been amended to incorporate a 3 m high acoustic barrier along the northern boundary of the site. The barrier has been specifically designed to break the line of sight between the external amenity areas and the principal noise-generating elements of the adjacent car wash.

The updated noise modelling, presented in **Figure D.7**, demonstrates that the acoustic barrier provides a meaningful reduction in noise levels within the affected gardens. Predicted daytime noise levels are reduced such that all external amenity areas contain usable areas at or below 55 dB $L_{Aeq,16hr}$, thereby falling within the guideline range identified by ProPG, BS 8233:2014 and the WHO Guidelines.

The acoustic barrier is not intended to provide significant mitigation of road traffic noise from Bedford Road, particularly at upper-floor level, but instead specifically addresses the commercial noise contribution from the adjacent car wash, which was previously responsible for the exceedance of the external amenity targets.

On this basis, the proposed external amenity areas are considered capable of providing a suitable acoustic environment for future occupants and are considered consistent with the intent of ProPG, BS 8233:2014 and the WHO Guidelines.

5.3.3 External Noise Ingress / Internal Noise Levels

5.3.3.1. Internal Noise Limits

The criteria for internal ambient noise levels (IANLs) are based primarily upon guidance from the ProPG.

In summary, IANL contributions from external noise sources inside the residential dwellings should be greater than those in the table below. The criteria are considered to be in line with the Lowest Observed Adverse Effect Level (LOAEL) referenced in national planning policy (**Appendix B**).

Table 5.3 – Internal ambient noise level (IANL) upper limits

Location	General/Overall Noise		Commercial Noise
	Daytime (07:00 – 23:00)	Nighttime (23:00 – 07:00)	Daytime (07:00 – 23:00)
Bedrooms	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}^1$	35 dB $L_{Aeq,1hr}$
All other 'habitable' rooms	35 dB $L_{Aeq,16hr}$	N/A	35 dB $L_{Aeq,1hr}$

In addition to road traffic noise, the dominant commercial noise influence affecting the site arises from activity to the north of the development, most notably the automated car wash associated with the adjacent petrol filling station. As demonstrated by the environmental noise survey and supporting noise modelling, operation of the car wash gives rise to regular and identifiable increases in measured noise levels during the daytime period and represents the principal commercial noise source relevant to the assessment.

Given the proximity of the car wash to the northern boundary of the site, and its intermittent but repeatable operation throughout the day, the assessment has been undertaken on the basis of a reasonable worst-case daytime commercial noise scenario, in addition to the prevailing road traffic noise environment. This approach ensures that the potential impact of commercial noise on the proposed dwellings is not underestimated and provides a robust basis for façade and internal noise design.

On this basis, PJA recommends that internal noise levels within habitable rooms arising from surrounding commercial activity, primarily associated with the car wash, should not exceed:

- 35 dB $L_{Aeq,1hr}$ during the daytime.

This internal noise criterion has been deliberately set to be more stringent than the standard internal noise targets set out in BS 8233:2014 and the Professional Practice Guidance on Planning and Noise (ProPG). While the headline level of 35 dB aligns with the typical daytime internal criterion, it is applied here as a short-term averaging period of $L_{Aeq,1hr}$, rather than the conventional $L_{Aeq,16hr}$.

This approach is intended to capture worst-case daytime conditions, specifically periods when the adjacent car wash is in near-continuous operation. When commercial activity of this nature is averaged over a full 16-hour daytime period, the resulting $L_{Aeq,16hr}$ level can be substantially lower, potentially by around 10 dB, due to extended periods when the car wash is inactive. By assessing against a 1-hour average, the criterion therefore provides a more conservative and protective basis for internal noise control, ensuring that short-duration but sustained commercial activity does not give rise to adverse internal conditions.

With regard to fixed mechanical plant, no evidence of significant or continuous plant noise was identified during the monitoring period. Fixed plant noise is therefore not considered to be a dominant factor at the site, and commercial activity to the north, in combination with road traffic noise, remains the primary consideration for internal noise control.

5.3.3.2. Internal Levels with Open Windows

The weakest elements of a façade in terms of sound reduction are the windows/glazing. This is particularly true when windows are open. BS 8233:2014 indicates that a partially open window will typically achieve a reduction from outside to inside of 15 dB. Based on this 15 dB reduction, and the external levels in **Table 5.1**, the predicted internal levels with windows open are shown in **Table 5.4**.

Table 5.4 – Predicted internal noise levels with open windows

Exposure Category	Predicted internal noise level with a partially open window			
	Daytime average (07:00 – 23:00) dB LAeq,16hr	Nighttime average (23:00 – 07:00) dB LAeq,8hr	Nighttime maximum (23:00 – 07:00) dB LAFmax	Daytime worst-case Commercial Noise (07:00 – 23:00) dB LAeq,1hr
Exposure 1	46 – 56	34 – 52	50 – 68	29 – 56
Exposure 2	37 – 47	32 – 39	48 – 55	44 – 52
Exposure 3	38 – 45	32 – 39	48 – 55	41 – 49
Exposure 4	24 – 35	19 – 29	35 – 45	25 – 36
Bedroom Criteria	≤35	≤30	≤45	≤35
All Other 'Habitable' Room Criteria	≤35	N/A	N/A	≤35

The results indicate that, for parts of the development, the predicted internal noise levels with windows open exceed the recommended internal noise criteria. While exceedances under open-window conditions are not uncommon in urban environments, the magnitude of exceedance varies across the site and has implications for occupant comfort when relying on open windows for ventilation and cooling.

When assessed in accordance with the Acoustics, Ventilation and Overheating (AVO) Guide (2020), which relates external noise exposure to internal noise risk under open-window conditions, the following exposure categories apply:

- **Exposure 1** falls within the **High** risk category. In these locations, predicted internal noise levels with windows open significantly exceed the recommended criteria, indicating a material risk of adverse effects such as sleep disturbance, difficulty falling asleep, or frequent awakening. Occupants in these areas would be unlikely to be able to rely on open windows for ventilation without experiencing disturbance.
- **Exposures 2 and 3** fall within the **Medium** risk category. In these areas, predicted internal noise levels with windows open are closer to the guideline values, but exceedances are still evident. While some occupants may tolerate open-window ventilation without significant disruption, others, particularly those more sensitive to noise, may experience disturbance or behavioural changes, such as closing windows for much of the time.

- **Exposure 4** falls within the **Low** risk category. In these locations, predicted internal noise levels with windows open generally meet the relevant internal noise targets, or at most exceed them by approximately 1 dB. As a result, these areas are considered suitable for open-window ventilation under most conditions, with minimal risk of adverse noise effects.

Overall, the results indicate that reliance on open windows as the primary means of ventilation may give rise to an increased risk of adverse noise impacts in parts of the development, particularly within Exposure 1 and, to a lesser extent, Exposures 2 and 3. In this context, it would be beneficial to consider an alternative ventilation strategy in line with the AVO, such as a mechanical or passive acoustically attenuated system (provided sufficient airflow can be achieved).

This approach would allow adequate background and purge ventilation, together with mitigation of overheating risk, while maintaining acceptable internal noise levels with windows closed. Windows would remain openable at the occupants' discretion, but would not be relied upon as the primary means of ventilation for the purposes of acoustic design. This is discussed further in subsequent sections.

5.3.3.3. Internal Levels with Closed Windows and Alternative Ventilation

The ProPG states *"where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g., trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded"*.

Given the expected exceedance of IANL targets with open windows on many elevations, the proposed dwellings should incorporate an alternative form of background ventilation, such as acoustically rated trickle ventilators or a mechanical ventilation system, enabling occupants to keep windows closed for acoustic protection while retaining the option to open them when desired.

Although trickle ventilators are acoustically weaker than the surrounding wall construction, acoustic-rated models can achieve much higher sound insulation, allowing internal ambient noise level (IANL) targets to be met while maintaining effective background ventilation. Closed windows can then be specified to achieve the remaining sound reduction needed for compliance, ensuring that IANL targets are achieved with windows closed but alternative ventilation operating.

Table 5.5 provides the **minimum sound reduction indices for glazing and ventilators** (the weakest elements acoustically) for each façade exposure, ensuring compliance with the internal noise level targets (from **Table 5.3**) with windows closed and background ventilation provided via trickle vents or other natural ventilators.

These ventilator ratings apply only where such openings are present — for example, trickle vents or air bricks. Where no natural ventilation openings are included and mechanical or mechanically-assisted ventilation is instead provided, the ventilator performance requirements would not be applicable.

Table 5.5 – Minimum sound reduction requirements of the building envelope

Exposure Category	Room Type	External Noise Level outside of the window				Minimum reduction required to meet internal noise targets dB	Minimum sound reduction indices/construction examples	
		Daytime average (07:00 – 23:00) dB L _{Aeq,16hr}	Nighttime average (23:00 – 07:00) dB L _{Aeq,8hr}	Nighttime maximum ¹ (23:00 – 07:00) dB L _{AFmax,5min}	Commercial Noise Level dB L _{Aeq,1hr}		Glazing ² See Appendix D.1	Ventilators ³ see Appendix D.2
Exposure 1	Bedrooms	61 - 71	49 - 67	65 - 83	44 – 71	36	36 dB R _w + C _{tr} Acoustic double glazing, i.e. - 8.8mm Saint Gobain Stadip Silence - 12mm air cavity - 8mm standard float	39 dB D _{n,e,w} + C _{tr} i.e., Titon SF Xtra Sound Attenuator
	Limit	≤35	≤30	≤45	≤35	-		
	Living Rooms / Study's	61 - 71	N/A	N/A	44 - 71	36		
	Limit	≤35	N/A	N/A	≤35	-		

Exposure Category	Room Type	External Noise Level outside of the window				Minimum reduction required to meet internal noise targets dB	Minimum sound reduction indices/construction examples	
		Daytime average (07:00 – 23:00) dB L _{Aeq,16hr}	Nighttime average (23:00 – 07:00) dB L _{Aeq,8hr}	Nighttime maximum ¹ (23:00 – 07:00) dB L _A Fmax,5min	Commercial Noise Level dB L _{Aeq,1hr}		Glazing ² See Appendix D.1	Ventilators ³ see Appendix D.2
Exposure 2	Bedrooms	52 - 62	47 - 54	63 - 70	59 - 67	32	32 dB R _w + C _{tr} i.e. Thick double glazing with glass panes of different thickness, i.e. - 8mm standard float - 16mm air cavity - 6mm standard float	35 dB D _{n,e,w} + C _{tr} i.e., Duco DucoTop 60 SR Alto AK
	Limit	≤35	≤30	≤45	≤35	-		
	Kitchen Dining	52 - 62	N/A	N/A	59 - 67	32		
	Limit	≤35	N/A	N/A	≤35	-		

Exposure Category	Room Type	External Noise Level outside of the window				Minimum reduction required to meet internal noise targets dB	Minimum sound reduction indices/construction examples	
		Daytime average (07:00 – 23:00) dB L _{Aeq,16hr}	Nighttime average (23:00 – 07:00) dB L _{Aeq,8hr}	Nighttime maximum ¹ (23:00 – 07:00) dB L _A Fmax,5min	Commercial Noise Level dB L _{Aeq,1hr}		Glazing ² See Appendix D.1	Ventilators ³ see Appendix D.2
Exposure 3	Bedrooms	53 – 60	47 - 54	63 - 70	56 - 64	29	29 dB R _w + C _{tr} Standard double glazing, i.e. - 4mm standard float - 12mm air cavity - 6mm standard float	32 dB D _{n,e,w} + C _{tr} i.e. Duco DucoStrip Slimline Trickle Vent
	Limit	≤35	≤30	≤45	≤35	-		
	Kitchen Dining Study's	53 – 60	N/A	N/A	56 - 64	29	-	-
	Limit	≤35	N/A	N/A	≤35	-		

Exposure Category	Room Type	External Noise Level outside of the window				Minimum reduction required to meet internal noise targets dB	Minimum sound reduction indices/construction examples	
		Daytime average (07:00 – 23:00) dB L _{Aeq,16hr}	Nighttime average (23:00 – 07:00) dB L _{Aeq,8hr}	Nighttime maximum ¹ (23:00 – 07:00) dB L _{AFmax,5min}	Commercial Noise Level dB L _{Aeq,1hr}		Glazing ² See Appendix D.1	Ventilators ³ see Appendix D.2
Exposure 4	Bedrooms	39 - 50	34 - 44	50 – 60	40 - 51	16	16 dB R _w + C _{tr} Any glazing	19 dB D _{n,e,w} + C _{tr} Any trickle vent
	Limit	≤35	≤30	≤45	≤35	-		
	Kitchen Dining Living Rooms	39 - 50	N/A	N/A	40 - 51	16		
	Limit	≤35	N/A	N/A	≤35	-	-	-

1.

Value exceeded 10 times per night.

2.

A non-exhaustive list of suitable glazing products is given in **Appendix D.1**. Standard double glazing will usually achieve a minimum sound reduction of 26 dB R_w + C_{tr}.

3.

A non-exhaustive list of suitable ventilator products is given in **Appendix D.2**. The acoustic performance should meet these values when the vent is open. They may not be required if the development uses mechanical ventilation. Low-performance trickle vents will usually achieve a minimum sound reduction of 25 dB D_{n,e,w} + C_{tr}.

The assessment has been based upon a simplified calculation method where only the weakest elements are considered (glazing and ventilators), as the sound reduction provided by the external wall and roof constructions would inherently be considerably higher than the minimum required.

The calculation method effectively treats the whole façade as being glazed – this means that a slightly higher and thus more robust sound reduction index is determined for glazing/trickle ventilators given that a full composite noise ingress calculation in accordance with BS 12354 would include for the high level of external wall performance, and thus require a lesser rating from the glazing to achieve the same overall composite sound reduction index. Hence this approach is seen to be a worst-case one which achieves a better end result for the future occupants.

A non-exhaustive list of example glazing constructions and ventilator products such as trickle vents and air bricks have been provided in **Appendix E**, which are capable of achieving the required $R_w + C_{tr}$ and $D_{n,e,w} + C_{tr}$ indices.

5.3.3.4. Ventilation and Overheating Considerations

As discussed in **Section 5.3.3.2**, assessing the external noise levels in accordance with the Acoustics, Ventilation and Overheating (AVO) Guide (2020) indicates that Exposure 1 would fall within the High category of potential noise impact, and Exposures 2 and 3 within the Medium category. This means that relying on open windows as the primary means of ventilation would not be suitable for extended periods, given the expected degree of behavioural change and potential disturbance associated with the higher noise exposures.

Table 5.5 provides acoustic ratings for passive ventilators such as trickle vents or air bricks that would meet the internal noise targets while providing a background ventilation opening for fresh air. However, whether the airflow through such ventilators alone would be sufficient to prevent overheating in accordance with Approved Document O of the Building Regulations is uncertain and would typically require further overheating assessment. In PJA's experience, these openings generally do not provide adequate airflow to achieve thermal comfort in warmer weather, and it may therefore be beneficial to consider a mechanical ventilation and/or comfort-cooling system.

A whole-dwelling mechanical ventilation system (e.g. MVHR) or air-conditioning system would allow occupants to maintain comfortable internal conditions without relying on open windows, while reducing exposure to external noise. This would also help to prevent overheating during warmer months, when relying solely on acoustically rated trickle vents may not provide sufficient airflow to maintain thermal comfort.

This approach does not imply that windows would be sealed closed; rather, it ensures that occupants have the flexibility to close them at their discretion during periods of higher external noise or warmer weather, rather than being forced to open them at the expense of internal noise levels.

Any proposed mechanical system should be designed with due regard to the AVO Guide and the acoustic criteria recommended within Approved Document F, CIBSE Guide A (2015) and Sound Control for Homes, ensuring that internal noise levels from mechanical systems do not exceed the following 'desirable' limits:

- Whole-dwelling ventilation: 30 dB L_{Aeq} in bedrooms and living rooms.
- Extract ventilation: 30 dB L_{Aeq} (NR 25) in bedrooms, 35 dB L_{Aeq} (NR 30) in living/dining rooms, and up to 45 dB L_{Aeq} (NR 40) in kitchens and bathrooms.

5.4 Summary and Conclusions

In summary, PJA considers that the noise impact on future occupants of the proposed dwelling can be controlled to an acceptable level and should not pose a barrier to planning permission, provided the recommendations in this report are implemented.

External amenity noise levels have been assessed in **Section 5.3.2**. The assessment demonstrates a clear variation in noise exposure across the site. External amenity areas associated with the westernmost residential building are well screened from Bedford Road and from adjacent commercial activity to the north, and are predicted to fall comfortably within the guideline range for outdoor amenity spaces, allowing these areas to be used and enjoyed as intended.

External amenity areas associated with the easternmost residential building were previously predicted to exceed the upper end of the guideline range, primarily due to noise from the adjacent car wash. Following discussions with the Local Planning Authority and Environmental Health Officer, the scheme has been amended to incorporate a 3 m high acoustic barrier along the northern boundary. The updated assessment demonstrates that the barrier provides a meaningful reduction in noise levels within the affected gardens, such that all external amenity areas now contain usable areas at or below 55 dB $L_{Aeq,16hr}$ and therefore fall within the guideline range identified by ProPG, BS 8233:2014 and the WHO Guidelines.

Internal noise levels have been assessed in **Section 5.3.3**. The assessment shows that internal noise criteria cannot be reliably achieved with windows open in all parts of the development, particularly within Exposure 1 and, to a lesser extent, Exposures 2 and 3, where external noise levels are highest. This does not imply that windows would be fixed shut; however, assessment against the Acoustics, Ventilation and Overheating (AVO) Guide (2020) indicates that reliance on open windows as the primary means of ventilation may result in increased noise intrusion and associated behavioural change, particularly at the more exposed façades.

Minimum sound-reduction indices for glazing and passive ventilators have been specified in **Table 5.5 (Section 5.3.3.3)** (corresponding with exposure levels in **Figure 5.1**), providing compliance with internal targets under closed-window conditions while maintaining a passive air path. These requirements are informed by both road traffic noise and commercial noise from the north of the site, including car wash activity. While example constructions are provided in Appendix E, the applicant must ensure that the final products meet or exceed the recommended $R_w + C_{tr}$ and $D_{n,e,w} + C_{tr}$ ratings and be prepared to provide supporting datasheets or schedules to the Local Planning Authority if requested.

As discussed in **Section 5.3.3.4**, consideration also needs to be given to overheating risk and compliance with Approved Document O. It is uncertain whether reliance on acoustically attenuated passive ventilators alone would provide sufficient airflow to maintain thermal comfort during warmer periods. Unless demonstrated otherwise through a separate overheating assessment, it may be beneficial to consider a whole-dwelling mechanical ventilation system and/or comfort-cooling, designed to meet the acoustic criteria and maintain acceptable internal noise levels.

Subject to the implementation of these measures, the proposed development is considered capable of achieving an acceptable internal and external acoustic environment, consistent with the intent of BS 8233:2014, the Professional Practice Guidance on Planning and Noise (2017), and the Acoustics, Ventilation and Overheating Guide (2020).

6.0 Operational Plant Noise Impact

The assessment of noise impact on nearby residential noise-sensitive receptors (NSRs) arising from potential plant noise associated with the proposed development has been undertaken with reference to BS 4142:2014+A1:2019.

At this stage, the mechanical plant serving the development has not been designed. The assessment is therefore based on setting indicative rating level limits ($L_{A,T,r}$) for plant noise emissions, derived from the measured background noise level ($L_{A90,T,r}$) at the site. Under BS 4142, the rating level is defined as the specific noise level (L_s) together with the addition of any applicable acoustic feature corrections, accounting for characteristics such as tonality, impulsivity, intermittency, or other sound features that may render the noise readily distinguishable from the residual acoustic environment.

It is assumed that plant serving the residential dwellings may operate on a 24-hour basis. Accordingly, separate daytime and nighttime rating level limits have been defined. Responsibility will then lie with the developer and the mechanical design team to ensure that the selected plant and any associated mitigation measures are designed such that these rating level limits are not exceeded at the nearest relevant residential receptors.

As discussed in the preceding sections of this report, the assessment of internal noise levels and ventilation strategy indicates that, in parts of the development, reliance on open windows as the primary means of ventilation would not be appropriate due to external noise from road traffic and adjacent commercial activity, including the nearby car wash. As a result, it is likely that some form of mechanical ventilation system will be required to provide adequate fresh air while maintaining acceptable internal noise levels.

Where mechanical ventilation, comfort-cooling, or other fixed plant is proposed, the noise emissions from such equipment will therefore need to be controlled in accordance with the BS 4142 rating level limits set out in this section, to ensure that the introduction of plant does not give rise to adverse noise impacts at neighbouring noise-sensitive receptors.

6.1 Background Sound Levels

In accordance with BS 4142:2014+A1:2019, the predicted rating level from plant noise should be assessed against a representative background sound level, defined in terms of $L_{A90,15min}$. The Standard makes clear that the background sound level should reflect typical conditions at the site and should not be derived solely from absolute minimum values, isolated anomalies, or a single modal value without consideration of the wider dataset.

Long-term unattended noise monitoring indicates that background sound levels at the site are generally elevated, with relatively limited variation over time. While a small number of unusually low $L_{A90,15min}$ values were recorded, these occurred infrequently and are not considered representative of the prevailing background sound environment. Reliance on such isolated minima would result in an unduly conservative assessment and would not reflect typical conditions, contrary to the intent of BS 4142.

To derive a representative background sound level, the assessment has therefore considered the distribution of $L_{A90,15min}$ values across the full monitoring period, rather than relying on either the minimum or modal values alone. On this basis, the 90th percentile of the measured $L_{A90,15min}$ dataset has been adopted as the representative background sound level. This approach captures the typical lower-end background sound conditions while avoiding undue influence from anomalously low values.

Given that L_{A90} is itself a statistical descriptor intended to represent background sound, the use of a percentile-based value from the L_{A90} distribution provides a robust, repeatable, and representative baseline against which potential plant noise can be assessed, consistent with both the wording and intent of BS 4142.

The representative background sound levels adopted for the plant noise assessment are summarised in **Table 6.1**.

Table 6.1 – Derived representative background sound level $L_{A90,T}$ at nearby residential NSRs

Noise-Sensitive Receptor (NSR)	Period	Representative Background Sound Level $L_{A90,T}$ (dB)
All nearby residential properties	Daytime (07:00 to 23:00)	44
	Nighttime (23:00 – 07:00)	32

6.2 Maximum Rating Levels

It is generally accepted that plant noise emissions should not exceed the representative background sound level, when assessed in accordance with BS 4142:2014+A1:2019 at the nearest noise-sensitive receptors, typically taken as 1 m outside the façade of the nearest residential windows (or at the site boundary where appropriate)

Table 6.2 – Maximum plant noise level at nearby noise-sensitive receptors

Noise-Sensitive Receptor (NSR)	Period	Maximum Plant Noise Rating Level $L_{A,r,Tr}$ (dB)
1m of outside of neighbouring residential windows	Daytime (07:00 to 23:00) Tr = 60-minutes	44
	Nighttime (23:00 – 07:00) Tr = 15-minutes	32

6.3 Design Implications

At this stage, the detailed mechanical ventilation design for the residential units has not been finalised. However, given the relatively elevated external noise environment and the conclusions of the preceding assessment, it is anticipated that the development will incorporate a mechanical ventilation strategy, such as MVHR and/or comfort-cooling systems, to provide adequate ventilation and thermal comfort without reliance on open windows.

The plant noise limits identified in **Section 6.2** are not considered unduly restrictive and can be readily achieved through standard good-practice mechanical and acoustic design. Where MVHR systems are proposed, these would typically include in-duct silencers (attenuators) on the external air paths, generally in the order of 600 – 1200 mm in length. Such measures are commonplace, readily available, and not considered onerous.

Where air source heat pumps (ASHPs), air-conditioning condensers, or similar items of external plant are proposed, these are not expected to present a significant noise risk provided that modern, well-specified equipment is selected and units are appropriately sited with due regard to separation distances, orientation, and nearby noise-sensitive façades. Depending on the plant sound power level, operating duty, and location, it may be necessary to incorporate local acoustic screening or enclosures to ensure compliance with the plant noise limits set out in this report.

Overall, no unusual, bespoke, or complex noise mitigation measures are anticipated to be necessary in order to achieve compliance with the plant noise criteria, provided that plant selection and layout are undertaken in accordance with standard good practice.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
C_{tr}	A weighting curve applied to level differences to account for low-frequency noise, typically associated with traffic noise. This is often applied as an addition to $D_{nT,w}$ and R_w ratings used to describe levels of sound insulation.
Frequency	Sound is generally assessed over the frequency range of 63 Hz to 4000 Hz (4 kHz), although humans can potentially hear between 20 Hz and 20 kHz. Frequency is often divided into ('first') octave bands for analysis, with the range above considered within 7-octave bands with centre frequencies at 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz and 4 kHz. 'Third' octave bands split this further into smaller frequency bands.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.

A.2 – Subjective Changes in Sound Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – National Planning Policy

B.1 – National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local people and their council can produce their own distinctive local and neighbourhood plans. With explicit reference to noise, the NPPF states that *"Planning policies and decisions should contribute to and enhance the natural and local environment by ... preventing new and existing development from contributing to, being put at unacceptable risk from ... noise pollution"*.

B.2 – Noise Policy Statement for England (NPSE)

The NPPF refers to the Noise Policy Statement for England (NPSE), which applies to most forms of noise including environmental noise. The NPSE sets out the long-term vision of Government policy which is to *"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."* It aims that *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The use of the terms *"significant adverse"* and *"adverse"* are key phrases within the NPSE. The guidance establishes the concept of how the level of adverse effect on health and quality of life can be referenced including:

- **NOEL – No Observed Effect Level** - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- **LOAEL – Lowest Observed Adverse Effect Level** - This is the level above which *adverse* effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level** - This is the level above which *significant adverse* effects on health and quality of life occur.

Under the first aim of the NPSE (*"avoid significant adverse impacts on health and quality of life"*), an impact in line with SOAEL should be avoided. Under the second aim (*"mitigate and minimise adverse impacts on health and quality of life"*), where the impact lies somewhere between LOAEL and SOAEL, requiring that all reasonable steps are taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, but does not mean that such adverse effects cannot occur.

B.3 - Planning Practice Guidance on Noise (PPG-N)

The Planning Practice Guidance on Noise (PPG-N) is part of a suite of web-based guidance which is intended to support the implementation of the policies in the NPPF and the NPSE.

It aids in expanding on the definitions from the NPSE of NOEL, LOAEL and SOAEL, by linking these terms to 'examples of outcomes', i.e., changes in behaviour and/or attitude to noise. The table below summarises the guidance from PPG-N in this regard.

Table B.1 – Noise exposure hierarchy based on the likely average response – adapted from PPG-N

Perception	Examples of outcomes	Increasing effect level	Action
NOEL - No Observed Effect Level ¹			
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL - Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g., turning up the volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL - Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g., avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to a change in the acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise leading to psychological stress or physiological effects, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g., auditory and non-auditory	Unacceptable Adverse Effect	Prevent
¹ This line is an assumption of the adverse effect level and is not explicitly referenced by PPG-N, though this appears to be a safe assumption.			

B.4 – The Professional Practice Guidance on Planning and Noise (ProPG)

The ProPG, published in 2017, is a design guide for new residential development that are exposed predominantly to airborne noise from transport sources. It was produced *"to provide practitioners with guidance on the management of noise within the planning system in England"*, though it is not an official code of practice or official interpretation of the law or government policy.

However, the ProPG extends on the guidance and numerical targets within BS 8233:2014 and WHO guidelines, as well as national planning policy, providing new and extended recommendations where these standards are considered to fall short. Therefore, it is considered to be the most relevant and up to date design standard for assessing the noise impact on new residential developments.

The ProPG *"advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging..."*

...The two sequential stages of the overall approach are:

- *Stage 1 – an initial noise risk assessment of the proposed development site; and*
- *Stage 2 – a systematic consideration of four key elements....*

The approach is underpinned by the preparation and delivery of an "Acoustic Design Statement" (ADS). An ADS for a site assessed as high risk should be more detailed than for a site assessed as low risk. An ADS should not be necessary for a site assessed as negligible risk."

B.4.1 - Stage 1: Initial Site Noise Risk Assessment

The ProPG recommends that an initial site noise risk assessment should be undertaken based on indicative external noise levels on the existing site, without accounting for the impact of any new or additional mitigation measures that may subsequently be included in development proposals. Figure 1 of the ProPG relates the increasing risk of adverse effect against indicative daytime noise levels ($L_{Aeq,16hr}$) and nighttime noise levels ($L_{Aeq,8hr}$) without noise mitigation. This is recreated in the table below.

Table B.2 – The ProPG initial site noise risk assessment guidelines

Indicative external daytime noise levels $L_{Aeq,16hr}$	Indicative external nighttime noise levels $L_{Aeq,8hr}$	Potential risk of adverse effect without noise mitigation
≤ 50 dB	≤ 40 dB	Negligible / No adverse effect ¹
> 50 dB and ≤ 60 dB	> 40 dB and ≤ 50 dB	Low
> 60 dB and ≤ 70 dB	> 50 dB and ≤ 60 dB	Medium
> 70 dB	> 60 dB	High
NOTES: The noise level limits are an interpretation of Figure 1 in the ProPG, which is presented as a diagram rather than a table and does not explicitly state the limits at which each risk category exists. ¹ An indication that there may be more than 10 noise events at night with $L_{Amax,F} > 60$ dB means the site should not be regarded as a negligible risk.		

B.4.2 – Stage 2: Good Acoustic Design Process

The ProPG talks about a “*good acoustic design process*”, that will be suitable in the majority of situations likely to be encountered in practice, with the aim of a more consistent approach from designers through the use of the document. In short, “good acoustic design” means that the acoustic design should:

- be considered early in the development control process;
- take an integrated approach to achieve ‘optimal’ acoustic conditions both internally and externally, which does not just focus on compliance with noise exposure standards, but aims to avoid compromises for other sustainable design objectives that may adversely affect living conditions and quality of life;
- avoid “unreasonable” and prevent “unacceptable” acoustic conditions, without overdesigning or ‘gold plating’ the new development; and
- consider the viability of alternative solutions rather than solely rely on the building envelope to provide sufficient sound insulation, which may adversely affect living conditions.

B.4.3 – Stage 2: Noise Management Measures

The ProPG recommends that the design of sealed shut/un-openable windows should be avoided where possible, as occupants would favour the ability to open the windows even if the resultant internal acoustic conditions are unsatisfactory.

Therefore, every effort should be made in the first instance to mitigate noise through alternative solutions before simply using the building envelope to mitigate noise. Supplementary Document 2 of the ProPG therefore advises that the following hierarchy of noise management measures (in descending order of preference) should be followed:

- Maximising the spatial separation of noise source(s) and receptor(s).
- Investigating the necessity and feasibility of reducing existing noise levels and relocating existing sources.
- Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
- Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
- Using the layout of the scheme to reduce noise propagation across the site.
- Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms.
- (and finally) Using the building envelope to mitigate noise to acceptable levels.

Any reliance on the use of the building envelope alone to mitigate noise levels should be justified. In many cases there is “justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources”.

B.4.4 – Stage 2: Internal Ambient Noise Levels

Whole Dwelling Ventilation

The ProPG provides internal ambient noise level targets based upon Table 4 of BS 8233:2014, with a few additions in guidance. These are summarised in the table below.

The ProPG suggests that the development layout should be designed such that internal noise level targets can be achieved with open windows in as many areas as possible, on the basis that residents will value the ability to open windows at will. It is generally stated within guideline documents (including the ProPG) that an open window will typically provide up to a 15 dB(A) reduction in noise from outside to inside.

However, an assessment can be made with closed windows and open ventilators (i.e., trickle vents) which provide “*whole dwelling ventilation*” (as defined by Building Regulations Approved Document F).

Table B.3 – The ProPG internal ambient noise level guidelines

Activity	Location	Daytime (07:00 – 23:00)	Nighttime (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}$ ¹
¹ a threshold by which 'good acoustic design' is achieved by not exceeding this threshold more than 10 times a night			

The following summarises the ProPG guidance which relates to the table above.

- Internal L_{Aeq} targets:
 - assume normal daytime fluctuations in external noise;
 - are based on average annual data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events such as bonfire night or New Year's Eve; and
 - can be relaxed by up to 5 dB where development is considered necessary or desirable, despite high external noise levels. However, most people will regard exceeding the targets by more than 5 dB on a regular basis as 'unreasonable' and exceeding by more than 10 dB as 'unacceptable'.
- Internal $L_{Amax,F}$ targets:
 - are set on the basis that regular individual noise events (such as aircraft and passing trains) can cause sleep disturbance; and
 - are not an absolute limit but a threshold by which 'good acoustic design' is achieved by not exceeding this threshold more than 10 times a night. However, where it is not practical to achieve this guideline, the judgement of acceptability will depend on the noise level, source, number, distribution, predictability and regularity of noise events.

Purge Ventilation

The guidelines above are generally not applicable under "*purge ventilation*" conditions (as defined by ADF), as this should only occur occasionally.

Mechanical Services

The ProPG indicates that "*where mechanical services are used as part of the ventilation or thermal comfort strategy for the scheme, the impact of noise generated by these systems on occupants should also be assessed.*" It does not, however, give an explicit set of noise level targets for any form of mechanical ventilation (continuous, extract or purge).

B.5 - BS 4142:2014

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment.

B.5.1 - Definitions

BS 4142:2014 provides the following definitions which are relevant at this pre-construction stage of assessment:

- **Background Sound Level, $L_{A90,T}$:** A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- **Rating Level, L_{A,r,T_r} :** Specific sound level plus any adjustment for the characteristic features of the sound.
- **Reference Time Interval, T_r :** Specified interval over which the specific sound level is determined. This is 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).
- **Specific Sound Level, $L_s = L_{Aeq,T_r}$:** Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .
- **Specific Sound Source:** Sound source being assessed.

The BS 4142:2014 definition of sound of an industrial and/or commercial nature includes "sound from fixed installations which comprise mechanical and electrical plant and equipment". The scope of BS 4142:2014 is not intended for sound from the passage of vehicles on public roads; people; and 'other sources falling within the scopes of other standards or guidance'.

B.5.2 - Specific Sound Level

The specific sound level L_s is the equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r , of 60-minutes during the day (07:00 – 23:00) and 15-minutes at night (23:00 – 07:00).

B.5.3 - Rating Level

The rating level L_{A,r,T_r} is the specific sound level L_s plus any 'penalties' which account for the characteristic features of the sound.

BS 4142:2014 provides the following with respect to the application of penalties to account for "the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention".

- **Tonality** – For sound ranging from not tonal to predominantly tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible;

- **Impulsivity** – A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible;
- **Intermittency** – When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied; and
- **Other Sound Characteristics** – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

PJA consider the word 'perceptible' to be important, and variable depending on the context of a site. For example at a site with a relatively high background sound level of 50 dB(A), an 'impulsive' sound source with a specific sound level of 30 dB(A) at an NSR is unlikely to be perceptible and should probably not be penalised.

However, the same source at a site with a lower background level of 30 dB(A) would be perceptible, and therefore a penalty of 3 or 6 dB could be applied to the rating level, with possibly a 9 dB penalty being applied if the specific sound level were to rise from 30 to 40 dB(A). Therefore the context is important in applying rating level penalties.

B.5.4 - Background Sound Level

BS 4142:2014 states that "in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

BS 4142:2014 further states that "a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value". Hence BS 4142:2014 does not provide a 'black and white' method of obtaining the assessment level for background sound $L_{A90,T}$. Note that it is standard practice that the $L_{A90,T}$ is determinable from the results of a baseline sound survey conducted at positions representative of sound levels at the nearest or worst affected NSRs.

B.5.5 - Assessment of Adverse Impact

The assessment of adverse impact contained in BS 4142:2014 is undertaken by comparing the rating level $L_{A,r,Tr}$ to the measured representative background sound level $L_{A90,T}$ outside the sensitive receptor location.

The significance of the impact of an industrial or commercial sound source depends on both the margin by which the rating level $L_{A,r,Tr}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. It is therefore essential to place the sound in context. But in general, "the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

Appendix C – Survey Methodology

C.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meters were calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter had been calibrated to a traceable standard within the 24 months preceding the survey.

The calibrator had been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of a BS EN 60942:2003 Class 1 device.

Table C.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
SVAN 949 Class 1 Sound Level Meter	9720	Jan-24	Jan-26
SV22 Class 1 Microphone	4012386	Jan-24	Jan-26
SVAN 949 Class 1 Sound Level Meter	9719	Jan-24	Jan-26
SV22 Class 1 Microphone	4011862	Jan-24	Jan-26
Casella CEL 120-1 Class 1 Calibrator	2651640	Feb-25	Feb-26

C.2 – Meteorological Conditions

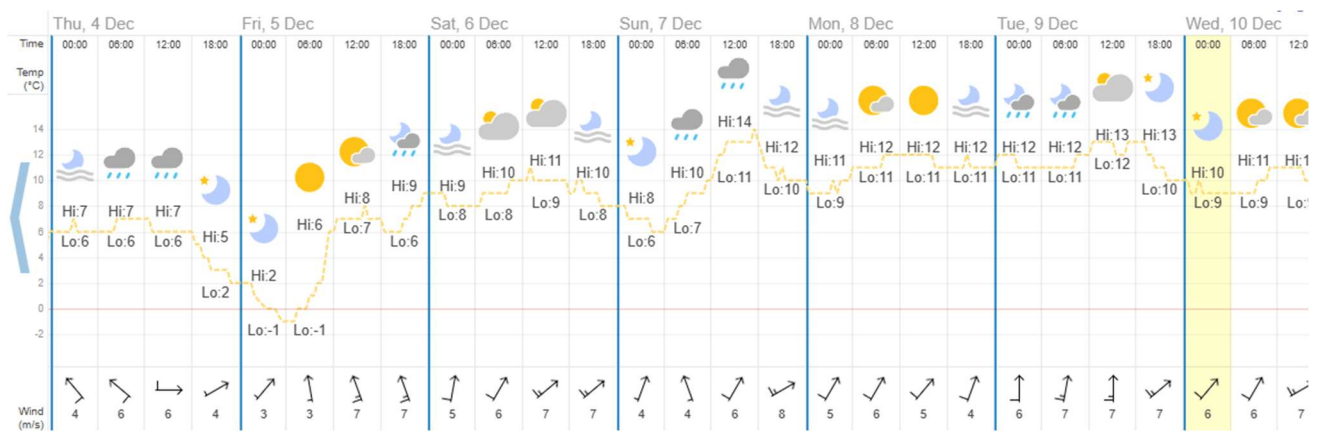
During the survey period, weather conditions were generally suitable for environmental noise monitoring in accordance with BS 7445: Description and Measurement of Environmental Noise.

Wind speeds were typically below 7 m/s, with the microphones fitted with weather protection kits and windshields throughout.

The overall length of the monitoring period ensured that sufficient valid data was captured under appropriate meteorological conditions for the purposes of this assessment.

The weather data below has been sourced from <https://www.timeanddate.com/weather/uk/hitchin/historic>.

Figure C.1 – Meteorological conditions during the survey



C.3 – Photos

Figure C.2 – Photographs of the noise monitoring positions



Appendix D – Noise Mapping

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package which implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The noise model accounts for the topography of the land based on data available from the Ordnance Survey. All of the objects within the model (buildings, roads, barriers, foliage, etc) have been imported from OpenStreetMap, or drawn in manually where the OSM did not contain sufficient data. The heights of the buildings and roads have been based upon Google Earth Pro, using the 3D view to be able to measure the elevation heights at the tops of objects, and then inserting this manually into the model. Lastly, the scaled site plan, floor plan, and elevation for the proposed development have been accounted for in the model.

The noise model has been used to predict the resulting daytime (16-hour) and nighttime (8-hour) L_{Aeq} and 10th highest $L_{AFmax,5min}$ noise levels across the site.

The noise map model has assumed:

- downwind propagation, i.e., a wind direction that assists the propagation of sound from source to receptor, as a worst-case.
- a ground absorption factor of:
 - 0 on roads, buildings, and tarmacked areas;
 - 0.5 in 'mixed land' – i.e., gardens and residential streets with a mixture of road, gardens, grass, pavements, patios.
 - 1 on grassland.
- a maximum reflection factor of two where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- receptor points in the plots of the existing site based on the position and height of the survey positions;
- façade receptor points representing the worst-case floor – placed at 0.05m from the façade (and not accounting for the sound reflection off that façade);
- additional receptor points at 1.5m within external amenity areas;
- atmospheric sound absorption based upon a temperature of 10°C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.

The images on the following pages contain the results of the mapping.

D.1 – Existing Site

Figure D.1 – Views of the model setup – existing site

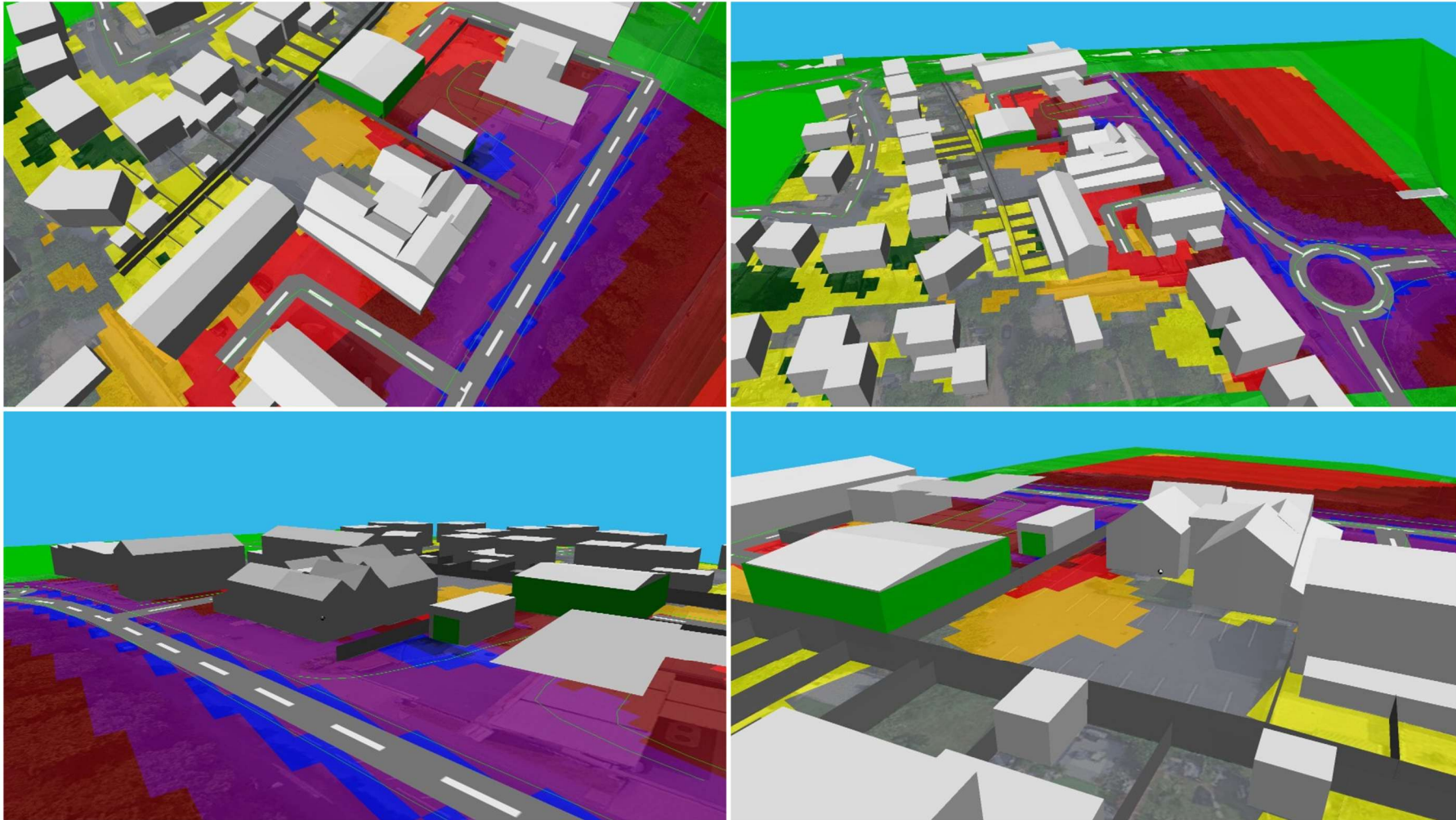


Figure D.2 – Existing site - Predicted dB L_{Aeq,16hr} external ambient noise levels – Daytime (07:00 – 23:00) – Receptor height 3.0m

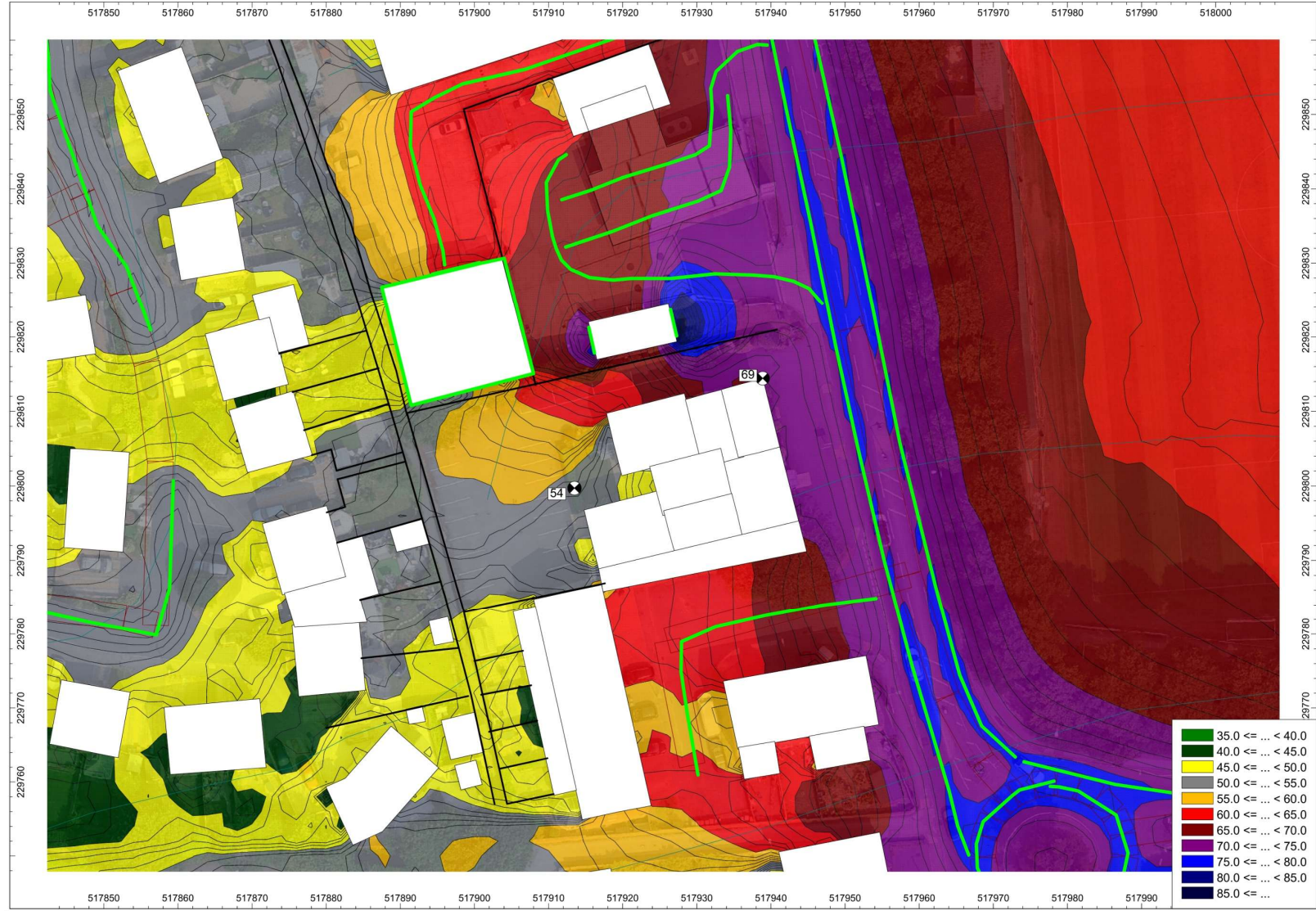


Figure D.3 – Existing site - Predicted dB LAeq,8hr external ambient noise levels – Nighttime (23:00 – 07:00) – Receptor height 3.0m

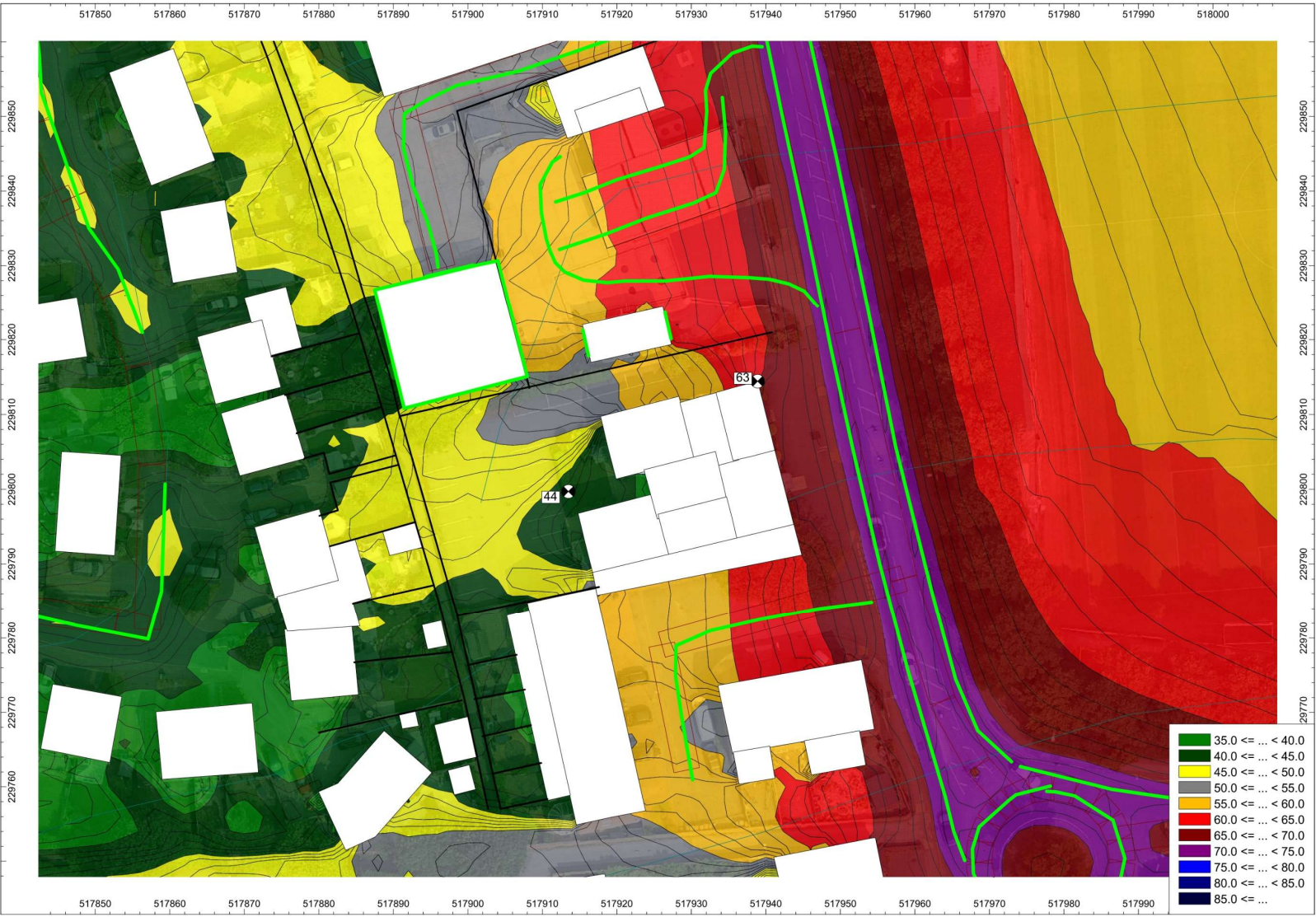


Figure D.4 – Existing site – Predicted 10th highest dB L_AF_{max,5min} maximum noise levels – Nighttime (23:00 – 07:00) – Receptor height 3.0m

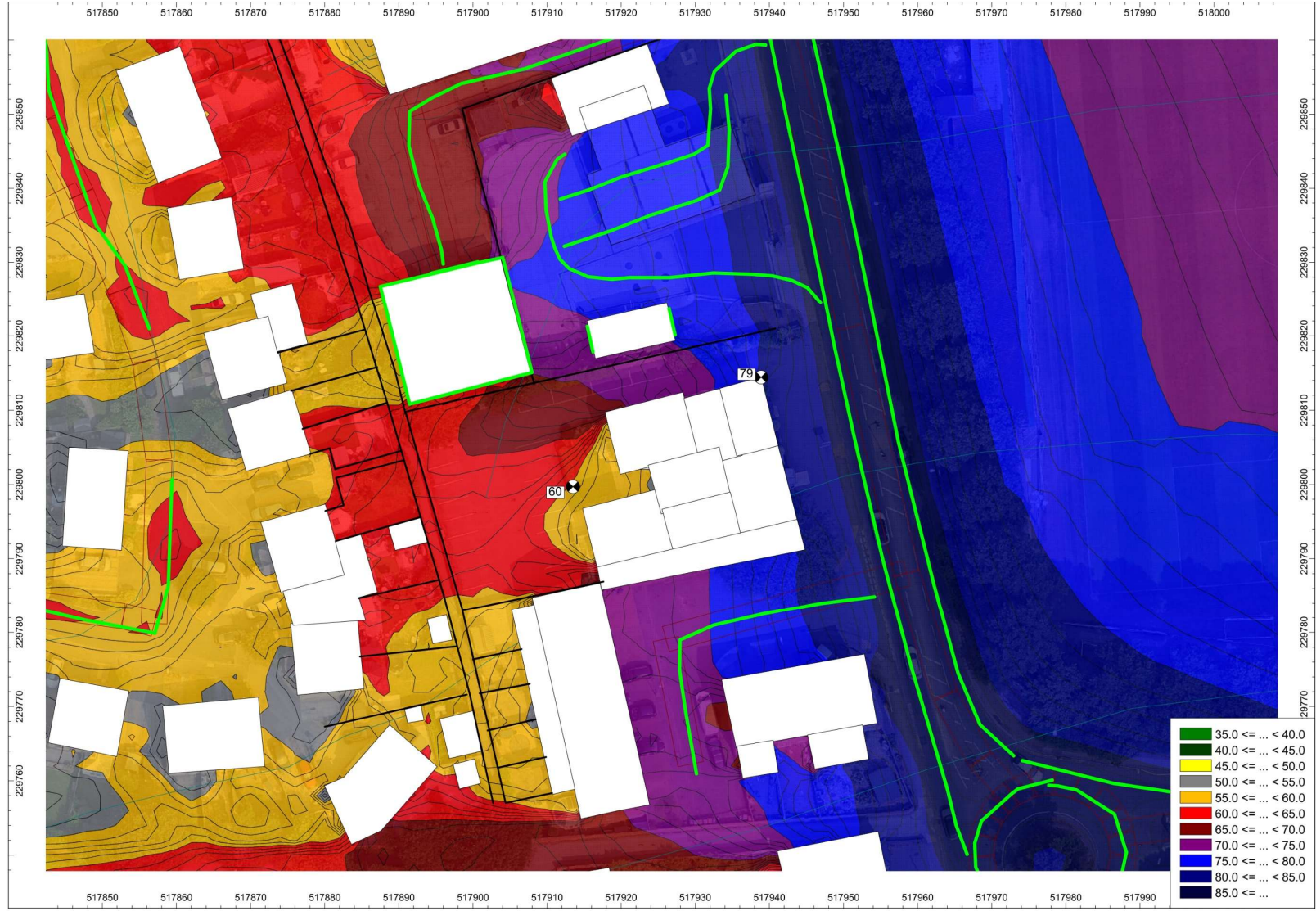
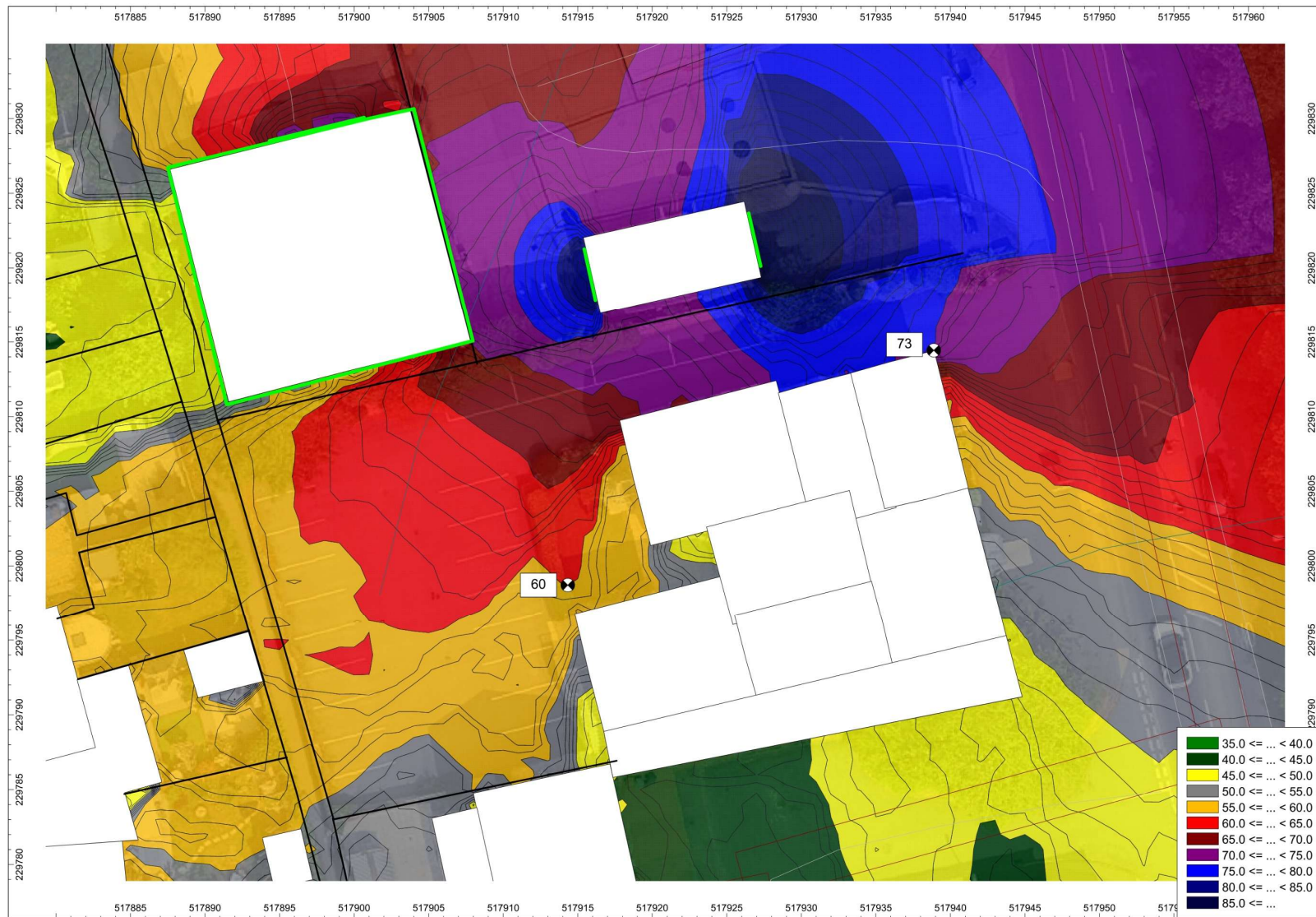


Figure D.5 – Commercial noise sources – Predicted $L_{Aeq,1hr}$ noise levels representing worst-case daytime emissions – Automated car wash and associated activity
– Receptor height 3.0 m.



D.2 – Proposed Development

Figure D.6 – Views of the model setup – proposed development

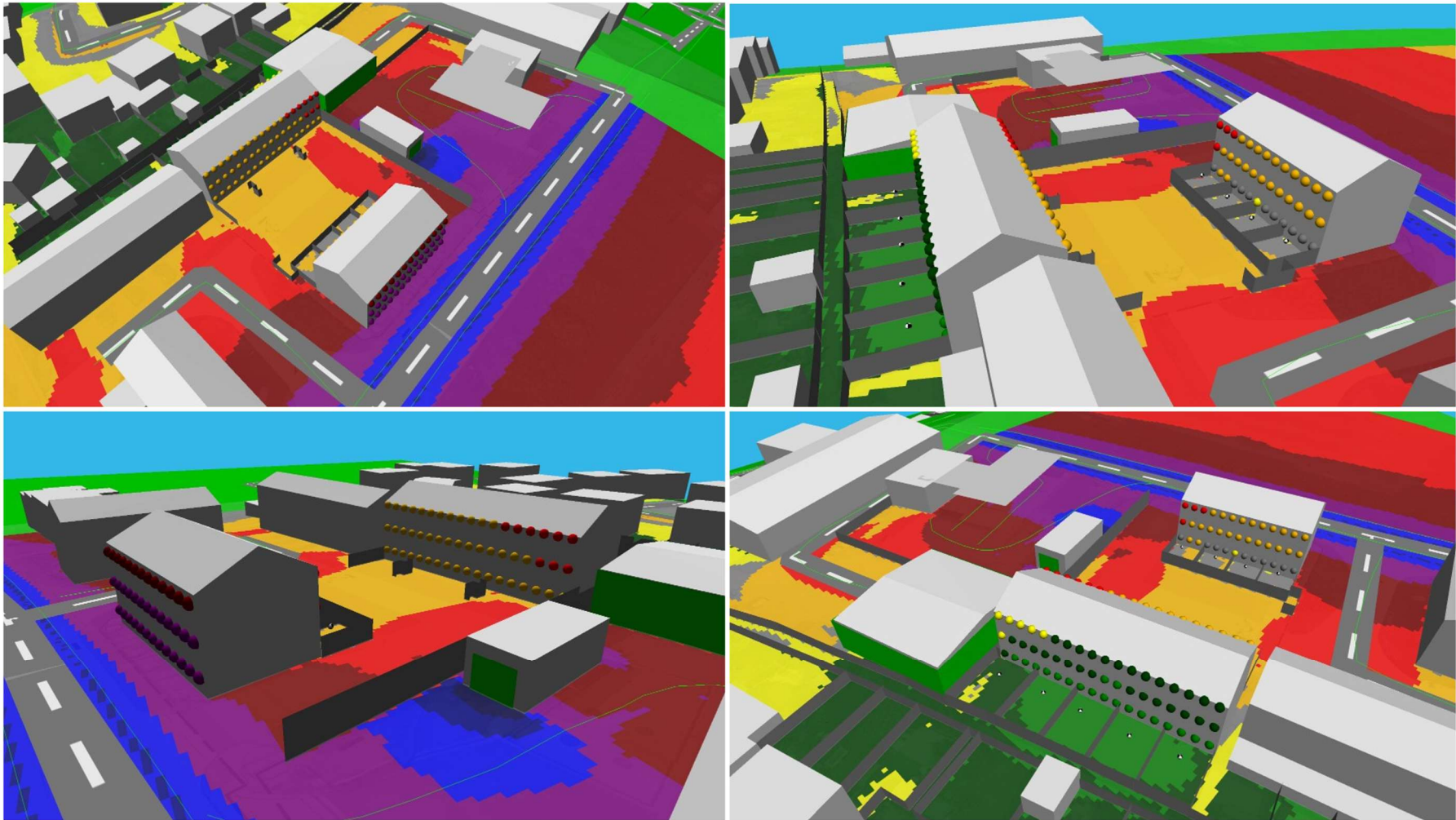


Figure D.7 – Proposed development – Predicted outdoor amenity noise levels, $L_{Aeq,16hr}$ – Daytime (07:00 – 23:00) – Receptor height 1.5 m.

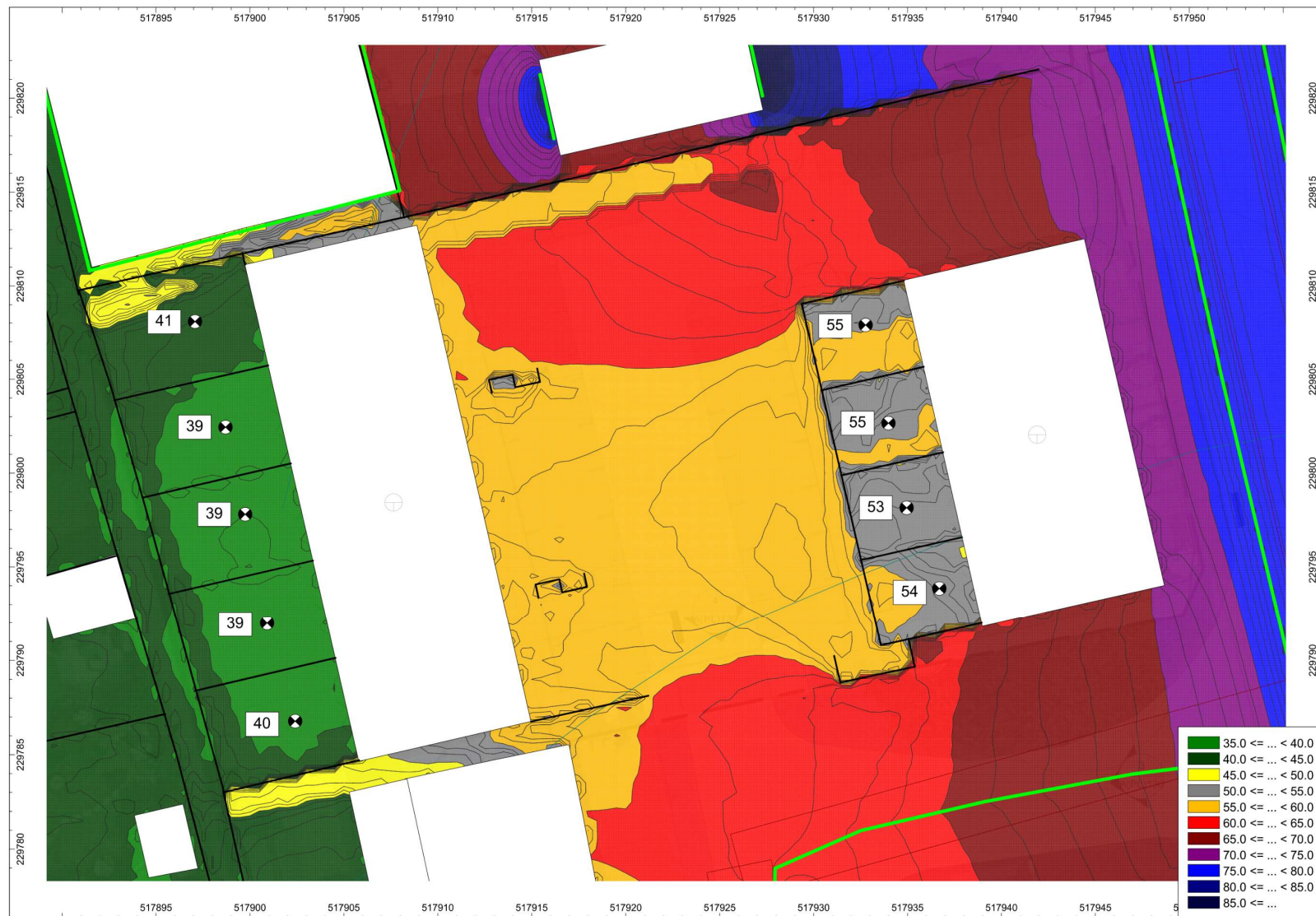


Figure D.8 – Proposed development – Predicted façade dB $L_{Aeq,16hr}$ exposure levels – Daytime (07:00 – 23:00) – Ground floor level (1.5 m).

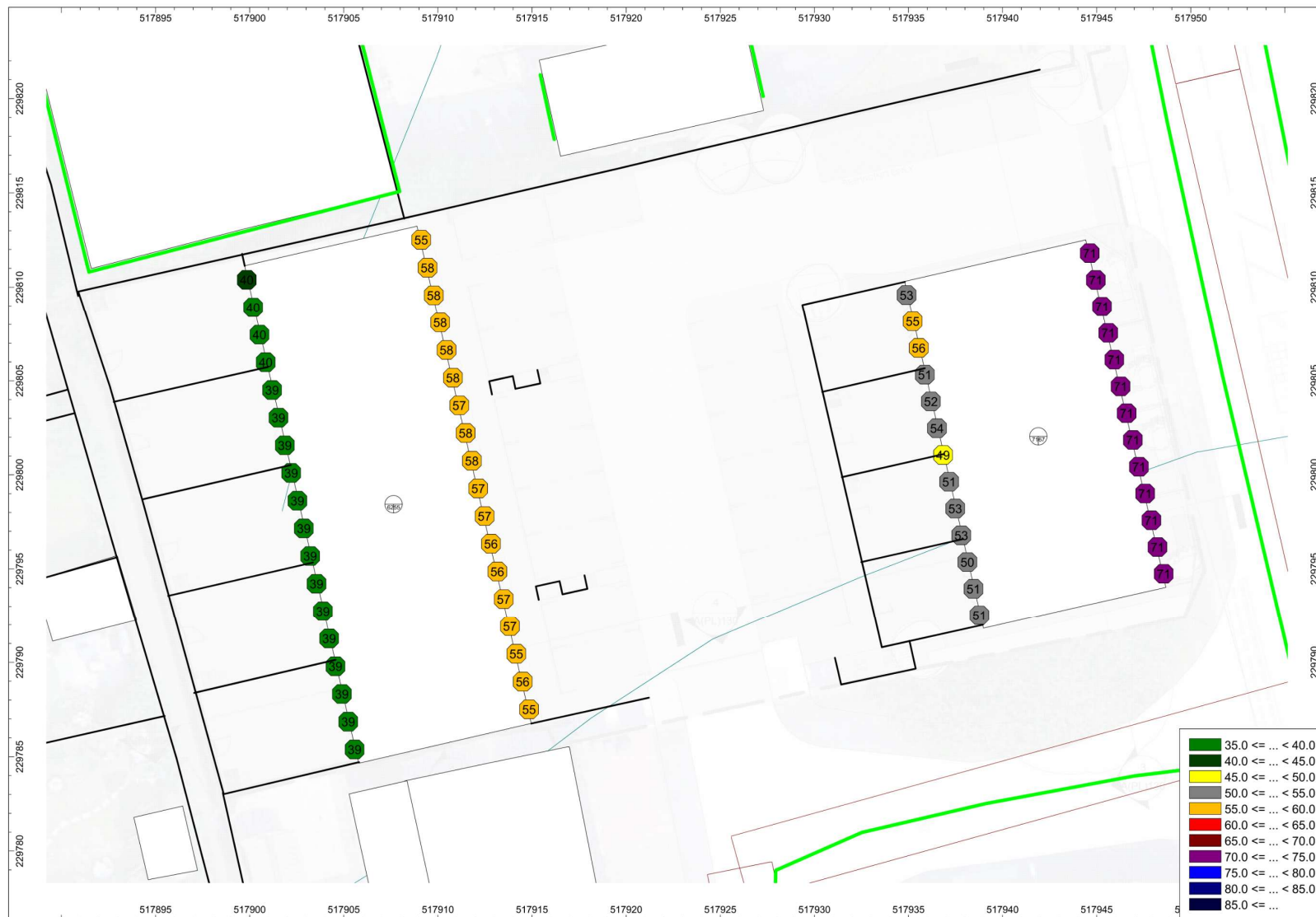


Figure D.9 – Proposed development – Predicted façade dB $L_{Aeq,16hr}$ exposure levels – Daytime (07:00 – 23:00) – 1st floor level (4.5 m).

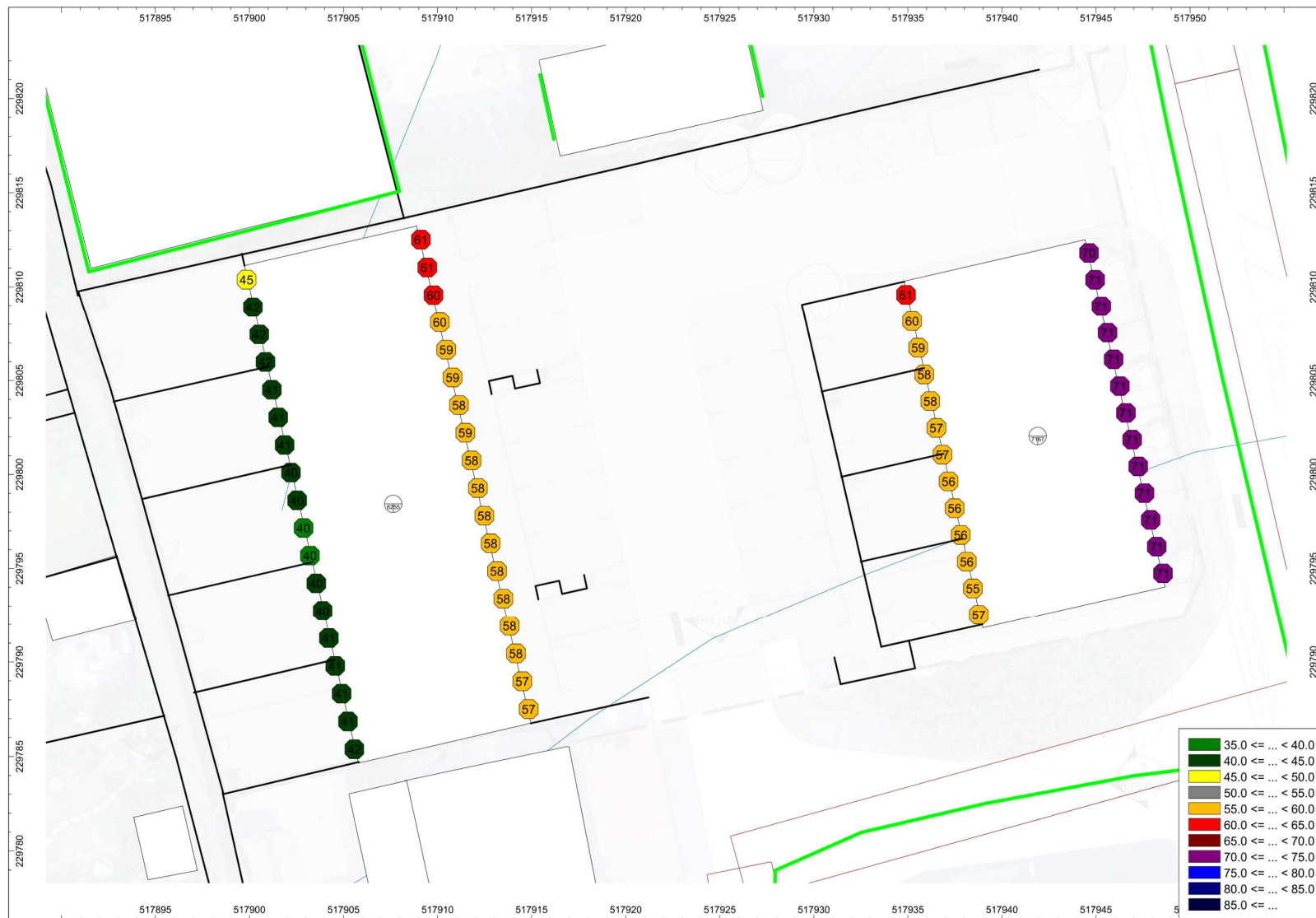


Figure D.10 – Proposed development – Predicted façade dB $L_{Aeq,16hr}$ exposure levels – Daytime (07:00 – 23:00) – 2nd floor level (7.5 m).

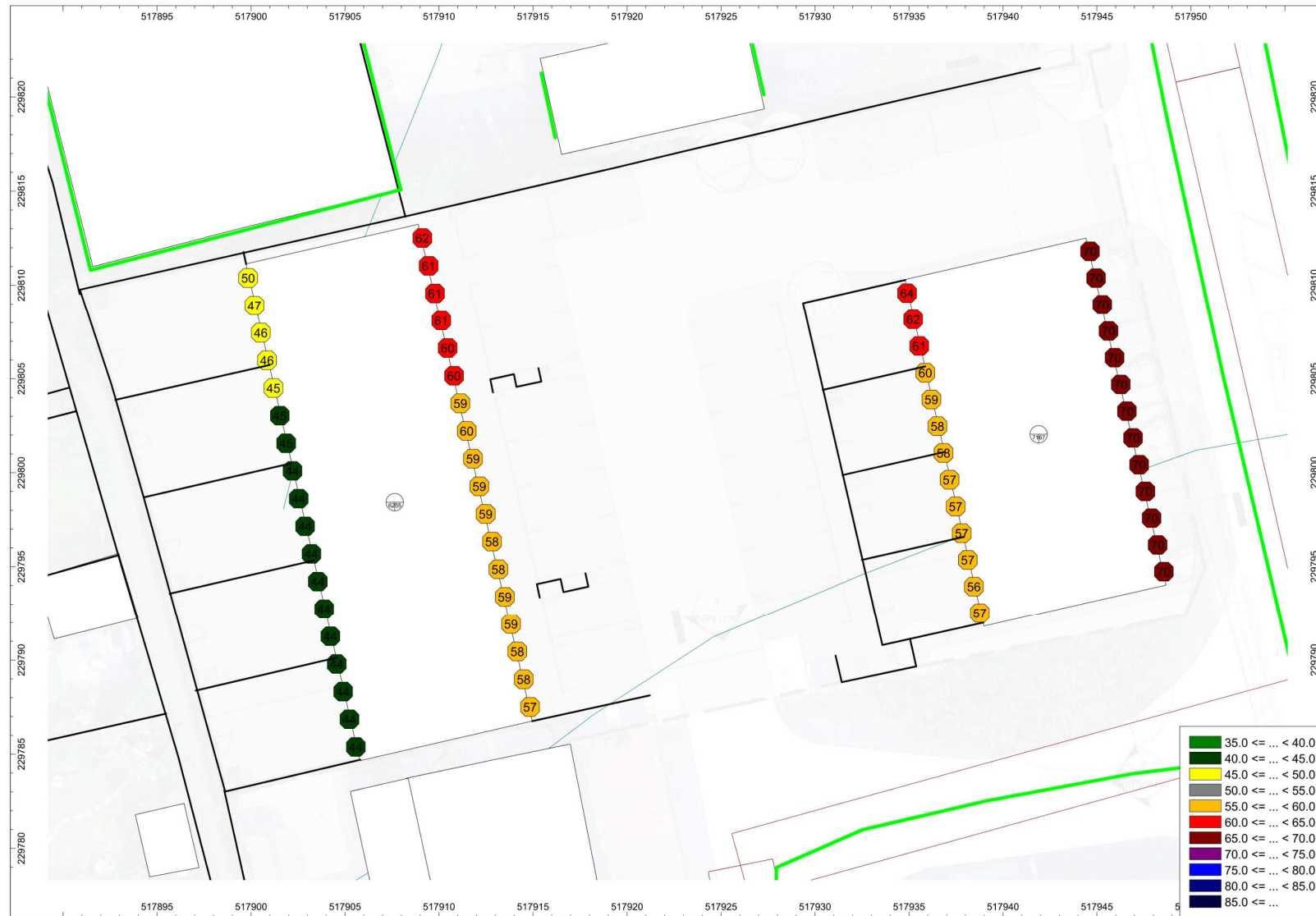


Figure D.11 – Proposed development – Predicted façade dB $L_{Aeq,8hr}$ exposure levels – Nighttime (23:00 – 07:00) – 1st floor level (4.5 m).

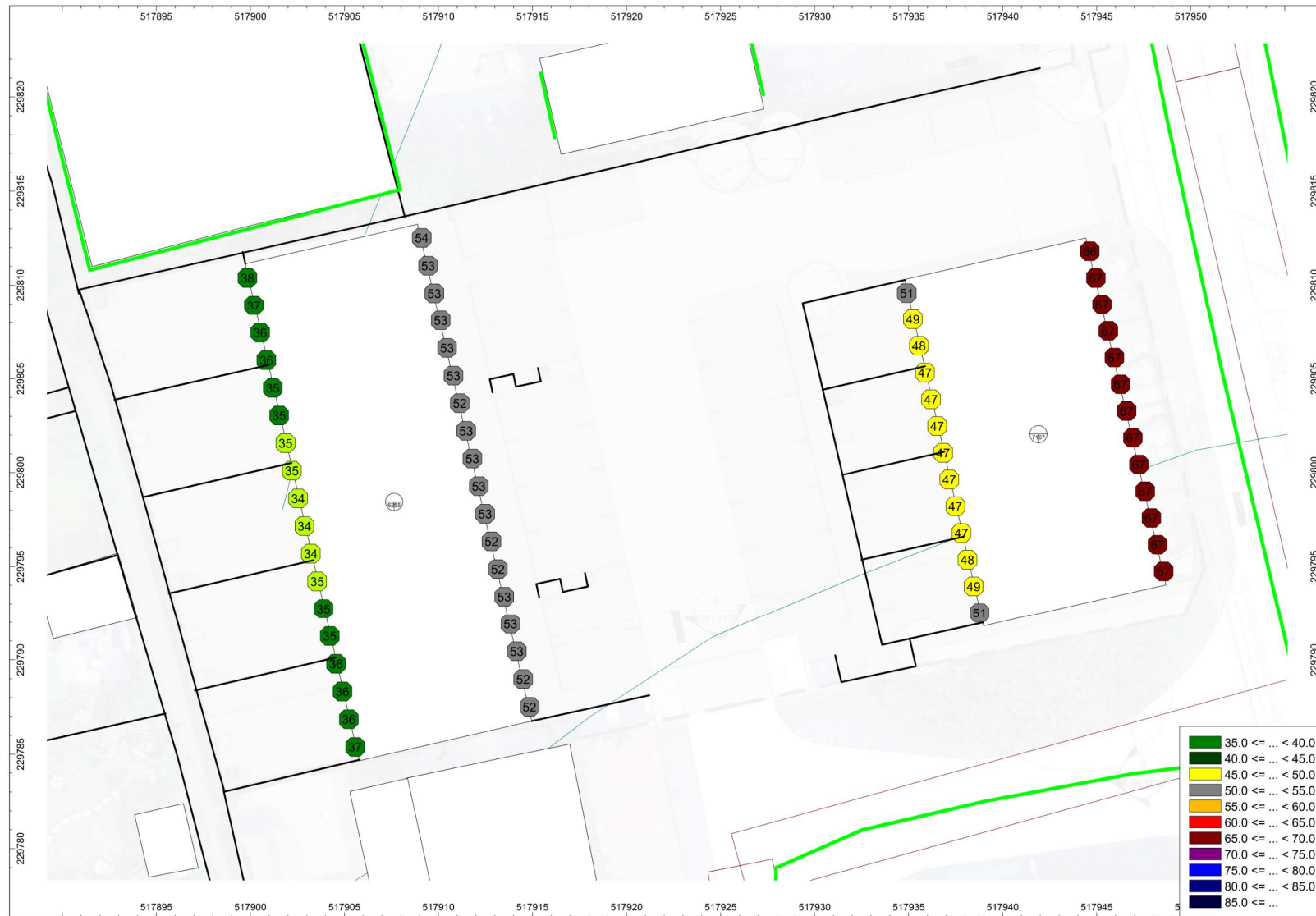


Figure D.12 – Proposed development – Predicted façade dB LAeq,8hr exposure levels – Nighttime (23:00 – 07:00) – 2nd floor level (7.5 m).

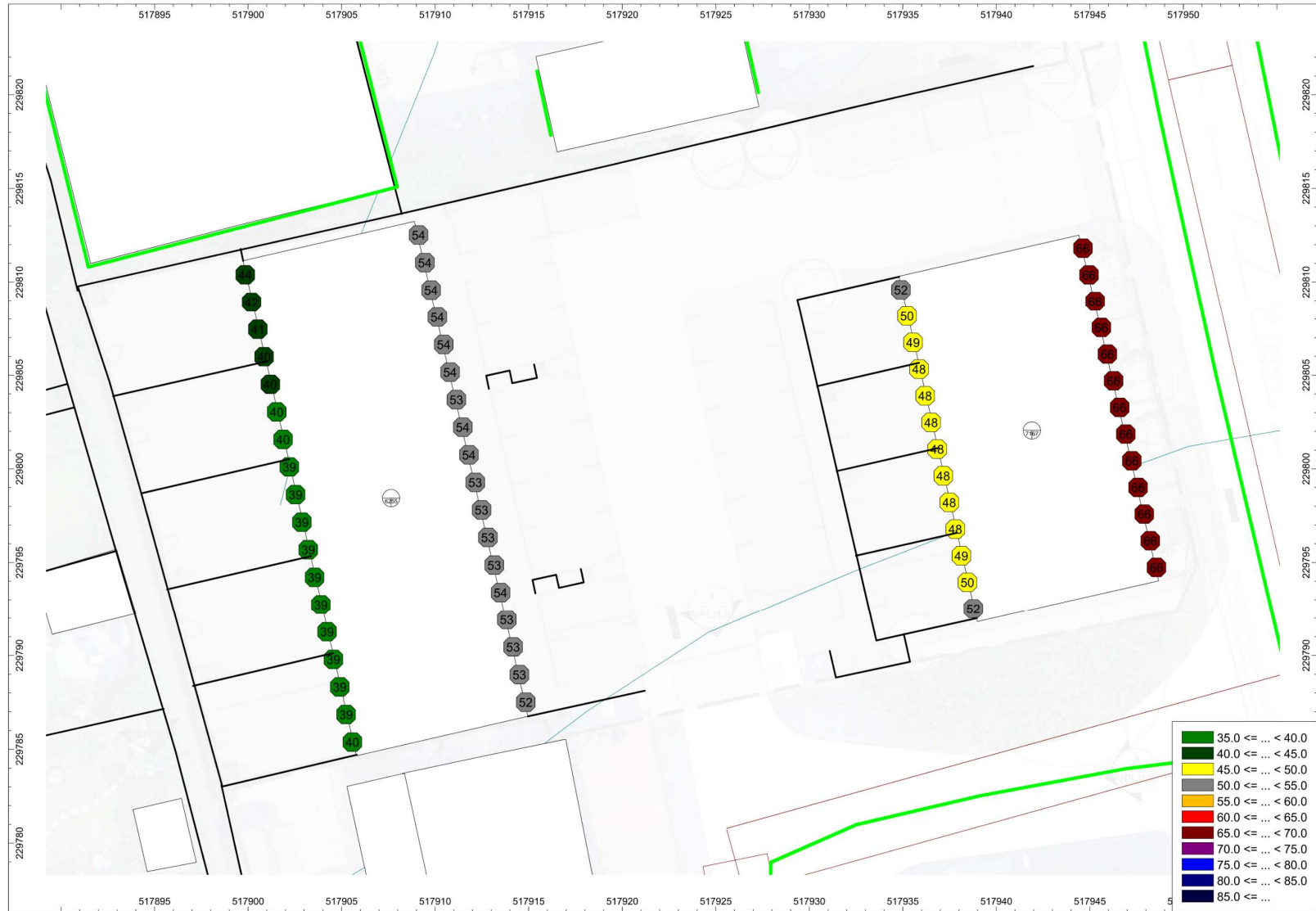


Figure D.13 – Proposed development – Predicted façade 10th highest dB $L_{AFmax,5min}$ maximum noise levels – Nighttime (23:00 – 07:00) – 1st floor level (4.5 m).

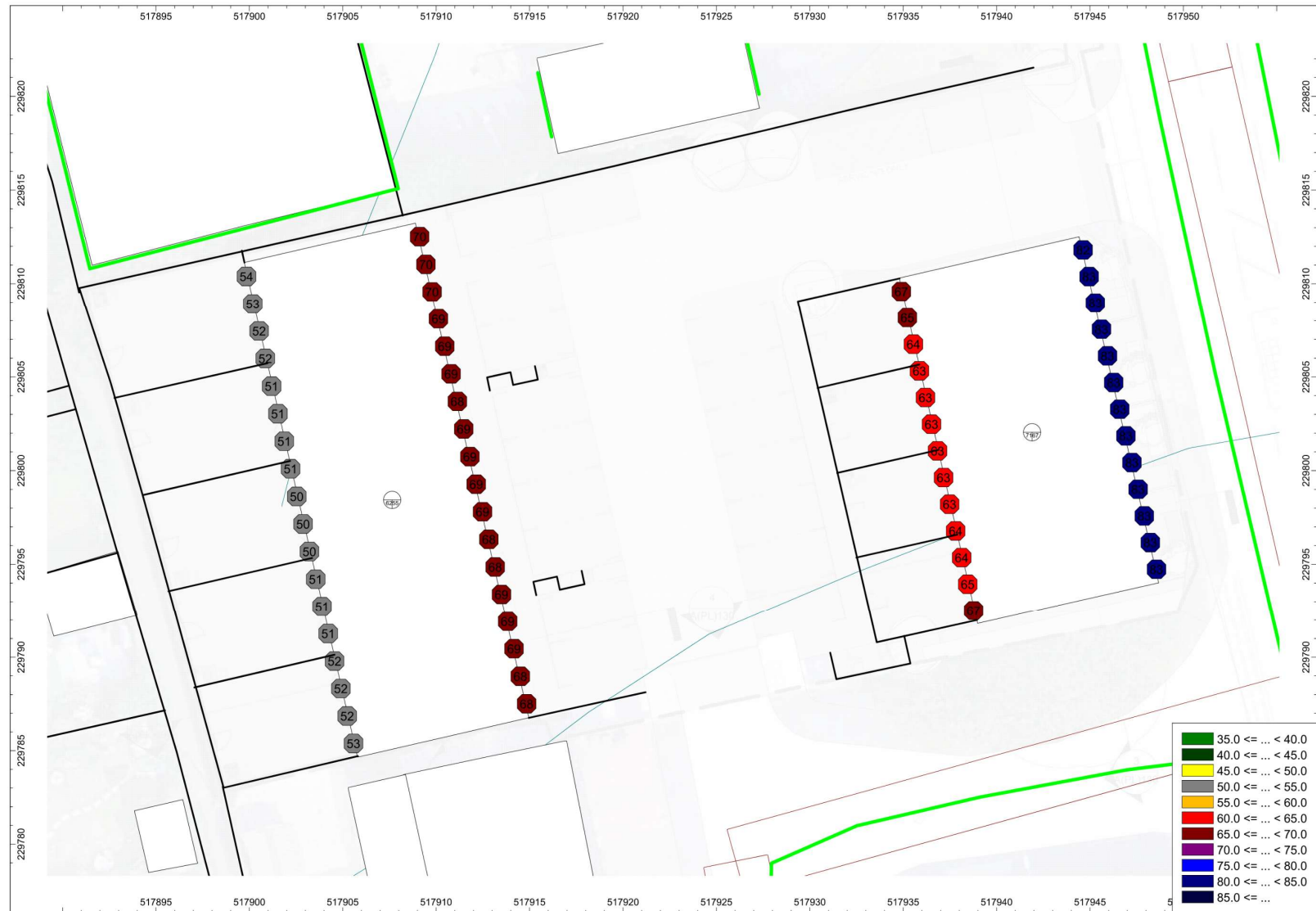


Figure D.14 – Proposed development – Predicted façade 10th highest dB $L_{A\text{Fmax},5\text{min}}$ maximum noise levels – Nighttime (23:00 – 07:00) – 2nd floor level (7.5 m).

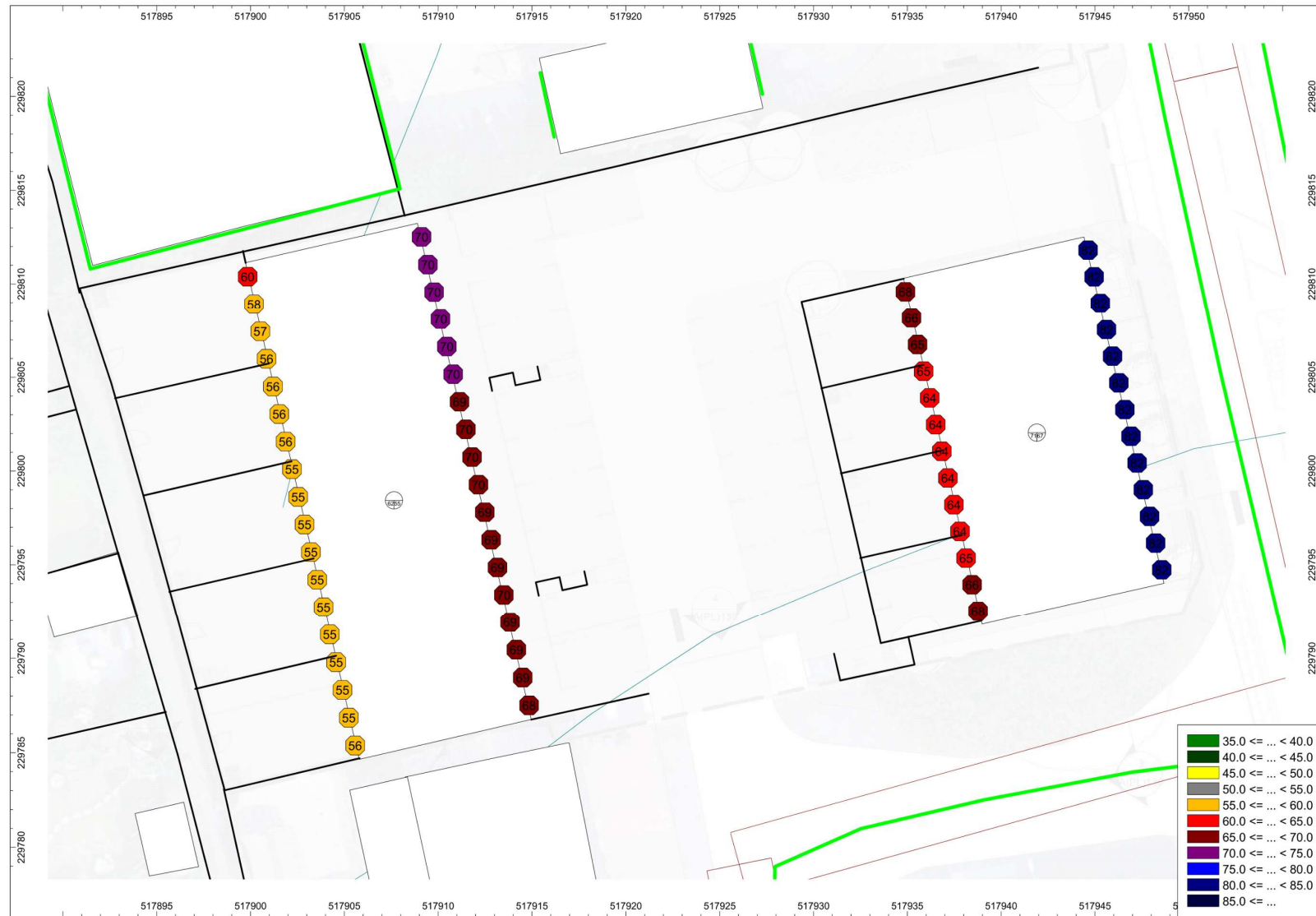


Figure D.15 – Proposed development – Predicted façade dB $L_{Aeq,1hr}$ exposure levels due to commercial noise sources – Worst-case daytime 1-hour period (sustained car wash usage)
– Ground floor level (1.5 m).

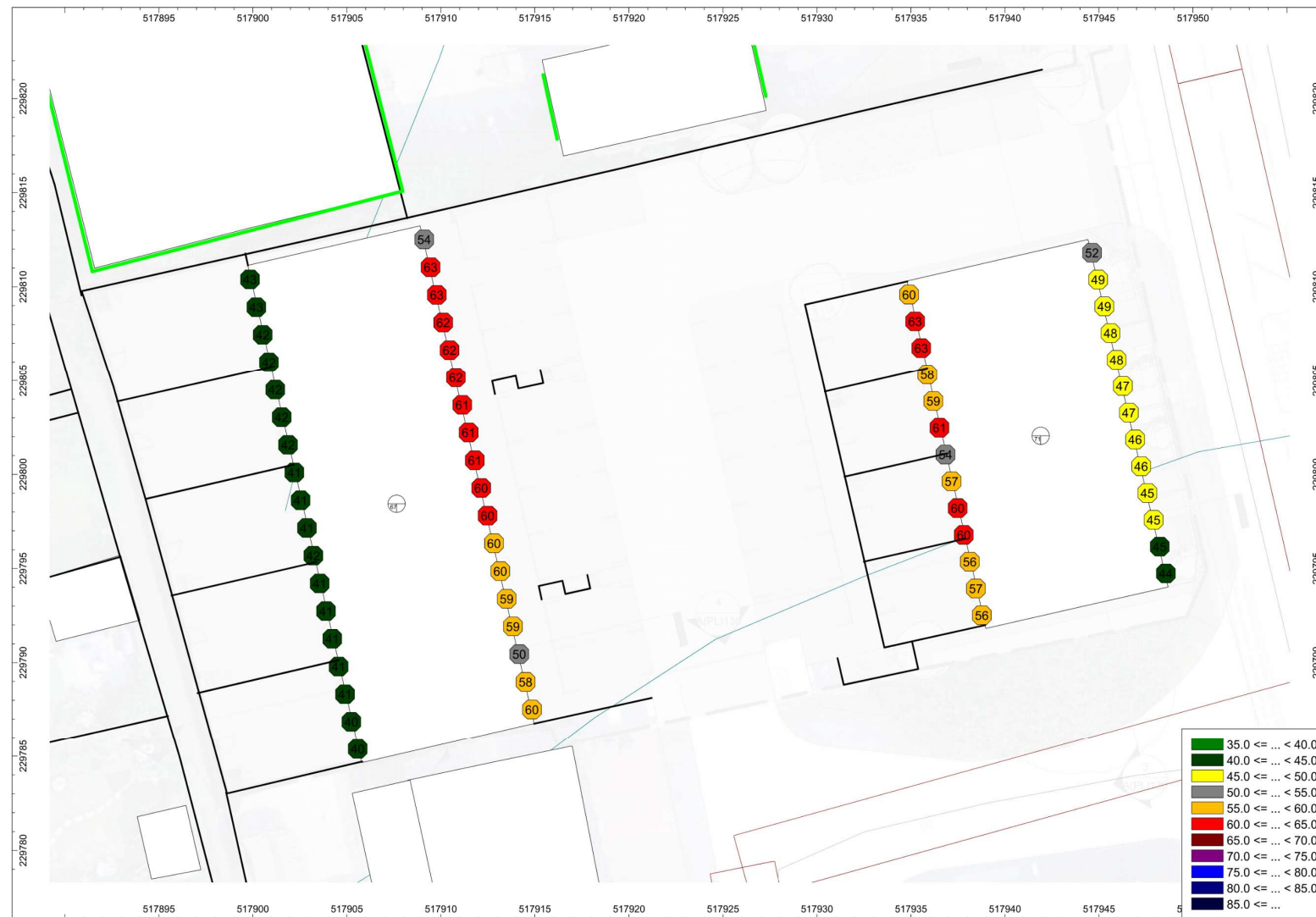


Figure D.16 – Proposed development – Predicted façade dB $L_{Aeq,1hr}$ exposure levels due to commercial noise sources – Worst-case daytime 1-hour period (sustained car wash usage) – 1st floor level (4.5 m).

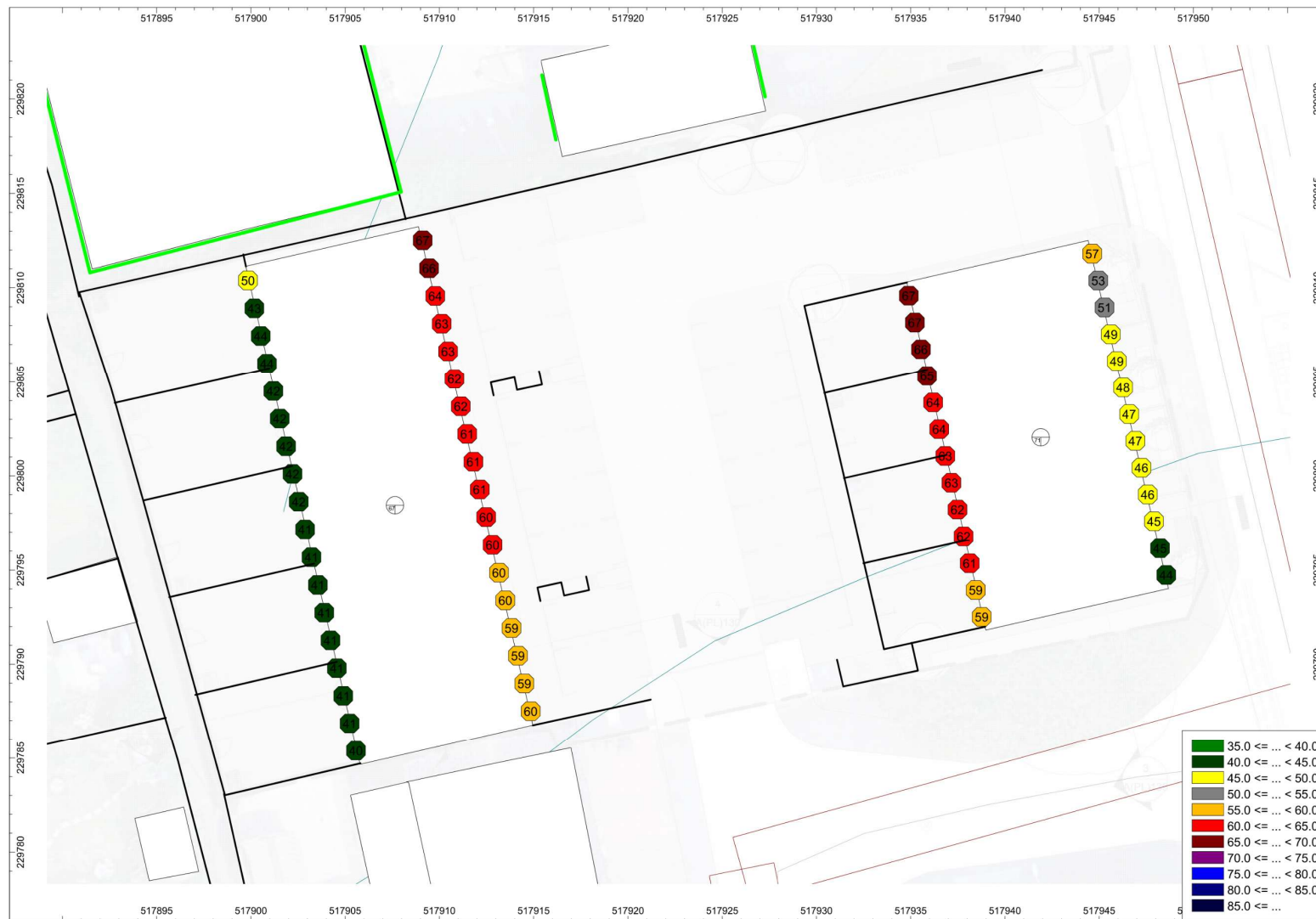
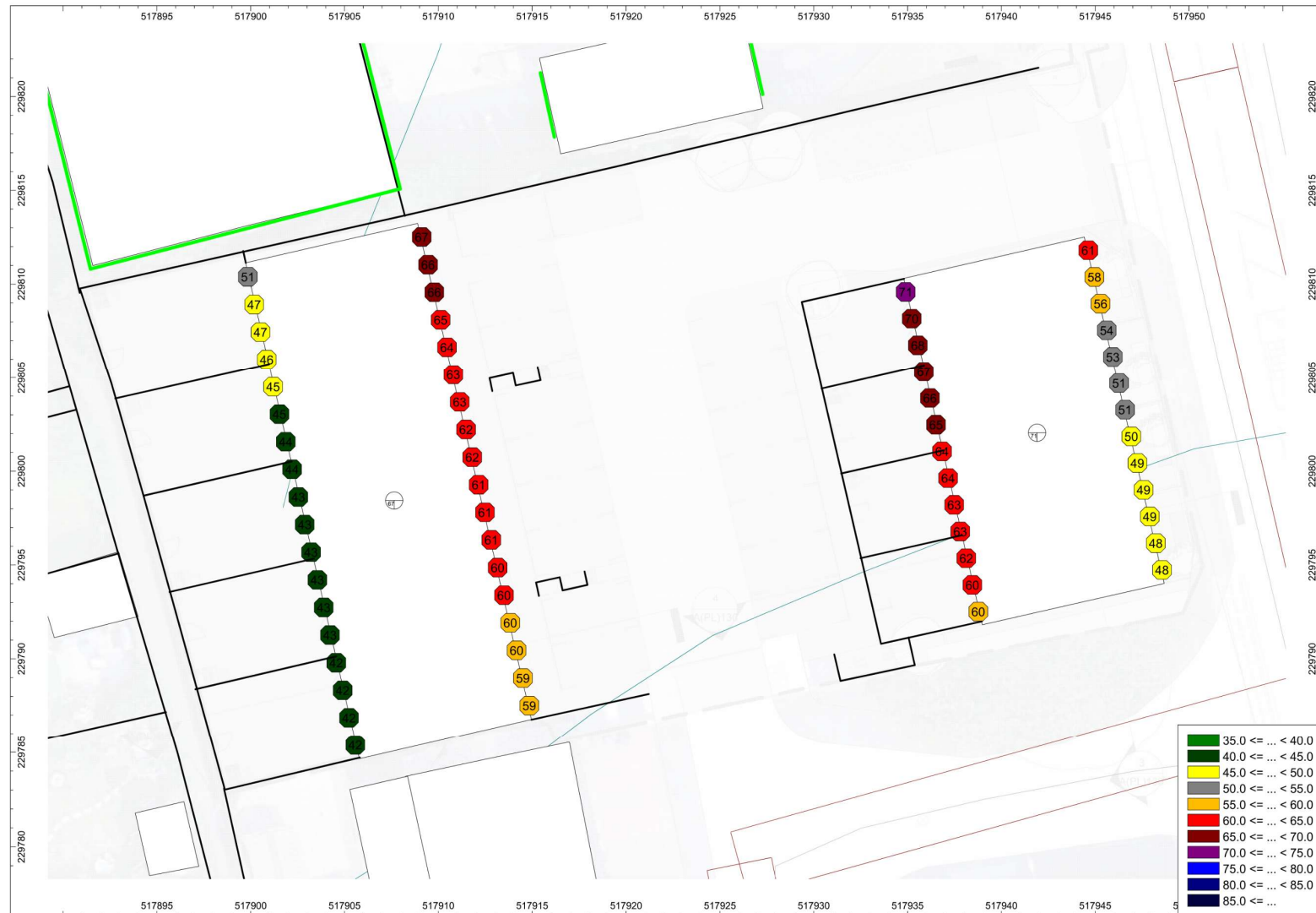


Figure D.17 – Proposed development – Predicted façade dB $L_{Aeq,1hr}$ exposure levels due to commercial noise sources – Worst-case daytime 1-hour period (sustained car wash usage) – 2nd floor level (7.5 m).



Appendix E – Example Façade Constructions

E.1 - Glazing

Table E.1 – Example glazing constructions and associated sound reduction indices

Single / Double / Triple	Configuration	Manufacturer	R _w + C _{tr} (dB)
Double	4 (12) 4	Saint Gobain	27
Double	4 (12) 6	Saint Gobain	29
Double	5 (12) 4	Saint Gobain	29
Double	4 (16) 8	Saint Gobain	30
Double	4 (12) 6.8P	Pilkington	30
Double	4 (10) 10	Saint Gobain	31
Double	6 (25) 4	Saint Gobain	31
Double	8 (18) 6	Saint Gobain	32
Double	8.8L (12) 8.8P	Pilkington	32
Double	4 (6) 10	Saint Gobain	33
Triple	4 (12) 4 (12) 8.4S	Saint Gobain	33
Double	4 (16) 8.8P	Pilkington	33
Double	10 (15) 6	Saint Gobain	34
Double	8 (6) 8.8S	Saint Gobain	34
Double	6 (16) 8.8P	Pilkington	34
Double	10 (6) 8.8S	Saint Gobain	35
Double	6 (24) 10	Saint Gobain	35
Double	6 (12) 9.5A	Saint Gobain	35
Triple	8 (12) 4 (12) 8.8P	Pilkington	35
Double	8 (12) 8.8A	Saint Gobain	36
Double	10 (12) 8.8A	Saint Gobain	37
Double	8.4A (16) 10.4A	Saint Gobain	38
Double	8.8P (16) 12.8P	Pilkington	39
Double	10 (16) 12.4A	Saint Gobain	40
Double	12.8A (15) 12.8A	Saint Gobain	41
Double	9.1P (20) 13.1P	Pilkington	42
Double	9.1P (20) 17.1P	Pilkington	43
Double	16.8A (15) 16.8A	Saint Gobain	44
Double	9.1P (20Arg) 17.1P	Pilkington	44
NOTATION A = Stadip Silence S = Stadip P = Optiphon L = Optilam Arg = Argon Cavity			
Further data at https://techhub.uk.saint-gobain-building-glass.com/acousticcalculator			

E.2 - Ventilators

For each additional ventilator, the required $D_{n,e,w} + C_{tr}$ should be increased by $10\log(n)$, where 'n' is the number of ventilators. The $D_{n,e,w} + C_{tr}$ must be assessed in the **open position**.

Table E.2 – Example ventilator products and associated sound reduction indices

Product	$D_{n,e,w} + C_{tr}$ (dB)
Duco DucoTop 60 SR (over window frame) – Corto STD	25
Duco DucoTop 60 SR (over window frame) – Corto AK	26
Duco DucoTop 60 SR (over window frame) – Grando STD	27
Duco DucoTop 60 SR (over window frame) – Corto AK+	28
Duco DucoTop 60 SR (over window frame) – Alto AK	30
Duco DucoTop 60 SR (over window frame) – Basso AK+	30
Titon Invent	30
Duco DucoTop 60 SR (over window frame) – Grando AK	31
Titon Hit & Miss HM5050	31
Duco DucoTop 60 SR (over window frame) – Medio AK+	32
Duco DucoStrip Slimline	32
Duco GlasMax – Air slot 20mm	32
Ryttons R2700 Window trickle ventilator (412mm wide)	33
Titon SF 3300 EA Vent	33
Greenwood Slotvent 3000S	33
Duco GlasMax – Air slot 10mm	34
Greenwood 2000D	35
Duco DucoTop 60 SR (over window frame) – Largo AK+	35
Duco DucoMax Corto 15	36
Duco DucoTop 60 SR (over window frame) – Grando AK+	37
Duco DucoMax Medio 25	37
Duco DucoMax Alto 25	38
Titon SF Xtra Sound Attenuator	39
Willan Fresh 100dB	40
Greenwood Airvac Acoustic Air Brick AAB-4000	40
Duco DucoMax Corto 10	41
Duco DucoMax Medio 15	42
Greenwood EHA574	42
Duco DucoMax Alto 15	43
Duco DucoMax Alto 10	45



ParkerJones Acoustics Limited

Bristol

11 Bankside Road
Brislington
Bristol
BS4 4LB

London

29 Lincoln's Inn Fields
Holborn
London
WC2A 3EE

Glasgow

126 West Regent Street
Glasgow
G2 2RQ

+44 (0)800 830 3338

+44 (0)117 914 6558

info@parkerjonesacoustics.com

www.parkerjonesacoustics.com

Registered in England and Wales

Company No. 12235614