



ACOUSTIC
CONSULTANTS LTD

Noise Impact Assessment

**Proposed Residential Development
Former Ambulance and Fire Station, Huyton**

Reference: 9975/SL

Client:

McCARTHY STONE

Life, well lived

Document Control

Version:	Revision Description:	Date:	Author:	Reviewed by:
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Revision A	Updated layout and results of overheating assessment added	03/02/23	Samuel Lawrence	Blake Lucas

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

Table of Contents

1.	Executive Summary	4
2.	Introduction	5
3.	The Site & Proposals	6
4.	Planning & Noise	7
5.	Assessment Criteria	11
6.	Noise Monitoring	13
7.	Noise Modelling	20
8.	External Noise Control	24
9.	Summary and Conclusion	32
10.	Appendix 1 – Glossary of Acoustic Terminology	33

1. Executive Summary

It is proposed to develop a block of residential flats at the Former Ambulance and Fire Station, Huyton. The site is located adjacent to Huyton Lane, Lathom Road and an ASDA carpark and this report addresses the effect of these noise sources on the proposed dwellings.

To establish the noise climate at the site, noise surveys were completed between the 30th November – 2nd December 2022 and on the 13th December 2022. During the survey, it was clear the predominant noise source was traffic on the surrounding road network.

Using the measured data reported in Section 6.4, computer noise modelling has been undertaken to predict the external noise levels at each façade of the proposed development (Section 7).

The results of the model have been used to determine mitigation measures to control external noise ingress in the form of minimum glazing requirements and the sound level difference required through the proposed mechanical ventilation system (Section 8).

Section 8.4.2 shows locations where bedroom windows would typically be required to be closed at night to control external noise, based on ADO Guidelines. The results of the overheating assessment carried out by Focus Consultants show that the requirements of Approved Document O will be met with the proposed mechanical ventilation system in these bedrooms.

With the advice set out in the report, we would consider external noise can be suitably controlled within the habitable rooms of the residential development and below the Lowest Observed Adverse Effect Level of the NPPG and we would consider that with a suitably designed noise scheme as set out in this report the development achieves the aims of the NPPF.

2. Introduction

McCarthy Stone appointed Acoustic Consultants Limited to undertake an environmental noise assessment for the proposed residential development located at the Former Ambulance and Fire Station, Huyton.

The report identifies relevant planning, noise guidance, establishes environmental noise levels at the site and provides noise mitigation measures for the proposed dwellings in support of a planning application.

The assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 8233:2014 (BS8233).

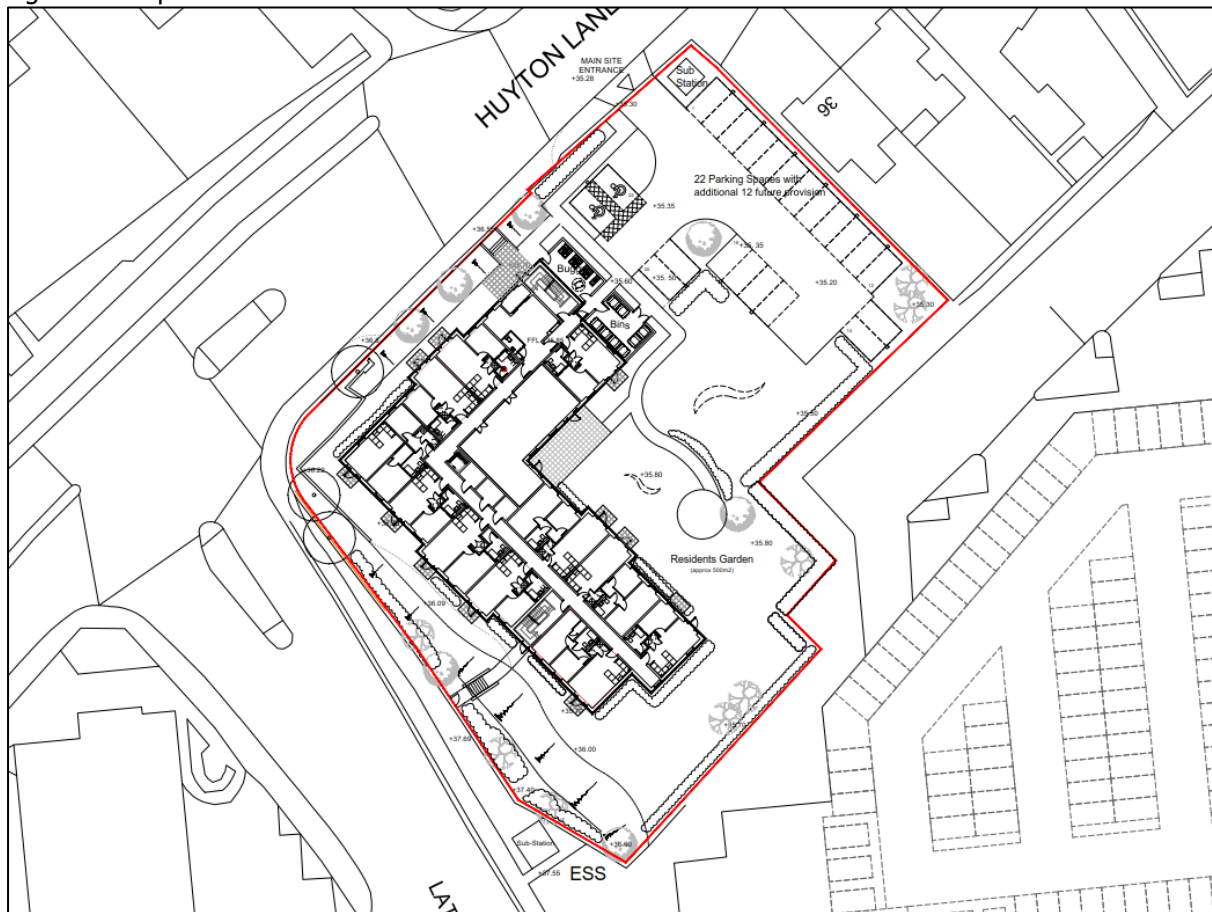
3. The Site & Proposals

The site is located at the Former Ambulance and Fire Station, Huyton with Lathom Road on the western border and Huyton Lane on the northern border. There is also an Asda Supercentre with associated carpark overlooking the site to the southeast.

The proposal is to construct a block of flats for retirement living, comprising 53 units in total (37 one bedroom and 16 two bedroom flats). The development will also include a carpark and communal garden.

The proposed site plan is shown below.

Figure 1: Proposed Site Plan



4. Planning & Noise

4.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in July 2021. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 174 states:

"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."*

Paragraph 185 states:

"185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "*

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise, and refers you to the NPSE.

4.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long-term vision of Government noise policy. This long-term vision is supported by three noise policy aims as follows:

"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 NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

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.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits. The NPSE does, however, emphasise that in dealing with noise Local Planning Authorities are required to take a balanced approach in considering the benefits of development as against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

4.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise, referred to here, is based on the current version (July 2019) as provided on the Planning Guidance Website.

It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

The document provides generic guidance on how to determine the impact of noise and what factors could be a concern.

It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE.

Table 1: NPPG Noise – Perception of Effect Levels

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

Response	Examples of Outcomes	Increasing Effect Level	Action
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels.

The NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum when taken into account against all other planning considerations.

Section 4 of this report identifies guidance which is considered to provide noise criteria equivalent to effect levels below the Lowest Observed Adverse Effect Level. This is where the perception of noise is “not noticeable” or “noticeable but not intrusive” as indicated in Table 1 above.

5. Assessment Criteria

The following section identifies guidance which is considered to provide noise criteria equivalent to or below the LOAEL described in NPPG and NPSE, i.e.

"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."

5.1. British Standard 8233:2014

This standard, entitled 'Guidance on sound insulation and noise reduction for buildings', provides advice on noise as it affects buildings of all types, giving consideration to various common sources of noise. This is considered relevant when assessing noise from external noise sources as it effects the proposed residential properties. It outlines design guidance in general terms and provides criteria for the indoor ambient noise levels (IANLs) for different types of room. These are stated in terms of the 'equivalent continuous sound pressure level' over the reference time period, the $L_{Aeq, T}$. The IANLs specified by British Standard 8233 that are relevant to this development are as follows.

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16 \text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16 \text{ hour}}$	30 dB $L_{Aeq,8 \text{ hour}}$

The British Standard does not provide any internal noise criteria for maximum noise levels.

Section 3.4 of the WHO Guidelines state *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)"*.

5.2. Approved Document O

The relevant noise requirements under overheating conditions are provided in the recently published and adopted Approved Document O. These are as follows:

"Noise

3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- a. 40dB LAeq,T, averaged over 8 hours (between 11pm and 7am).*
- b. 55dB LAFmax, more than 10 times a night (between 11pm and 7am).*

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use. NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020)."

6. Noise Monitoring

Two noise surveys were completed at the site, the first between the 30th November – 2nd December 2022 and the second on the 13th December 2022.

6.1. Monitoring Equipment

Sound Pressure Levels were measured using a Class 1 sound level meter with a half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-18928-E0	26/04/2021	UK-21-029
Pre-Amp, NTI, MA220	9785	26/04/2021	UK-21-029
Microphone, NTI, MC230A	A20919	26/04/2021	UK-21-029
Calibrator, Larson Davis, CAL200	17656	22/12/2021	44552-17656-CAL200
SLM, NTI, XL2	A2A-18475-E0	13/10/2020	UK-20-072
Pre-Amp, NTI, MA220	9378	13/10/2020	UK-20-072
Microphone, NTI, MC230A	A19093	13/10/2020	UK-20-072
Calibrator, Larson Davis, CAL200	17656	22/12/2021	44552-17656-CAL200

The measurement systems were checked before and after use with the noted calibrators and no significant drift was detected.

6.2. Weather Conditions

The weather conditions are as below and are considered acceptable with no adverse impact on the measured data.

Table 4: Weather Conditions During Survey

Date	Wind Speed (m/s)	Prevailing Wind Direction	Average Air Temperature (°C)	Precipitation (time/hrs)	Cloud Cover (%)
30 th November – 2 nd December 2022	≤4	SE	2 - 7	0	-
13 th December 2022	≤3	NE	-2 - 0	0	-

6.3. Noise Monitoring Procedure

The monitoring locations 'A' - 'G' are shown in the figure below. The meter at all locations was calibrated before and after the measurement with no drift detected and the microphone was situated at an approximate height of 1.5m.

Figure 2: Monitoring Locations 'A' – 'G'



6.3.1. Monitoring Locations 'A' & 'B'

A partially attended, simultaneous, long-term noise survey was completed, between the 30th November and 2nd December 2022 to determine the level of noise from traffic on Huyton Lane (ML A) and Lathom Road (ML B) impacting upon the site. Measurements were taken in screened positions due to the temporary hoarding surrounding the site, leading to further monitoring exercises (at locations 'C' – 'F') being undertaken. The measured levels at these monitoring locations were predominantly determined by road traffic noise from the surrounding road network only.

6.3.2. Monitoring Locations 'C' & 'D'

An attended, simultaneous, 30-minute noise survey was undertaken on the 13th December 2022 at Monitoring Locations 'C' & 'D' to determine the level difference inside and outside of the hoarding in order to correct the measured long term levels at Location 'A'.

6.3.3. Monitoring Location 'E' & 'F'

An attended, simultaneous, 30-minute noise survey was undertaken on the 13th December 2022 at Monitoring Locations 'E' & 'F' to determine the level difference inside and outside of the hoarding in order to correct the measured long term levels at Location 'B'.

6.3.4. Monitoring Location 'G'

An attended, short-term, 30-minute noise survey was undertaken on the 30th November 2022 to determine the level of noise from the Asda Supercentre car-park impacting upon the site. Measurements were taken in a free-field position. The measured levels are considered a worst-case representative of the levels present at the southern and eastern façades of the proposals during the day.

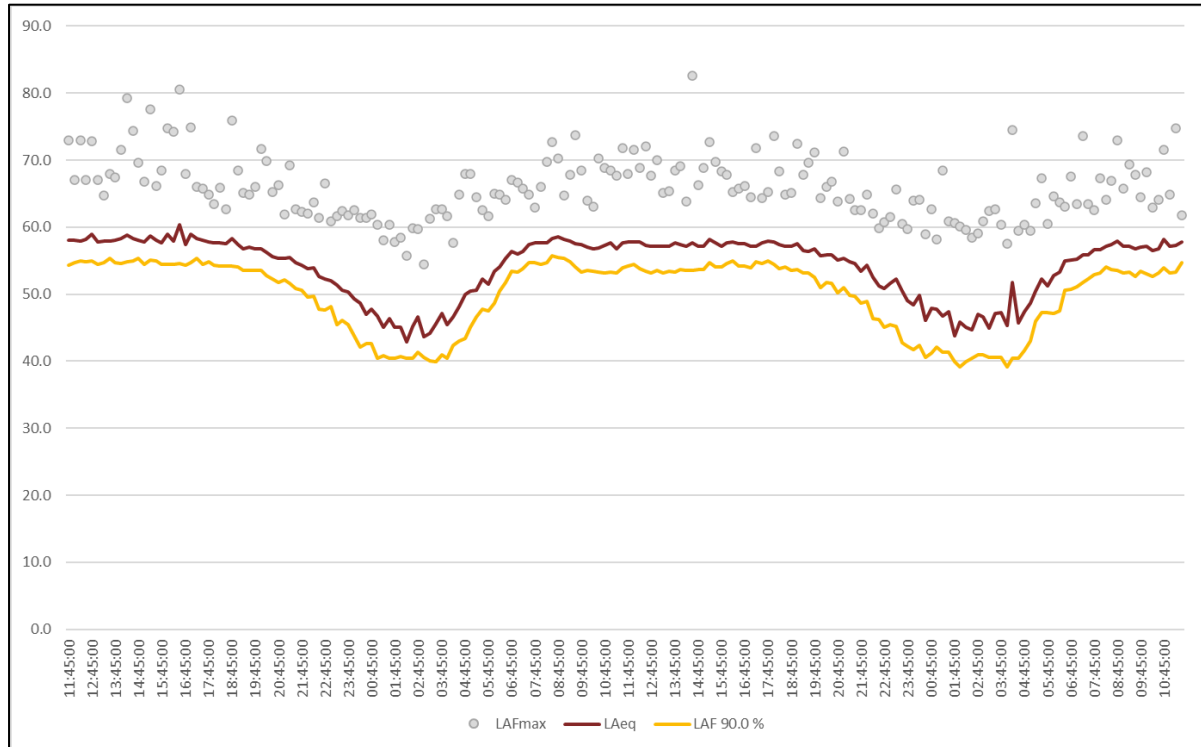
Levels were primarily determined by noise from road traffic on the surrounding road networks.

6.4. Measured Noise Levels

6.4.1. Monitoring Location 'A'

A chart of the variation in noise levels over time, at the noted monitoring location, is provided below.

Chart 1: Measured Noise Levels at Monitoring Location 'A'



The equivalent noise levels and design night-time maximum noise levels determined from the measurement data at the monitoring location are provided in the table below.

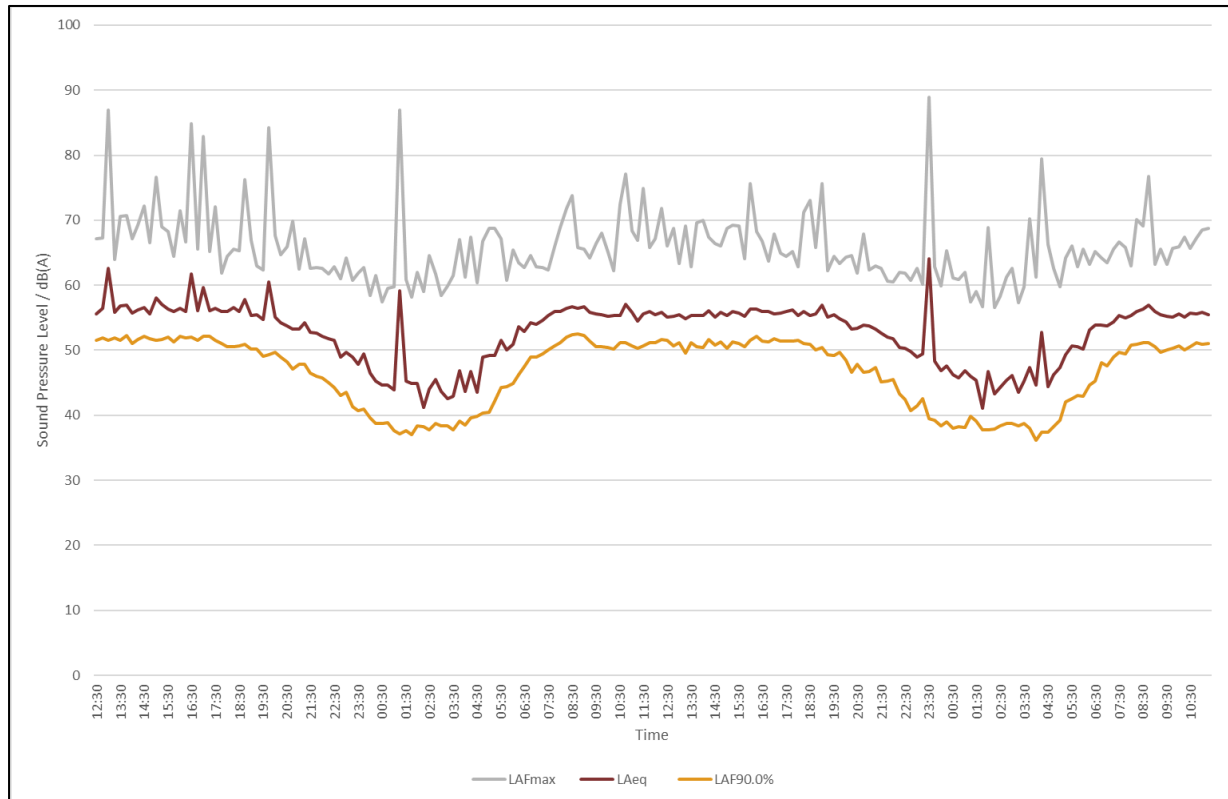
Table 5: Measured equivalent and maximum noise Levels for Monitoring Location 'A'

Period	Frequency								dB(A)
	63	125	250	500	1K	2K	4K	8K	
Leq(16hrs)	68	61	56	53	54	48	39	29	57
Leq(8hrs)	58	53	48	46	47	41	31	24	50
L _{maxF}	69	71	62	63	57	54	48	41	64

6.4.2. Monitoring Location 'B'

A chart of the variation in noise levels over time, at the noted monitoring location, is provided below.

Chart 2: Measured Noise Levels at Monitoring Location 'B'



The equivalent noise levels and design night-time maximum noise levels determined from the measurement data at the monitoring location are provided in the table below.

Table 6: Measured equivalent and maximum noise levels for Monitoring Location 'B'

Period	Frequency								dB(A)
	63	125	250	500	1K	2K	4K	8K	
L _{eq} (16hrs)	66	57	53	50	53	48	40	34	56
L _{eq} (8hrs)	58	50	47	44	45	41	32	26	49
L _{maxF}	72	62	63	61	61	56	48	40	65

6.4.3. Monitoring Locations 'C' & 'D'

The equivalent spectral levels and maximum levels at each monitoring location and the level difference between them is provided in the table below.

Table 7: Measured equivalent and maximum noise levels at Monitoring Locations 'C' and 'D' and the level differences between them (dB)

Parameter	Frequency								L _{Aeq}	L _{AFmax}
	63	125	250	500	1K	2K	4K	8K		
Inside Hoarding (ML 'C')	69.4	60.7	55.7	52.6	54.4	48.6	41.3	34.8	57.4	68.4
Outside Hoarding (ML 'D')	72.4	65.5	62.1	60.2	63.6	59.9	54.6	52.9	66.9	81.1
Level Difference	3.0	4.8	6.4	7.6	9.2	11.3	13.3	18.1	9.5	12.7

6.4.4. Monitoring Locations 'E' & 'F'

The equivalent spectral levels and maximum levels at each monitoring location and the level difference between them is provided in the table below.

Table 8: Measured equivalent and maximum noise levels at Monitoring Locations 'E' and 'F' and the level differences between them (dB)

Parameter	Frequency								L _{Aeq}	L _{AFmax}
	63	125	250	500	1K	2K	4K	8K		
Inside Hoarding (ML 'E')	69.2	59.3	51.9	51.8	52.5	48.6	40.4	33.1	56.0	68.3
Outside Hoarding (ML 'F')	71.2	64	61.9	61.4	64.1	61.9	55.9	51.3	67.9	82.6
Level Difference	2.0	4.7	10	9.6	11.6	13.3	15.5	18.2	11.9	14.3

6.4.5. Monitoring Location 'G'

Below are the measured equivalent spectral noise levels measured at Monitoring Location 'G'. These levels are used in the daytime external noise control calculations for the car park-facing (eastern) facades that were otherwise screened from noise from traffic on the surrounding road network.

Table 9: Measured Equivalent noise levels for Monitoring Location 'G'

Parameter	Frequency								dB(A)
	63	125	250	500	1K	2K	4K	8K	
L _{eq,T}	68	58	52	50	52	47	40	34	55

6.5. Corrected Long-Term Levels

Due to the original long-term measurements (locations 'A' and 'B') being partially screened from noise sources on the surrounding road network due to the temporary hoarding around the site, the measured data needs to be corrected by the level differences established through surveys 'C' & 'D' and 'E' & 'F'. The tables below show the corrected levels that are used in our modelling calculations.

6.5.1. Huyton Lane

Table 10: Equivalent and maximum noise levels representative of Huyton Lane at Location 'D'

Period	Frequency								dB(A)
	63	125	250	500	1K	2K	4K	8K	
L _{eq} (16hrs)	71	66	62	61	63	59	52	47	66
L _{eq} (8hrs)	61	58	54	54	56	52	44	42	59
L _{maxF}	77	76	75	74	69	70	69	68	77

6.5.2. Lathom Road

Table 11: Equivalent and maximum noise levels representative of Lathom Road at Location 'F'

Period	Frequency								dB(A)
	63	125	250	500	1K	2K	4K	8K	
L _{eq} (16hrs)	68	62	63	59	64	61	55	52	68
L _{eq} (8hrs)	60	55	57	53	57	54	47	45	60
L _{maxF}	72	62	73	70	77	69	65	63	79

7. Noise Modelling

7.1. Modelling Parameters

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik. The software predicts road traffic noise propagation using the method of '*The Calculation of Road Traffic Noise 1988*' (CRTN'88). A verification model has been created to calibrate the noise model to the measured survey data. This model is available upon request.

The noise predictions have been undertaken using supplied plans of the proposed site and the following general modelling parameters:

- Road traffic source noise levels on Huyton Lane have been calibrated to the corrected long-term measurement data at Location 'D'.
- Road traffic source noise levels on Lathom Road have been calibrated to the corrected long-term measurement data at Location 'F'.
- The ground across the full modelling is considered to be hard and reflective ($G = 0.0$).
- The proposed building heights are based on provided architectural drawings. Receivers for each storey are considered to be at the mid-point height of the storey and each storey is considered to be 3 metres.
- The calculation grid's receiver height is 1.5m during the day and night.
- Building receivers are displayed at worst-case per façade.
- Surrounding building heights has been determined from on-site observations and Google Maps imagery.
- Topography of the site has been imported from Defra survey data from the Department for Environment Food & Rural Affairs.
- Three noise maps have been created:
 1. Daytime $L_{Aeq(16hr)}$ road traffic.
 2. Night-time $L_{Aeq(8hr)}$ road traffic.
 3. Night-time $L_{Amax(F)}$ road traffic.

7.2. Modelling Results

Figure 3: Equivalent noise levels from road traffic during the day ($L_{Aeq, 16\text{hour}}$)

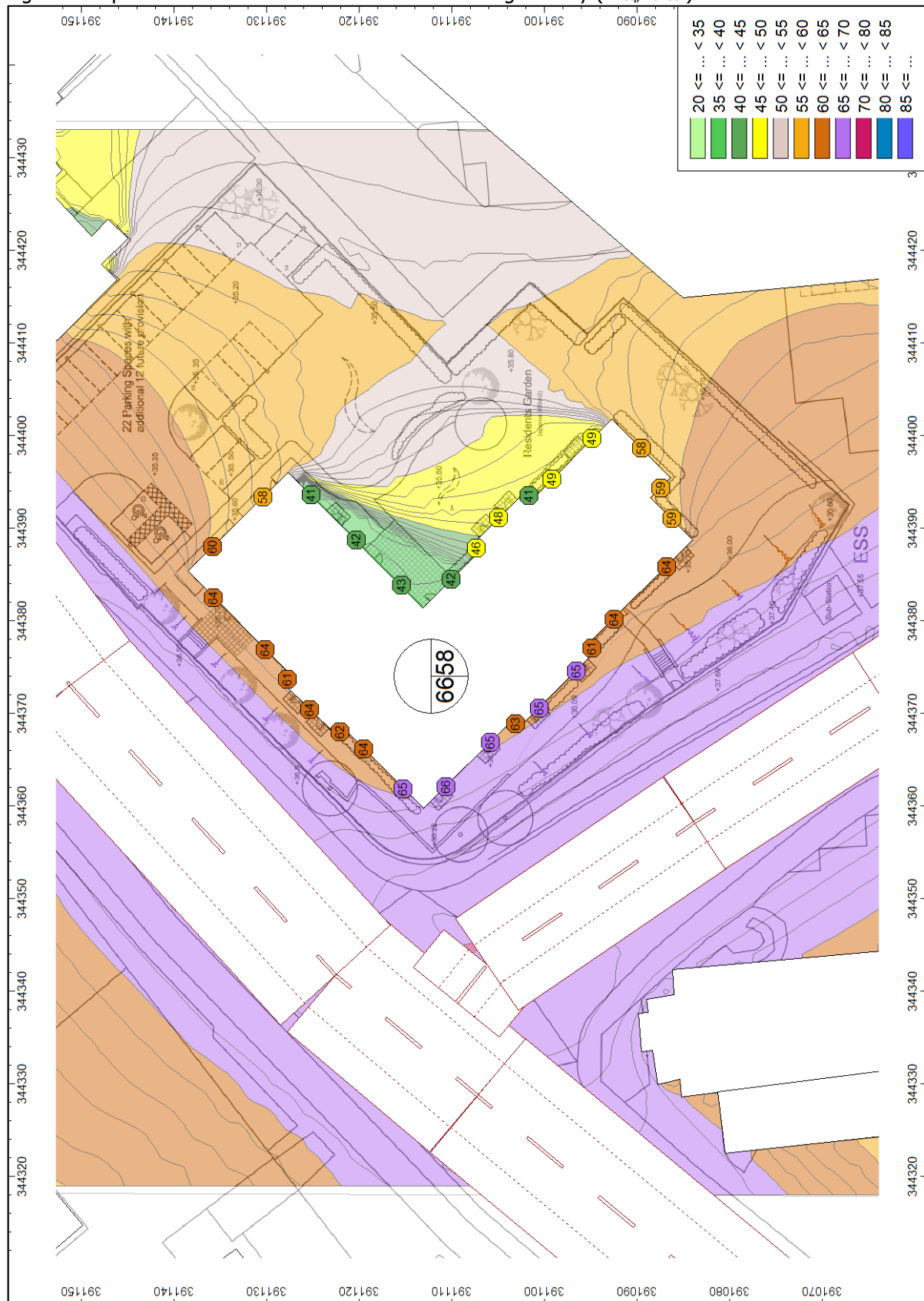


Figure 4: Equivalent noise levels from road traffic during the night (L_{Aeq} 8 hour)

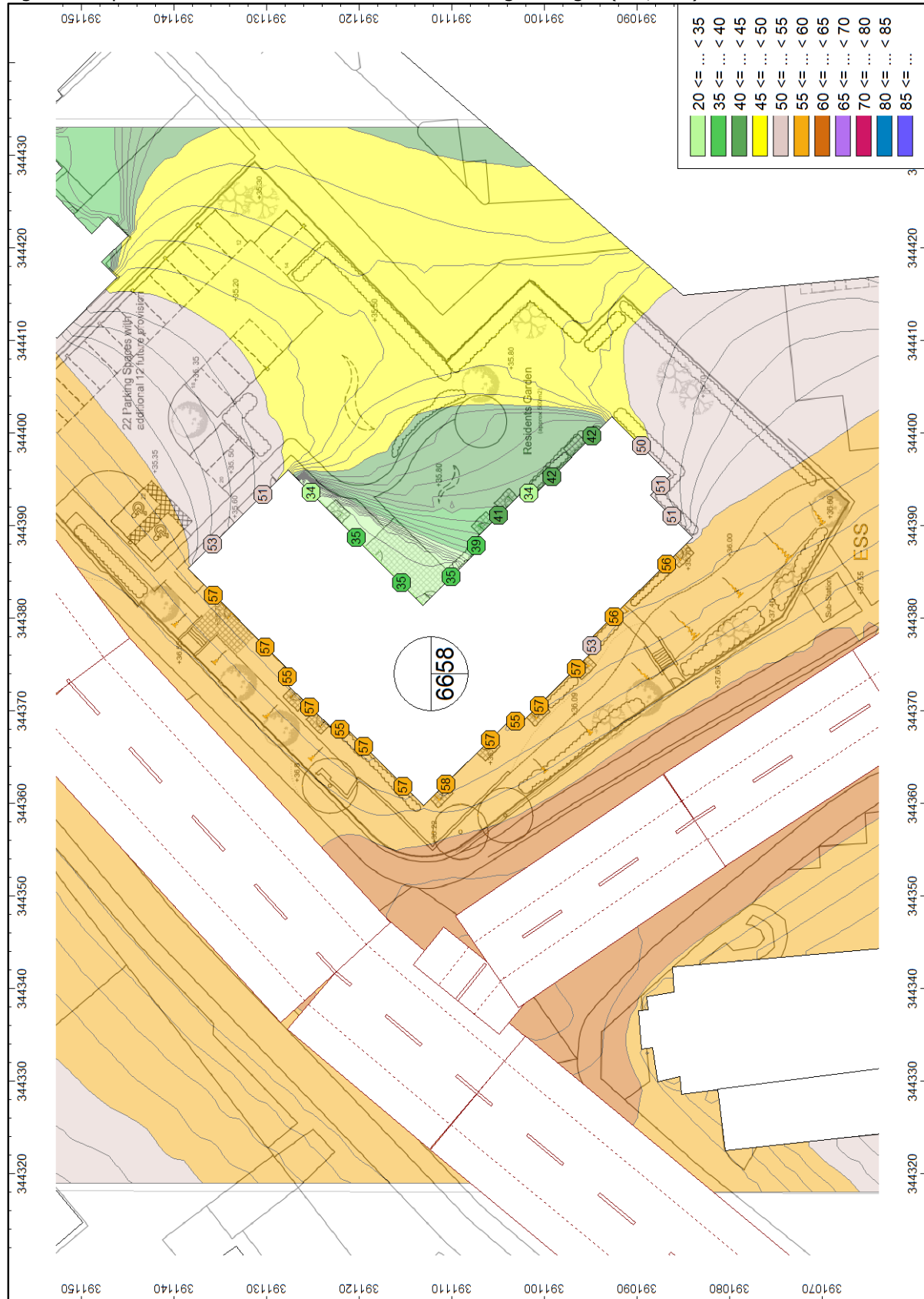
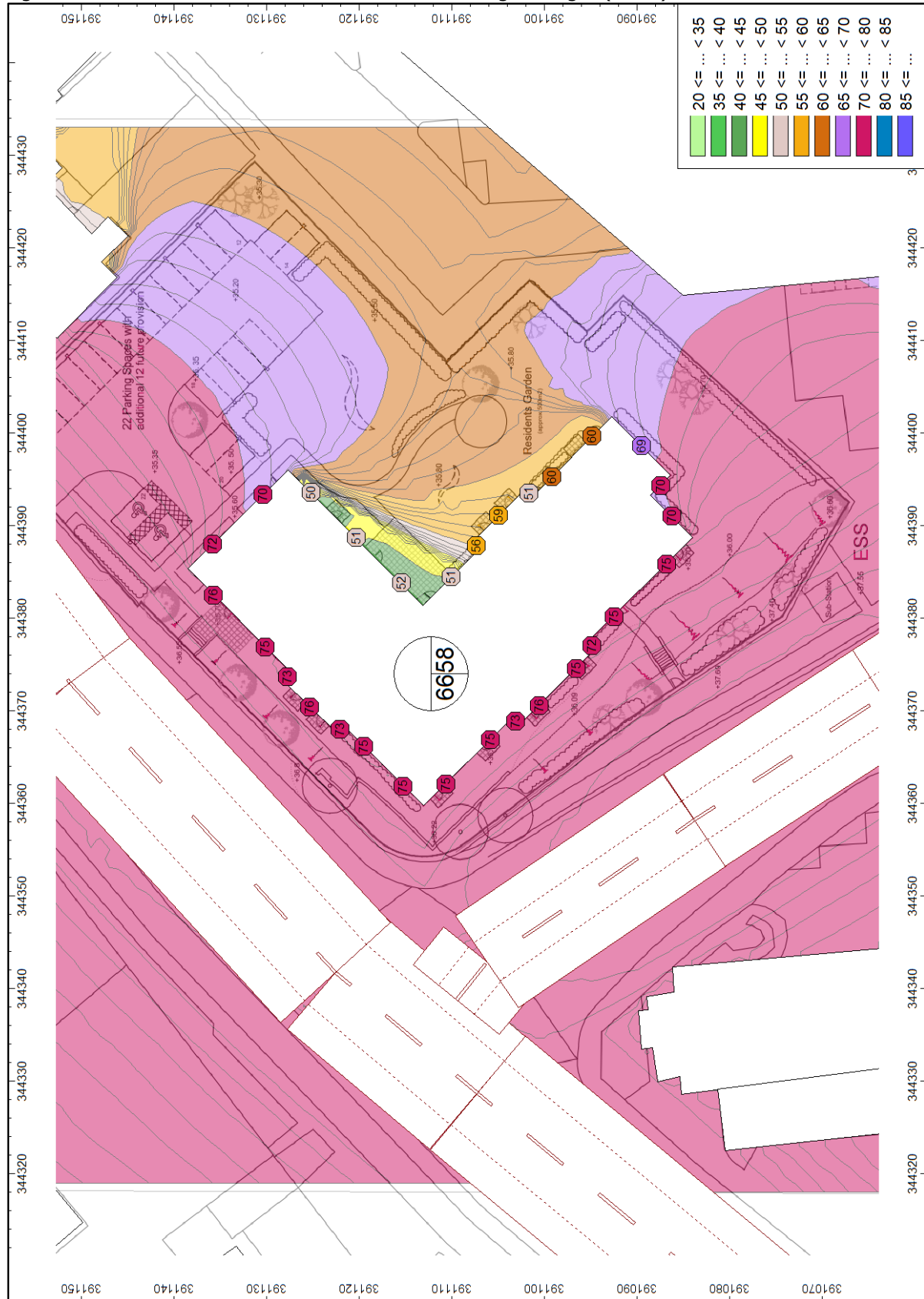


Figure 5: Maximum noise levels from road traffic during the night (L_AF_{max})



8. External Noise Control

8.1. Calculation Method

Calculations for the internal ambient noise levels due to road traffic noise have been undertaken using the calculation method provided in Annex G Section G.2 of British Standard 8233:2014.

The calculations have been undertaken using the building façade construction specified below and the octave band free-field design equivalent noise levels and maximum noise levels taken from the measured noise spectra noted above.

The calculations work on the basis of the following:

- Room size: 12m² to living rooms and 9m² bedrooms.
- Windows: 3m² to living rooms and 2m² to bedrooms.
- Façade: 10m² to living rooms and 8m² bedrooms.
- Reverberation time (T_{mf}) of 0.5 seconds in all habitable rooms.

We advise that building elements, having the sound insulation performances noted below, are incorporated into the design of the façades including the windows, doors, floor, and the building roof.

Alternative constructions to those noted below could be used, however they would need to be assessed to ensure they control external noise to within the BS 8233:2014 recommended internal ambient noise level criteria.

8.3.3. Window Construction

The windows on all elevations could be openable. However, they need to be sealed airtight to control external noise when the windows are closed within the areas noted above. There should be no un-attenuated vents or openings in the building façade.

The performance for each window is provided below. Other constructions may also achieve this level of sound attenuation.

Table 14: Required minimum sound reduction indices of windows

Zone	Minimum Sound Reduction Index (dB) per Octave Band								R _w	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
	21	26	27	34	40	38	46	46	37	10/12/6
	20	24	20	25	35	38	35	36	31	4/12/4

The glazing supplier should confirm the above performance is achievable when tested to the current British Standards.

8.4. Ventilation Provisions

8.4.1. Background Ventilation

The habitable rooms of the development will be ventilated via attenuated means. It is proposed to install Vent Axia Sentinel MVHR units to provide whole dwelling ventilation which will reduce the need to open windows.

The total sound level difference to 'habitable rooms' through the mechanical ventilation system required to meet BS8233:2014 and WHO 1999 guidelines would be, at a minimum, as follows:

Table 15: Required total sound level difference for MVHR system

Atmospheric Terminal Location	Minimum Sound Level Difference per Octave Band (dB)							
	63	125	250	500	1k	2k	4k	8k
	23	31	45	44	43	38	36	37
	14	17	28	29	38	31	25	24

This is the difference between the outside façade level and the level inside a furnished room at one-and-a-half metres from the vent. The supplier should ensure the chosen mechanical ventilation system is designed to achieve the 'out-to-in' sound level differences above.

The above is the required total loss through the entire system including the fan.

Detailed mechanical ventilation layouts are not known at this stage, but assuming a 200x200mm opening, no bends, no loss along the ductwork and a receive room volume of 25m³, the approximate atmosphere-side attenuator required per system per zone would be as follows:

Table 16: Approximate required insertion loss for attenuators

Zone	Minimum Sound Level Difference per Octave Band (dB)							
	63	125	250	500	1k	2k	4k	8k
	3	13	32	34	35	30	28	29
	3	5	15	19	30	23	17	16

The attenuator requirements above are in outline and are intended as guidance only. The supplier should ensure the chosen mechanical ventilation system as a whole, including the attenuator, is designed to achieve the 'out-to-in' sound level differences above in Table 15.

8.4.2. Overheating

Approved Document O (ADO) is currently a Building Regulations requirement in England. As such, the implications of this document should be considered at planning stage.

ADO states:

"3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am)."

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).*
- 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).*

ADO states the following regarding means of removing excess heat:

"Excess heat should be removed from the residential building by any of the following means:

- Opening windows (the effectiveness of this method is improved by cross-ventilation).*
- Ventilation louvres in external walls.*
- A mechanical ventilation system.*
- A mechanical cooling system."*

8.5. Effect of Mitigation Measures

With the mitigation measures installed to habitable rooms of the dwellings in the rooms noted above, the predicted internal noise levels are below British Standard 8233:2014 and WHO (1999) criteria and, on this basis, we would consider noise to be below the lowest observed adverse effect level of the NPPG.

The predictions are shown below for the worst-case bedroom:

Free Field Level at Façade									
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq,16hour}$	71	66	62	61	63	59	52	47	66
Night $L_{eq,8hour}$	60	57	53	53	55	51	43	41	58
Night-time $L_{max(10s)}$	76	75	74	73	68	69	68	67	76
Building Façade Construction									
External Element		63	125	250	500	1000	2000	4000	8000
Trimvent 4000 - 37 Dnew	D_{ue}	32	32	37	37	36	36	35	40
	Number of	1							
		0	0	0	0	0	0	0	0
Brick with Cavity Insulation		43	50	52	61	65	67	75	75
	Area	8							
		0	0	0	0	0	0	0	0
Double Glazed: 10/12/6 - 37 Rw		21	26	27	34	40	38	46	46
	Area	2							
		0	0	0	0	0	0	0	0
100mm concrete 2340kg/m3 roof	R	25	39	47	53	58	53	60	55
	Area	12							
MVHR		63	125	250	500	1000	2000	4000	8000
Insertion Loss		23	31	45	44	43	38	36	37
Calculations to BS EN 12354									
	63	125	250	500	1000	2000	4000	8000	
Sum	0	0	0	0	0	0	0	0	through façade
10log sum	-26	-36	-38	-45	-51	-49	-56	-55	
10log S/A	4	4	4	4	4	4	4	4	
correction factor +3	3	3	3	3	3	3	3	3	
Octave Band - Cumulative through façade and MVHR	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq,16hour}$	54.19794	40.38579	30.88718	24.48562	24.37187	24.81002	19.09268	13.17562	33
Night $L_{eq,8hour}$	43.19794	31.38579	21.88718	16.48562	16.37187	16.81002	10.09268	7.17562	24
Night-time $L_{max(10s)}$	59.19794	49.38579	42.88718	36.48562	29.37187	34.81002	35.09268	33.17562	43

9. Summary and Conclusion

McCarthy Stone appointed Acoustic Consultants Limited to undertake an environmental noise assessment for the proposed residential development located at the Former Ambulance and Fire Station, Huyton.

The report is based upon noise levels measured at the site. This report considers the impact of noise, associated with traffic on the surrounding road network and activity within the car park associated with the ASDA Supercentre to the southeast, on the proposed residential development.

The report identifies relevant planning, noise guidance, establishes environmental noise levels and provides noise mitigation measures for the proposed dwellings in support of a planning application. Mitigation has been recommended per façade of the development in the form of minimum glazing requirements and sound level difference for the mechanical ventilation system.

The results of the overheating assessment carried out by Focus Consultants show that, where bedroom windows need to be closed at night to control noise, the requirements of Approved Document O will be met with the proposed mechanical ventilation system.

We would therefore consider, with the mitigation measures set out in this report, external noise can be suitably controlled within the habitable rooms of the residential development and below the lowest observed adverse effect level of the NPPG.

10. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \lg_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

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 .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

Rating level, L_{A_r,T_r} – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, $eVDV$ – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).



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