RSK Acoustics

Royal Brunswick Park

Noise Impact Assessment

FINAL Report Ref. 298362-RSK-RP-001(00)

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Revision	Description	Date	Prepared	Approved
0	Draft issue	13 July 2021	Federico Gottardo	Jonathan Mart
1	Final issue	06 August 2021	Federico Gottardo	Jonathan Mart

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1 Introduction

1.1 Instruction

1.1.1 RSK Acoustics Ltd has been instructed by Comer Homes Group (the applicant) to undertake a noise assessment for the redevelopment of the North London Business Park (herein referred to as Royal Brunswick Park) situated in Brunswick Park Road, London, N11 1GN.

1.1.2 The assessment seeks to support a hybrid planning application for the phased comprehensive redevelopment of the North London Business Park to deliver a residential-led mixed use development. The proposed development was subject to an efficiency review to all blocks within the detailed and outline phases.

1.1.3 This report describes the assessment methodology, baseline conditions currently prevailing across the application site and the effect of the noise levels on the proposed development.

1.1.4 Mitigation measures have been identified where necessary and practicable to achieve appropriate acoustic standards.

1.2 Scope of the Assessment

1.2.1 The scope of the assessment within this report is summarised as follows:

- Identify sources of noise that may impact upon the residents/occupiers of the proposed development;
- Quantify and report the noise climate across the site to determine the suitability of the site for the proposed use;
- Assess the suitability of the site against the design targets within local and national guidelines/policies;
- Determine the level of impact from the proposed development on existing receptors; and
- Inform the architect design and suggest appropriate mitigation measures (where necessary) to reduce the potential for disturbance at future sensitive receptors.

2 Legislation, Policy and Guidance

2.1 National Planning Policy Framework (NPPF): 2021

2.1.1 The National Planning Policy Framework (NPPF) (published March 2012 & updated in February 2019 and July 2021) is the means by which noise is considered within the planning regime. The NPPF does not contain assessment criteria, instead providing a series of policies, giving local authorities the flexibility in meeting the needs of local communities. The NPPF states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by […] preventing new and existing development from contributing to, being put at unacceptable risk from, 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."

"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."

2.2 Noise Policy Statement for England (NPSE): March 2010

2.2.1 The Noise Policy Statement for England is published by the Department for Environment, Food and Rural Affairs (Defra) and sets out the approach to noise within the Government's sustainable development strategy. There are two established concepts from toxicology that are currently being applied to noise impacts (for example, by the World Health Organisation). They are:

- *"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.*

Extending these concepts for the purpose of this NPSE leads to the concept of a Significant Observed Adverse Effect Level.

- *SOAEL - Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur."*

2.2.2 The three aims of the NPSE are stated as:

- avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;
- mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and

- where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.3 Professional Practice Guidance on Planning and Noise (ProPG), 2017

2.3.1 The Professional Practice Guidance on Planning and Noise is written to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The CIEH, IOA and the ANC have worked together to produce the guidance which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. This Professional Practice Guidance is based on the best knowledge available at the time of publication. 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.

2.3.2 In relation with achieving internal noise values with open windows ProPG states that:

"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".

Acoustic Design

ProPG encourages the use of acoustic design as a means to inform the site masterplans and is key to avoiding or reducing to a minimum any adverse effects on any sensitive internal or external spaces. In considering acoustic design, consideration should be given by the developer to the management of noise through a hierarchy of potential mitigation measures which may include:

- Maximising the separation distance between source and receiver;
- Incorporate noise barriers (where applicable) to screen the development site (or individual plots) from significant sources of noise;
- Use existing features to reduce noise propagation across the site;
- Orientate the buildings in a manner which reduces the noise levels within habitable rooms (particularly bedrooms);
- Building envelope design to mitigate the noise to acceptable levels, whilst providing adequate ventilation.

2.4 The London Plan, 2021

Policy D14 Noise

2.4.1 In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:

1) avoiding significant adverse noise impacts on health and quality of life

2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change

3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses

4) improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity

5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation

6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations.

2.5 London Borough of Barnet's 'Core Strategy' and 'Development Management Policies', 2012

Air and noise pollution

2.5.1 18.11.1) Levels of noise and air pollution have a major bearing on the health and well being of all Barnet residents. The majority of Barnet's housing growth will take place in areas that already suffer from air and noise pollution. The design of the built environment has an important role in managing the degree to which people are exposed to pollution. Within Barnet emissions from traffic have the most severe and pervasive impact on air quality.

2.5.2 18.11.3) Persistent and intermittent noises such as those made by industrial activities, transport, construction and congregations of people can undermine quality of life. We will take into account noise considerations when assessing development proposals. Regard will be made to the Mayor's Ambient Noise Strategy as a reference source for understanding noise and identifying best practice. We will require Noise Impact Assessments for developments likely to generate or be exposed to significant noise. Further guidance on noise quality and when assessments will be required is provided in our SPD on Sustainable Design and Construction.

2.6 London Borough of Barnet's Supplementary Planning Document: Sustainable Design and Construction, 2016

Noise Quality

2.6.1 2.14.1) Noise can have a significant effect on the quality of life enjoyed by those who live work and visit the borough. Noise can also impact the natural environment. Vibration is also an issue, often related to noise.

2.6.2 2.14.2) The main sources of noise (and vibration) in Barnet include road and rail traffic, commercial and industrial land use, refrigeration and air handling plant [building services plant], sound systems, construction activities and people. Management of noise is an issue which significantly increases in importance for higher densities of population and economic activity. Noise can be persistent such as traffic, air conditioning or refrigeration units or intermittent such as drilling or early morning delivery vehicles.

2.6.3 2.14.3) Receptors which are particularly sensitive to noise include residential, health care facilities and schools. Noise also affects people enjoying outdoor amenity space and public open space. Noise exposure can have effects including significant sleep disturbance and annoyance. Recent evidence shows that noise can impair cognitive learning in school children. It is also agreed by many experts that environmental noise can lead to chronic health effects. For example, associations have been found between long term exposure to some types of transport noise, particularly from aircraft and road traffic, and an increase in the risk of cardiovascular effects (heart disease and hypertension). This guidance aims to address the effect that noise can have on quality of life and deliver the best acoustic outcome for a site.

2.6.4 2.14.4) In order to affect the design process it is important to assess and address noise impacts arising or existing for a new development at the earliest stage. If there is insignificant noise and vibration, then mitigation requirements maybe unlikely and further assessment maybe unnecessary. However, if there are significant noise or vibration levels, then the noise affects would need to be assessed carefully using suitably qualified consultants providing a Noise Impact Assessment which identifies optimum mitigation measures to reduce the noise impacts to an acceptable level.

2.6.5 2.14.5) To help consider noise at a site at an early stage an initial noise risk assessment should assess the Noise Risk Category of the site to help provide an indication of the likely suitability of the site for new residential development from a noise perspective. Figure 1: Initial Site Risk Assessment sets out the indicative noise levels for the Noise Risk Categories and a description of the potential effect of noise were no further noise mitigation to take place as well as additional pre-planning application guidance.

Noise Risk Category	Potential Effect if Unmitigated	Pre-Planning Application Guidance
0 – Negligible $L_{Aeq,16hr}$ < 50dB $L_{Aeq,8hr}$ < 40dB	May be noticeable but no adverse effect on health and quality of life	In this category the development is likely to be acceptable from a noise perspective, nevertheless a good acoustic design process is encouraged to improve the existing environment and/or safeguard against possible future deterioration and to protect any designated tranquil areas. A noise assessment may be requested to demonstrate no adverse impact from noise. Application need not formally be delayed on noise grounds.
1- Low $L_{Aeq16,hr}$ 50 - 63dB $L_{Aeq,8hr}$ 40 - 55dB	Adverse effect on health and quality of life	In this category the development may be refused unless a good acoustic design process is followers and is demonstrated via a Level 1 Acoustic Design Statement, which confirms how the adverse impacts of noise on the new development will be mitigated and minimised, and that a significant adverse noise impact will not arise in the finished development. Planning conditions and other measures to control noise may be required.
2 – Medium $L_{Aeq,16hr}$ 63-69dB $L_{Aeq,8hr}$ 55-60dB L_{AFmax} > 80dB	Significant adverse effect on health and quality of life	In this category the development is likely to be refused unless a good acoustic design process is followed and is demonstrated via a Level 2 Acoustic Design Statement which confirms how the adverse impacts of noise on the new development will be mitigated and minimised, and clearly demonstrates that a significant adverse noise impact will not arise in the finished development. Planning conditions and other measures to control noise will normally be required.
3 – High $L_{Aeq,16hr}$ > 69dB $L_{Aeq,8hr}$ > 60dB L_{AFmax} > 80dB	Unacceptable adverse effect on health and quality of life	In this category the development is very likely to be refused on noise grounds, even if a good design process is followed and is demonstrated via a Level 2 Acoustic Design Statement. Applicants are advised to seek expert advice on possible mitigation measures. Advice on the circumstances when the refusal of new housing on noise grounds should normally be anticipated is included in the ProPG.

Table 2.1 Initial Site Risk Assessment (Figure 1, page 31, Barnet Council Supplementary Planning Document, 2016)

2.6.6 2.14.6) Barnet will consider daytime and night time averages, background noise levels and maximum intermittent noise levels during the night in order to establish appropriate mitigation in accordance with guidance. Barnet would expect a good acoustic design with mitigation measures that ensure a good level of amenity both externally and internally

2.6.7 A number of further design principles are provided on page 31 of the supplementary planning document.

2.7 BS 5228-1: 2009 +A1:2014 'Code of practice for noise and vibration control on construction and open sites. Noise'

2.7.1 Construction phase impacts have the potential for a short-term impact on noise sensitive receptors in the vicinity of the development. These impacts are assessed by calculating the site noise level ($L_{Aeq,T}$) as a result of such activities using the methods described by BS 5228-1. To do this, noise emissions from various anticipated construction activities are calculated and compared against a pre-determined criteria based on the pre-construction ambient noise.

2.7.2 The method for assessing the significance of noise from demolition and construction activities are provided within Annex E of BS 5228. One such method of applying significance to noise effects is repeated in Table 2.2 below.

Assessment Category and Threshold Value Period, L_{Aeq}	Threshold Value in Decibels, dB		
	Category A[1]	Category B[2]	Category C[3]
Night-time (23.00−07.00)	45	50	55
Evenings and weekends [4]	55	60	65
Daytime (07.00−19.00) and Saturdays (07.00−13.00)	65	70	75

[1] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
[2] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.
[3] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.
[4] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Table 2.2 Criteria for assessing potential significant effects

2.7.3 A significant effect has been deemed to occur if the site noise level (construction only), exceeds the threshold level for the Category appropriate to the ambient noise level for a month or more. If the baseline ambient noise level exceeds the Category C values then a significant effect is deemed to occur if the total noise level (construction + ambient noise) for the period increases by more than 3 dB.

2.7.4 Works for a shorter duration that might result in a significant effect are considered by using the trigger levels for sound insulation and time criteria from Annex E.4 of BS 5228-1.

2.7.5 Exceedance of identified levels as shown in the table below and trigger a responsibility on the developer to provide noise insulation. The standard suggests that noise insulation should be provided if the trigger levels (or a noise level 5 dB above the existing noise level, whichever is higher) are predicted to be exceeded for a period of ten or more days of working in any fifteen consecutive days, or for a total of days exceeding 40 in any six month period.

Time	Relevant Time Period	Averaging Time, T	Noise Trigger Level, dB $L_{Aeq, T(1)}$
Monday to Friday	07.00 – 08.00	1 h	70
	08.00 – 18.00	10 h	75
	18.00 – 19.00	1 h	70
	19.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Saturday	07.00 – 08.00	1 h	70
	08.00 – 13.00	5 h	75
	13.00 – 14.00	1 h	70
	14.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Sunday and Public Holidays	07.00 – 21.00	1 h	65
	21.00 – 07.00	1 h	55

Note 1 - Equivalent continuous A-weighted noise level predicted or measured at a point 1m in front of the most exposed windows or doors leading directly to a habitable room (living room or bedroom) in an eligible dwelling.

Table 2.3 Criteria for assessing eligibility for noise insulation

2.7.6 BS 5228-1 continues to state within the example criteria, that temporary re-housing, or a reasonable cost thereof, would be offered by the developer where noise levels are 10 dB above any of the trigger levels (or a noise level 10 dB above the existing noise level, whichever is higher).

2.8 BS 5228-2: 2009 +A1:2014 'Code of practice for noise and vibration control on construction and open sites. Vibration'

2.8.1 BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Vibration' (BS5228) provides guidance on vibration levels that can be used to assess the likely impacts of construction activities on buildings and on humans. Annex B of the standard gives guidance on the significance of vibration effects in terms of human response to vibration and structural response.

Vibration Level (PPV)	Effect
0.14 mms^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.3 mms^{-1}	Vibration might be just perceptible in residential environments
1.0 mms^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10 mms^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level

Table 2.4 Guidance on effects of vibration levels perceptible on humans

Line	Type of Building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures / Industrial and heavy commercial buildings	50 mms^{-1} at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial buildings	15 mms^{-1} at 4 Hz increasing to 20 mms^{-1} at 15 Hz	20 mms^{-1} at 15 Hz increasing to 50 mms^{-1} at 40 Hz and above

Note 1 – values referred to are at the base of the building;
Note 2 – for line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

Table 2.5 Transient vibration guide values for cosmetic damage

2.8.2 BS5228 states that the guide values in Table 2.5 predominantly relates to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where

the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 2.5 might need to be reduced by up to 50%.

2.9 British Standard 8233: 2014 'Guidance on sound insulation and noise reduction for buildings'

2.9.1 British Standard (BS) 8233 establishes internal ambient noise levels for dwellings based upon occupancy patterns and derived from World Health Organisation (WHO) guidelines for community noise. These are summarised below:

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

Table 2.6 Design targets for indoor ambient noise levels

2.9.2 BS8233 also provides design targets for external noise and Section 7.7.3.2 states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

2.10 World Health Organisation Guidelines, 1999

2.10.1 The World Health Organisation (WHO) Guidelines for Community Noise was published in 1999 as a response to a need for action together with a generic need for improvements in legislation at a national level. Although not legislation, this document provides general guidance and guidelines which have been set for different health effects, using the lowest noise level that produces an adverse health effect in specific human environments.

Specific Environment	Critical Health Effect(s)	$L_{Aeq,\ T}$ (dB)	Time base, T (hours)	L_{AFmax} (dB)
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	--
	Moderate annoyance, daytime and evening	50		
Dwellings, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	--
Inside bedrooms	Sleep disturbance, night-time	30	8	45[(a)]
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

[(a)] Should not exceed 45 dB L_{AFmax} more than 10-15 times a night

Table 2.7 Guidelines for community noise levels

2.11 British Standard 4142: 2014 + A1: 2019 'Methods for rating and assessing industrial and commercial sound'

2.11.1 BS 4142: 2019 describes the methods for rating and assessing noise from industrial or commercial sources, including manufacturing processes, fixed installations and plant equipment, loading of goods and sound from mobile plant. The standard is applicable for the purpose of assessing sound at proposed new dwellings, through the determination of a rating level of an industrial or commercial noise source.

2.11.2 Where certain acoustic features are present at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5dB is likely to be an indication of adverse impact depending on the context.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact depending on the context.

2.11.3 BS8233 provides good internal design threshold for new developments, including residential. This standard is derived from the WHO Guidelines for Community Noise (see above). For the use of BS 4142 in assessing new residential development applications ProPG (Paragraph 2.43) states that:

"Professional judgement will have to be exercised in addressing these sorts of issues. One possible approach may be to apply BS 4142:2014 character corrections to the noise level guideline values

in order to derive suitable effect thresholds and/ or mitigation design targets and to use the same reference time periods recommended in the standard".

2.11.4 Where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be taken into account, including:

- The absolute level;
- The character and level of the residual sound;
- The sensitivity of the receptor and whether dwellings will already (or likely) to incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as: i) façade insulation treatments, ii) ventilation and/or cooling, and iii) acoustic screening.

2.11.5 BS 4142 states that, *"A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor; 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible"*.

2.12 Building Bulletin 93 'Acoustic design of schools: performance standards', 2015

2.12.1 Acoustic criteria for new and refurbished school buildings is defined by Building Bulletin 93: 'Acoustic Design of Schools', 2014 (BB93). BB93 outlines the acoustic performance standards, including the minimum internal ambient noise levels to be achieved in the different spaces within the school and noise levels within external teaching spaces.

2.12.2 Suitable indoor ambient noise levels are required for clear communication of speech between teacher and students and also to ensure activities requiring concentration can be carried out undisturbed. The indoor ambient noise level is a function of external noise sources and noise from building services.

2.12.3 The BB93 upper limit levels for various room types likely to be present at the proposed development are presented in Table 2.8. For naturally ventilated rooms, the limits are to be applied when ventilators or windows are open as required to provide adequate ventilation. If mechanically assisted ventilation is used, the internal noise limits apply to the cumulative effect of both internal mechanical services noise and external noise ingress.

2.12.4 The noise targets are for each type of space when unoccupied and exclude noise contributions from teaching activities and associated equipment.

Room	BB93 Indoor Ambient Noise Level (IANL) Upper Limit
Art and design	≤ 40 dB $L_{Aeq,30min}$
Calm room	≤ 35 dB $L_{Aeq,30min}$
Dining room	≤ 45 dB $L_{Aeq,30min}$
Food technology	≤ 40 dB $L_{Aeq,30min}$
General classroom	≤ 35 dB $L_{Aeq,30min}$
Interview room	≤ 40 dB $L_{Aeq,30min}$
Multi-use hall	≤ 35 dB $L_{Aeq,30min}$
Office	≤ 40 dB $L_{Aeq,30min}$
Science laboratory	≤ 40 dB $L_{Aeq,30min}$
Staff room	≤ 40 dB $L_{Aeq,30min}$
WC / Changing	≤ 50 dB $L_{Aeq,30min}$
Teaching space intended specifically for students with special hearing and communication needs (SEN)	≤ 30 dB $L_{Aeq,30min}$

1. Where target IANL is 40 dB $L_{Aeq,30min}$ or lower, a +5 dB relaxation can be applied where a natural or hybrid ventilation strategy is implemented. This applies only to noise from external sources (not noise from building services).
2. During the hottest 200hrs of the year, noise from external sources is permitted up to 55 dB(A) provided a natural/hybrid system is installed. Noise from mechanical systems may be relaxed by +5 dB above the IANL target. This relaxation only applies where ventilation is under local control of the teacher so noise can be reduced to normal levels when needed.
3. The noise level from locally controlled intermittent boost mechanical ventilation may exceed the IANL by up to +5 dB for dilution of fumes during practical activities. If natural ventilation is utilised for this purpose, noise levels up to 55 dB(A) may be permitted.
4. To protect students from regular discrete noise events (e.g. aircraft), IANLs should not exceed 60 dB LA01,30min. This is achieved by default for spaces with IANLs up to 40 dB LAeq,30min.

Table 2.8 BB93 target indoor ambient noise levels

2.13 Calculation of Road Traffic Noise, 1988

2.13.1 The Calculation of Road Traffic Noise (CRTN) sets out standard procedures for calculating noise levels from road traffic. The calculation method uses a number of input variables, including traffic flow volume, average vehicle speed and percentage of heavy vehicles (HGV), to predict the $L_{A10,18hour}$ or $L_{A10,1hour}$ noise level for any receptor point at a given distance from the road.

2.14 Design Manual for Roads and Bridges, LA111 Noise and Vibration, 2020

2.14.1 The assessment is based on the procedure set out in the Design Manual for Roads and Bridges (DMRB). The assessment covers both the magnitude and significance of any change as a result of any new or amended highway scheme however is relevant for noise assessment of other project types. DMRB refers specifically to noise impacts and as such will be discussed in these terms for the purposes of this assessment.

2.14.2 A significant change is defined as an increase in the 18-hour traffic flow which is equal or greater than 25%, or a decrease which is equal or greater than 20%. Changes of this magnitude are equivalent to a change in noise level of at least 1 dB.

2.14.3 The magnitude of noise impact is therefore assessed by comparing the increase and decrease in noise levels between both short term and long-term scenarios. DMRB defines this impact both in the short term (immediate impact) and long term (future impact).

Magnitude of Change	Noise Change, dB $L_{A10, 18hr}$	
	Short Term	Long Term
Major	Greater than or equal to 5.0	Greater than or equal to 10.0
Moderate	3.0 to 4.9	5.0 to 9.9
Minor	1.0 to 2.9	3.0 to 4.9
Negligible	less than 1.0	less than 3.0

Table 2.9 DMRB magnitude of change

2.15 British Standard 6472-1:2008 'Guide to evaluation of human exposure to vibration in buildings'

2.15.1 BS 6472 acknowledges that specific magnitudes and types of vibration can cause unfavourable reactions to occupants within buildings. It provides general guidance on human exposure to building vibration in the frequency range 1 Hz to 80 Hz.

2.15.2 The table below shows the assessment criteria for determining human response to building vibration for both daytime and night-time periods. In accordance with BS 6472, for there to be a low adverse probability of comment, the VDV must be between 0.2 to 0.4 $m/s^{1.75}$ during the day and between 0.1 to 0.4 $m/s^{1.75}$ during the night.

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

Table 2.10 Vibration dose value ranges of adverse comment

2.16 Acoustics Ventilation and Overheating - Residential Design Guide: 2020

2.16.1 Whilst the noise criteria outlined within BS 8223: 2014 provides guidance for 'normal' conditions, it is widely considered that a relaxation in acoustic criteria is permissible during peak summer months where occupants may be willing to compromise on noise ingress for purpose of thermal comfort. Suitable internal noise levels during overheating periods (i.e. when open windows or other measures are required to be implemented for the control of overheating) are provided in Acoustics Ventilation and Overheating: Residential Design Guide (AVO).

2.16.2 A summary of the recommended levels for the most noise-sensitive spaces (bedrooms) are provided below for average ambient noise levels throughout a given time period (LAeq) and maximum noise levels (L_{max}) during the night.

Period	Normal condition (As per BS 8223)	Overheating condition
Daytime (07:00 to 23:00)	35 dB $L_{Aeq,16hr}$	40 – 50 dB $L_{Aeq,16hr}$
Night-time (23:00 to 07:00)	30 dB $L_{Aeq,8hr}$ 45 dB L_{Amax}	35 – 42 dB $L_{Aeq,8hr}$ 65 dB L_{Amax}*

* Note L_{AFmax} refers to the level not normally exceeded, and not the 10th highest L_{AFmax} highest level used within WHO guidelines

Table 2.11 Ventilation and overheating design targets

2.16.3 The lower ambient noise level thresholds in the overheating condition (40 dB(A) and 35 dB(A) for day and night respectively) correspond to the recommendation within BS 8233:2014 for internal noise levels that would be considered "reasonable" under normal conditions.

2.16.4 The appropriate target level within the range is determined by considering the duration for which windows or ventilation openings are required to be utilised to control overheating. While there are no defined values as to what is considered "rarely" or "most of the time", guidance is provided through assessment of overheating risk assessments or thermal modelling output.

2.16.5 It should be noted that the noise levels stated are considered to apply for transportation noise sources and industrial noise is not considered by the AVO guide. It is therefore necessary to include the previously identified corrections to measured noise levels for acoustic characteristics of industrial sound that residents may find more annoying or disturbing (e.g. where noise sources have prominent tonal qualities, are intermittent or are impulsive).

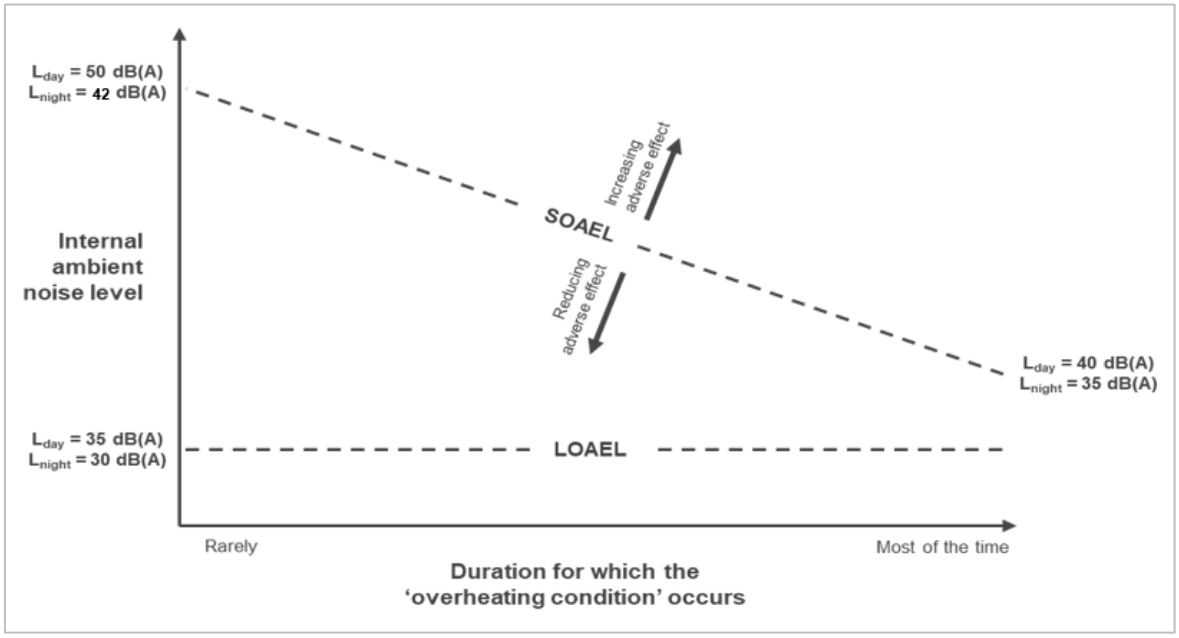

Figure 2.1 Relationship between internal ambient noise level and duration of overheating situation

2.17 Sport England 'Artificial Grass Pitch (AGP) Acoustics', 2015

2.17.1 This guidance provides details of the acoustic implications associated with AGP facilities and follows on from an acoustic research programme involving detailed analysis of relevant noise guidance documents and site testing in a range of locations. It proposes appropriate noise criteria and assessment methods and outlines practical measures that can be applied to reduce noise in particularly sensitive areas.

2.18 Local Authority Consultation

2.18.1 Discussions with the Environmental Health Officer at London Borough of Barnet (LBB) were sought to agree the scope and methodology of the assessment. The baseline survey methodology and methodology of assessment was discussed via telephone conversation and subsequent emails on 20 April 2021.

2.18.2 The Environmental Health Officer advised that the design targets within BS 8233: 2014 and WHO would apply for the design of internal noise levels. In addition, the noise emitted from plant and machinery (associated with the development site) shall be at least 5 dB(A) below the background level, as measured from any point 1 metre outside the window of any room of a neighbouring residential property. If the noise emitted has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or distinct impulse (bangs, clicks, clatters, thumps), then it shall be at least 10 dB(A) below the background level, as measured from any point 1 metre outside the window of any room of a neighbouring residential property.

2.18.3 In addition, it was advised that overheating should also be considered within the assessment, with suitable mitigation measures incorporated through design.

3 Scheme Overview

3.1 Site Location and Proposed Development

3.1.1 The application area sits within the North London Business Park and extends to approximately 163,640 sqm, accessed off Brunswick Park Road, N11 1GN.

3.1.2 The current site comprises of circa 38,000 sqm employment floorspace, the majority of which is now vacant, which hosts a series of flat roofed buildings with extensive landscaping and hardstanding roads/car parking. A lake is also situated in the southern portion of the site.

3.1.3 The detailed element of the proposals comprises up to 461 residential units in five blocks reaching nine storeys, the provision of a 5 form entry secondary school, a gymnasium, a multi-use sports pitch and associated changing facilities and improvements to open space and transport infrastructure, including improvements to the access from Brunswick Park Road and; the outline element comprises up to 1,967 additional residential units in buildings ranging from three to twelve storeys, up to 7,148 sqm of non-residential floor space (use Class E) and 20,250 sqm of open space. The proposals also include associated site preparation/enabling works, transport infrastructure and junction work, landscaping and car parking.

3.1.4 The site is predominantly bordered by residential housing, with a railway line running adjacent to the west.

3.1.5 For reference, a development zone plan showing the block identification name is presented in Figure 3.1.

Figure 3.1 Development zone plan - Extracted and edited from Drawing no. HED-1140-RBP-LA-1002 issued by HED on 21/06/2021.

4 Baseline Conditions

4.1 Overview

4.1.1 A baseline noise and vibration survey was undertaken between 13 and 17 May 2021 to establish the existing levels across the site, with the resulting data set used to inform the assessment. Monitoring comprised of unattended measurements.

4.1.2 Six long term noise monitoring stations were installed at various positions within and along the boundary of the Development in order to measure the noise environment across the site. Vibration monitoring was undertaken at one position, towards the western boundary (adjacent to the railway line).

4.2 Monitoring Locations

4.2.1 The measurement locations and identified noise sources observed during attendance are provided below:

ID	Location	Observations
UL1	North-west boundary (noise and vibration)	Train movements to the west, road traffic noise (particularly the A109), NLBP vehicles entering/exiting the car park.
UL2	North-east boundary (noise)	Road traffic noise, NLBP vehicle noise, bird song.
UL3	East boundary 1 (noise)	Road traffic noise, NLBP vehicle noise, bird song.
UL4	East boundary 2 (noise)	Road traffic noise (particularly from Brunswick Park Road), NLBP vehicle noise, bird song.
UL5	South-east boundary (noise)	Road traffic noise (particularly from Brunswick Park Road), NLBP vehicle noise, bird song.
UL6	South-west boundary (noise)	Train movements to the west, road traffic noise (particularly the A109), NLBP vehicle noise.

Table 4.1 Monitoring locations

4.2.2 The noise environment across the site was dominated by transportation sources, namely the railway line running adjacent to the west boundary (East Coast Main Line), Brunswick Park Road running to the east, and Oakleigh Road North to the south-west of the site. Vehicle movements along the internal business park roads also contributes to the existing daytime noise environment, particularly within the central portion of the site.

4.2.3 Due to the terrain profile, the south-west portion of the site sits at a similar ground level relative to the railway therefore, this area is currently exposed to higher noise levels from the operational line. Towards the north-west, the terrain profile raises relative to the railway, providing additional screening from this source to the northern portion of the development.

4.2.4 To a lesser extent, birdsong and community noise near existing vegetated areas and boundary adjacencies with existing residential properties were noted during calm periods.

Figure 4.1 Receptor location plan

4.2.5 A full breakdown of the weather conditions is provided in Appendix 2. Weather conditions were noted and considered suitable for monitoring purposes in accordance with BS 7445-1: 2003.

4.3 Survey Equipment

4.3.1 Noise and vibration monitoring was undertaken using the following equipment:

Equipment	Type	Serial number	Calibration date
Class 1 Sound Level Meter	Rion NL-52	386770	08/12/2020
		643029	06/11/2019
		876025	06/11/2019
		976246	19/12/2019
		976250	19/12/2019
		1043373	15/04/2021
Vibration Meter	Rion XV-2P	1270050	07/01/2020
Acoustic Calibrator	Rion NC-74	34857331	22/03/2021

Table 4.2 Monitoring equipment

4.3.2 All measurements were undertaken in free field conditions with the microphone positioned away from reflecting surfaces and at 1.5 m above the ground height to the requirements of BS 7445-1: 2003.

4.3.3 The calibration of each sound level meter was checked before and after the measurements, using the acoustic calibrator at 94 dB at 1 kHz; and calibration drift was within acceptable tolerances. The sound level meters used conform to the requirements of BS EN 61672-1: 2013 and the calibrator used conforms to the requirements of BS EN 60942: 2018. The equipment used has a calibration history that is traceable to a certified calibration institution.

4.3.4 Measurements were logged in continuous 15-minute integration periods and obtained using a combination of broadband indices; L_{Aeq}, L_{A10}, L_{A90} and L_{Amax}. Short-term audio was also recorded based on pre-set trigger levels to assist in the identification of extraneous noise levels.

4.4 Baseline Noise Data

4.4.1 The following tables show the resultant noise levels measured at each monitoring location:

ID	Time Period	Measured Noise Level, dB			
		$L_{Aeq, T}$	L_{Amax}*	$L_{A10, T}$	$L_{A90, T}$
UL1	Daytime (07:00 – 23:00)	62	90	55	41
	Night-time (23:00 – 07:00)	56	86	47	39
UL2	Daytime (07:00 – 23:00)	50	88	50	40
	Night-time (23:00 – 07:00)	46	87	43	35
UL3	Daytime (07:00 – 23:00)	52	92	52	42
	Night-time (23:00 – 07:00)	49	77	47	36
UL4	Daytime (07:00 – 23:00)	66	96	70	51
	Night-time (23:00 – 07:00)	60	90	60	39
UL5	Daytime (07:00 – 23:00)	54	94	54	44
	Night-time (23:00 – 07:00)	48	72	48	36
UL6	Daytime (07:00 – 23:00)	68	103	57	43
	Night-time (23:00 – 07:00)	61	92	47	35

* Highest individual L_{Amax} throughout the monitoring period

Table 4.3 Noise monitoring results

4.4.2 Graphs, illustrating the noise data throughout the monitoring period are provided in Appendix 1.

4.5 Derivation of Maximum Noise Level (L_{AFmax})

4.5.1 A detailed appraisal of the night-time event levels has been undertaken to establish the 10-th highest event level which occurred on each night of the survey (in line with WHO guidance). The appraisal has been undertaken by plotting the 1 second measurement data over the night-time periods, from which individual noise events can be derived. Table 4.4 presents the 10-th highest event level occurring on each night of the survey at each monitoring location. The maximum noise level highlighted in bold has been used for assessment purposes.

Start Date	10th Highest Maximum Noise Level, dB L_{AFmax}					
	UL1	UL2	UL3	UL4	UL5	UL6
13 May 2021	**78**	**66**	63	**78**	65	85
14 May 2021	78	68	**64**	77	**64**	**86**
15 May 2021	77	64	64	--	64	82
16 May 2021	78	66	63	--	64	84

Table 4.4 10th highest maximum night-time event levels

4.6 Derivation of Background Noise Level ($L_{A90,T}$)

4.6.1 Analysis of the representative baseline data to inform the assessment of fixed plant noise, has considered the context of the hourly noise levels ($L_{A90,1hr}$) for the daytime period (07:00 – 23:00) and 15-minute samples ($L_{A90,15min}$) for the night-time period (23:00 - 07:00). Such an approach is in line with the requirements of BS 4142: 2014+A1: 2019, and is considered to suitably provide a representative value for the background noise in the local environment.

4.6.2 The representative background noise levels for each monitoring position are provided below:

Date	Representative Background Noise Level, dB $L_{A90,T}$					
	UL1	UL2	UL3	UL4	UL5	UL6
Daytime (07:00 – 23:00)	39	38	39	50	45	43
Night (23:00 – 07:00)	36	30	30	36	30	34

Table 4.5 10th highest maximum night-time event levels

4.6.3 Given the specific local authority requirements of fixed plant noise, the criteria at receptor location(s) are based on the local authority requirement of '5 dB below the background noise' (assuming no corrections apply).

4.7 Baseline Vibration Data

4.7.1 Operational vibration monitoring, accounting for train movements along the adjacent railway line, was conducted at measurement location UL1 between 13 – 17 May 2021. This position can be considered representative of the residential buildings within Phases 4 and 5 (Blocks 4B, 4C, 5A and 5B). The results of the monitoring are provided below:

Date	Vibration Dose Value, $ms^{-1.75}$	
	Daytime (07:00 – 23:00)	**Daytime (07:00 – 23:00)**
13 – 14 May 2021	0.038	0.031
14 – 15 May 2021	0.048	0.046
15 – 16 May 2021	0.049	0.023
16 – 17 May 2021	0.046	0.029
TOTAL	**0.065**	**0.050**

Table 4.6 Measured vibration dose values

5 Computer Noise Modelling

5.1 Overview

5.1.1 A computer noise model of the proposed development has been constructed using SoundPLAN v8.2.

5.1.2 The noise levels across the proposed development site have been derived from a noise prediction model which has been calibrated against the measured levels at the baseline monitoring. The model has considered the following scenarios for the purposes of site suitability and to inform the mitigation scheme:

- daytime - ambient $L_{Aeq,16hr}$;
- night-time - ambient $L_{Aeq,8hr}$; and
- night-time – individual events L_{AFmax}.

5.2 Modelling Parameters

5.2.1 The model has been setup with the following parameters.

Item	Setting
Algorithms	Calculation of Road Traffic Noise (CRTN) ISO 9613-2:1996 BS5228-1:2009 (Construction noise)
Ground Absorption	Hard, acoustically reflective ground (0.1 coefficient) – Roads, pavements and hard standing areas Acoustically soft (assumed 0.8 coefficient) – grass or vegetated areas Acoustically hard (assumed 0.1 coefficient) – hardstanding areas
Met Conditions	10 degrees Celsius 70% humidity Wind from source to receiver
Receptor Height	Ground Floor 1.5m above ground Upper Floors 1.5m above floor height (based on elevation drawings supplied)
Source Modelling	External noise sources, such as road and rail traffic have been treated as line sources. Noise from road and rail traffic sources was deemed as being the dominant consistent source affecting the proposed development site. In order to calibrate the averaged baseline noise levels ($L_{Aeq,T}$), both road and rail sources have been introduced in the model for assessment purposes. The night-time L_{AFmax} levels from road pass-by events have been calibrated against the measured noise level at survey position UL4 where the night-time L_{AFmax} levels from rail pass-by events have been calibrated against the measured noise level at survey position UL6 i.e. the value typically not exceeded more than 10 times per night. The night-time L_{AFmax} levels at survey positions UL2, UL3 and UL5 i.e. the value typically not exceeded more than 10 times per night, have been calibrated and derived from bird song and random sources situated at the nearby tree line (5 m height) within the south and east portion of the site. This is a result of the occurrence of night Lmax samples (mostly at dawn).
Traffic Information	Individual road and rail traffic noise levels calculated from measured noise data
Terrain	Terrain data (LiDAR DTM with a 2-metre resolution) has been included within the model

Table 5.1 Computer noise modelling parameters

5.3 Validation of Computer Noise Model

5.3.1 The noise model has been validated against the measured noise levels obtained during the baseline monitoring. The model has considered the following scenarios:

- Daytime - ambient $L_{Aeq,16hr}$; and
- Night-time - ambient $L_{Aeq,8hr}$; and
- Night-time - maximum L_{Amax}.

6 Construction Phase Assessment

6.1 Noise

6.1.1 The activity noise levels used in the assessment of construction noise are summarised below:

No.	Activity	Activity Noise Level at 10 metres, dB $L_{Aeq,T}$
1	Demolition and Earthworks	78
2	Foundations	79
3	Construction	76

Table 6.1 Construction activity noise levels

6.1.2 As detailed methods and phasing of construction are not currently available, the construction noise assessment is necessarily conservative. The activity levels have been used to determine worst case noise levels at existing receptors adjacent to the development site adopting the calculation methods provided in BS 5228-1:2009+A1: 2014. A site hoarding (2-metre height) has been assumed at the perimeter of the site.

6.1.3 Worst-case noise predictions assume that all the plant and equipment is in operation at the closest point to each receptor (site boundary); the results are summarised in Table 6.2.

Receptor	Adopted Daytime Noise Criteria, dB $L_{Aeq,T}$	Predicted Noise Level, dB $L_{Aeq,T}$		
		Activity 1	Activity 2	Activity 3
Fernwood Crescent (UL1)	65 (Cat. A)	60	61	58
Denham Road (UL1)	65 (Cat. A)	56	56	53
Ashbourne Avenue (UL1)	65 (Cat. A)	63	65	62
Brunswick Park Gardens (UL2)	65 (Cat. A)	69	70	67
Brunswick Park Road (UL4)	70 (Cat. B)	50	65	62
Brunswick Crescent (UL5)	65 (Cat. A)	62	66	63
Oakleigh Close (UL6)	75 (Cat. C)	62	63	60

Activity 1 – Demolition and Earthworks
Activity 2 – Foundations
Activity 3 – Construction

Table 6.2 Construction activity noise levels

6.1.4 Based on an indicative assessment of construction noise impacts from a variety of likely activities, noise levels have the potential to exceed the Category A threshold during specific daytime operations, without mitigation in place. It should be noted that the predicted noise levels are based on assumed working methods, incorporating assumed plant items with all those items of plant positioned at closest distance to the receptors. In reality, the works would be transient, with limited noise sources positioned at the boundary of each working area; predicted noise levels in Table 6.2 would likely last for a number of days and not be sufficient to trigger the requirements for noise insulation within BS 5228-1:2009+A1: 2014.

6.1.5 Once full details relating to the chosen construction methods are known, it is recommended to update the assessment of noise for inclusion in the Construction Noise and Vibration Management Plan. Appropriate mitigation measurements pertinent to the updated methodologies should be discussed, with appropriate mitigation measures identified where necessary.

6.2 Vibration

6.2.1 Estimated vibration levels from piling works (based on the calculation methodology in BS 5228-2:2009+A1: 2014) indicate potential exceedances of the cosmetic damage criteria for any properties situated in a radius between 9 metres (for vibratory piling) and 13 metres (for impact piling) from the rig, depending on the type of plant, soil conditions and piling technique used. In terms of human comfort, vibration levels derived from piling works within a radius of 12 metres (for vibratory piling) and 18 metres (for impact piling) are likely to be intolerable for any more than a very brief exposure to this level.

6.2.2 Where the contractor is intending to adopt CFA piling. Section F3.2.4 in BS 5228-2:2009+A1: 2014 provides the following statement in respect of vibration from CFA techniques:

"The levels of vibration associated with continuous flight auger injected piling and pressed-in piling are minimal, as the processes do not involve rapid acceleration or deceleration of tools in contact with the ground but rely to a large extent on steady motions. Continuous vibrations at a low level could be expected from the prime movers."

6.2.3 The use of CFA piling is also referenced in BS 5228-2:2009+A1: 2014 (Section 8.5.3 of the standard) as a vibration mitigation measure i.e. an alternative method that is considerably less likely to give rise to unacceptable levels of vibration. Furthermore, BS 5228-2:2009+A1: 2014 (Table D.6, Ref. no.100) provides measured data of an auguring procedure measured at 7 metres from the pile location. The resultant peak particle velocity vibration level was recorded at a level of 3.2 mms^{-1}. Therefore, at these distances the evidence of the likely vibration levels generated by CFA piling techniques is not considered to be significant in terms of maintaining the integrity of the structure (< 15 mms^{-1}) and human tolerance (< 10 mms^{-1}) thresholds.

6.2.4 Estimated vibration levels from compaction activities indicate potential exceedances of the cosmetic damage criteria for any properties situated closer than 4 metres from the works, depending on the type of plant used and soil conditions. In terms of human comfort, vibration levels derived from compaction activities within a radius of 5 metres are likely to be intolerable for any more than a very brief exposure to this level.

6.2.5 Once full details relating to the chosen vibration methods are known, it is recommended to update the assessment of vibration for inclusion in the Construction Noise and Vibration Management Plan. Appropriate mitigation measurements pertinent to the updated methodologies should be discussed, with appropriate mitigation measures identified where necessary.

7 Operational Phase Assessment

7.1 Road Traffic

7.1.1 At the time of writing, Transport for London (TfL) were not in a position to disaggregate the traffic flows associated with the committed developments in the area from the opening and future scenarios to enable a road traffic noise assessment, as requested by the project's traffic consultants (Stomor). Through agreement with the planning consultants, the assessment has been informed with the available data incorporated in the previously submitted ES Noise and Vibration Addendum prepared in May 2018 by The EQUUS Partnership noise consultants.

7.1.2 The document included predicted traffic flows for the opening year (2025) on Brunswick Park Road only, deemed the potentially most affected road section following consultation with London Borough Barnet in 2018.

Road Link	Two Way Flows		Noise Level Change, dB $L_{A10, 18hr}$
	2025 Baseline + Committed	2025 Baseline + Committed + Development	Short Term
Brunswick Park Road	15,705	15,335	-0.1

Table 7.1 Change in road traffic noise levels (extracted from the ES Noise and Vibration Addendum prepared in May 2018 by The EQUUS Partnership noise consultants)

7.1.3 Based on the third-party traffic data, the proposed development will lead to a small reduction in total two-way traffic flows along Brunswick Park Road when compared with the baseline plus committed development scenario in the opening year. The reduction in noise level as a factor solely of the development traffic is 0.1 dB, and therefore of negligible impact in the short term.

7.1.4 An updated road traffic assessment will be incorporated into a technical addendum upon receipt of the required full set of traffic flow data.

7.2 Fixed Plant

7.2.1 The type and location of any fixed plant associated with the development is currently undetermined. According to BS 4142: 2014+A1: 2019, where the rating noise level (L_{Ar}) does not exceed the background sound level ($L_{A90,T}$), this is an indication of the specific sound source having a low impact. The requirement of London Borough of Barnet (LBB) is more onerous in this regard and recommends that fixed plant should be designed to achieve L_{A90} – 5 dB (or L_{A90} - 10 dB where fixed plant emits tonal components). The baseline noise monitoring has been used to inform the assessment at each of the nearest receptors.

7.2.2 Analysis of the baseline data, to inform receptor criteria from operational fixed plant has considered the analysis of hourly noise levels for daytime periods (07:00 – 23:00) and 15-minute levels at night (23:00 – 07:00). Such an approach is in line with the requirements of BS 4142: 2014+A1: 2019, and is considered to suitably represent the noise in the existing environment.

7.2.3 The following noise level targets would apply at nearest sensitive receptors:

No.	Sensitive Receptor	Daytime Noise Target, dB $L_{Aeq, T}$*	Night Noise Target, dB $L_{Aeq, T}$*
1	Fernwood Crescent (UL1)	34	31
2	Denham Road (UL1)	34	31
3	Ashbourne Avenue (UL1)	34	31
4	Brunswick Park Gardens (UL2)	33	25
5	Brunswick Park Road (UL4)	45	31
6	Brunswick Close (UL5)	40	25
7	Oakleigh Close (UL6)	38	29

* To achieve local authority criteria of background noise ($L_{90, T}$) – 5dB (excluding tonal components)

Table 7.2 Noise model validation

7.2.4 Should it be determined that the operational regime of proposed plant items is likely to occur on a 24-hour basis, the lower night time values should be used to inform the design of any fixed plant attached to the operation of this building(s). Assuming the noise design targets are adhered to as part of the design, the proposed fixed plant would have a low impact.

8 Site Suitability Assessment

8.1.1 The guidance document, BS 8233:2014 on sound insulation and noise reduction for buildings state indoor noise levels within bedrooms should not exceed 30 dB(A) during the night-time and 35 dB(A) within living rooms for the daytime. Furthermore, in accordance with WHO guidelines, maximum internal noise levels have been assessed, based on the analysis of the 10-th highest measured maximum noise level (L_{AFmax}). It is considered that these levels are the lowest observed adverse affect level (LOAEL) in line with the Noise Policy Statement for England (NPSE).

8.2 **Residential - Internal Noise**

8.2.1 A computer noise model of the site has been constructed using SoundPLAN (v8.2) noise prediction software of the proposed development site inclusive of existing buildings and the proposed development plan.

8.2.2 The suitability of the Development has taken into account both the measured noise levels during the baseline noise survey and the results of the modelling exercise. The graphical output of the computer noise modelling, illustrating how the noise attenuates across the site, is provided in Appendices 4 and 5.

8.2.3 Table 8.1 defines the worst-case predicted noise level (one which informs the highest level of mitigation) for each of the residential blocks. Values are rounded to the nearest whole number.

Block/Floor*	Highest Predicted Façade Noise Level, dB		
	Daytime, $L_{Aeq, 16hr}$	Night, $L_{Aeq, 8hr}$	Night, L_{AFmax}
1B / F1	48	42	60
1C / F9	52	45	63
1D / F9	52	46	64
1E / F6	52	45	66
1F / GF	52	45	66
2A / F2	47	41	58
2B / F1	47	41	58
2C / F2	61	54	78
3A / F10	54	47	70
3B / F3-F9	66	59	82
4A / F10	56	49	70
4B / F1	68	61	85
4C / GF-F2	68	61	85
5A / GF-F3	68	61	85
5B / GF-F3	68	61	85

* Floor(s) which informs the highest level of mitigation from either averaged daytime and night-time levels, or night-time discrete maximum levels predicted on the block.

Table 8.1 Highest predicted façade noise level - residential

8.2.4 The results of the noise modelling have been used to inform the mitigation of the residential building façade elements. Due to the nature of the hybrid application, the recommended mitigation measures for the Phase 1 detailed application (Blocks 1C, 1D, 1E and 1F) is informed by detailed break-in calculations, in accordance with the method set out in Section G.2.1 of BS 8233: 2014, which is based on the method presented in BS EN ISO 12354-3:2017 'Building acoustics. Estimation of acoustic performance of buildings from the performance of elements. Airborne sound insulation against outdoor sound'. As a result, the recommended mitigation measures associated with the Phase 1 detailed application includes specific glazing and ventilator specifications (and suggested manufacturers), whereas the outline application blocks (1B, 2A, 2B, 2C, 3A, 3B, 3C, 4A, 4B, 4C, 5A and 5B), would include the noise level reduction (based on simple level difference – in dB) to which the building façade should provide. It is acknowledged

that the design of the outline phases 2, 3, 4 and 5 would be refined at a later stage and it is recommended that the results of this assessment should be used to feed into the development of the final design.

8.2.5 The highest predicted noise levels upon proposed residential blocks would likely be along the south-western boundary of the site, where the separation distance between the railway line and likely building façades would be at its minimum. Predicted levels within the south-west portion of the site are 68 dB $L_{Aeq,16\ hrs}$ during the daytime and 61 dB $L_{Aeq,8\ hrs}$ during the night period, with likely maximum night-time noisy events (10-th highest) of 85 dB L_{AFmax} at ground, first and second floors.

8.2.6 Predicted noise levels on those proposed residential blocks facing Brunswick Park Road and positioned to the eastern portion (detailed application block reference 1C, 1D, 1E and 1F), would understandably experience a lower noise level as a result of the setback distance to this source and the screening provided by existing and proposed buildings situated to the east and west. Highest predicted noise levels at those indicative façades are 52 dB $L_{Aeq,16\ hrs}$ during the daytime period, 46 dB $L_{Aeq,8\ hrs}$ during the night-time period with likely maximum night-time noisy events (10-th highest) of 66 dB L_{AFmax}. A visual indication of the highest predicted daytime and night-time noise levels is included in Appendix 3.

8.3 Residential - External Noise

8.3.1 The majority of external noise levels across public amenity areas (ground floor level) are predicted to be below the recommended upper guidance limit of 55 dB $L_{Aeq,16\ hrs}$, with the exception of a small portion situated to the south-west corner of the site, off Oakleigh Avenue (adjacent to the proposed southern site access). This is the result of their proximity to the railway line. The remaining of the site, with focus on the central portion hosting the main public amenity areas would be subject to noise levels below 50 dB $L_{Aeq,16\ hrs}$ as a result of the building positioning and screening provided against the main transportation sources.

8.3.2 Most exposed balconies of detailed blocks 1C to 1F would be subject to external daytime noise levels comfortably below 55 dB $L_{Aeq,16\ hrs}$.

8.4 Residential – Operational Vibration

8.4.1 Continuous monitoring of ground borne vibration was undertaken between 13 and 17 May 2021 at the north-west boundary of the Development site. The monitoring enabled the calculation of the Vibration Dose Value (VDV – in $ms^{-1.75}$) during standard daytime (16hr) and night time (8hr) reference periods.

8.4.2 The below table shows the calculated VDV levels and their comparison against the guideline values contained within BS 6472-1: 2008:

Block/Floor*	Vibration Dose Value, $ms^{-1.75}$		Difference
	Measured Level	Lowest Criteria*	
Daytime (07:00 – 23:00)	0.065	0.2 to 0.4	-67.5%
Night (23:00 – 07:00)	0.050	0.1 to 0.2	-50%

* Low probability of adverse comment

Table 8.2 Operational vibration dose value assessment

8.4.3 Measured VDV levels are considerably below the criteria within BS 6472-1:2008. The highest appreciable levels (compared to the criteria) were recorded during the night period, which resulted in levels 50% below the lowest interpretation of the threshold criteria for the lowest probability of adverse comment.

8.5 School Building – Internal Noise

8.5.1 BB93 provides guidance for indoor ambient noise levels for schools and associated space. The guidance has been used to inform the predicted noise levels and level of mitigation required for the proposed main Teaching Block. The results of the noise modelling at ground floor along with the first and second floors of the main Teaching Block are provided below.

Floor/Facade	Use	Noise Level, dB $L_{Aeq, 30mins}$	
		Predicted Level*	Design Target**
GF / East	Food room, constructional textiles room, general classrooms, chapel, meeting room	64	35
GF / South	Science classrooms	61	40
GF / West	Kitchen, science classrooms, store rooms, seminar room, music classrooms	44	35
GF / North	Music classroom, general classroom, office, meeting room	62	35
F1 / East	General classroom, seminar room, meeting room	64	35
F1 / South	General classroom, staff room	62	35
F1 / West	General classroom	46	35
F1 / North	General classroom, art room, office	62	35
F2 / East	General classroom, seminar room, science lab	64	35
F2 / South	General classroom, study area	62	35
F2 / West	Social space, science labs	49	40
F2 / North	Science labs	62	40

* Free-field noise level (subtraction of +2.5 dB from CRTN façade noise calculations)

** Most sensitive use. Upper limits for new builds intended for learning and administrative use

Table 8.3 Predicted façade noise level – school teaching block

8.5.2 Calculated worst case façade noise levels of the main school teaching block would be 64 dB(A) on all floors to the eastern façade. The building envelope would be required to reduce external to internal noise levels by up to 29 dB(A) (based on detailed break-in calculations) assuming the space at the eastern façade is used for learning purposes.

8.6 School Building – External Noise

8.6.1 While there is no requirement within BB93 to meet specific noise levels within external teaching spaces, the following recommendations are made within the accompanying design guide:

"For new schools, 60 dB $L_{Aeq,30min}$ should be regarded as an upper limit for external noise at the boundary of external premises used for formal and informal outdoor teaching, and recreational areas.

Playgrounds, outdoor recreation areas and playing fields are generally considered to be of relatively low sensitivity to noise, and indeed playing fields may be used as buffer zones to separate school buildings from busy roads where necessary. However, where used for teaching, for example sports lessons, outdoor ambient noise levels have a significant impact on communication in an environment which is already acoustically less favourable than most classrooms. Noise levels in unoccupied playgrounds, playing fields and other outdoor areas should not exceed 55 dB $L_{Aeq,30min}$ and there should be at least one area suitable for outdoor teaching activities where noise levels are below 50 dB $L_{Aeq,30min}$. If this is not possible due to a lack of suitably quiet sites, acoustic screening should be used to reduce noise levels in these areas as much as practicable".

8.6.2 External daytime noise levels derived from the noise modelling exercise indicate that those areas designated as outdoor spaces, specifically those positioned to the west of the main Teaching Block and Sports Hall would benefit from the screening provided by these blocks and would be subject to levels below 50 dB $L_{Aeq,30min}$. An ambient noise level of this magnitude is in line with desired noise targets at the boundary of external premises.

8.7 School Building – MUGA

8.7.1 Based on the most up to date site layout, the school has two external areas that have the potential to cause disturbance to the nearest and proposed residential receptors; a rooftop MUGA (Teaching Block) and the playing fields to the south-west portion of the school boundaries.

8.7.2 The nearest receptors to the rooftop multi-use games area (MUGA) are situated approximately 35 metres to the south (along Brunswick Crescent) and 15 metres to the west (proposed Block 1C).

8.7.3 It is understood that these outdoor spaces will be used during school hours only, limiting the exposure of noise levels on nearest receptors from Monday to Friday.

8.7.4 A noise design target based on the external daytime noise levels for residential use set out in BS 8233:2014 and WHO, 1999 has been adopted for residential outdoor amenity spaces, with the desired range being between 50 – 55 dB $L_{Aeq,16hour}$.

8.7.5 Considering a potential use of a full size MUGA and adopting a typical free-field noise level from an artificial ground pitch (at 10 metres from the side line halfway marking) of 58 dB $L_{Aeq,1hour}$ as per the Design Guidance Note for 'Artificial Grass Pitch (AGP) Acoustics' issued by Sport England, a distance of 15 metres from the edge of the MUGA to the nearest receptor would be sufficient to achieve external noise levels at nearest receptors between 50 – 55 dB $L_{Aeq,T}$ however, the AGP guidance document states that a minimum distance of 40 metres (page 8) should be maintained to future residential receptor locations. It is recommended that this be incorporated in the final design. The positioning of a club house, school building or auxiliary structure between the western MUGA boundary and nearest proposed residential blocks could be explored in order to provide additional screening to future receptors.

8.7.6 Based on the minimum distances from the MUGA to receptors stated above and in the context of the expected hours of use, noise emissions would comply with relevant design targets for external amenity areas for residential receptors.

9 Mitigation

9.1 Construction

9.1.1 Construction mitigation measures and best practical means (BPM) will be discussed in order to reduce the likely noise and vibration emissions during the construction phases. Measures would likely include the selection of less intrusive (lower noise and vibration emitting) plant items, temporary hoardings to screen construction activities from existing dwellings and noise management measures aimed to minimise the exposure time to likely noisy activities.

9.1.2 Mitigation for construction noise would concentrate on those examples provided in BS 5228, whilst taking into account the Best Practicable Means (BPM) approach:

- Site inspections shall include checks to ensure that plant is being operated with any specified acoustic covers in place. Excessively noisy plant shall be removed from the Site for repair or maintenance. Quieter construction methods will be used, where required and where considered reasonable and feasible;
- Where generators are operated overnight, measures shall be taken to minimise noise levels at the nearest dwellings;
- Equipment will be switched off when not in use (including during breaks and down times of more than 30 minutes);
- Where possible, noisy plant should not be used simultaneously and/or close together to avoid cumulative noise impacts;
- Equipment and excavation work sites should be oriented, where possible, to reduce noise emissions to sensitive receivers;
- Normal working hours are expected to be:
    - Mon – Fri: 08:00 - 18:00;
    - Saturday: 08:00 – 13:00; and
    - No work on Sundays and Bank Holidays where noise will be audible at the site boundary.
    - Sunday working shall be undertaken only in emergencies or with prior approval from the local authority;
- Contact will be made with local authorities, where required to ensure that planned designated routes are set in place to minimise disturbance;
- Vehicle weight limits will be taken into consideration and permits obtained from transport authorities if warranted;
- Site speed limits will be set to minimise noise and vibration levels if required;
- As far as reasonably practicable, noise from reversing alarms will be managed through the following hierarchy of techniques:

- The Site layout will be designed to limit and where reasonably practicable, avoid the need for the reversing of vehicles. Measures will be undertaken to ensure that drivers are familiar with the worksite layout.
- Banksmen will be utilised to avoid the use of reversing alarms.
- Reversing alarms incorporating one of more of the features listed below or any other comparable system will be used where reasonably practicable:
    - Highly directional sounders;
    - Use of broad band signals;
    - Self adjusting output sounders; and
    - Flashing warning lights.
    - Reversing alarms will be set to the minimum output noise level required for health and safety compliance.
- The contractor shall aim to be a proactive and considerate neighbour; any potentially affected residents shall be approached in advance of any potential disturbance and kept informed as works progress. A noise complaint handling procedure will be established and responded to quickly.

9.1.3 Based on the short separation between some of the proposed building blocks and existing residents, it is recommended the selection of the least intrusive piling techniques (e.g. CFA) be employed. A further assessment of the piling methodology shall be incorporated in the site-specific CNVMP for the construction phase works.

9.2 Operational Fixed Plant

9.2.1 Design targets for the operation of fixed plant have been recommended at nearest receptor locations. The recommended noise design targets (excluding possible tonal components of the noise source) are in line with the local authority requirements and based on the representative background noise levels (day and night). Mitigation of any proposed fixed plant can be secured through an appropriately worded planning condition.

9.3 Residential Facades – Detailed Phase 1

9.3.1 The insertion loss performance of a partially open window is widely accepted as being between 10 - 15 dB(A). Noise level reduction can be provided through various façade treatment methods such as glazing or ventilation products, however the level of mitigation would be dependent on factors such as room size and room volume.

9.3.2 Based on highest predicted external noise levels on Blocks 1C, 1D, 1E and 1F which form part of the detailed application, it is apparent that internal noise levels will result in a marginal exceedance of the recommended acoustic design target during a situation in which windows are partially open for ventilation purposes. Calculations of worst case internal noise levels likely to be experienced on those most exposed façades, with consideration of most restrictive bedroom sizes (taken from detailed drawings), have been undertaken in the form of break-in calculations.

9.3.3 The sound insulation performance of the external roof element is specified to achieve a minimum sound insulation of 39 dB R_{w+Ctr}. This can be achieved with the use of tiled / slate roof, 12.5mm p/b ceiling + 200mm mineral wool. Non-glazed (wall) elements of the façades need to be designed to achieve a sound insulation performance of at least 48 dB R_{w+Ctr}.

Element	Octave band centre frequency, Hz					$D_{n,T}$ / R_w +C_{tr}, dB
	125	250	500	1000	2000	
External wall	33	41	46	50	48	48
Roof	26	39	46	50	51	39

Note 1: The external wall build-up is based on masonry cavity construction, with cavity insulation infill.

Note 2: Minimum roof performance example.

Table 9.1 Acoustic performance specification – wall and roof residential phase 1

9.3.4 To ensure an appropriate internal acoustic standard within the proposed residential properties of phase 1 during normal conditions (non-overheating) the level of attenuation necessary for the weakest element (i.e. glazing) is 27 dB R_{w+Ctr}. This is assuming those façades would be occupied for sleep at night. The required level of attenuation can be achieved using standard glazing and trickle vent products.

Element	Minimum Acoustic requirement for façade	
	Acoustic performance	Product type
Window	27 Rw + Ctr	Saint Gobain Paniclear Double Glazing 4/16/4
Ventilation	29 Rw + Ctr	Greenwood 8000HA (6400mm EA)

Table 9.2 Initial façade treatment recommendations – residential phase 1

9.3.5 It should be noted that the acoustic performance requirements set out in the table above are readily available via a number of different specifications. A tolerance of +2 dB has been assumed for the internal noise calculations following the methodology set out in BS 8233: 2014.

9.4 Residential Facades – Outline Phases 2 – 5

9.4.1 Calculations of the likely noise attenuation required on those blocks which form part of the outline part of the application, have determined that blocks 4B, 4C, 5A and 5B situated adjacent to the railway line would require enhanced mitigation products. Based on simple difference calculations, the level of attenuation necessary for the indoor areas of those residential façades facing the railway line (west of the development) is 40 dB(A), assuming those facades would be occupied for sleep at night (required performance governed by night-time maximum events).

The required level of attenuation can be achieved using high specification glazing products; the exact type to be confirmed during the detailed design of the development with consideration to most restrictive sensitive room dimensions.

9.4.2 Less exposed units will benefit from a slightly lower specification façade and ventilation system, although this should be confirmed at detailed design following building layouts.

9.4.3 At those proposed residential locations to the west portion of the site, it is recommended to have ancillary rooms such as storerooms, bathrooms/toilets and kitchen/dining rooms facing the railway line, with bedrooms and living rooms positioned at the sheltered façades.

9.4.4 No additional mitigation is required for external public amenity spaces, assuming the buildings can effectively be used as a screening element.

9.5 Overheating

9.5.1 In line with the guidance set out in the Acoustics, Ventilation and Overheating Residential Design Guide (AVO Guide), it is considered reasonable to allow higher levels of internal ambient noise when increased rates of ventilation are required in relation to an overheating condition. The basis for this is that the overheating condition occurs for a limited time and during this period, occupants may accept a trade-off between acoustic and thermal conditions, given that they have some control over their environment.

9.5.2 During an overheating condition, the preference is to adopt opening windows as a primary means of mitigating thermal issues, however, this is subject to the resultant internal ambient noise level.

9.5.3 On the basis that a partially open window provides 13-15 dB of attenuation, to meet an internal ambient level of 42 dB $L_{Aeq,8hr}$, the upper SOAEL limit for night-time hours, the external noise level must not exceed 55 - 57 dB $L_{Aeq,8hr}$. Furthermore, in order to not exceed the lower SOAEL limit for night-time hours (35 dB $L_{Aeq,8hr}$), the external free-field noise level must not exceed 48 - 50 dB $L_{Aeq,8hr}$. The highest predicted external night-time noise levels across phase 1 blocks (detailed application) is 48 dB(A). The highest level of 46 dB(A) predicted on the eastern façade facing Brunswick Park Road and together with the remaining building façades, noise levels are unlikely to exceed the upper or lower night-time SOAEL limit. As such, should the risk of overheating be high, the use of open windows infrequently and for short periods of time is likely to be an acceptable means of overheating control.

9.5.4 Assuming the same level of reduction for a partially open window during the daytime hours, the upper SOAEL limit for internal ambient levels would be 50 dB $L_{Aeq,16hr}$, ensuring the external noise level must not exceed 63 – 65 dB $L_{Aeq,16hr}$. Similarly, in order to not exceed the lower SOAEL limit for daytime hours (40 dB $L_{Aeq,16hr}$), the external free-field noise level must not exceed 53 - 55 dB $L_{Aeq,16hr}$. The highest predicted external free-field day-time noise levels across phase 1 blocks (detailed application) are 52 dB(A), and unlikely to exceed the upper or lower daytime SOAEL limit. As such, should the risk of overheating be high, the use of open windows infrequently and for short periods of time is likely to be an acceptable means of overheating control.

9.5.5 Regarding those residential facades within outline phases 2 – 5, windows will need to remain closed (although not sealed) to achieve the required level of mitigation and, as such, a suitable ventilation system, compliant with Building Regulations Part F compliant and acoustically attenuated, will be required. Any ventilation should also allow for potential overheating scenarios, taking into account the Associate of Noise Consultants (ANC) publication 'Acoustics Ventilation and Overheating – Residential Design Guide. The building fabric should also be designed and constructed to ensure that a minimum 40 dB(A) reduction is achieved. This would represent a reasonably high specification of façade and roof, with supplementary ventilation system. It is recommended input be sought from the wider design team to identify areas of high overheating risk and to ensure subsequent mitigation options compliment ventilation, architecture and structural design strategies and assessments.

9.6 School Building Facades

9.6.1 Based on a highest predicted noise level of 64 dB(A) on the most exposed eastern façade of the school building, the building envelope (glazed and non-glazed areas) should achieve a noise reduction index of at least 29 dB R_{w+Ctr} to ensure the most stringent acceptable IANL of 35 dB(A). This is based on a noise break-in calculation following the methodology outlined in Annex G of BS 8233:2014 and considering the smallest room volume exposed (seminar room 2, first floor). The required noise attenuation can be achieved with double-glazed products providing at least, the following specifications:

Element	Minimum Acoustic requirement for façade	
	Acoustic performance	**Product type**
Window	29 Rw + Ctr	Saint Gobain Paniclear Double Glazing 6/24/4

Table 9.3 School building façade treatment recommendations

9.6.2 Due to the magnitude of predicted external noise levels incident upon the eastern, northern and southern façades and the proposed room type distribution as per the architect's drawings, mechanical ventilation would be required on these facades. It is understood that the standard classrooms will be ventilated through a heat recovery unit (HRU) situated behind a suspended raft. This unit will provide both supply and extract ventilation, with openable windows used to provide additional ventilation during summer months.

9.6.3 It is understood that the special education needs (SEN) teaching rooms would not be located directly on any façade of the main school building.

9.6.4 Plant noise levels should be limited to a rating level (L_{Ar}) 5 dB below representative background noise levels at the façade of the nearest existing or proposed noise sensitive receptors. Individual plant items may need to be designed to a lower limit such that the cumulative noise level of all plant items operating simultaneously, including any applicable noise penalty (as defined in BS 4142: 2014+A1:2019), achieves the stated design targets.

10 Conclusions

10.1.1 RSK Environment Ltd (RSK) has been appointed by Comer Homes Group to provide a noise assessment in support of a planning application for the proposed development on Royal Brunswick Park, London.

10.1.2 The assessment utilises updated baseline noise and vibration monitoring, obtained in May 2021 and noise propagation modelling based on existing noise levels derived from rail and road sources, to re-assess the site suitability and changes in road traffic noise.

10.1.3 The assessment indicates that the residual effect of construction noise is considered to be temporary, and unlikely to exceed the trigger levels for noise insulation, assuming appropriate mitigation measures are incorporated. It is recommended that a further assessment be undertaken and incorporated in the site Construction Noise and Vibration Management Plan (CNVMP) once full details of construction plant, phasing and timings are known.

10.1.4 At the time of writing, Transport for London (TfL) were not in a position to disaggregate the traffic flows associated with the committed developments in the area from the opening and future scenarios to enable a road traffic noise assessment.

10.1.5 Based on the third-party traffic data, the proposed development will lead to a small net reduction in total two-way traffic flows along Brunswick Park Road when compared with the baseline plus committed development scenario in the opening year. The reduction in noise level as a factor solely of the development traffic is 0.1 dB, and therefore of negligible impact in the short term. An updated road traffic assessment will be incorporated into a technical addendum upon receipt of the required full set of traffic flow data.

10.1.6 Based on mitigation imbedded within the design, particularly through the use of high specification double glazed windows and supplementary ventilation systems, the criteria for internal noise levels (within BS 8233: 2014 and WHO) of the proposed residential dwellings situated adjacent to the railway line would be met. For those blocks included in the detailed application area (Phase 1), standard double-glazed products and passive ventilation would ensure adequate internal noise levels and ventilation.

10.1.7 External noise levels within residential balconies associated with Phase 1 buildings would remain below the recommended upper noise criteria of 55 dB $L_{Aeq,16hr}$.

10.1.8 Operational noise impacts associated with fixed plant situated on the main Teaching Block's rooftop are negligible and not significant, assuming appropriate selection of plant and mitigation measures are incorporated to meet daytime and night-time thresholds (background minus 5 dB).

10.1.9 Noise generated with the use of the MUGA and external playing fields within the school site, would remain within the recommended upper guidelines for residential use at nearest and proposed receptors.

10.1.10 Based on mitigation imbedded within the design, particularly through the use of standard specification double glazed windows and supplementary ventilation systems, the criteria for internal noise levels (within BB93) of the proposed main Teaching Block facing Brunswick Park Road would be met (eastern, southern and northern façades). Rooms situated away from the road can benefit from natural ventilation.

Appendix 1 – Noise Survey Results

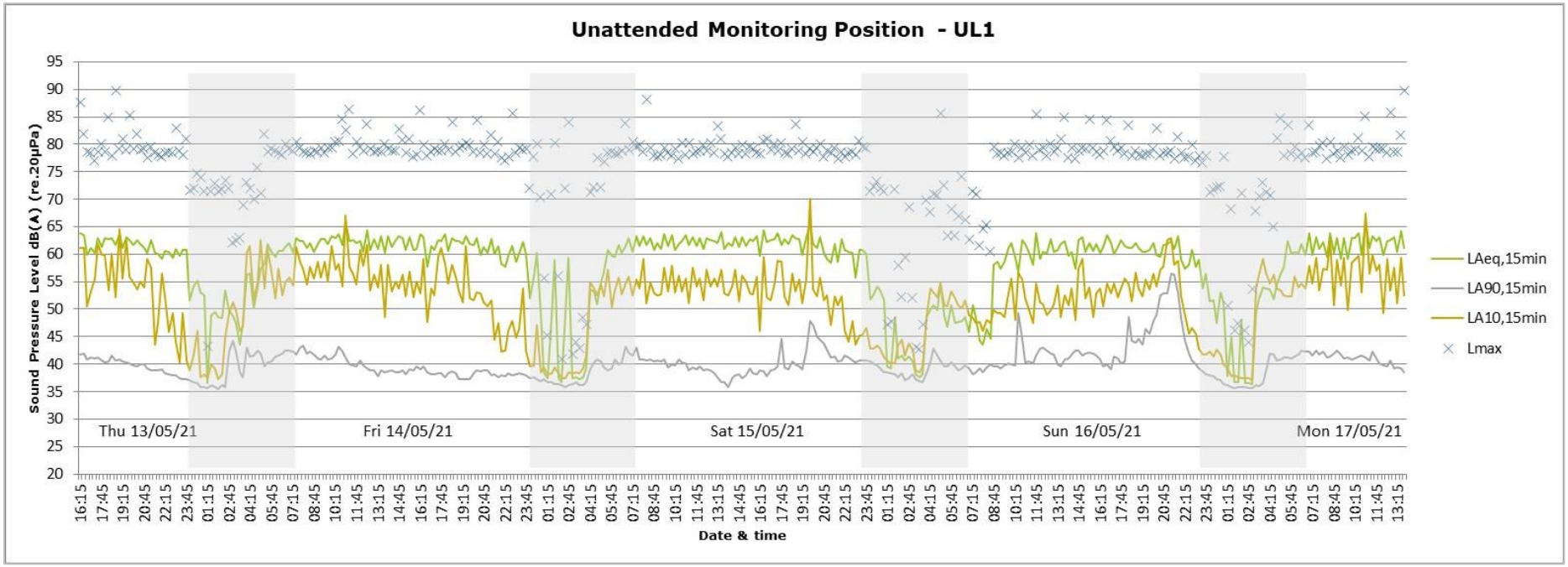

Figure A1.1 Noise survey results – position UL1 (north-west boundary)

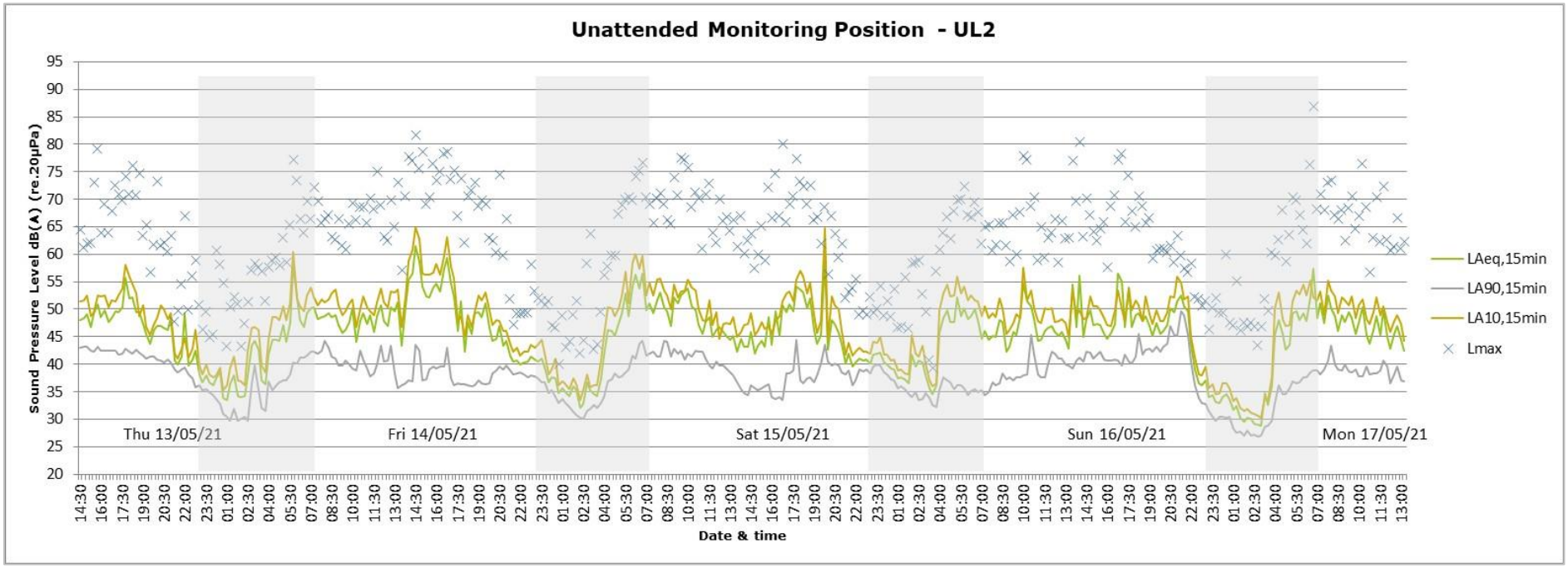

Figure A1.2 Noise survey results – position UL2 (north-east boundary)

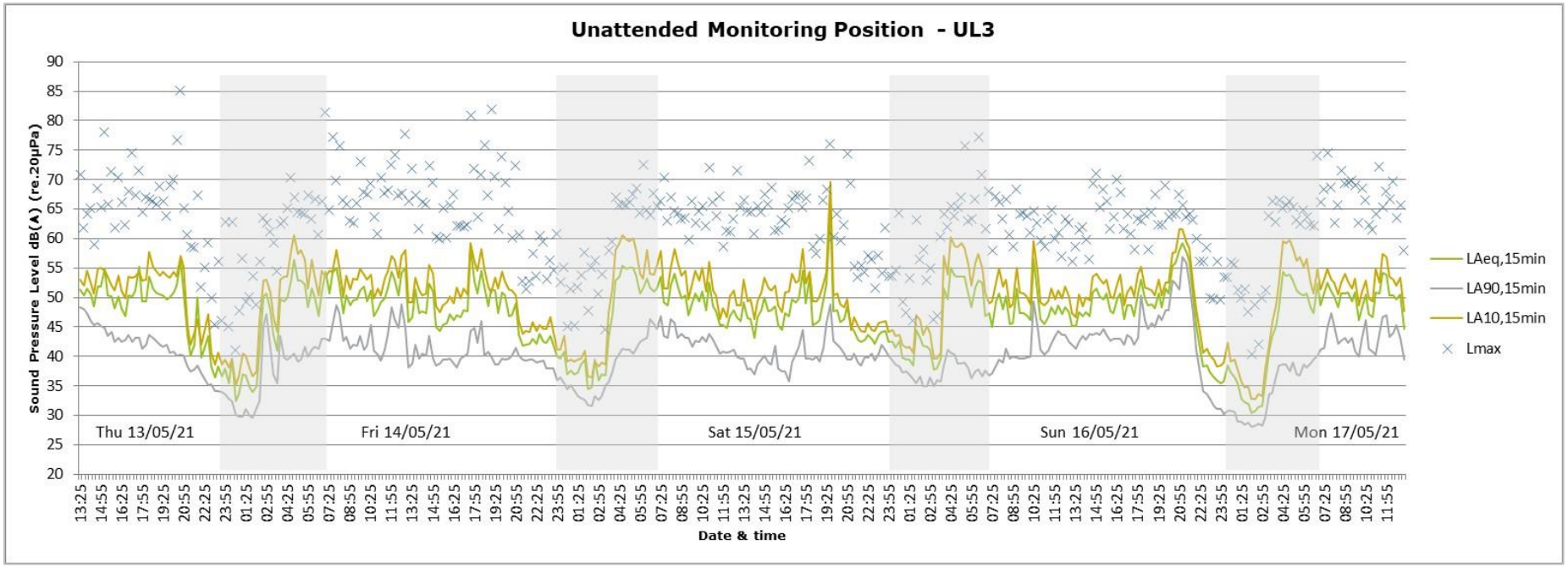

Figure A1.3 Noise survey results – position UL3 (east boundary 1)

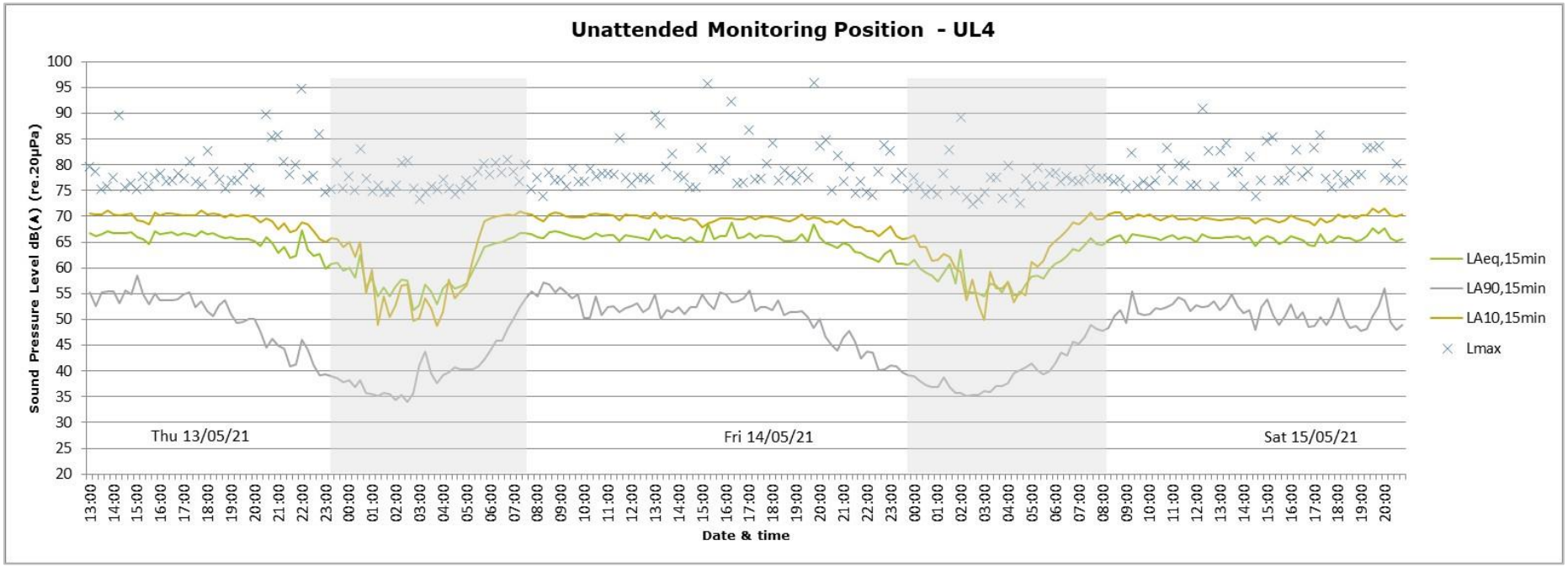

Figure A1.4 Noise survey results – position UL4 (east boundary 2)

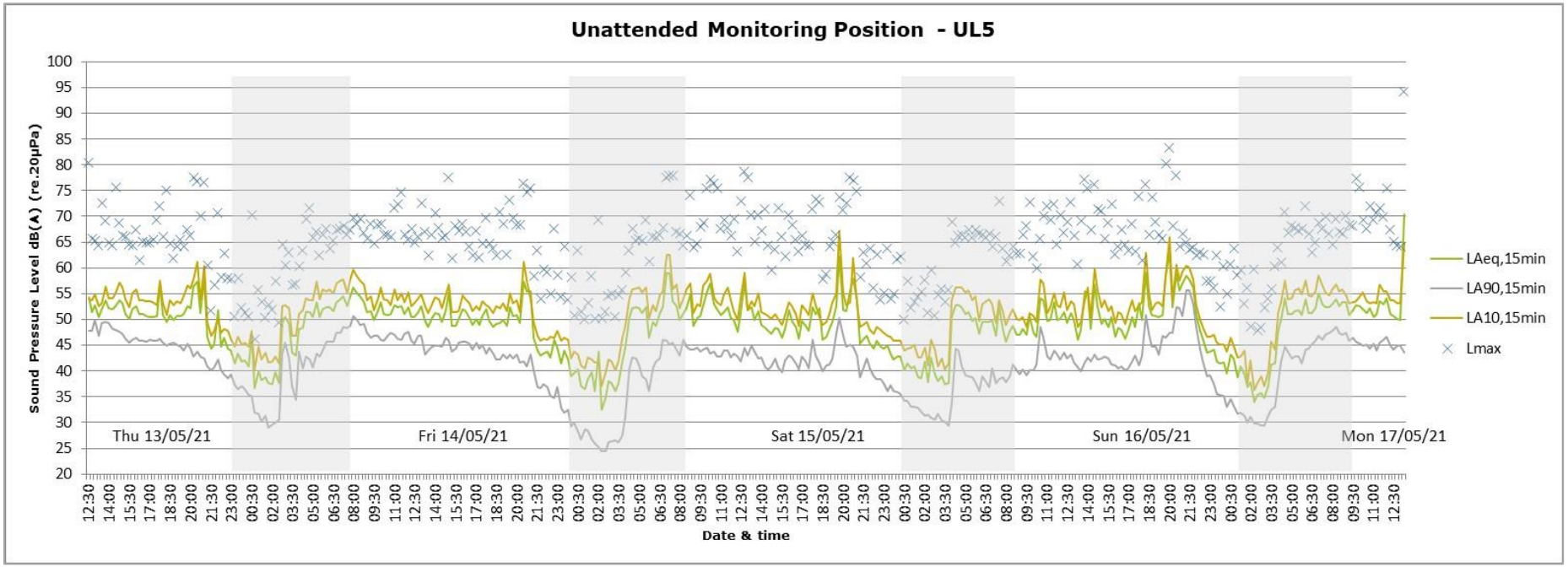

Figure A1.5 Noise survey results – position UL5 (south-east boundary)

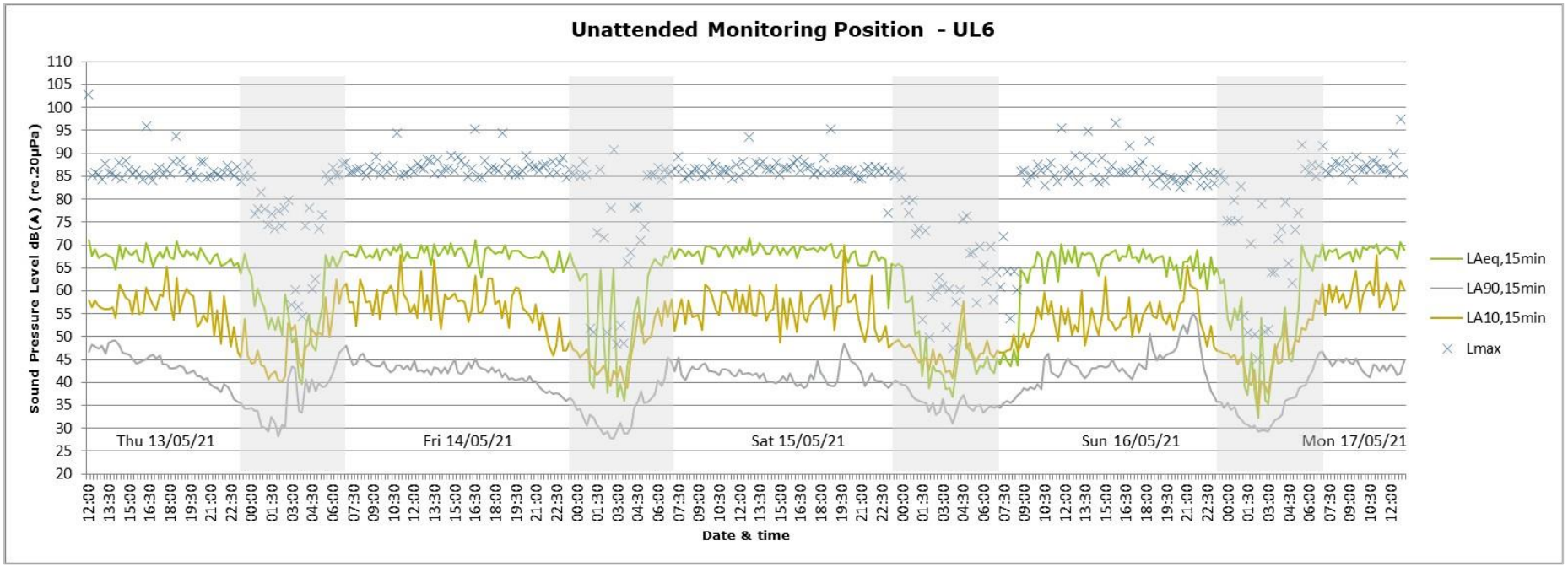

Figure A1.6 Noise survey results – position UL6 (south-west boundary)

Appendix 2 – Weather Data

Date/Time	Average Temperature / ºC	Average Wind Speed / ms^{-1}	Dominant Wind Direction	Weather Conditions
13/05/2021 1200-1800	10 – 14	4.2	E	Partly sunny
14/05/2021 0000-0600	8 – 10	3.6	NE	Passing clouds
14/05/2021 1200-1800	10 – 12	2.5	NNW	Partly sunny
15/05/2021 0000-0600	8 – 10	2.5	ESE	Passing clouds
15/05/2021 1200-1800	12 – 15	2.5	WSW	Partly sunny
16/05/2021 0000-0600	7 – 9	1.7	SW	Passing clouds
16/05/2021 1200-1800	11 – 15	4.4	SSW	Broken clouds
17/05/2021 0000-0600	10	3.1	WNW	Passing clouds

Table A2.1 Summary of weather data (13 – 17 May 2021)

Appendix 3 – Noise Contour Maps

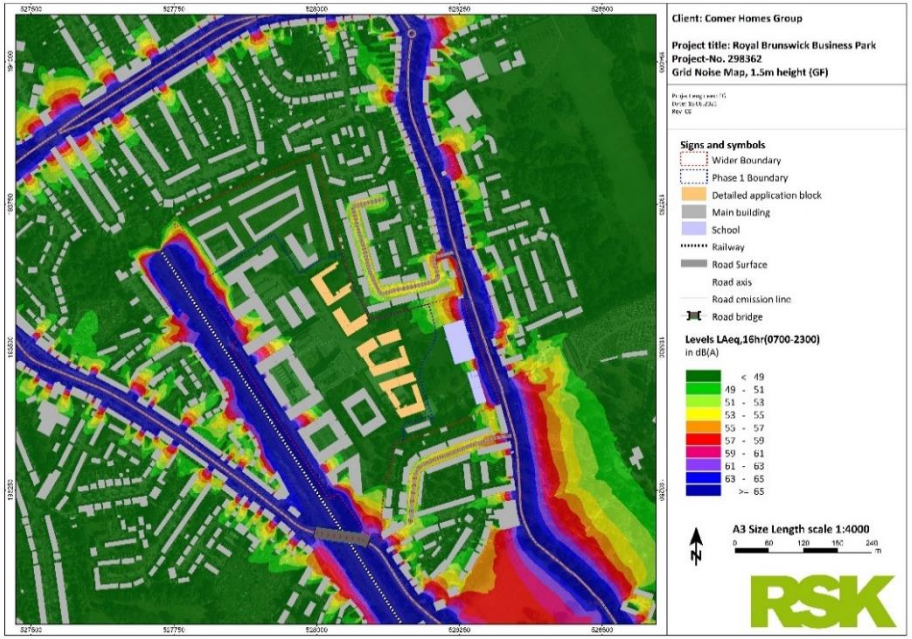

Figure A3.1 Daytime grid noise map (ground floor)

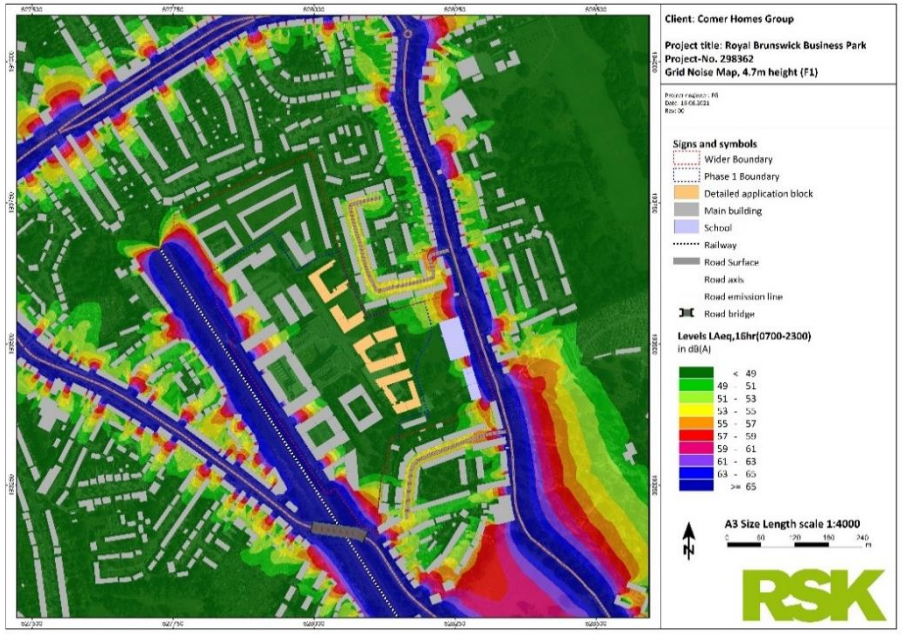

Figure A3.2 Daytime grid noise map (first floor)

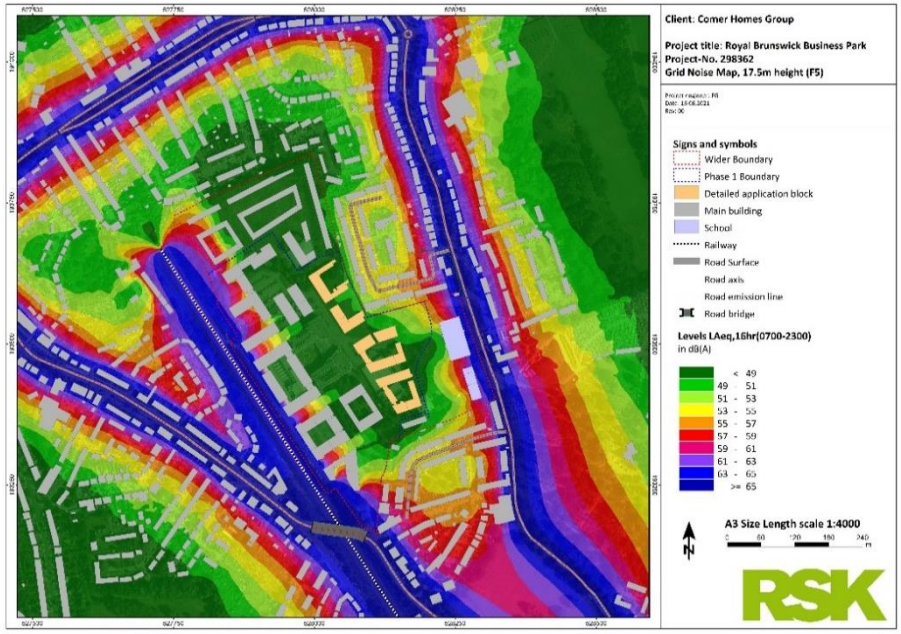

Figure A3.3 Daytime grid noise map (fifth floor)

Figure A3.4 Daytime grid noise map (tenth floor)

Figure A3.5 Night-time grid noise map (first floor)

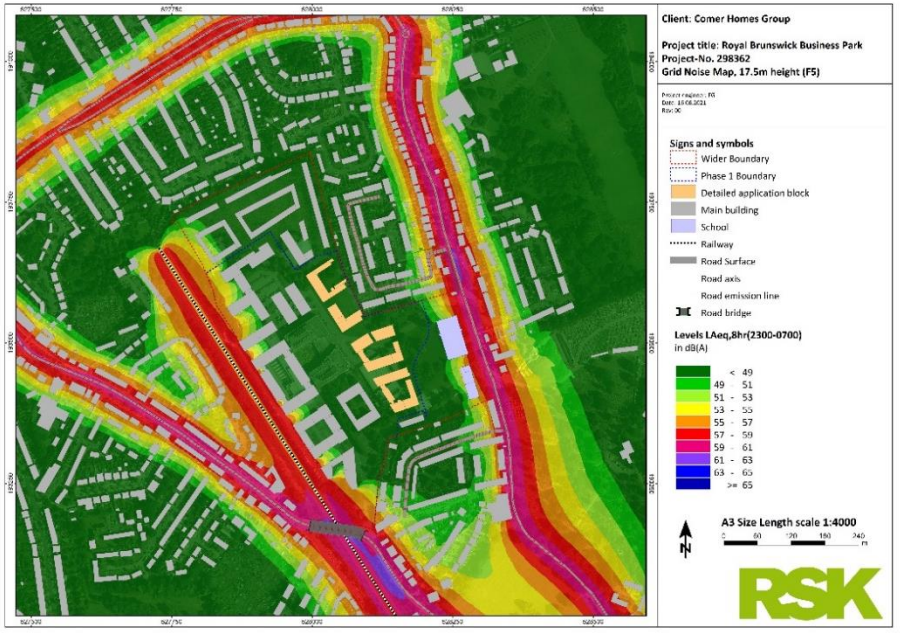

Figure A3.6 Night-time grid noise map (fifth floor)

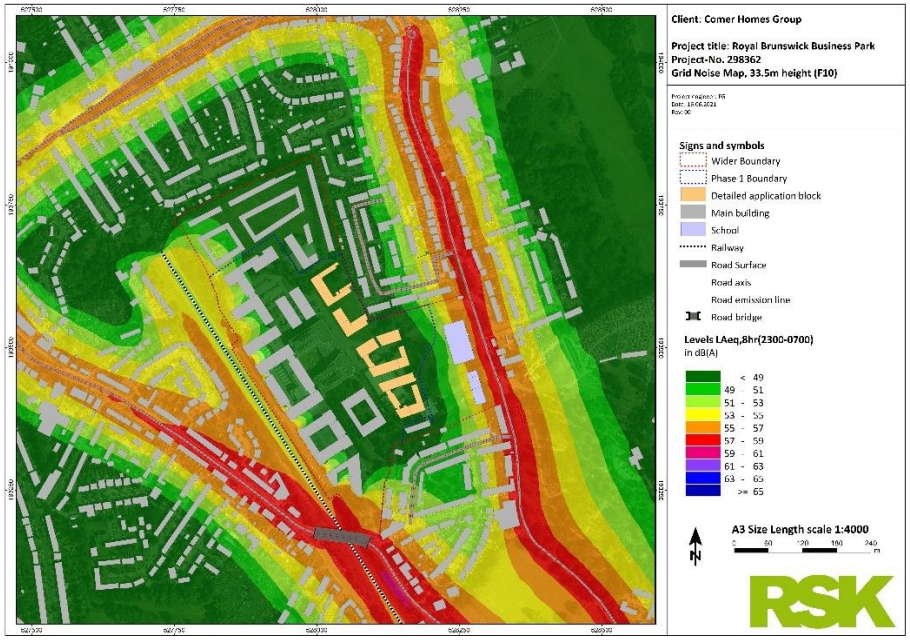

Figure A3.7 Night-time grid noise map (tenth floor)

Appendix 4 – Façade Noise Maps

Figure A4.1 Daytime facade noise map

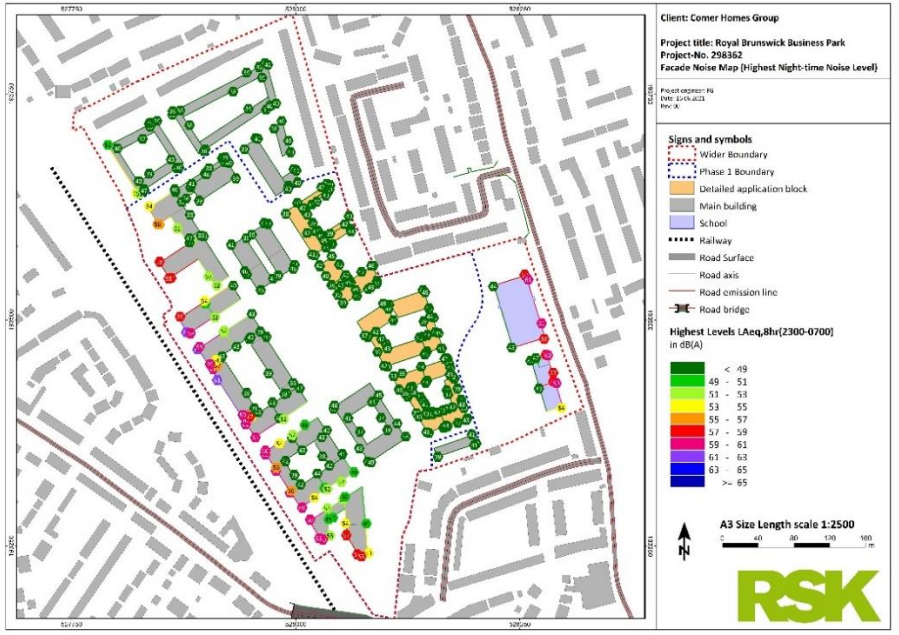

Figure A4.2 Night-time façade noise map

Appendix 5 - References

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- Noise Policy Statement for England (NPSE). DEFRA, 2010.
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- ProPG: Planning & Noise - Professional Practice Guidance on Planning & Noise, 2017.
- Acoustics Ventilation and Overheating, Residential Design Guide: 2020.
- Sport England, Artificial Grass Pitch (AGP) Acoustics, 2015.

Appendix 6 - Glossary of Acoustic Terms

dB (decibel)

Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. 2x 10-5 Pascal.

dB (A)

A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.

Time Weighting

Sound level meters use various averaging times for the measurement of RMS sound pressure level. The most commonly used are fast (0.125 s averaging time), slow (1 s averaging time) and impulse (0.035 s averaging time). Variables that are measures with time weightings are expressed as L_{AFmax} etc.

Frequency Weighting Networks

Frequency weighting networks, which are generally built into sound level meters, attenuate the signal at some frequencies and amplify it at others. The A-weighting network approximately corresponds to human frequency response to sound. Sound levels measured with the A-weighting network are expressed in dB(A). Other weighting networks also exist, such as C-weighting which is nearly linear (i.e. unweighted) and other more specialised weighting networks. Variables such as L_p and L_{eq} that can be measured using such weightings are expressed as L_{pA} / L_{pC}, L_{Aeq} / L_{Ceq} etc.

$L_{Aeq,T}$

This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{Amax}

This is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{Aeq} noise level but will still affect the noise environment.

L_N - Percentile or Statistical Levels

If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L10 is the level exceeded for 10% of the time, and the L90 is the level exceeded for 90% of the time.

L_p

Sound Pressure Level. The basic unit of sound measurement is the sound pressure level, which is measured on a logarithmic scale and expressed in decibels (dB). The logarithmic scale makes

it easier to manage the large range of audible sound pressures, and also more closely represents the way the human ear responds to differences in sound pressure.

Pre-existing ambient noise
Pre-existing ambient noise means the level of ambient noise, expressed as a level of LAeq determined with respect to the relevant time period and the relevant LAeq averaging time, prevailing one metre in front of relevant windows or doors in a façade of a dwelling, immediately before the placing of a contract for the construction.

Free-field Level
A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.

Façade Level
A sound field determined at a distance of 1 metre in front of a large sound reflecting object such as a building façade.

R_w – Weighted Sound Reduction Index
Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. Value, in decibels, of the reference curve at 500 Hz after shifting it in accordance with the method specified in this part of ISO 717.

C; C_{tr} – Spectrum Adaptation Terms
Value, in decibels, to be added to the single-number rating (e.g. Rw) to take account of the characteristics of a particular sound spectra.

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

Residual sound
Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

Specific sound source
Sound source being assessed.

L_{Ar} – Rating level
Specific sound level plus any adjustment for the characteristic features of the sound as per BS 4142:2014+A1:2019. Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level, for example: tonality, impulsivity, intermittency or other sound characteristics that are readily distinctive against the residual acoustic environment.

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