SYNTEGRA CONSULTING

3 Viveash Avenue,
Hayes,
UB3 4RY

Noise & Vibration Impact Assessment

August 2021

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Revision	-	*Rev. A*
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1. Executive Summary

An assessment has been carried out of the present noise and vibration climate at **3 Viveash Avenue, Hayes, UB3 4RY** and the impact of that noise and vibration on the proposed development. The proposed scheme involves a mixed use development of residential and commercial land uses at 3 Viveash Close, London.

The assessment is based on the results of a noise and vibration measurement survey that has been carried out over a 4-day period at the proposed development site and has considered the advice of local and national planning policy and best practice guidance.

The site is located on Viveash Close in a predominantly industrial area, with some residential properties to the south. Immediately to the north is the Great Western Mainline railway, as well as Hayes & Harlington station, which was noted as carrying both passenger and freight trains. Plant associated with the railway line was noted close to the boundary of the site. Immediately to the east is aresidential development on the site of of the former Nestlé factory which is currently under construction. To the south is 4 Viveash Close, which was noted as having units of plant between their building and 3 Viveash Close. It is noted that the proposed masterplan for area would remove this industrial use from the local area.

The initial site risk assessment identified that the site is *medium* risk in terms of noise.

It has been identified that the requirements of the Local Authority in respect of internal noise levels can only be achieved through careful consideration of the building envelope. The construction assumptions that have led to this conclusion are:

- **The façade build-up will be a standard brick and block construction (or equivalent) and should achieve an R_w of approximately 55 dB.**
- **For the north and west façades, and any side façade with a habitable room with a clear line of sight to railway:**
  - **A double glazing system in a 10/12/6 configuration (or equivalent) will be installed to give a Sound Reduction Index (SRI) of 36 dB R_w.**
  - **Appropriately specified acoustic vents, with a $D_{n,e,w}$ of at least 42 dB, or an alternative means of ventilation will be installed to allow adequate ventilation without the requirement to open windows.**
- **For the south and east façades:**
  - **A typical double glazing system in a 4/12/6 configuration (or equivalent) will be installed to give a Sound Reduction Index (SRI) of 28 dB R_w.**
  - **Appropriately specified acoustic trickle vents, with a $D_{n,e,w}$ of at least 34 dB, or an alternative means of ventilation will be installed to allow adequate ventilation without the requirement to open windows.**

The assessment has also shown that the external noise level criteria should be achieved within the balconies surrounding the building. External noise level criteria should also be achieved in the southern communal gardens, provided a standard timber fence is installed around the boundary. It should also be noted that a masterplan for the site involves the demolition of the existing 4 Viveash Close, which would eliminate the dominant source of noise to the south, provided the masterplan is implemented.

Vibration has been shown to be at or below the level where a '*low probability of adverse comment*' would be expected during the daytime period and during the night-time period and as such would be considered acceptable.

Overall, it has been shown that, through careful consideration of the building envelope construction, the proposed development should avoid future residents being exposed to harmful levels of noise. It can therefore be concluded that significant adverse impacts on the health or quality of life of those future residents would be avoided, in line with the aims of the NPPF, NPSE and PPG-Noise.

2. Introduction

This report has been prepared to support the planning application for the proposed development at **3 Viveash**. The proposed scheme involves a mixed use development of residential and commercial land uses at 3 Viveash Close, London.

The report assesses, through on-site noise and vibration measurements, the impact of the existing noise and vibration climate on the proposed development.

A glossary of acoustic terminology is provided in **Appendix 1**.

The site is located on Viveash Close in a predominantly industrial area, with some residential properties to the south. Immediately to the north is the Great Western Mainline railway, as well as Hayes & Harlington station, which was noted as carrying both passenger and freight trains. Plant associated with the railway line was noted close to the boundary of the site. Immediately to the east is aresidential development on the site of of the former Nestlé factory which is currently under construction. To the south is 4 Viveash Close, which was noted as having units of plant between their building and 3 Viveash Close. It is noted that the proposed masterplan for area would remove this industrial use from the local area. The location of the proposed development site is provided in **Figure 2.1.** The proposed ground and first floor site layouts are provided in **Figure 2.2** and **Figure 2.3** respectively.

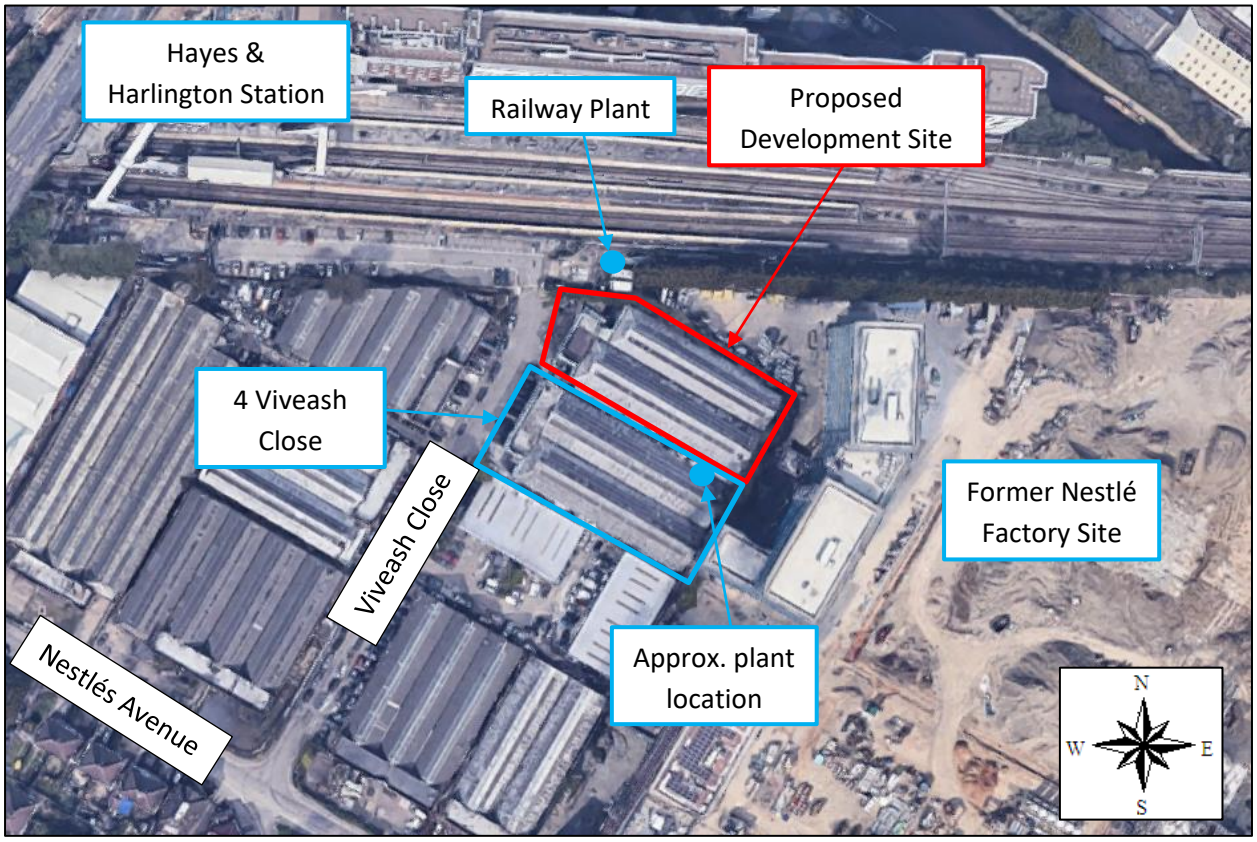


Figure 2.1: Site Location

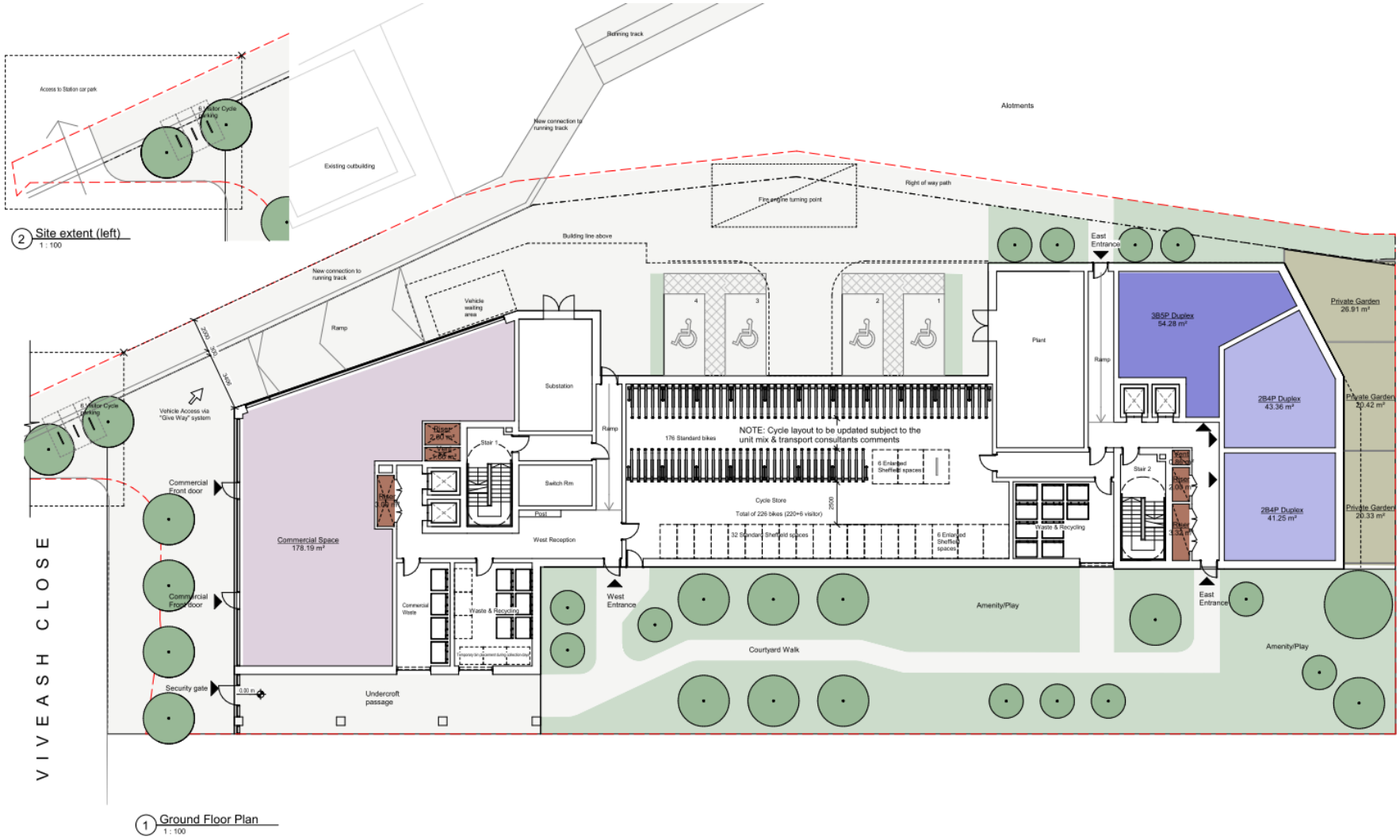
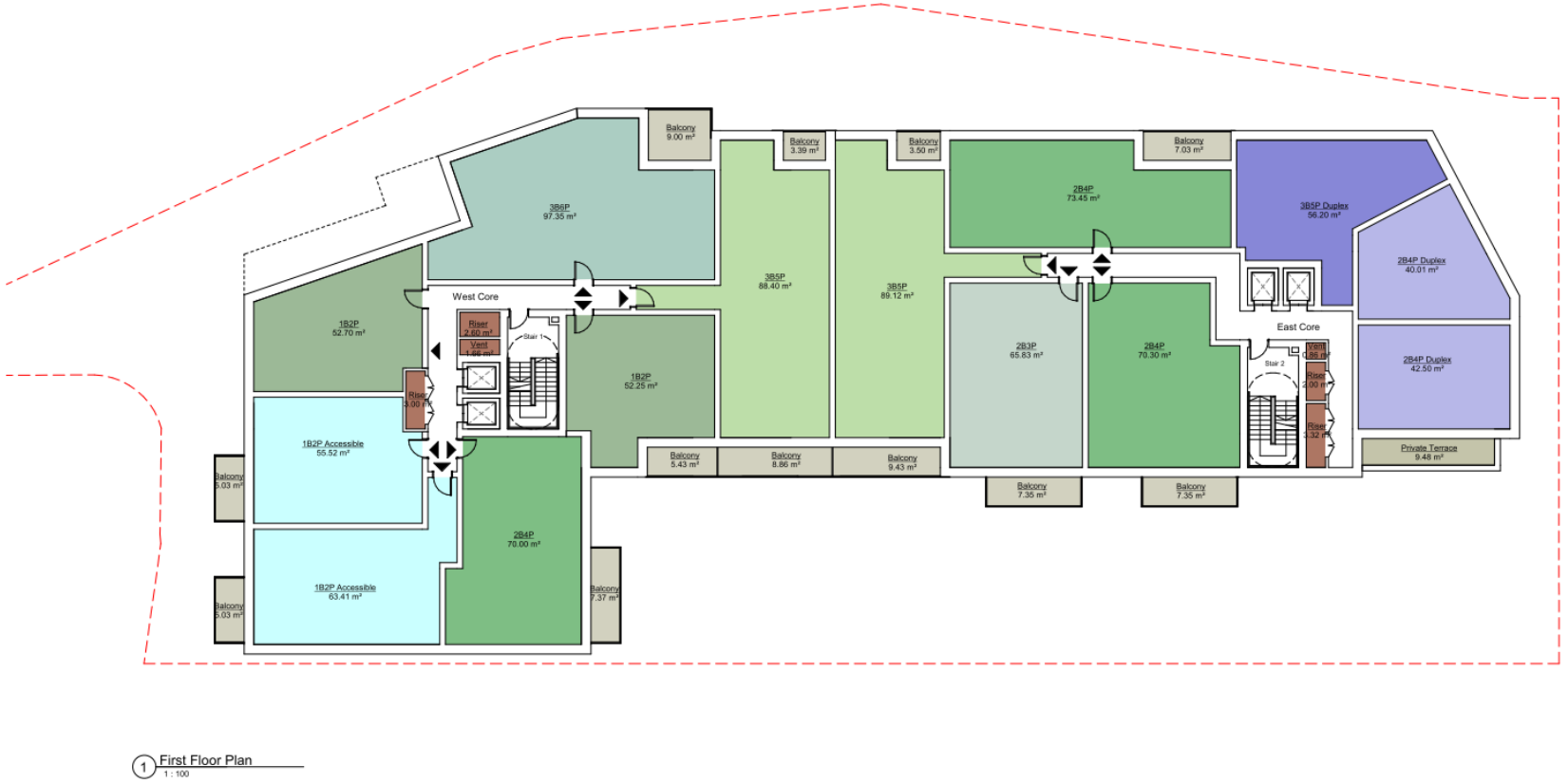


Figure 2.2: Proposed Ground Floor Plan



1 First Floor Plan
1 : 100

Figure 2.3: Proposed First Floor Plan

3. Planning Policy

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was released in March 2012 and last updated in July 2021. The purpose of the planning system is to contribute to the achievement of sustainable development and to encourage good design. There are three dimensions to sustainable development: economic, social and environmental.

Central to the NPPF, paragraph 10 states: *'At the heart of the National Planning Policy Framework is a **presumption in favour of** **[permitting]** **sustainable development**'*. This is expanded upon in paragraph 11, where it is stated:

*'…For **decision-taking** this means:*

- *approving development proposals that accord with an up-to-date development plan without delay; or*
- *where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:*
    - *the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or*
    - *any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole'*

Paragraph 174 states '*Planning policies and decisions should contribute to and enhance the natural and local environment by… preventing new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of… noise pollution…*'.

Paragraph 185 states: '*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:*

- *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 (see Explanatory Note to the Noise Policy Statement for England (DEFRA)).*
- *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*
- *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'*

3.2. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) aims to '*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'.*

3.3. **Local Planning Policy**

The site is located within the administrative boundary of the London Borough of Hillingdon. *Section 5.0: Environmental Protection Unit Advice* from their *Noise: Supplementary Planning Document* (adopted April 2006) is relevant to noise impact on the proposed development, and states:

"To ensure an acceptable environment for all, the Council applies the following standards for judging noise levels for various types of development. They should be used in conjunction with the detailed advice set out in the previous sections."

Along side the advice, the *Noise: Supplementary Planning Document* provides *Table 2: Residential Noise Criteria* which is presented below as **Table 3.1**;

		Recommended Noise Level (dB)
Daytime Noise (0700 – 2300)	Outdoor living areas	As low as practicable, and < 50 $L_{Aeq,T}$* (free-field)
	Indoor living areas	< 35 $L_{Aeq,T}$*
Night-time Noise (2300 – 0700)	Outside bedroom windows	< 45 $L_{Aeq,T}$* (façade) < 45 $L_{Amax,Fast}$ (façade)
	Inside bedrooms	< 30 $L_{Aeq,T}$* < 45 $L_{Amax,Fast}$

Table 3.1: London Borough of Hillingdon Noise Level Criteria

Source: Derived from BS8233: 1999 and "Guidelines for Community Noise", World Health Organisation, 1999

**** Time base T should be appropriate for the circumstances, typically 1 hour day and 5 minutes night***

4. Guidance Documents

4.1. Planning Practice Guidance for Noise

The Planning Practice Guidance for Noise (PPG-Noise) was published in March 2014 and last updated in July 2019. The PPG provides advice on how to determine the noise impact on development:

'Plan-making and decision making need to take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.'

The document goes on to provide a definition for the levels of noise exposure at which an effect may occur:

*'**Significant observed adverse effect level:** this is the level of noise exposure above which significant adverse effects on health and quality of life occur.*

***Lowest observed adverse effect level:** this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*

***No observed effect level:** this is the level of noise exposure below which no effect at all on health and quality of life can be detected.'*

It is important to understand that as the PPG-Noise does not provide any advice with respect to specific noise levels/ limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment.

4.2. Professional Practice Guidance on Planning & Noise.

The Professional Practice Guidance (ProPG) on Planning and Noise for New Residential Development was published in May 2017 by the Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH). The document has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England and provides numerical acoustic standards in line with the objectives of the Government's planning and noise policy. As a collaboration between the ANC, IOA and CIEH the document has been designed to encourage a good acoustic design process and aims to protect people from the harmful effects of noise.

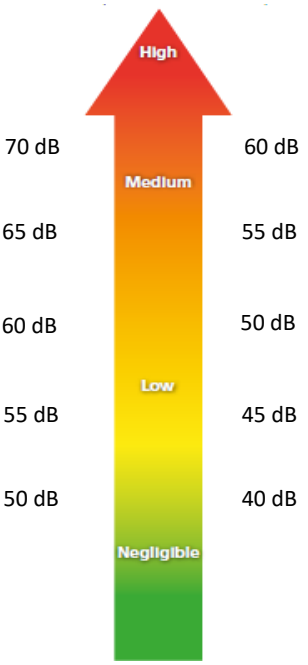
The ProPG notes that it '*does not constitute an official government code of practice and neither replaces nor provides an authoritative interpretation of the law or government policy on which users should take their own advice as appropriate'.*

The ProPG advocates a two-stage approach, first providing an initial noise risk assessment of the proposed development site before undertaking a systematic approach to the noise impact assessment. The results of the initial noise risk assessment are an indication as to how detailed the noise impact assessment will need to be in order to satisfactorily assess all acoustic challenges.

4.2.1. **Stage 1: Initial Site Noise Risk Assessment**

The initial noise risk assessment compares the site noise levels (which can be obtained by measurement or prediction, or a combination of the two, as appropriate) against a risk scale and determines the risk of adverse effects from noise at the site. The purpose of the initial noise risk assessment is to provide an indication of the level of acoustic challenges at the site. In general, the higher the level of risk identified, the greater the level of detail that will be required within the noise impact assessment in order to satisfactorily demonstrate that adverse impacts will be minimised to an acceptable level.

The initial risk assessment and associated notes are provided in Figure 1 of the ProPG and reproduced in **Table 4.1**.

Noise Risk Assessment		Potential Effect Without Noise Mitigation	Pre-Planning Application Advice
Indicative Daytime Noise Levels, $L_{Aeq,16hr}$	Indicative Night-time Noise Levels, $L_{Aeq,8hr}$		
		Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed Acoustic Design Statement (ADS). Applicants are strongly advised to seek expert advice.
			As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.
			At low noise levels, the site is likely be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
		No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.

Notes:

a. Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.

b. Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant".

c. $L_{Aeq,16hr}$ is for daytime 0700 hrs – 2300 hrs, $L_{Aeq,8hr}$ is for night-time 2300 hrs – 0700 hrs.

d. An indication that there may be more than 10 noise events at night (2300 hrs – 0700 hrs) with $L_{Amax,F}$ > 60 dB means that the site should not be regarded as negligible risk.

Table 4.1: Stage 1: Initial Site Risk Assessment

Where sites are exposed to industrial or commercial noise that is considered to be "dominant" then an assessment in line with BS 4142:2014 '*Methods for rating and assessing industrial and commercial sound'* should be carried out.

4.2.2. **Stage 2: Full Assessment**

4.2.2.1. **Stage 2: Element 1 – Good Acoustic Design Process**

Following a good acoustic design process is an implicit part of achieving good design as required by Government planning and noise policy. It is imperative that acoustic design is considered at an early stage of the development process and the aim should be to avoid "unreasonable" acoustic conditions and prevent "unacceptable" acoustic conditions.

Good acoustic design does not simply mean compliance with the recommended internal and external noise criteria. Instead, an integrated solution should be provided whereby the optimal acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of residents or other sustainable design objectives and requirements.

A good acoustic design should consider (in this order):

- *'Maximising the spatial separation of noise sources and receptors.*
- *Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.*
- *Using 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.*
- *Using the building envelope to mitigate noise to acceptable levels.'*

4.2.2.2. **Stage 2: Element 2 – Internal Noise Level Guidelines**

The ProPG contains Figure 2, which is a table with associated notes drawing on the advice contained within BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings'*, the World Health Organization's Guidelines for Community Noise 1999 (WHO guidelines) and current best practice. This table is reproduced in **Table 4.2**.

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$ 45 dB $L_{Amax,F}$ (Note 4)

NOTE 1 The Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the internal L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. 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, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.

Table 4.2: ProPG Internal Noise Level Guidelines

4.2.2.3. **Stage 2: Element 3 – External Amenity Area Noise Assessment**

The ProPG considers the advice provided within BS 8233:2014 and the PPG-Noise in respect of external amenity areas, and presents the following advice, which is selected from both documents, in order to carry out a full assessment of noise levels:

i. *'If external 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.'*

ii. *'The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$.'*

iii. *'These guideline values may not be achievable in all circumstances where development might*

be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces.'

iv. *'Whether or not external amenity spaces are an intrinsic part of the overall design, consideration of the need to provide access to a quiet or relatively quiet external amenity space forms part of a good acoustic design process'*

v. *'Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*

- *A relatively quiet façade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*
- *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
- *a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquility) that is nearby (e.g. within a 5 minute walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations.'*

4.2.2.4. Stage 2: Element 4 – Assessment of Other Relevant Issues

The final element of Stage 2 is an assessment of '*other relevant issues*' and the ProPG suggests that the following issues are considered before making any final conclusions with respect to noise impacts:

i. *'compliance with relevant national and local policy'*

ii. *'magnitude and extent of compliance with ProPG'*

iii. *'likely occupants of the development'*

iv. *'acoustic design v. unintended adverse consequences'*

v. *'acoustic design v. wider planning objectives'.*

The ProPG notes that '*not all of the issues listed above will arise in every planning application and some may already have been addressed as an inherent part of good acoustic design. In addition, LPAs* [Local Planning Authorities] *may wish to add other relevant issues depending on local circumstances and priorities.'*

4.3. British Standard BS 6472:2008 Part 1

British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting*. This is the British Standard methodology used for measuring and evaluating human exposure to vibration from sources such as railways. The Vibration Dose Value (VDV) is used as a metric to define the level of exposure of the human population to vibration. It is energetically summed over the day and night-time periods. The day and night-time periods are defined as 0700 hrs – 2300 hrs and 2300 hrs – 0700 hrs respectively.

Table 4.3 summarises the levels of VDV and the corresponding probability of adverse comments.

Place and Time	Low probability of adverse comment ($m/s^{1.75}$)	Adverse comment possible ($m/s^{1.75}$)	Adverse comment probable ($m/s^{1.75}$)
Residential buildings - 16hr day	0.2 - 0.4	0.4 - 0.8	0.8 - 1.6
Residential buildings - 8hr night	0.1 - 0.2	0.2 - 0.4	0.4 - 0.8

Table 4.3: BS 6472 – Vibration Dose Values which might result in various probabilities of adverse comment within residential buildings

Accordingly, the design aim is to minimise the possibility of adverse comment such that the probability is low.

5. Baseline Noise Levels

5.1. Noise Measurements

In order to determine the extent to which the site is currently affected by noise, a detailed measurement study has been carried out at the site. Measurements have been carried out in order to characterise the existing noise climate over a 4-day period. The noise climate of the area was dominated by plant noise from 4 Viveash Close to the south and plant noise from the railway plant to the north. Noise from passing trains also significantly contributed to the noise climate and were noted as passing regularly while on site. Noise from ongoing works at the Former Nestlé Factory site were also audible during construction hours.

The noise measurements utilised two Type 1 Precision Sound Level Meters; a Norsonic 140 and a Svantek 977A. Both meters hold a current certificate of calibration, the full list of equipment is detailed in **Appendix 3**. Before and after the measurement period the equipment was calibrated in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB). Noise Measurements were carried out in consecutive 5 minutes periods with a 1 second resolution.

Measurements were carried out between 1100 hrs on Thursday 24th June 2021 and 1040 hrs on Monday 28th June 2021.

During the noise measurement survey, the weather conditions ranged from a high of 23°C during the daytime to a low of 14°C overnight. The wind speeds were moderate (approximately 2 – 4 m/s), with occasional stronger gusts, predominantly north-westerly in direction from Thursday to Saturday, changing to a north-easterly wind on Sunday. Cloud cover was noted to be 60% at the start of the survey and 100% at the end. Heavy rainfall was noted on Sunday evening, affecting noise levels measured during this period. As such, noise levels from 1900 hrs on Sunday 26th June have not been included in the analysis.

Noise measurements were carried out over a 4-day period at Measurement Position 1 (MP1) in a free-field location approximately 2m above ground level, at the boundary fence on the northern façade of 3 Viveash Avenue. The position had a clear line of sight to the railway and the plant associated with the railway. Plant noise from the railway plant was the dominant source of noise at the position, with passing trains also a major source of noise. Noise from ongoing works at the Former Nestlé Factory site were also audible during construction hours. The position was chosen in order to determine noise levels to the north of the site from the main source of noise that will affect the proposed development (the railway to the north).

To the south of the site, noise levels were generally dominated by plant noise from 4 Viveash Close. It was not possible to find a secure location for a semi-permanent measurement position on the south of the site and therefore a 15 minute noise measurement was also carried out at MP2 in order to determine noise levels produced by the plant. MP2 was located on Viveash Close, approximately 30m from the plant location.

The noise monitoring positions are shown in **Figure 5.1**.

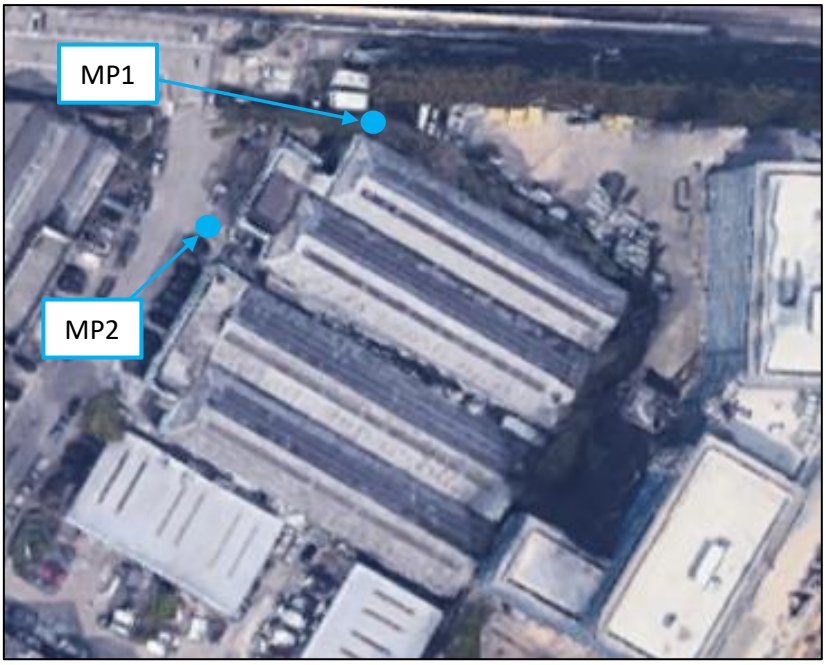


Figure 5.1: Noise and Vibration Monitoring Locations

Table 5.1 below displays a summary of the measured noise levels and detailed measurement results are presented in **Appendix 4**.

Measurement Position	Period (hours)	$L_{Aeq,T}$ (dB)	L_{Amax} (dB)	L_{A90} (dB)
MP1	Daytime (0700 – 2300)	61	77	52
	Night-time (2300 – 0700)	57	79	50
MP2	1110 – 1125	62	70	60

Table 5.1: Summary of Free Field Semi-Permanent Noise Levels

Note: The average noise levels stated are logarithmic for L_{Aeq} and the arithmetic L_{A90}. The $L_{Amax,F}$ noise levels stated are the arithmetic average of the hourly noise levels during the daytime (0700 hrs – 2300 hrs) and the 10th highest $L_{Amax,F,5min}$ noise level at night (2300 hrs – 0700 hrs), as noted in Table 4.2.

5.2. Noise Modelling

In order to determine the future noise levels across the site, the noise measurement data has been utilised to inform a noise model of the proposed development site within the SoundPLAN noise modelling software. Rail traffic count information for the passenger and freight trains has also been obtained from the *Realtime Trains* website. Calculations of railway noise have been carried out within SoundPLAN using the methodologies set out within the Technical Memorandum *'Calculation of Railway Noise'* (CRN) produced by the Department of Transport in 1995.

Noise levels from the plant associated with the railway were determined from L_{A90} noise levels from measurements at MP1 as background levels at this location were considered to be dominated by the plant. An arithmetic average of the daytime L_{A90} levels for each day as an approximation of L_p levels of the plant at the receptor. A distance correction from MP1 to the plant location (approximately 22m)

was applied and converted to L_W levels. The plant was then modelled within SoundPLAN using a point source.

To predict noise levels produced by plant associated with 4 Viveash Close, L_{A90} noise levels from measurements at MP2 have been utilised as background levels at this location were considered to be dominated by the plant. An arithmetic average of the measured L_{A90} levels was used as an approximation of L_p levels of the plant at the receptor. A distance correction from MP2 to the plant location (approximately 30m) was applied and converted to L_W levels. The plant was then modelled within SoundPLAN using a point source beside 4 Viveash Close. The plant was assumed to be operational from 0800 hrs – 1800 hrs as a worst case.

The L_{Amax} has been predicted using a standard distance correction from the railway, assuming a point source at the closest point of the railway. An additional -10 dB correction has been applied on the South Façade to account for screening provided by the proposed building.

The predicted noise level for each façade of the proposed building at first floor level (which is the worst-case for all façades) is provided in **Table 5.2** and noise contours across the future site (with the proposed development in place) are provided in **Appendix 5**.

Assessment Location	Daytime $L_{Aeq,16hr}$ (dB)	Night-time $L_{Aeq,8hr}$ (dB)	Night-time L_{Amax} (dB)
North Façade	61	57	79
West Façade	60	56	74
South Façade	58	35	62
East Façade	50	45	69

Table 5.2: Predicted Noise Levels

5.3. Vibration Measurements

Vibration measurements to obtain the VDV were carried out between 1100 hrs and 1900 hrs on Thursday 24th June 2021. Further measurements were not possible due to battery failure. A Svantek 106 vibration meter was utilised with a SV84 tri-axial accelerometer.

Vibration measurements were carried out utilising a vibration monitoring position which was located at MP1 close to the noise monitoring position. The accelerometer was mounted on a metal plate on the ground in accordance with ISO 14837-1:2005 "*Mechanical vibration – Ground-borne noise and vibration arising from rail systems – Part 1: General guidance*". The mounting plate (DIN plate) meets the requirements identified in the DIN standard 45669-2:2005. The x-axis of the accelerometer was positioned horizontally and parallel to the railway line and the y-axis was horizontal and perpendicular to the railway line. The z-axis of the accelerometer recorded the vertical vibration levels. The monitoring position (MP1) is shown in **Figure 5.1** above.

The total VDV levels for each direction of motion (x, y and z) over the measurement period are presented in **Table 5.3**. Detailed results are provided in **Appendix 4**.

Period (hrs)	Total Number of Train Pass-bys Noted	Vibration Dose Value (VDV) $m/s^{1.75}$		
		X	Y	Z
11:00-12:00	49	0.002	0.003	0.021
12:00-13:00	47	0.002	0.003	0.021

Period (hrs)	Total Number of Train Pass-bys Noted	Vibration Dose Value (VDV) $m/s^{1.75}$		
		X	Y	Z
13:00-14:00	45	0.002	0.003	0.019
14:00-15:00	46	0.003	0.003	0.021
15:00-16:00	44	0.002	0.003	0.020
16:00-17:00	47	0.002	0.003	0.021
17:00-18:00	48	0.002	0.003	0.021
18:00-19:00	55	0.002	0.003	0.021

Table 5.3: Total VDV in each direction for the measurement periods

The vibration measurement data presented in **Table 5.3** has been utilised to derive daytime (0700 hrs – 2300 hrs) and night-time (2300 hrs – 0700 hrs) period estimated VDV (VDV_{est}) levels.

The derivation has been made by assessing the typical train pass-bys (inclusive of freight and passenger trains) using the *Realtime Trains* website which generates a list of each passenger and freight train that passes through a particular station or point each day. From this information it has been determined that:

- During the daytime period (0700 hrs – 2300 hrs), between 40 to 50 passenger trains will pass through Hayes & Harlington Station per hour. There will also be approximatley 4 freight train pass-bys an hour during the daytime.
- During the night-time period (2300 hrs – 0700 hrs) there are typically:
    - 27 passenger trains and 3 freight trains between 2300 hrs and 0000 hrs.
    - 20 passenger trains and 15 freight trains between 0000 hrs and 0500 hrs.
    - 24 passenger trains and 12 freight trains between 0500 hrs and 0600 hrs.
    - 41 passenger trains and 4 freight trains between 0600 hrs and 0700 hrs.

For the daytime period, it has been assumed that the vibration levels presented in **Table 5.3** will be generated during each eight hour period and therefore the measured data has been utilised twice in order to represent the 16 hour period.

During the night-time period, it has been identified that there are 166 trains passing through Hayes and Harlington Station. Some of these hours will contain a higher proportion of freight trains which are likely to cause higher vibration levels than passenger trains due to the age, condition, length and weight of the trains. As a very worst-case assessment the measured data from the 4 periods with lowest number of train pass-bys, totalling 182 trains will therefore be utilised to represent the night-time period.

The vibration levels have been energetically summed in accordance with the procedures set out in BS 6472-1:2008 in order to obtain the VDV_{est} levels. The calculated period VDV_{est} levels are presented in **Table 5.4**.

Period (hrs)	Estimated Vibration Dose Value (VDV_{est}) $m/s^{1.75}$		
	X	Y	Z
Daytime (0700 – 2300)	0.005	0.006	0.042
Night-time (2300 – 0700)	0.004	0.004	0.027

Table 5.4: VDV_{est} for the daytime and night-time periods

6. Initial Site Risk Assessment

The initial site risk assessment has been carried out by comparing the results of the noise measurement survey against the criteria presented in **Table 4.1**. The outcome of the initial site risk assessment is presented in **Table 6.1**.

Measurement Position	Daytime Ambient Noise Level $L_{Aeq,16hr}$ (dB)	Initial Noise Risk Assessment (Daytime)	Night-time Ambient Noise Level $L_{Aeq,8hr}$ (dB)	Initial Noise Risk Assessment (Night-time)
MP1	61	*Medium*	57	*Medium*

Table 6.1: Initial Site Risk Assessment

The results of the initial site risk assessment based on the measured noise levels indicate that the site has a *medium* risk in terms of noise. The pre-application advice associated with this risk category is:

Medium: '*As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an Acoustic Design Statement (ADS) which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development.'*

7. Full Assessment

7.1. Internal Noise Level Assessment

Note 5 of **Table 4.2** suggests that internal noise levels should ideally be achieved in as many properties as possible with windows open. Due to the relatively high noise levels present at the site, habitable rooms will not be able to achieve the requirement with windows open, and therefore the sound insulation of the building façade will be required to mitigate noise levels. In carrying out our assessment, Syntegra have therefore made the following assumptions:

- The façade build-up will be a standard brick and block construction (or equivalent) and should achieve an R_w of approximately 55 dB.
- For the north and west façades, and any side façade with a habitable room with a clear line of sight to railway:
  - A double glazing system in a 10/12/6 configuration (or equivalent) will be installed to give a Sound Reduction Index (SRI) of 36 dB R_w.
  - Appropriately specified acoustic vents, with a $D_{n,e,w}$ of at least 42 dB, or an alternative means of ventilation will be installed to allow adequate ventilation without the requirement to open windows.
- For the south and east façades:
  - A typical double glazing system in a 4/12/6 configuration (or equivalent) will be installed to give a Sound Reduction Index (SRI) of 28 dB R_w.
  - Appropriately specified acoustic trickle vents, with a $D_{n,e,w}$ of at least 34 dB, or an alternative means of ventilation will be installed to allow adequate ventilation without the requirement to open windows.

Table 7.1 identifies the likely L_{Aeq} and L_{Amax} internal noise levels, assuming windows closed, utilising the *Simple Calculation Method* described in BS 8233:2014.

Assessment Location	Period (hrs)	External Noise Levels (dB) (ref. **Table 5.2**)	Sound Insulation of Glazing (dBA)	Internal Noise Levels (dB)	Compliance with ProPG Criteria
Ambient Noise Level L_{Aeq} (dB)					
North Façade	Daytime (0700 – 2300)	61	36	25	✓
	Night-time (2300 – 0700)	57		21	✓
West Façade	Daytime (0700 – 2300)	60	36	24	✓
	Night-time (2300 – 0700)	56		20	✓
South Façade	Daytime (0700 – 2300)	59	28	31	✓
	Night-time (2300 – 0700)	35		7	✓
East Façade	Daytime (0700 – 2300)	50	28	22	✓
	Night-time (2300 – 0700)	45		17	✓

Assessment Location	Period (hrs)	External Noise Levels (dB) (ref. **Table 5.2**)	Sound Insulation of Glazing (dBA)	Internal Noise Levels (dB)	Compliance with ProPG Criteria
Maximum Noise Level L_{AFmax} (dB)					
North Façade	Night-time (2300 – 0700)	79	36	43	✓
West Façade	Night-time (2300 – 0700)	74	36	38	✓
South Façade	Night-time (2300 – 0700)	62	28	34	✓
East Façade	Night-time (2300 – 0700)	69	28	41	✓

Table 7.1: Internal Noise Levels

7.2. External Noise Level Assessment

The site layouts in **Figure 2.2** and **Figure 2.3** above indicate the location of communal gardens to the south of the proposed building as well as balconies on the north, west and south façades.

The noise levels from **Table 5.2** indicate a daytime noise level of 59 dB $L_{Aeq,16hr}$ to the south of the proposed building. Noise levels in the gardens are predominantly dominated by plant noise from the neighbouring 4 Viveash Close. As such, noise levels in the gardens can be reduced with the introduction of a standard timber fence between the garden and the plant, which should provide an approximate 10 dB reduction. Accordingly, noise levels would not be expected to exceed 49 dB $L_{Aeq,16hr}$ in the communal gardens of the proposed building, which would achieve the lower guideline criteria (50 dB $L_{Aeq,16hr}$). It should also be noted that a master for the site involves the demolition of the existing 4 Viveash Close, which would eliminate the dominant source of noise to the south, provided the masterplan is implemented.

For balconies, the assessment will consider the worst-case of a balcony located in a similar position to MP1, for which a daytime noise level of 61 dB $L_{Aeq,16hr}$ was recorded. Noise levels on balconies would be expected to be reduced by approximately 5 dB – 10 dB, assuming a solid balustrade. Accordingly, noise levels on the worst affected balconies should just achieve the upper guideline criteria (55 dB $L_{Aeq,16hr}$). Noise levels on balconies on different façades to MP1 would be expected to be reduced and in most cases should readily achieve the lower guideline criteria (50 dB $L_{Aeq,16hr}$).

Accordingly, noise levels in amenity areas should be acceptable.

7.3. Vibration Assessment

As the vibration levels were measured externally on the ground, it is necessary to take into account the amplification factors of the proposed building. It has been assumed that an amplification factor of between 2 and 4, due to the height of the building and floor resonances, will occur from the ground vibration measurements obtained on site. The measured vibration data, when adjusted using the worst-case amplification factor of 4 has been compared against the criteria presented in BS 6472. The results of the comparison are presented in **Table 7.2**.

Direction	VDV ($m/s^{-1.75}$)		BS6472: Residential Criterion	
	Daytime	Night-time	Daytime	Night-time
X	0.02	0.01	Below '*Low probability of adverse comment*'	Below *'Low probability of adverse comment'*
Y	0.02	0.02	Below '*Low probability of adverse comment*'	Below *'Low probability of adverse comment'*
Z	0.17	0.11	Below '*Low probability of adverse comment*'	*'Low probability of adverse comment'*

Table 7.2: Internal Vibration Levels

With reference to **Table 7.2**, it can be seen that the derived internal VDV values have been compared against the assessment criteria within BS 6472. The assessment concludes that, VDV values are below the range where a '*low probability of adverse comment'* would be expected during the daytime period and during the night-time period across most axes. During night-time, vibration levels in the Z-axis reach the range where '*low probability of adverse comment'* is possible.

Accordingly, vibration levels in across the site would be unlikely to cause an adverse impact on the proposed development.

7.4. Assessment of Other Relevant Issues

The assessment has shown that a reasonable internal noise environment can be achieved, in line with the requirements of the Local Authority, BS 8233 and the ProPG through careful consideration of the building envelope and ventilation requirements. Whilst it would be ideal to achieve the internal level criteria with open windows, it is common to achieve the criteria relying on closed windows in noisier areas. Such as an approach is advocated in the PPG-Noise.

The assessment has also shown that the external noise level criteria would be achieved within the communal gardens to the south and balconies surrounding the building.

Vibration has been shown to be at or below the level where a '*low probability of adverse comment'* would be expected during the daytime period and during the night-time period and as such would be considered acceptable.

Overall, it has been shown that, through careful consideration of the building envelope construction, the proposed development should avoid future residents being exposed to harmful levels of noise. It can therefore be concluded that significant adverse impacts on the health or quality of life of those future residents would be avoided, in line with the aims of the NPPF, NPSE and PPG-Noise.

8. Conclusion

An assessment has been carried out of the present noise and vibration climate at **3 Viveash Avenue, Hayes, UB2 4RY** and the impact of that noise and vibration on the proposed development.

The assessment is based on the results of a noise and vibration measurement survey that has been carried out over a 4-day period at the proposed development site and has considered the advice of local and national planning policy and best practice guidance.

The initial site risk assessment identified that the site is *medium* risk in terms of noise.

It has been identified that the requirements of the Local Authority in respect of internal noise levels can only be achieved through careful consideration of the building envelope. The construction assumptions that have led to this conclusion are:

- **The façade build-up will be a standard brick and block construction (or equivalent) and should achieve an R_w of approximately 55 dB.**
- **For the north and west façades, and any side façade with a habitable room with a clear line of sight to railway:**
  - **A double glazing system in a 10/12/6 configuration (or equivalent) will be installed to give a Sound Reduction Index (SRI) of 36 dB R_w.**
  - **Appropriately specified acoustic vents, with a $D_{n,e,w}$ of at least 42 dB, or an alternative means of ventilation will be installed to allow adequate ventilation without the requirement to open windows.**
- **For the south and east façades:**
  - **A typical double glazing system in a 4/12/6 configuration (or equivalent) will be installed to give a Sound Reduction Index (SRI) of 28 dB R_w.**
  - **Appropriately specified acoustic trickle vents, with a $D_{n,e,w}$ of at least 34 dB, or an alternative means of ventilation will be installed to allow adequate ventilation without the requirement to open windows.**

The assessment has also shown that the external noise level criteria should be achieved within the balconies surrounding the building. External noise level criteria should also be achieved in the southern communal gardens, provided a standard timber fence is installed around the boundary. It should also be noted that a masterplan for the site involves the demolition of the existing 4 Viveash Close, which would eliminate the dominant source of noise to the south, provided the masterplan is implemented.

Vibration has been shown to be at or below the level where a '*low probability of adverse comment*' would be expected during the daytime period and during the night-time period and as such would be considered acceptable.

Overall, it has been shown that, through careful consideration of the building envelope construction, the proposed development should avoid future residents being exposed to harmful levels of noise. It can therefore be concluded that significant adverse impacts on the health or quality of life of those future residents would be avoided, in line with the aims of the NPPF, NPSE and PPG-Noise.

9. Appendix 1: Glossary of Acoustic Terminology

Term	Description
'A'-Weighting	*This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.*
Decibel (dB)	*This is a tenth (deci) of a bel. The decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.*
$L_{Aeq,T}$	*The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location.* $L_{Aeq,T}$ *can be measured directly with an integrating sound level meter.*
L_{A10}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 per cent of a given time and is the* L_{A10T}*. The* L_{A10} *is used to describe the levels of road traffic noise at a particular location.*
L_{A50}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 per cent of a given time and is the* L_{A50T}*.*
L_{A90}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time and is the* L_{A90T}*. The* L_{A90} *is used to describe the background noise levels at a particular location.*
L_{Amax}	*The 'A'-weighted maximum sound pressure level measured over a measurement period.*

10. Appendix 2: Professional Statement

David Yates

David Yates is a full member of the Institute of Acoustics (MIOA) and has over ten years' experience in acoustic consultancy. David has particular expertise in environmental noise providing acoustic consultancy for residential and mixed use planning applications, plant noise and vibration, construction noise and the design of acoustic, noise and vibration control. David is also experienced in providing sound insulation testing and design advice. David is familiar with the application of all relevant standards associated with his work, including but not limited to, BS 4142, BS 8233, BS 7445, BS 6472, BS 5228, BS 140 series, BS 16283 series and BS 717 series. David manages the acoustic department and is responsible for maintaining Syntegra's ANC membership.

11. Appendix 3: List of Equipment

Equipment Type	Manufacturer	Serial Number	Calibration Certification Number	Date of Last Calibration Check
Nor-140 Type 1 Sound Level Meter	Norsonic	1406389	33658	December 2019
Nor-1225 Microphone	Norsonic	225519	33657	December 2019
Nor-1209 Preamplifier	Norsonic	20598	33658	December 2019
Nor-1251 Sound Calibrator	Norsonic	35115	36310	November 2020
SVAN 977A	Svantek	67915	36313	November 2020
7052E Microphone	ACO PACIFIC	70760	36312	November 2020
SV12L Preamplifier	Svantek	73668	36313	November 2020
SV36 Sound Calibrator	Svantek	73463	36311	November 2020
SV 106 Data Recorder	Svantek	81020	*No number provided on certificate*	March 2019
SV84 Tri-Axial Accelerometer	Svantek	H3371	*No number provided on certificate*	March 2018

12. Appendix 4: Detailed Noise Measurement Results

Measured Noise levels – MP1 – Thursday 24th June 2021

Time	$L_{Aeq,T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
11:00-12:00	62	78	62	52
12:00-13:00	62	78	59	52
13:00-14:00	62	78	60	52
14:00-15:00	63	80	61	52
15:00-16:00	62	77	61	53
16:00-17:00	62	77	60	52
17:00-18:00	62	78	59	52
18:00-19:00	62	79	60	52
19:00-20:00	62	78	60	52
20:00-21:00	62	79	60	51
21:00-22:00	61	77	57	51
22:00-23:00	60	76	57	51
23:00-00:00	61	74	57	51
11:00-23:00	**62**	**78**	**60**	**52**
23:00-00:00	**61**	**74**	**57**	**51**

Measured Noise levels – MP1 – Friday 25th June 2021

Time	$L_{Aeq,T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
00:00-01:00	59	69	55	51
01:00-02:00	61	63	55	49
02:00-03:00	59	66	55	50
03:00-04:00	55	65	53	49
04:00-05:00	57	65	53	50
05:00-06:00	58	72	55	50
06:00-07:00	60	76	58	51
07:00-08:00	63	79	64	52
08:00-09:00	63	78	61	53
09:00-10:00	63	79	62	54
10:00-11:00	62	79	61	53
11:00-12:00	63	79	63	53
12:00-13:00	62	78	62	53
13:00-14:00	62	77	61	52
14:00-15:00	63	81	63	52
15:00-16:00	62	78	60	52
16:00-17:00	62	77	60	52
17:00-18:00	62	77	60	52
18:00-19:00	63	79	62	52
19:00-20:00	62	75	60	51
20:00-21:00	61	77	57	51
21:00-22:00	61	77	57	52
22:00-23:00	60	75	56	51
23:00-00:00	59	72	56	50
07:00-23:00	**62**	**78**	**61**	**52**
23:00-07:00	**59**	**69**	**55**	**50**

Measured Noise levels – MP1 – Saturday 26th June 2021

Time	$L_{Aeq,T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
00:00-01:00	58	68	56	50
01:00-02:00	57	63	54	50
02:00-03:00	51	53	51	50
03:00-04:00	56	64	54	51
04:00-05:00	54	59	53	50
05:00-06:00	57	70	55	51
06:00-07:00	60	75	56	51
07:00-08:00	61	79	58	51
08:00-09:00	61	77	57	52
09:00-10:00	61	77	58	52
10:00-11:00	62	78	59	52
11:00-12:00	61	74	59	51
12:00-13:00	61	76	61	52
13:00-14:00	61	74	61	51
14:00-15:00	61	77	59	52
15:00-16:00	61	76	57	52
16:00-17:00	61	76	56	50
17:00-18:00	61	77	56	51
18:00-19:00	61	77	57	51
19:00-20:00	60	77	57	51
20:00-21:00	60	75	57	52
21:00-22:00	60	75	57	52
22:00-23:00	59	72	56	52
23:00-00:00	57	67	55	52
07:00-23:00	**61**	**76**	**58**	**51**
23:00-07:00	**57**	**65**	**54**	**51**

Measured Noise levels – MP1 – Sunday 27th June 2021

Time	$L_{Aeq,T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
00:00-01:00	53	62	53	51
01:00-02:00	52	58	53	51
02:00-03:00	52	57	52	50
03:00-04:00	52	58	53	50
04:00-05:00	52	58	52	51
05:00-06:00	54	62	54	51
06:00-07:00	54	64	55	51
07:00-08:00	54	65	55	51
08:00-09:00	58	74	57	51
09:00-10:00	61	78	60	52
10:00-11:00	62	79	61	52
11:00-12:00	60	76	58	52
12:00-13:00	61	75	57	52
13:00-14:00	60	75	59	52
14:00-15:00	60	77	59	52
15:00-16:00	60	75	56	51
16:00-17:00	61	76	56	51
17:00-18:00	60	74	55	51
18:00-19:00	61	77	56	51
19:00-20:00	61	77	56	51
20:00-21:00	62	75	60	54
21:00-22:00	63	75	60	56
22:00-23:00	61	76	59	54
23:00-00:00	64	73	61	57
07:00-19:00	**60**	**75**	**57**	**52**
00:00-07:00	**53**	**60**	**53**	**51**

Note: Values highlighted in red have not been used in analysis due to being affected by rain noise.

Measured Noise levels – MP1 – Sunday 27th June 2021

Time	$L_{Aeq,T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
00:00-01:00	60	70	61	56
01:00-02:00	55	62	55	51
02:00-03:00	51	55	51	49
03:00-04:00	54	58	53	49
04:00-05:00	53	61	52	49
05:00-06:00	58	72	55	50
06:00-07:00	60	75	59	51
07:00-08:00	62	78	59	51
08:00-09:00	63	79	63	52
09:00-10:00	63	80	62	54
07:00-10:00	**63**	**79**	**61**	**53**
00:00-07:00	**56**	**64**	**54**	**50**

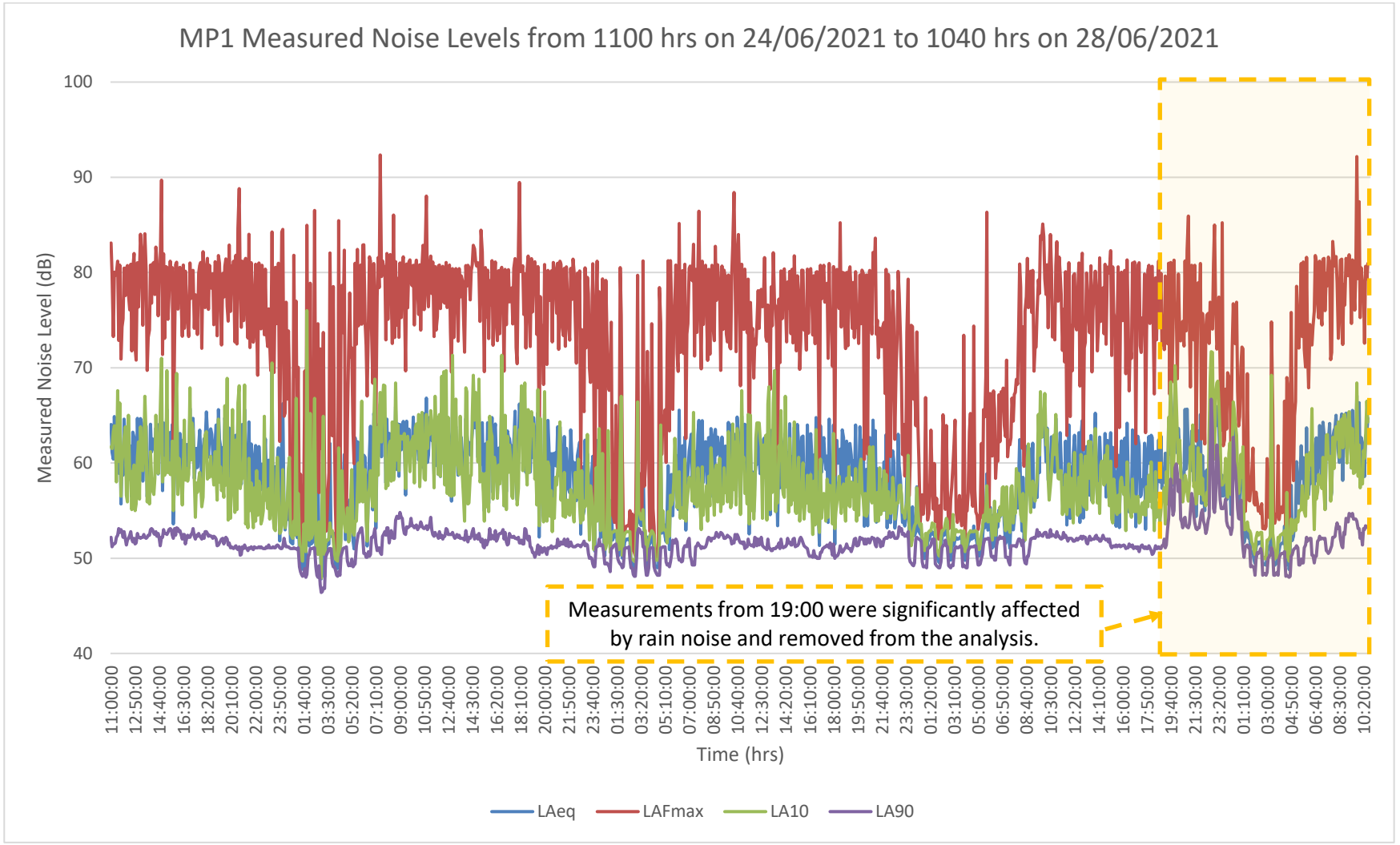
Note: Values highlighted in red have not been used in analysis due to being affected by rain noise.

Measured Vibration levels – MP1 – Thursday 24th June 2021

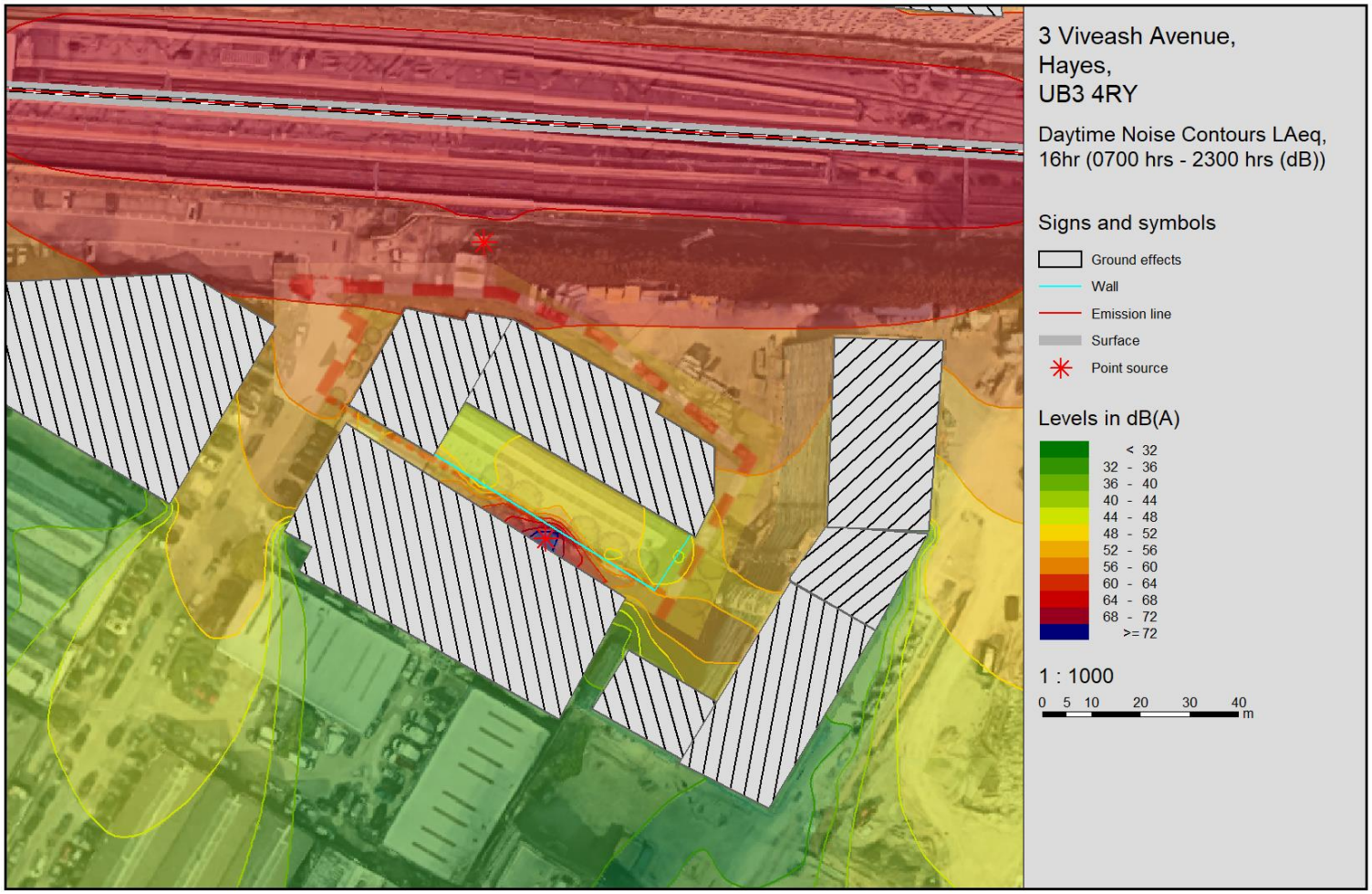
Time	Measured Vibration Dose Value (VDV) $m/s^{1.75}$		
	X	Y	Z
11:00-12:00	0.002	0.003	0.021
12:00-13:00	0.002	0.003	0.021
13:00-14:00	0.002	0.003	0.019
14:00-15:00	0.003	0.003	0.021
15:00-16:00	0.002	0.003	0.020
16:00-17:00	0.002	0.003	0.021
17:00-18:00	0.002	0.003	0.021
18:00-19:00	0.002	0.003	0.021
11:00-19:00	**0.004**	**0.005**	**0.035**

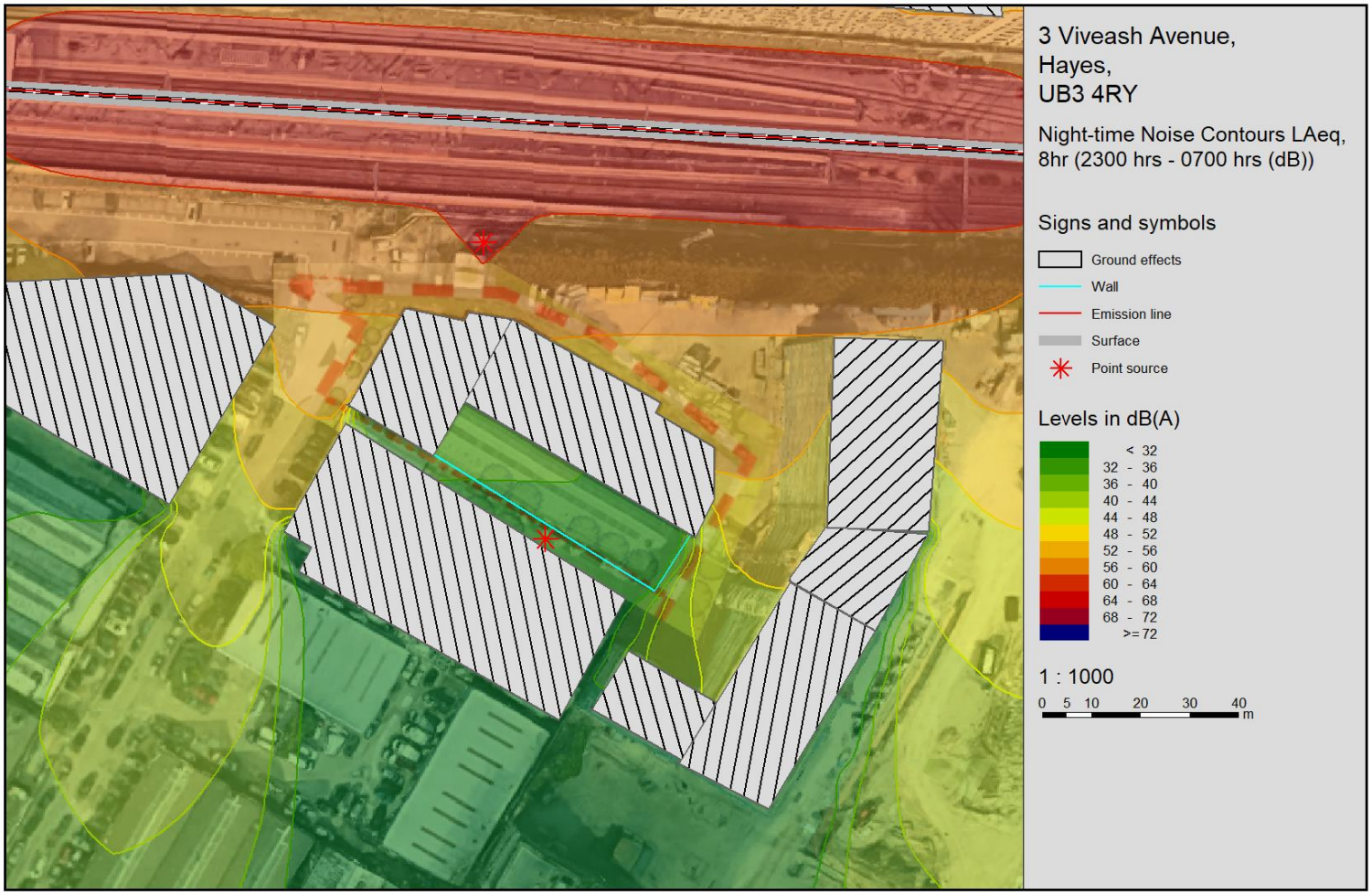
Measured Noise levels – MP2

Time	$L_{Aeq,T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
11:05-11:10	61	66	63	60
11:10-11:15	63	76	62	60
11:15-11:20	63	76	63	60
11:20-11:25	62	70	63	60
11:05-11:25	61	66	63	60


MP1 Measured Noise Levels from 1100 hrs on 24/06/2021 to 1040 hrs on 28/06/2021
Measured Noise Level (dB)
100
90
80
70
60
50
40
Measurements from 19:00 were significantly affected by rain noise and removed from the analysis.
11:00:00
12:50:00
14:40:00
16:30:00
18:20:00
20:10:00
22:00:00
23:50:00
01:40:00
03:30:00
05:20:00
07:10:00
09:00:00
10:50:00
12:40:00
14:30:00
16:20:00
18:10:00
20:00:00
21:50:00
23:40:00
01:30:00
03:20:00
05:10:00
07:00:00
08:50:00
10:40:00
12:30:00
14:20:00
16:10:00
18:00:00
19:50:00
21:40:00
23:30:00
01:20:00
03:10:00
05:00:00
06:50:00
08:40:00
10:30:00
12:20:00
14:10:00
16:00:00
17:50:00
19:40:00
21:30:00
23:20:00
01:10:00
03:00:00
04:50:00
06:40:00
08:30:00
10:20:00
Time (hrs)
LAeq
LAFmax
LA10
LA90

13. Appendix 5: Noise Contours across the Proposed Development Site




3 Viveash Avenue,
Hayes,
UB3 4RY
Night-time Noise Contours LAeq, 8hr (2300 hrs - 0700 hrs (dB))
Signs and symbols
Ground effects
Wall
Emission line
Surface
Point source
Levels in dB(A)
< 32
32 - 36
36 - 40
40 - 44
44 - 48
48 - 52
52 - 56
56 - 60
60 - 64
64 - 68
68 - 72
>= 72
1 : 1000
0 5 10 20 30 40 m