Hillingdon Hospital Noise and Vibration Assessment

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
0	24/02/2022	Issue	YL	Yuyou Liu	Regional Director, Acoustics
1	03/03/2022	Amended to respond to comments from Savills	YL	Yuyou Liu	Regional Director, Acoustics
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1. Introduction

1.1 AECOM were commissioned by the Hillingdon Hospital's NHS Foundation to undertake a noise assessment to support a planning application for demolition of existing buildings and redevelopment of the site to provide the new Hillingdon Hospital, multi-storey car park and mobility hub, vehicle access, highways works, associated plant, generators, substation, new internal roads, landscaping and public open space, utilities, servicing area, surface car park/ expansion space, and other works incidental to the proposed development.

1.2 A noise survey was undertaken to obtain representative baseline noise data at the Site and nearby sensitive receptors. Unattended noise monitoring was carried out from 26th February 2021 to 5th March 2021 at three locations and attended noise monitoring was carried out at one location on the 26th February 2021. Additional unattended noise monitoring was carried out at one location from 16th to 22nd March 2022.

1.3 This report includes assessments of resulting noise and vibration levels at the nearest sensitive receptors from:

- Construction noise and vibration (including construction traffic on public roads); and
- Operational noise (including building services and site traffic on public roads).

1.4 An assessment of the suitability of the proposed site for the redevelopment has also been undertaken with preliminary recommendations provided for the sound reduction performance of the external façade.

1.5 A glossary of acoustic terminology can be found in Appendix A

2. Site Description

2.1 Hillingdon Hospital is located to the south of Pield Heath Road, bound by Royal Lane to the west, and Colham Green Road to the east. The site is located within the Brunel Ward. The site comprises a ten storey block built in the 1960s and a mix of other hospital buildings scattered across the site. Many of the acute beds are in single storey wards built in the 1940s, which are in very poor condition.

2.2 The remainder of the site consists mainly of surface level car parking, interspersed with pockets of landscaping. Hillingdon Hospital is located within the urban area of Hillingdon and is not subject to any designations such as Green Belt or site allocations. It is not within a conservation area.

2.3 The site is located within Flood Risk Zone 1. There are two Tree Preservation Order (TPO) within the site: one south of The Furze and the second is west of the Woodlands Centre. A culvert runs west-east crossing both TPO's and being canalised under the service road and partially under the Woodlands Centre. On the east of the Site is a Grade II Listed Building, The Furze.

2.4 There are several points of access to the site; the main entrance is from Pield Heath Road with a separate access for A&E. There are three separate access points from Royal Lane and a separate access from Colham Green Road. Cycle access is only through the vehicular traffic road path. The site has a PTAL rating of 3. There are three bus stops on Pield Heath Road with links to Uxbridge, Heathrow Central and Hayes Town. Uxbridge town centre is approximately 2km to the north west.

2.5 To the west of the site along Royal Lane comprises two storey detached and semi-detached residential properties, to the north west corner of the site lies a three storey flatted residential block rising to four storeys along Pield Health Road opposite the entrance to the Outpatient Department.

2.6 The nearest sensitive receptors are the residential developments to the north, south and west, and the existing hospital that will be to the east of the proposed new building. The Site layout is illustrated in Figure 2-1.

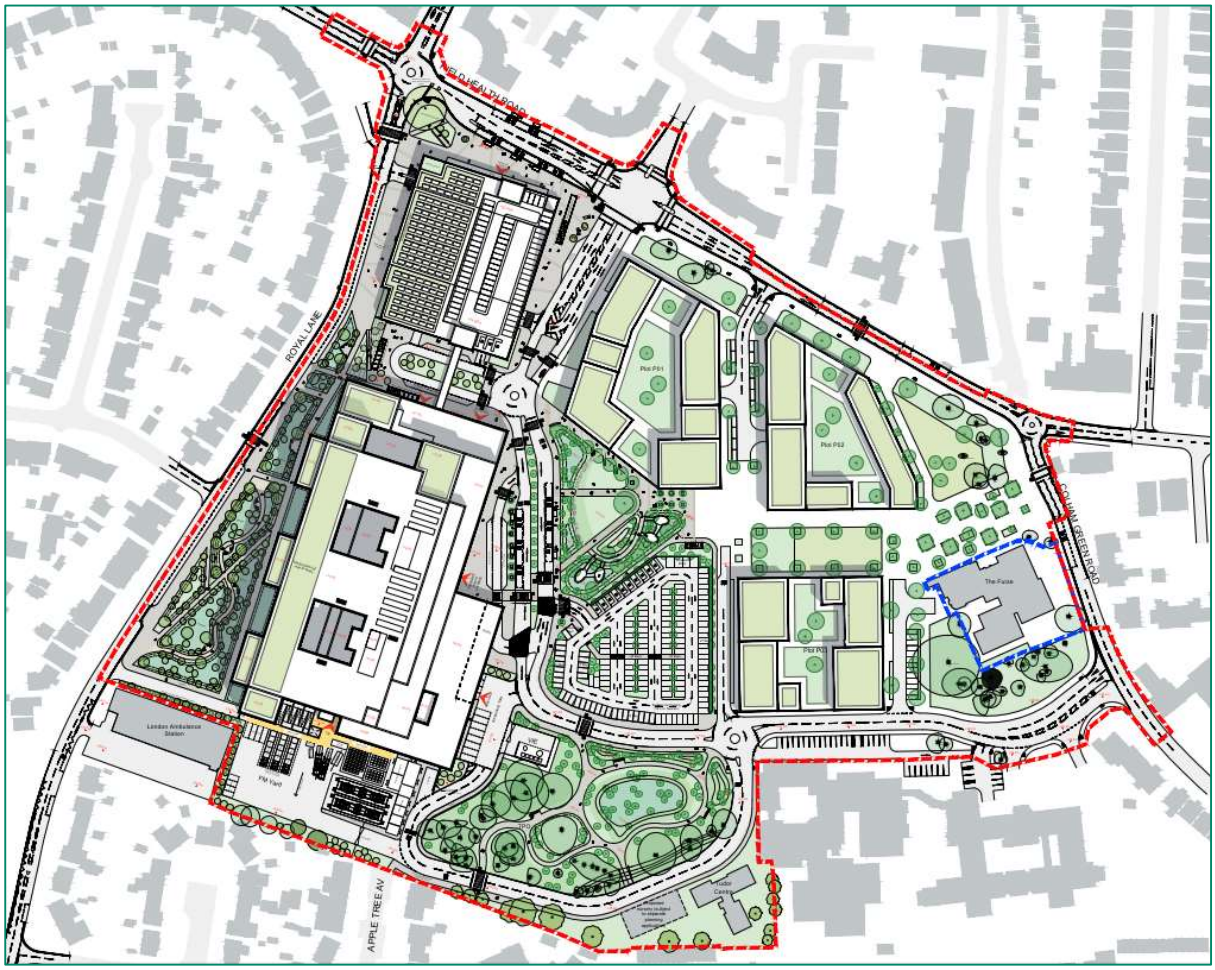

Figure 2-1 Site Layout

3. Planning Policy Context

National Policy

National Planning Policy Framework (2021)

3.1 The revised National Planning Policy Framework (NPPF) (Ref 1) was published in July 2021 and sets out the government's planning policies for England and how these are expected to be applied. In respect of noise and vibration, the NPPF states in paragraph 174 that:

"planning policies and decisions should contribute to and enhance the natural and local environment by:…

preventing new and existing development from contributing to, being put at unacceptable risk from, 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…"

3.2 Paragraph 185 also relates to noise through the following statement:

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

mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;… [and]

identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason".

Noise Policy Statement for England (2010)

3.3 The Noise Policy Statement for England (NPSE) (Ref 2) seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

3.4 The NPSE sets out the long-term vision of the government's noise policy, which is to "promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development".

3.5 This long-term vision is supported by three aims:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *"Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvements of health and quality of life."*

3.6 The 'Explanatory Note' within the NPSE provides further guidance on defining 'significant adverse effects' and 'adverse effects' using the concepts:

- No Observed Effect Level (NOEL) - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) - the level above which significant adverse effects on health and quality of life occur.

3.7 With reference to the SOAEL, the NPSE states:

"It is recognised that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

3.8 For situations where noise levels are between the LOAEL and SOAEL, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur.

Planning Practice Guidance: Noise (2019)

3.9 The Planning Practice Guidance: Noise (PPGN) (Ref 3) was last updated in July 2019. It is a web-based resource that and references both the NPPF and NPSE. It defines when noise is relevant to planning stating: "Noise needs to be considered when new developments may create additional noise, or would be sensitive to the prevailing acoustic environment".

3.10 The PPG states that local planning authorities should take account of the acoustic environment and in doing so consider:

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

Regional Policy

The London Plan- the Spatial Development Strategy for Greater London (2021)

3.11 The London Plan March 2021 (Ref 4) sets a framework for development of London over the next 20-25 years. With regards to noise, Policy D14 provides requirements on how noise from new developments may be managed to improve health and quality of life:

i. *"avoiding significant adverse noise impacts on health and quality of life*

ii. *reflecting the Agent of Change principle as set out in Policy D13 Agent of Change*

iii. *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*

iv. *improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity*

v. *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*

vi. *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*

vii. *promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver".*

3.12 Policy D13 Agent of Change Principle places the responsibility for mitigating noise impacts on the proposed new noise-sensitive development. The aim of this policy is to protect businesses and activities that generate noise from being impacted by new noise sensitive developments. Development proposals should manage noise and other potential nuisances by:

i. *"ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area*

ii. *exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations*

iii. *separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures".*

Local Policy

Hillingdon Local Plan: Part 1, Strategic Policies (2012)

3.13 The Hillingdon Council Local Plan Part 1 (Ref 5) sets out a framework and detailed policies to guide planning decisions and is the starting point for considering whether planning applications should be approved.

3.14 Policy EM8 of the Local Plan states that a "The Council will seek to ensure that noise sensitive development and noise generating development are only permitted if noise impacts can be adequately controlled and mitigated."

Hillingdon Local Plan: Part 2, Development Management Policies (2020)

3.15 The Hillingdon Council Local Plan Part 2 (Ref 6) provides detailed policies that will form the basis of the Councils decisions on individual planning applications.

3.16 Policy DMT 1: Managing Transport Impacts states that "In order for developments to be acceptable they are required to have no significant adverse transport or associated air quality and noise impacts on the local and wider environment, particularly on the strategic road network."

3.17 Policy DMT 2: Highways Impacts states that "development proposals must ensure that they do not contribute to the deterioration of air quality, noise or local amenity or safety of all road users and residents."

London Borough of Hillingdon – Noise Supplementary Planning Document. Noise (2006)

3.18 The Hillingdon Noise Supplementary Planning Document (SPD) on Noise (Ref 7) contains detailed technical advice on noise issues. With regards to plant noise from industrial uses affecting residential areas, it is recommended that '*the development should be controlled such that the rating level of the noise from the proposed development determined according to BS4142 is at least 5dB below the background noise level LA90,T. Ideally, the assessment of noise should give a positive indication that complaints are unlikely*.'

London Boroughs of Hillingdon; Hounslow; Richmond upon Thames – Development Control for Noise Generating and Noise Sensitive Development (2016)

3.19 The Supplementary Planning Document (SPD) has been produced by the three London Boroughs of Richmond Upon Thames, Hounslow and Hillingdon (Ref 8) in order to address common noise issues affecting all three Boroughs and assist in providing a consistent approach to development where noise is an issue.

3.20 Part 2 of the SPD deals with the technical aspects of acoustic design and contains details on requirements relating to design criteria for noise sensitive and noise generating developments.

3.21 The document makes reference to hospitals being noise sensitive developments and recommends that the hospital acoustic design is in line with the requirements contained in Health Technical Memorandum 08-01.

3.22 To control the impact of sound from an industrial and/or commercial nature, the SPD requires an assessment of noise in line with the methodology given in BS4142:2014. As a general rule, a rating level that is at least 5dB(A) below the background noise level LA90 should be achieved.

Other Relevant Standards and Guidance

British Standard 7445-1:2003

3.23 BS: 7445 'Description and Measurement of Environmental Noise. Part 1 – Guide to Quantities and Procedures' (Ref 9) defines the parameters, procedures and instrumentation requirements for noise measurement and analysis.

British Standard 5228:2009+A1:2014

3.24 BS 5228-1 'Code of practice for noise and vibration control on construction and open sites' (Ref 10) provides a 'best practice' guide for noise control and includes sound power level (Lw) data for individual plant as well as a calculation method for noise from construction activities.

Calculation of Road Traffic Noise (1998)

3.25 The Department of Transport/Welsh Office Memorandum 'Calculation of Road Traffic Noise' (CRTN) (Ref 11) describes procedures for traffic noise calculation and is suitable for environmental assessments of schemes where road traffic may have an effect.

Design Manual for Roads and Bridges (2020)

3.26 The Highways Agency's Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA 111 Noise and Vibration (DMRB) (Ref 12) This document sets out the requirements for assessing and reporting the effects of highways noise and vibration from construction, operation and maintenance projects.

Health Technical Memorandum 08-01: Acoustics

3.27 The Department of Health's (DoH) 'Health Technical Memorandum 08-01: Acoustics' (HTM 08-01) (Ref 13) provides information on the acoustic requirements for healthcare facilities.

4. Assessment Methodology

Baseline Noise Monitoring Methodology

4.1 Baseline noise monitoring was carried out to establish the existing noise climate in the area. The monitoring procedures followed guidance from BS 7445-2 1991 'Description and Measurement of Environmental Noise'.

4.2 Unattended noise monitoring equipment was set up at four locations surrounding the proposed development. Continuous measurements were undertaken at LT1-LT3 between 26th February 2021 and 5th March 2021 and LT4 between 16th March 2022 and 22nd March 2022 to establish ambient noise levels during daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods. Attended noise monitoring equipment was set up at one location to establish the daytime ambient noise levels to the north of the site. The sound level meters were field calibrated with an acoustic calibrator both prior to commencement and after completion of the noise measurements.

4.3 Noise monitoring locations are presented in Figure 4-1 and described in Table 4-1.

Table 4-1 Noise Monitoring Locations

Monitoring Location	Measurement Type	Description	GPS coordinates
LT1	Unattended	Signpost in close proximity to a staff only entrance on the western boundary of the site, across Royal Lane.	51.525980, -0.463628
LT2	Unattended	Carpark north of LT4, in close proximity to the new proposed A&E entrance.	51.5244888, -0.4633147
LT3	Unattended	Lamppost at the southern boundary carpark of the site.	51.5255658, -0.4628487
LT4	Unattended	Groundskeepers compound at the southern boundary of site adjacent to the ambulance station.	51.524430, -0.464198
ST1	Attended	Signpost on the north-western boundary of the site, at the intersection of Royal Lane and Piled Heath Road.	51.527138, -0.462565

Methodology for Determining Sensitive Receptors

4.4 Potential sensitive receptors (i.e. buildings whose occupants may be disturbed by adverse noise and vibration levels, and structures that are sensitive to vibration) have been taken into consideration when

assessing the effects associated with noise and vibration levels from the construction and operational phases of the Proposed Development.

4.5 The effect of noise and vibration generated during the construction and operational phases of the Proposed Development has been considered at nearby sensitive receptors. A number of receptors that may potentially be affected have been considered in this assessment, which are the nearest receptors to the Site, i.e. the receptors that will experience the highest levels of noise and vibration. Although noise and vibration may be perceivable at other receptors in the area around the Proposed Development, effects will not be significant if they are suitably controlled at the identified receptors.

4.6 The identified sensitive receptors are shown in Figure 4-1.

Figure 4-1 Noise Monitoring Locations and Sensitive Receptor Locations

Methodology for Determining the Suitability of the Site for Development

Ambient Noise – Noise within the Proposed Development

4.7 External facades of the Proposed Development will be designed to provide suitable internal noise conditions in accordance with Health Technical Memorandum (HTM) 08-01: Acoustics. HTM 08-01 sets limits for noise levels in internal spaces as a result of intrusion from external noise sources through the building envelope. The information from HTM 08-01 is reproduced below.

Table 4-2 HTM 08-01 Criteria for internal noise levels from external sources

Room Type	Example	Criteria
Ward – single person	Single bed ward, single bed recovery areas and on-call room, relatives' overnight stay	40dB $L_{Aeq,1hr}$ day-time 35dB $L_{Aeq,1hr}$ night 45dB L_{AFmax} night
Ward – multi-bed	Multi-bed wards, recovery areas	45dB $L_{Aeq,1hr}$ day-time 35dB $L_{Aeq,1hr}$ night 45dB L_{AFmax} night
Small office-type spaces	Private offices, small treatment rooms, interview rooms, consulting rooms	40dB $L_{Aeq,1hr}$
Open clinical areas	A&E	45dB $L_{Aeq,1hr}$
Circulation spaces	Corridors, hospital street, atria	55dB $L_{Aeq,1hr}$
Public areas	Dining area, waiting areas, playrooms	50dB $L_{Aeq,1hr}$
Personal hygiene (en-suite)	Toilets, showers	45dB $L_{Aeq,1hr}$
Personal hygiene (public and staff)	Toilets, showers	55dB $L_{Aeq,1hr}$
Small food preparation areas	Ward kitchens	50dB $L_{Aeq,1hr}$
Large food preparation areas	Main kitchens	55dB $L_{Aeq,1hr}$
Large meeting rooms (> 35 m^2 floor area)	Lecture theatre, meeting rooms, board rooms, seminar rooms, classrooms	35dB $L_{Aeq,1hr}$
Small meeting rooms (≤ 35 m^2 floor area)	Meeting rooms, board rooms, seminar rooms, classrooms	40dB $L_{Aeq,1hr}$
Operating theatres	Operating theatres	40dB $L_{Aeq,1hr}$ 50dB L_{AFmax}
Laboratories	Laboratories	45dB $L_{Aeq,1hr}$

Source: HTM 08-01 Table 1

Notes:

2. *Night is defined as the hours between 23:00 and 07:00.*
3. *A $L_{Amax,f}$ limit for short-term events is included for sleeping areas and operating theatres. The intention is that this should apply to events that occur several times during the night (for example passing trains) rather than sporadic events.*
4. *Where windows have trickle vents, the criteria would normally apply with the windows closed but trickle vents open. If natural ventilation is provided by means other than trickle vents, the acoustic criteria are to be achieved while the required amount of ventilation is supplied.*
5. *To achieve the acoustic criteria on noisy sites, acoustically treated trickle vents or mechanical ventilation may be required. Sealed façades may be necessary for the noisiest sites. The acoustic adviser should liaise with the services designer to establish what constitutes the required amount of ventilation, the size of trickle vents, and the acoustic implications of natural ventilation.*
6. *Noise from a service yard and other similar activities should be designed not to disturb noise-sensitive accommodation or noise-sensitive receptors outside the site. Where possible, the service yard should be kept away from accommodation, and canopies and other acoustic screening methods should be considered. Without these, it is unlikely that noise-sensitive rooms overlooking a service yard can use trickle vents or openable windows for ventilation. A sealed façade and mechanical ventilation are therefore likely to be required in these locations.*

7. *The intrusive noise criteria do not include plant noise from adjacent hospital buildings. This should be considered as mechanical-service noise.*

4.8 In addition to the requirements above, HTM 08-01 also requires that noise generated by rain impact on roofs is controlled so that it doesn't exceed the levels given in Table 4-2 by more than 20dB or should not be more than 65dB during "heavy" rainfall (as defined in BS EN ISO 140-18), whichever is the lower.

Methodology for Determining Construction and Operational Effects

Methodology for Determining Construction Noise Effects

4.9 The construction programme is at an early stage of development and detailed information is not yet available. To assess potential noise impacts due to construction activities, periods (i.e. discrete 'snapshots' of construction activities occurring) have been selected from the construction programme that are considered representative of the highest noise-generating periods (representing a worst case).

4.10 The construction phases identified to represent the likely highest levels of noise emissions are during the demolition, basement excavation, piling and sub-structure works.

4.11 Specific details of the construction works associated with the Proposed Development will be available once a contractor has been appointed and the detailed construction methodology has been prepared. Therefore, at this stage, representative construction activities and reasonable worst-case assumptions, including the likely type of construction plant, have been assumed based on AECOM's experience of approaches to construction activities for similar projects for the construction phases identified above.

4.12 For the purposes of assessing noise from construction activities, Sound Power Level (Lw) values for plant and equipment likely to be used during those construction phases have been sourced from BS 5228-1. Noise predictions of construction activities have been undertaken based on the methodology described in BS 5228-1. A list of indicative plant considered likely to be used during the demolition basement excavation, piling and sub-structure works is presented in Appendix C.

4.13 BS 5228-1 provides practical information on noise and vibration reduction measures during construction works and promotes a Best Practicable Means (BPM) approach to control noise and vibration. The calculation method provided in BS 5228-1 is based on the number and type of equipment operating, their associated Sound Power Level (Lw), and the distance between the equipment being used and the sensitive receptors.

4.14 Criteria for assessing construction noise effects are presented in Table 4-3 and have been defined with reference to 'example method 1 – the ABC method' as defined in BS 5228-1. Category A criteria in the ABC method are interpreted as LOAEL and Category C criteria are considered equivalent to SOAEL. These criteria have been applied in commercial and residential developments throughout London as well as nationally significant infrastructure projects and therefore, are considered appropriate for this assessment.

Table 4-3: Construction Noise Criteria

Time Periods	Threshold Value ($L_{Aeq,T}$ dB)	
	LOAEL	SOAEL
Day (07:00 – 19:00) Saturday (07:00 – 13:00)	65	75
Weekends (13.00–23.00 Saturdays and 07.00–23.00 Sundays) Evening (19.00 – 23.00)	55	65
Night (23.00 – 07.00)	45	55

The values apply to a location one metre from a residential building façade containing a window, ignoring the effect of the acoustic reflection from that façade.

4.15 Although a significant effect due to construction activities may be determined through an assessment based on exceedances of the defined SOAELs for construction noise and vibration, additional

consideration of the significance of the effect for temporary construction activities is given through qualitative discussion of the following:

- Duration of activities;
- Frequency of events; and
- Sensitivity of receptor.

Construction Works Vibration

4.16 Although the piling methodology has not been finalised, it is assumed that an auger piling method will be adopted for the structural piles. Table 4-4 provides Peak Particle Velocity (PPV) levels for different piling activities at various distances from piling locations which are sourced from BS 5228-2. The vibration effect depends on the type of piling, ground conditions, and receptor distance from the vibration source.

Table 4-4: Sample Construction Vibration Levels

PPV Level	Effect	Approximate Distance to Receptor
0.14 to < 0.3 mm/s	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.	> 20 m
0.3 to < 1 mm/s	Vibration might be just perceptible in residential environments.	10 to 20 m
1.0 to < 10 mm/s	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.	5 to 10 m

4.17 When defining assessment criteria, reference has been made to BS 5228 2, which provides descriptions of the impact of vibration in terms PPV on human receptors. For residential receptors, the LOAEL has been defined as a vibration dose value of 0.3 mm/s (millimetres per second), this being the point at which construction vibration is likely to become perceptible. The SOAEL has been defined as a vibration dose value of 1.0 mm/s, this being the level at which construction vibration can be tolerated with prior warning.

4.18 In addition to human annoyance, building structures may be damaged by high levels of vibration. The levels of vibration that may cause building damage are far in excess of those that may cause annoyance. Consequently, if vibration levels are controlled to below those which would result in human annoyance then it is highly unlikely that buildings will be damaged by vibration from demolition and construction activities.

Construction Traffic Noise

4.19 Road traffic noise levels have been calculated with reference to the methodology within the CRTN which contains an equation for the calculation of the Basic Noise Level (BNL) from a road in terms of the 18-hour AAWT (Average Annual Weekday Traffic) flow from 06:00 to 24:00.

4.20 The magnitude of a noise impact due to changes in road traffic noise levels has been assessed with reference to criteria outlined in the DMRB. The criteria used for the assessment of changes in road traffic noise levels arising from construction works have been taken from Table 3.54a of the DMRB and are provided in Table 4-5.

Table 4-5: Road Traffic Noise Assessment Criteria

Magnitude of impact	Increase in BNL (dB)
Negligible	Less than 1.0
Minor	Greater than or equal to 1.0 and less than 3.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Major	Greater than or equal to 5.0

4.21 The DMRB also defines the LOAEL as 55dB LA10,18h and the SOAEL as 68dB LA10,18h[1]. The DRMB goes on to state that:

"Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0dB or over results in a likely significant effect".

4.22 This implies that receptors experiencing noise levels exceeding the SOAEL are more sensitive to smaller changes in noise than receptors experiencing absolute noise levels below the SOAEL. As the BNL is calculated at 10m from the roadside, the absolute noise level is not considered to be representative of the noise levels that nearby receptors may experience; however, the BNL is appropriate for defining a change in noise level. Should an increase in noise of greater than 1dB be identified from a road where the BNL exceeds the SOAEL, additional calculations are undertaken to identify the absolute noise levels at nearby receptors and the likelihood of significant effects.

Methodology for Determining Operational Effects

Road Traffic Noise

4.23 Operational road traffic noise has been assessed by considering the change in traffic flows during the Proposed Development assessment scenarios with reference to both the CRTN and DMRB. At the selected road traffic noise receptors, the magnitude of the predicted change in noise levels uses the criteria which are based on the current guidance on short-term changes (upon opening) in traffic noise levels in the DMRB, as presented in Table 4-5.

4.24 Road traffic flows for the following scenarios are presented in Appendix D:

- Scenario 1 – 2025 Future Baseline; and
- Scenario 2 – 2025 Future Baseline with proposed Development.

Building Services Plant Noise

4.25 BS 4142 provides a means of assessing the significance of building services and plant noise. A key aspect of the BS 4142 assessment procedure is a comparison between the background noise level in the vicinity of residential locations and the rating level of the noise source under consideration. The relevant parameters in this instance are as follows:

- Background Sound Level, $L_{A90,T}$, defined in the Standard as the 'A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels';
- Specific Sound Level, $L_{Aeq,Tr}$,the 'equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr'; and
- Rating Level, $L_{Ar,Tr}$, the specific sound level plus any adjustment made for the characteristic features of the sound'.

4.26 BS 4142 recommends that the specified interval over which the specific sound level is determined as 1 hour during the day from 07:00 to 23:00 hours and a shorter period of 15 minutes at night from 23:00 to 07:00 hours.

4.27 The standard recognises that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:

- Tonality - a penalty of 2dB is applied for a tone which is just perceptible at the receptor, 4dB where it is clearly perceptible and 6dB where it is highly perceptible;

[1] LOAEL and SOAEL for the daytime period are calculated from DMRB LA10,18h values by applying a correction of -3 dB to convert from the façade level to a free-field level and by applying a further correction of -2 dB to convert from LA10,18h to LAeq,16h.

- Impulsivity - a penalty of 3dB is applied for impulsivity which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;
- Intermittency - a penalty of 3dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions;
- Other sound characteristics - a penalty of 3dB can be applied where the specific sound features characteristics that are neither tonal nor impulsive but are readily distinctive against the residual acoustic environment.

4.28 Once any adjustments have been made, the background level and the rating levels are compared. BS 4142 advises the following;

a. *Typically, the greater the difference, the greater the magnitude of impact.*

b. *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.*

c. *A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.*

d. *The lower the rating level is to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context.*

4.29 Supplementary Planning Document - Noise of the London Borough of Hillingdon (Ref 7) and Supplementary Planning Document – Development Control for Noise Generating and Noise Sensitive Development of London Boroughs of: Hillingdon; Hounslow and Richmond upon Thames (Ref 8) advises the criterion for fixed plant rating noise level at 5dB below the background noise level.

4.30 With reference to the two the documents referred to above, the LOAEL is defined in this assessment as where there rating level is 5dB below the background level, and the SOAEL as where the rating level is 10dB greater than the background level.

4.31 Buildings to the east of the Proposed Development are hospital and healthcare buildings of the existing Hillingdon Hospital. Consequently, guidance in HTM 08-01, which provides design guidance on acoustic standards and requirements to be achieved at healthcare and hospital facilities, has been referenced.

4.32 HTM 08-01 provides guidance on external noise emissions to receptors off the hospital site and also external areas of the hospital and states that the following should apply with the most stringent taking precedence:

- *"Noise levels at the site boundary should meet reasonable standards required by the local authority or other relevant body;*
- *Noise outside the buildings should be controlled to allow the internal noise criteria to be achieved; and*
- *Open external areas should be protected. Noise from services should not exceed the existing day-time background noise level or 50 dB L_{A90}, whichever is the higher. This limit should be achieved in any areas normally occupied by staff (except maintenance staff, notwithstanding the requirements of the Control of Noise at Work Regulations 2005) or the public (for example open courtyards and accessible landscaped areas)".*

4.33 It is not known whether noise intrusion at the existing buildings, as a result of the external ambient noise levels, is within the requirements of HTM 08-01. In order that the Proposed Development does not impact the existing hospital buildings, the Proposed Development should not result in an increase in the external ambient noise levels outside these existing hospital buildings. To achieve this, the noise levels from the Proposed Development should be at least 10dB below the existing ambient noise levels outside these hospital buildings.

Limitations and Assumptions

4.34 A series of assumptions were made regarding some elements of existing noise sources that have the potential to affect noise levels at the Proposed Development.

4.35 To assess the potential noise and vibration effect of the Proposed Development, it was necessary to determine the baseline conditions. It is considered that the baseline noise levels have been appropriately defined using noise survey data logged at the Site from 26th February to 5th March 2021. Consequently, noise data presented in this report are considered representative of the typical noise environment of the Proposed Development.

4.36 Traffic patterns, operation and frequency have been affected by the COVID-19 outbreak in the UK. With regards to the noise data presented in this report, the absolute level of the dominant noise sources has not changed; however, the frequency of occurrence of the noise sources has reduced, for instance, traffic flow around the UK has decreased significantly since the UK lockdown was implemented as less cars are on the roads due to an 'essential travel only' scheme. In considering the effect of Covid-19 on the assessment, it is likely the measured ambient and background noise levels are lower than would be typical; therefore, assessment criteria based on measured $L_{Aeq,T}$ ambient and $L_{A90,T}$ background noise levels is likely to be lower than what may be expected during normality. As such, the assessment may be taken to represent a conservative worst-case then would be usual and thus is considered to be robust.

4.37 Construction noise predictions have been undertaken using typical items of equipment that are used in these types of developments (details are provided in Appendix C). These items of plant are taken to be representative of the equipment that will be used during construction of the Proposed Development. Noise predictions were carried out to represent a conservative scenario where construction plant is operational at the closest distance to each sensitive receptor. Consequently, the noise predictions may overestimate construction noise levels and can therefore be considered as worst case.

4.38 The measured $L_{A90,T}$ background noise level has been used to define design criteria for fixed plant associated with the Proposed Development. Background noise levels may change in the period between the survey and the future assessment years; however, as the $L_{A90,T}$ background noise level is a statistical value based on a range of measured noise data, it is not possible to predict future background noise levels with any degree of accuracy. It is considered that background noise levels are unlikely to reduce in the intervening period between the 2021 baseline survey and the 2025 assessment year due to the ongoing development of areas surrounding the Proposed Development. Consequently, it is considered that the derived design criteria provide suitable noise thresholds to ensure that noise effects from future building services plant are negligible.

5. Baseline Conditions

Noise Monitoring Results

5.1 A summary of baseline noise measurements is presented in Table 5-1 and Table 5-2. Full details of the noise survey and measurements are presented in Appendix B. This data is considered representative of typical baseline noise conditions at the Site.

Table 5-1: Unattended Noise Monitoring Results

Location	Daytime			Night-time		
	Ambient $L_{Aeq,16h}$ dB[1]	Typical Background $L_{A90,1h}$ dB[2]	Average $L_{A10,18h}$ dB[3]	Ambient $L_{Aeq,8h}$ dB[4]	Typical Background $L_{A90,1h}$ dB[5]	Typical L_{AFmax} dB[6]
LT1	64	50	66	56	41	79
LT2	62	44	54	49	39	73
LT3	51	45	51	45	39	60
LT4	52	47	53	50	45	67

1 Logarithmic average of the ambient noise measurement (07:00 – 23:00)

2 Mode of the $L_{A90,1h}$ (07:00 – 23:00)
3 Arithmetic average of the LA10 (06:00 – 00:00)
4 Logarithmic average of the ambient noise measurement (23:00 – 07:00)
5 Mode of the $L_{A90,1h}$ (23:00 – 07:00)
6 Typical L_{AFmax} is calculated as the 10th percentile (23:00 – 07:00)

Table 5-2: Attended Noise Monitoring Results

Location	Date/ Time	Duration	Average Sound Level $L_{Aeq,T}$ dB	Background Noise Level $L_{A90,T}$ dB	Maximum Sound Level L_{AFmax} dB
ST1	26/02/2021 12:25-14:25	2 hours	66	58	90

Noise Sensitive Receptors

5.2 The nearest existing noise sensitive receptors to the Proposed Development have been selected for the assessment. The receptors identified are listed in Table 5-3 with the locations illustrated in Figure 4-1. Each sensitive receptor was assigned a measurement location for the purposes of the assessment and appropriate noise level data have been applied at each receptor location for assessment purposes.

Table 5-3: Noise and Vibration Sensitive Residential Receptors

Receptor Group	Description	Receptor Type
R1	Properties along the western boundary of the site along Royal Lane	Residential
R2	Properties along the northern boundary of the site on Pield Heath Road	Residential
R3	Properties along the southern boundary of the site on Royal Lane and Bryony Close	Residential
R4	Existing hospital to the east of proposed hospital building	Hospital
R5	Meadow Special School to the south west of the site	School

6. Assessment of Noise and Vibration Effects

Introduction

6.1 This section presents the results of the assessment of effects to sensitive receptors associated with noise and vibration arising from the construction activities and on completion and occupation of the Proposed Development. Potential vibration effects have been considered during the construction phase of the Proposed Development only, since the Proposed Development will not include any significant vibration sources once it is complete and occupied.

Assessment of the Suitability of the Site for Development

6.2 To achieve the HTM 08-01 internal ambient noise levels detailed in Table 4-2, external noise ingress must be controlled by the building envelope.

6.3 Results of the baseline noise monitoring on site were used to determine representative external noise levels on the different facades of the proposed hospital building; see Table 6-1 and Figure 6-1.

Table 6-1: Unattended Noise Monitoring Results

Facade		Daytime		Night-time	
		Ambient $L_{Aeq,1h}$ dB	Typical L_{AFmax} dB	Ambient $L_{Aeq,1h}$ dB	Typical L_{AFmax} dB
	Royal Lane Western and Northern elevations towards Royal Lane	64	82	56	79
	Southern and Northern elevations away from Royal Lane	62	79	49	73
	Eastern elevations	51	69	45	60

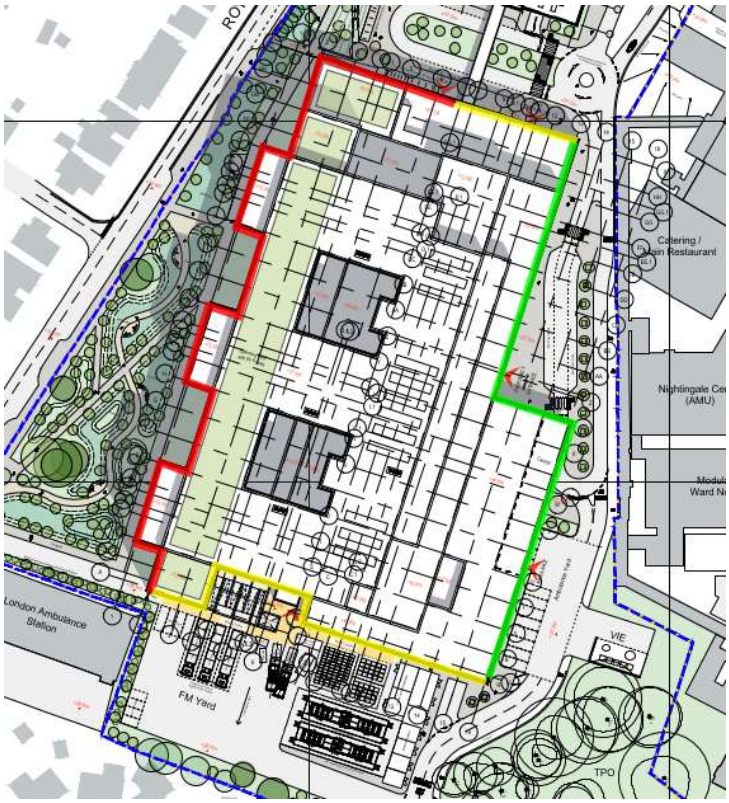

Figure 6-1 Façade Noise Level Areas (Existing Sources)

6.4 Based on the measured and predicted façade incident sound levels and information on available architectural plans provided by IBI, initial calculations have been undertaken to review the internal noise levels as a result of external noise ingress through the proposed façade constructions against the internal ambient noise levels provided in Table 4-2.

6.5 It is understood that the building will be mechanically ventilated and will have a façade comprising a combination of masonry external wall constructions (predominately brick or architectural concrete cavity walls) and glazed elements.

6.6 Table 6-2 presents the minimum sound insulation requirements for the glazed elements of the building envelope. The minimum glazed element specification assumes the use of external wall elements with the performance also given in Table 6-2.

Table 6-2: External Envelope Sound Insulation Requirements

Façade Element	Example construction	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)								R_w (C_{tr}) dB
		63	125	250	500	1000	2000	4000	8000	
Glazed elements - Western and Northern elevations towards Royal Lane	10mm float glass /12mm air cavity/6mm float glass	30	33	29	32	40	40	37	37	37 (-4)
Glazed elements – All other facades	4mm float glass /12mm air cavity/6mm float glass	22	25	24	27	36	41	44	44	33 (-3)
External walls*	Brick or concrete cavity walls with SFS	35	45	53	55	60	65	65	65	59 (-4)

* Assumed build up performance based on outline design proposals

6.7 The required glazing specifications should be met by the entire glazing system, inclusive of any framing, spandrels, transoms or detailing losses that are anticipated.

6.8 The specifications given in Table 6-2 are based on ground floor single patient bedroom areas which are the most onerous in terms of requirements for the control of external noise intrusion with an internal floor area of 20m^2, volume of 60m^3, total external façade area of 11.4m^2, the use of Class C acoustically absorbent ceilings (in line with HTM 08-01 requirements) and mechanical ventilation. During detailed design stages, the external envelope specifications per façade and façade level will be further investigated and refined based on detailed design information.

6.9 Assuming external envelope minimum sound insulation requirements given in Table 6-2 are met, it is anticipated that the noise levels within the Proposed Development will comply with the requirements of HTM 08-01 and will provide suitable conditions for future users.

Effects during Construction

Construction Noise Effects

6.10 The worst-case and more typical levels of construction noise predicted at the identified sensitive receptors are presented in Table 6-3. These levels have been calculated to consider the plant items listed in Appendix C operating at the closest distance from each receptor to the Site and from the approximate centre of the Site. The full calculations are provided in Appendix C. Predicted noise levels greater than the SOAEL are shown in bold. Predicted noise levels greater than the LOAEL are underlined.

Table 6-3: Construction Noise Predictions ($L_{Aeq,T}$ dB)

Plant	R1		R2		R3		R4		R5	
	Worst Case	Average Case	Worst Case	Average Case	Worst Case	Average Case	Worst Case	Average Case	Worst Case	Average Case
Backhoe mounted hydraulic breaker	**80**	73	**80**	68	**80**	68	**80**	74	68	59
Pulveriser mounted on excavator	72	65	72	60	72	60	72	66	60	51
Tracked excavator (loading dump truck)	**77**	70	**77**	65	**77**	65	**77**	71	65	56
Tracked excavator	74	67	74	62	74	62	74	68	62	53
Dozer	72	65	72	60	72	60	72	66	60	51
Hydraulic vibratory compactor (tracked excavator)	70	63	70	58	70	58	70	64	58	49

Crawler mounted rig (auger piling)	71	64	71	59	71	59	71	65	59	50
Concrete pump	70	63	70	58	70	58	70	64	58	49

6.11 Based on the predicted levels, construction noise may exceed the SOAEL at four of the receptors when the activity is at the closest distance for two of the plant items. Mitigation measures should be put in place to reduce the potential for significant effects on health and quality of life. It should be noted however, high noise generating activities are only likely to take place at the closet distance for a short period of time. In reality this would be likely to be less than 10 days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months[2]. for individual residential receptors. Furthermore, some of the activities, e.g. piling, would not occur at the closest distance to each of the receptors. Consequently, it is expected that prior warning of the timings and durations of potential high levels of noise would be sufficient to offset any potential significant noise effects.

6.12 More typical (average) construction noise levels are unlikely to exceed the SOAEL and, in many cases, do not exceed the LOAEL. At R5 only one activity would result in worst case noise levels above the LOAEL and no exceedances of the LOAEL. However, given the potential for exceedances of the LOAEL, BPM should be applied as standard working practice across the Site.

Construction Vibration Effects

6.13 The estimated distances from identified sensitive receptors to the footprint of the new hospital buildings where it is assumed piling would take place are presented in Table 6-4 along with the potential vibration effect based on sample data in Table 4-4.

Table 6-4: Construction Vibration Effects

Receptor	Approximate Distance to Proposed Development (m)	Estimated Level of Piling Vibration	Potential Vibration Impact
R1	30	0.14 - <3.0mm/s	Below the LOAEL
R2	35	0.14 - <3.0mm/s	Below the LOAEL
R3	45	0.14 - <3.0mm/s	Below the LOAEL
R4	15	0.3 - <1mm/s	Above the LOAEL
R5	130	0.14 - <3.0mm/s	Below the LOAEL

6.14 Based on the predictions presented in Table 6-4 potential vibration levels affecting sensitive receptors are likely to exceed the LOAEL at R4 only. At all other receptors, vibration levels are expected to be below the LOAEL. At all receptors, vibration levels are unlikely to exceed the SOAEL. Construction vibration is not considered to be significant; however, mitigation measures covering BPM will be put in place to ensure that vibration is minimised at all times throughout the construction programme.

Construction Traffic Noise Effects

6.15 The magnitude of change of road traffic noise due to construction traffic associated with the Proposed Development has been identified through BNL calculations using road traffic data presented in Appendix D. It is understood a preliminary construction traffic assessment has identified between 25 to 90 daily trips throughout the construction period with a typical daily number of trips of 40. As a worst-case assessment 40 trips have been added to the total traffic flows on each road link in the traffic assessment and the BNL calculated. This is considered to represent a worst-case assessment as it would not be possible for all 40 trips to occur on each road link.

6.16 The results of the construction traffic noise assessment are presented in Table 6-5.

[2] Temporal criteria as referenced in Annex E.4 of BS5228-1:2009.

Table 6-5: Construction Traffic Noise Effects

Road Link	2021 Baseline BNL dB	2021 Baseline with Construction Traffic BNL dB	Change in BNL dB	Magnitude of Change
Pield Heath Road	68.1	68.3	0.1	Negligible
Kingston Lane	68.1	68.2	0.1	Negligible
Pield Heath Road	69.9	70.0	0.1	Negligible
Royal Lane	62.2	62.7	0.5	Negligible
Royal Lane	66.1	66.3	0.2	Negligible
Royal Lane	64.9	65.2	0.3	Negligible
Royal Lane	61.8	62.4	0.6	Negligible
Pield Heath Road	69.7	69.7	0.1	Negligible
Pield Heath Road	69.2	69.3	0.1	Negligible
Colham Green Road	67.8	67.9	0.1	Negligible
Colham Green Road	67.6	67.8	0.1	Negligible
Colham Green Road	66.4	66.6	0.2	Negligible
A437 Harlington Road	70.0	70.1	0.1	Negligible
Lees Road	69.9	70.0	0.1	Negligible
A437 Harlington Road	72.7	72.8	0.0	Negligible
A408 Park View Road	70.2	70.3	0.1	Negligible
Apple Tree Avenue	65.8	66.1	0.2	Negligible
Church Road	66.9	67.1	0.2	Negligible

6.17 Using the BNL road traffic calculation methodology, it has been calculated that at a worst case the construction road traffic associated with the Proposed Development will result in an increase in road traffic noise of up to 0.6dB. This increase in noise is equivalent to a negligible impact and is not significant.

Effects Once the Proposed Development is Complete and Occupied

Road Traffic Noise Effects

6.18 Table 6-6 presents the calculated BNLs and the change in noise levels between the future 2025 baseline scenario and the 2025 baseline with the Proposed Development scenario (based on traffic flows presented in Appendix D). The resultant change in noise levels is considered to be representative of the change in road noise that may be experienced at nearby noise sensitive receptors.

Table 6-6: Operational Road Traffic Noise Effects

Road Link	2025 Baseline BNL ($L_{A10,18h}$ dB)	2025 Baseline with Development Traffic BNL ($L_{A10,18h}$ dB)	Change in BNL ($L_{A10,18h}$ dB)	Magnitude of Change
Pield Heath Road	67.7	68.3	+0.6	Negligible
Kingston Lane	66.9	68.2	+1.2	Minor
Pield Heath Road	69.0	70.0	+1.0	Minor
Royal Lane	61.5	62.4	+0.9	Negligible
Royal Lane	65.0	65.5	+0.5	Negligible
Royal Lane	64.7	65.2	+0.5	Negligible
Royal Lane	61.3	62.1	+0.7	Negligible
Pield Heath Road	68.5	70.2	+1.6	Minor

Pield Heath Road	67.9	69.3	+1.4	Minor
Colham Green Road	66.8	68.1	+1.3	Minor
Colham Green Road	66.9	67.8	+0.8	Negligible
Colham Green Road	65.7	66.6	+0.9	Negligible
A437 Harlington Road	70.1	70.2	+0.1	Negligible
Lees Road	70.0	70.1	+0.1	Negligible
A437 Harlington Road	72.9	72.9	+0.1	Negligible
A408 Park View Road	70.3	70.4	+0.1	Negligible
Apple Tree Avenue	65.6	66.0	+0.4	Negligible
Church Road	66.6	67.1	+0.5	Negligible

6.19 Comparison of the calculated baseline BNLs with the future operational BNLs calculated from operational road traffic flows associated with the Proposed Development indicates that changes in road traffic flows will result in a change in noise level of less than 1 dB and a negligible impact at receptors adjacent to the majority of road links. Consequently, changes in road traffic noise levels as a result of the Proposed Development at these receptors are not considered to be significant.

6.20 At receptors adjacent to five of the road links, the change in noise level is calculated to be greater than 1dB but less than 3dB and therefore a minor impact. It is generally accepted that a change of 3dB is the minimum perceptible to the average human ear. However, as the future BNL is predicted to be above the SOAEL, as noted in paragraph 4.21, this represents a likely significant effect.

Building Services Plant Noise Effects

6.21 Building services and plant will be designed to achieve suitable operational noise levels at nearby existing and future sensitive receptors. The building services plant will be required to achieve rating noise levels set to 5dB below the measured $L_{A90,T}$ background noise level representative of the receptor location for residences and the school. For hospital buildings, a limit of 10dB below the $L_{Aeq,T}$ ambient noise level has been set. Temporary limits during emergencies have been set at 10dB above the measured $L_{A90,T}$ background noise level.

6.22 These operational noise limits have been derived from the background and ambient noise measurements taken at the Site for both typical and emergency operating conditions. Night-time noise limits have not been identified for the school (R5) since this will not be occupied at night.

6.23 Table 6-7 presents the recommended noise limits for proposed building services plant associated with the Proposed Development to ensure that noise effects at nearby sensitive receptors are negligible. This includes a limit for the residential blocks which will form part of the wider masterplan shown in Figure 2-1.

Table 6-7: Building Services Plant Noise Limits

Receptor	Receptor Type	Daytime (07:00-23:00) Noise Limit $L_{Aeq,1h}$ dB		Night-time (23:00-07:00) Noise Limit $L_{Aeq,15min}$ dB	
		Typical	Emergency	Typical	Emergency
R1	Residential	45	55	36	46
R2	Residential	45	45	36	46
R3	Residential	39	49	34	44
R4	Hospital	41	51	35	45
R5	School	39	49	N/A	N/A
F1	Future Residential	40	55	34	49

Note: Limits for R2 are based on measured levels at LT1 due to incomplete dataset at ST1

6.24 It is assumed that the building services plant will be operated in accordance with manufacturers' instructions and will not result in any noise which is tonal, impulsive or distinctive in nature. Should the plant noise exhibit any such acoustic features then the relevant 'penalty'/ correction should be applied in

accordance with BS 4142 to ensure that the resultant rating level falls within the limit levels identified in Table 6-7.

6.25 An important aspect of the BS 4142 assessment method is that sound sources should be considered in the context of the residual noise environment. Therefore, once the details of building services plant at the Proposed Development are confirmed during the Stage 4 detailed design stage, appropriate mitigation measures will be specified with reference to guidance within BS 4142 considering the proposed noise sources in context.

6.26 Two twin generators are proposed to be installed at the Site. These will be located towards the south of the site approximately 25 metres from residences on Bryony Close and Apple Tree Avenue (represented by R3). The generators will be located within acoustic enclosures and fitted with intake and exhaust silencers to achieve a sound pressure level of 65dB at 1 metre. The generators are for standby use only and will be tested for 1 hour per month for the system on building load and for 3 hours per month on Load Bank. Taking distance attenuation into account and applying a 3dB penalty as the sound is likely to be readily distinctive against the residual acoustic environment, the predicted level at the nearest residence during operation of a single generator is 40dB. This is 9dB below the 'emergency' noise limit.

6.27 As all other building services plant will be designed to achieve the recommended limits shown in Table 6-7 operational building services noise from the Proposed Development will be below the LOAEL and so noise effects from these sources are considered to be not significant.

6.28 A service yard with three loading bays for delivery vehicles is proposed at the south side of the new hospital building. Noise due to movement of these vehicles entering and manoeuvring in the yard has been considered.

6.29 It is noted the Hillingdon Noise SPD refers to BS 4142 as the appropriate assessment methodology for noise due to "Premises, such as warehouse distribution premises, where delivery lorries are driven and manoeuvred, and are loaded or unloaded by forklift trucks etc; Premises where there are manoeuvring lorries on which on-board refrigeration plant is run; Loaders, dumpers and haulage vehicles operating in yards handling building materials or at waste disposal sites".

6.30 For the purposes of this assessment, an SEL of 91dB at 10 metres has been used as a noise source term for HGV movements from AECOM's in-house database. It is assumed each of the loading bays could be used in a one-hour period, i.e. three vehicle movements per hour. This is the period advised in BS 4142 for daytime assessments.

6.31 The distance from the centre of the service yard to the nearest residential façade is around 25 metres. There is a solid timber fence at the site boundary which will be retained. It is estimated this will provide at least 10dB screening to ground floor windows and external amenity areas. First floor bedroom windows would not be screened.

6.32 Noise due to HGVs arriving and manoeuvring is not considered to be tonal or impulsive but could be described as intermittent. A +3dB penalty has therefore been added in accordance with BS 4142 guidance. A further +3dB penalty has also been applied as the HGV noise may be readily distinctive against the residual acoustic environment.

6.33 The noise rating level has been calculated using the following formula:

$$L_{Aeq} = SEL + 10\log N - 10\log T$$

Where N = number of events, and T = time in seconds

6.34 Table 6-8 presents the predicted noise level at the nearest residence.

Table 6-8: Service Yard Assessment

Activity	Noise Level (dB L_{Aeq})	
	Daytime	Night-time
Delivery vehicle arrive and manoeuvre	84	84
Distance correction	-8	-8

No of delivery vehilces	+5	0
Time Correction	-36	-30
Barrier	-10	0
Specific Noise Level	35	46
Intermittency Correction	+3	+3
'Other' feature correction	+3	+3
Rating noise level	41	52
L_{A90}	47	45
Difference	-6	+7

6.35 As noted in paragraph 4.28, for the assessment the rating level and the background level should be compared, and BS 4142 advises the following

a) Typically, the greater the difference, the greater the magnitude of impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context.
d) The lower the rating level is to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending upon the context.

6.36 On the basis of the above, the assessment indicates an low impact during the daytime depending on the context, and an indication of an adverse impact during the night depending on the context.

6.37 BS 4142 advises the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

6.38 The follow factors have been considered:

6.38.1 The absolute level of sound: BS 4142 suggests that the magnitude of an impact may be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. In this instance the residual sound (the ambient sound at the assessment location in the absence of the specific sound) is 52dB $L_{Aeq,16h}$ during the day and 50dB $L_{Aeq,8h}$ during the night. These are considered to be typical for an outer London location i.e. neither low nor high. The absolute level of sound due to the delivery vehicles is 35dB $L_{Aeq,1h}$ during the day and 46dB $L_{Aeq,15min}$ at night. The typical sound reduction through a partially open window is 10-15dB. Assuming the average of these, the level inside a dwelling would be 23dB $L_{Aeq,1h}$ during the day and 34dB $L_{Aeq,15min}$ at night. This is 12dB below the daytime guideline level of 35dB $L_{Aeq,16h}$ advised in BS 8233:2014[3] although the recommended night-time internal level of 30dB $L_{Aeq,8h}$ is exceeded.

6.38.2 The nearest noise sensitive receptors are dwellings on Bryony Close. These are two storey semi-detached houses. The properties appear to be around 1930 construction date but also appear to have more recent double glazed windows. These would be expected to provide at least 30dB sound reduction of external noise and hence internal noise from delivery vehicles would be less than 10dB $L_{Aeq,T}$ when windows are closed during the day and 16dB $L_{Aeq,T}$ at night.

6.38.3 The character and level of the residual sound compared to the character and level of the specific sound: The specific sound during the day is 35dB $L_{Aeq,1h}$ whilst the residual sound level is 52dB $L_{Aeq,16h}$. At night, the specific sound is 46dB $L_{Aeq,15min}$ whilst the residual is 50dB $L_{Aeq,8h}$. The specific sound is therefore 17dB below the residual sound for the daytime and 4dB below the residual sound at

[3] BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

night. The residual sound environment is characterised by road traffic. In particular there is an ambulance station immediately to the north which will remain and will be adjacent to the new service yard. This ambulance station operates throughout the day and night so there are already frequent vehicle movements affecting the residences potentially affected by the new service yard. Furthermore, there is an access road which runs to the south of the current hospital buildings which is accessible at all times and in use at night. Noise from the proposed development will be very similar in character to that which already exists.

6.38.4 The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions: As noted above, the receptors are dwellings which are already exposed to road traffic noise, noise from the ambulance station and hospital access road. The dwellings have double glazing which would be expected to be adequate to attenuate the delivery vehicle sound to below guideline levels.

The assessment of the rating level in outdoor areas during the day results in a low impact. The residual sound is 52dB which is already above the desirable level of 50dB $L_{Aeq,T}$ stated in BS8233 but below the upper guideline level of 55dB $L_{Aeq,T.}$ The sound level due to delivery vehicles would be 15dB below the desirable level in outdoor areas.

6.39 Overall, taking context into account, the noise impact is considered to be less significant than the initial assessment would suggest. During the day the impact is low. During the night internal noise levels would be below guideline levels with windows closed and only 4dB above guideline levels with windows partially open which is considered to be acceptable.

7. Mitigation and Monitoring

7.1 This section describes any required noise and vibration monitoring regimes, including monitoring of specific receptors/resources, or monitoring the effectiveness of mitigation measures.

Mitigation during Construction

7.2 Mitigation will be provided through the adoption of BPM, as defined in section 72 of the CoPA (Ref 14). Noise mitigation measures and noise management plans to implement BPM will be put into place to ensure that noise is minimised at all times throughout the construction programme.

7.3 Good industry standards, guidance and practice procedures (i.e. compliance with the Considerate Constructor's Scheme) will be followed in order to minimise noise and vibration effects during construction. Noise and vibration arising during the construction works will be managed to avoid and minimise impacts, and mitigation measures will be documented within a Construction Environmental Management Plan (CEMP) which will be prepared by the Principal Contractor, which will take into account the relevant guidance documents and standards relating to noise and vibration.

7.4 The CEMP will provide the basis for a live / working document that will be implemented and updated by the Principal Contractor during the construction works.

Mitigation of Construction Noise

7.5 Mitigation measures will be employed to ensure that potential noise impacts at nearby sensitive receptors due to construction activities are minimised. The preferred approach for controlling construction noise is to reduce source levels where possible, but with due regard to practicality. The simplest and most effective method of reducing noise at nearby receptors is to ensure that noisy plant is located as far from receptors as practicable and is screened using temporary, localised barriers. Noise can also be reduced by limiting the daily time that noisy equipment is operated; however, it is acknowledged that sometimes a greater noise level may be acceptable if the duration of the construction activity, and therefore length of disruption, is reduced.

7.6 Section 4 of BS 5228-1 provides details on the effectiveness of a good communication strategy. Consequently, it is recommended that prior to works being undertaken, liaison is undertaken with occupiers of sensitive receptors that may be adversely affected by construction noise. Providing

information regarding construction works and advance notice of when high noise generating activities are to take place can reduce adverse effects. All communications will contain contact details for the person to whom any questions or complaints should be directed.

7.7 Noise will also be minimised through the adoption of BPM as standard working practices across the Proposed Development to ensure that noise is reduced whenever practicable. The following provisions, although not exhaustive, will be adhered to where practicable throughout the construction programme:

- Vehicles and mechanical plant used for the purpose of the works will be fitted with effective exhaust silencers, maintained in good and efficient working order, and operated in such a manner as to minimise noise emissions. The contractor will ensure that all plant complies with the relevant statutory requirements;
- Machines in intermittent use will be shut down or throttled down to a minimum when not in use;
- Compressors will be fitted with properly lined and sealed acoustic covers which will be kept closed whenever in use. Pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Equipment which breaks concrete, brickwork or masonry by bending, bursting or “nibbling” will be used in preference to percussive tools. Where possible, the use of impact tools will be avoided where the site is close to occupied premises;
- Rotary drills and bursters activated by hydraulic, chemical, or electrical power will be used for excavating hard or extrusive material;
- Wherever possible, equipment powered by mains electricity will be used in preference to equipment powered by internal combustion engine or locally generated electricity;
- No part of the works nor any maintenance of plant will be carried out in such a manner as to cause unnecessary noise except in the case of an emergency when the work is absolutely necessary for the saving of life or property or the safety of the works;
- Plant will be maintained in good working order so that extraneous noise from mechanical vibration, creaking and squeaking is kept to a minimum; and
- Noise emitting machinery which is required to run continuously will be housed in a suitable acoustically lined enclosure.

Construction Noise Monitoring

7.8 A construction noise monitoring strategy will be agreed with the LBH once a Principal Contractor has been appointed. Noise monitoring will be undertaken at receptor locations that are considered to be at risk to potential high noise levels. Noise monitoring will determine compliance with LBH limits and the need for any additional mitigation if noise limits are exceeded.

Mitigation of Construction Vibration

7.9 To ensure that potential vibration impacts due to piling are minimised, the contractor, where feasible, will use a piling technique that is least likely to cause adverse vibration impacts (e.g. auger piling), to ensure that the effect of vibration is minimised and controlled to a negligible or minor adverse significance at nearby receptors. In addition, best practice should be adopted during the demolition phase to ensure that unnecessary levels of vibration are generated.

Mitigation of Construction Traffic Noise

7.10 Although construction traffic has been predicted as having, at worst, a negligible (not significant) effect, where feasible the following measures will be implemented to ensure that construction traffic noise effects are not significant:

- Vehicles employed for any activity associated with the construction works will, where reasonably practicable, be fitted with effective exhaust silencers and shall be maintained in good working order and operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable;

- Time slots will be adopted for deliveries to ensure that convoys of vehicles do not arrive simultaneously and to avoid unnecessary idling on-site or nearby;
- Strict control to prevent temporary parking on kerbsides in the vicinity of noise sensitive receptors near the Proposed Development.

Mitigation Once the Proposed Development is Complete and Occupied

7.11 Noise effects as a result of the operational Proposed Development due to changes in road traffic flows were identified as being not significant for the majority of road links and likely to be significant for five of the road links. Mitigation for road traffic noise would either be an acoustic barrier or a low-noise road surface. As the roads are off-Site, these mitigation measures are not practicable. Consequently, as the change in noise level is below that generally accepted to be perceptible to the average human ear consequently, no additional mitigation measures are recommended.

7.12 All building services plant will be designed to achieve the operational limits consistent with the requirements of BS 4142, which may require mitigation to be incorporated into the fixed plant design to achieve the noise criteria detailed in Table 6-7. It is assumed that the building services plant will be operated in accordance with manufacturers' instructions and will not result in any noise which is tonal, impulsive or distinctive in nature. Should the noise exhibit any such acoustic features then the relevant penalty/correction should be applied in accordance with BS 4142 to ensure that the resultant rating level falls within the limit levels.

7.13 Noise due to operation of the new service yard is expected to result in a low impact during the daytime. It is also not expected to result in an adverse impact during the night-time. No specific mitigation is therefore proposed. It may be noted however that the boundary fence between the hospital and residences will be replaced and new planting introduced to provide visual screening.

8. Conclusions

8.1 An assessment of potential noise and vibration effects due to temporary works undertaken during the construction phase and permanent changes to the noise environment due to the operational Proposed Development has been carried out.

8.2 Noise and vibration generated by construction activities associated with the Proposed Development are likely to exceed the LOAEL at nearby sensitive receptors throughout the construction programme. Noise emissions during some demolition and substructure works may result in exceedances of the SOAEL at existing receptors.

8.3 Through an effective communication strategy, noise monitoring to determine compliance with noise limits and adoption of BPM to reduce construction noise as far as reasonably practicable, it is considered that all reasonable steps have been undertaken to reduce noise emissions and, therefore, exceedances of the SOAEL will be minimised.

8.4 Changes in road traffic noise due to construction traffic associated with the Proposed Development have been identified as negligible and not significant.

8.5 Changes in road traffic noise due to operational traffic associated with the Proposed Development have been identified as likely to be significant, but the change in noise levels is below that generally accepted to be perceptible to the average human ear. Consequently, not additional mitigation measures are recommended.

8.6 Building services plant will be required to achieve noise levels set to 10dB below the measured background noise level with temporary limits during emergencies set at 10dB above the measured background noise level. Building services plant will be designed to achieve the specified noise limits at nearby sensitive receptors.

9. References

Ref 1. Department for Communities and Local Government (2019) National Planning Policy Framework.

Ref 2. Department for Environment Food and Rural Affairs, (2010); Noise Policy Statement for England.

Ref 3. Department for Communities and Local Government (DCLG), (last updated July 2019) Planning Practice Guidance.

Ref 4. Greater London Authority (2021), The London Plan - The Spatial Development Strategy for London.

Ref 5. Hillingdon Council, (2012); Local Plan: Part 1 Strategic Policies

Ref 6. Hillingdon Council, (2020; Local Plan: Part 2 Development Management Policies

Ref 7. London Borough of Hillingdon, (2006), Noise Supplementary Planning Document

Ref 8. London Boroughs of: Hillingdon; Hounslow; Richmond upon Thames (2014), Development Control for Noise Generating and Noise Sensitive Development

Ref 9. British Standards Institute, (2003); BS 7445 - Description and Measurement of Environmental Noise. Part 1 – Guide to Quantities and Procedures, BSi, London

Ref 10. British Standards Institute, (2009); BS 5228+A1:2014 - Code of practice for noise and vibration control on construction and open sites, BSi, London

Ref 11. Department of Transport/Welsh Office (1998); Calculation of Road Traffic Noise.

Ref 12. Highways Agency (2020); Design Manual for Road and Bridges Sustainability and Environment Appraisal LA 111 Noise & Vibration.

Ref 13. Department of Health (2010); Health Technical Memorandum 08-01: Acoustics

Ref 14. Her Majesty's Stationery Office, (1974); Section 72 Control of Pollution Act.

Appendix A Acoustic Terminology

Term	Description
Decibel (dB)	The range of audible sound pressures is approximately 2 x 10-5 Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0dB to 140dB. Mathematically Sound Pressure level = 20 log {p(t)/p0} Where P0 = 2 x 10-5 Pa.
"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of risk of damage of hearing due to noise.
Frequency (Hz)	The number of cycles per second, for sound this is subjectively perceived as pitch.
Frequency Spectrum	Analysis of the relative contributions of different frequencies that make up a noise.
Ambient Sound	Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far (The ambient sound comprises the residual sound and the specific sound when present).
Ambient Sound Level La = LAeq,T	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Equivalent Continuous A-weighted Sound Pressure Level LAeq,T	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $LAeq,T = 10 \times log\left\{\left(\frac{1}{T}\right)\left(\frac{P_A^2}{P_o^2}\right)dt\right\}$ Where p0 is the reference sound pressure (20μPA); and PA(t) is the instantaneous A-weighted sound pressure level at time t.
Peak Particle Velocity	Is the greatest instantaneous particle velocity during a given time interval. If measurements are made in 3-axis then the resultant PPV is the vector sum is the square root of the summed squares of the maximum velocities, regardless of when in the time history those occur.
Sound Exposure Level (SEL)	The constant sound level that has the same amount of energy in one second as the original noise event.

Appendix B Baseline Noise Monitoring

B.1 Noise Monitoring Locations

A description of noise monitoring locations together with notes of the acoustic environment made during the noise survey is given below. **Error! Reference source not found.** also presents the noise monitoring locations as well as location of noise sensitive receptors.

LT1 – Royal Lane Hospital Entrance

Signpost in close proximity to a staff only entrance on the western boundary of the site, across Royal Lane. The microphone was placed approximately 3 m above ground level, attached to a signpost as shown in Figure 9-1. The noise meter at LT1 stopped recording at 03:00 on the 27th February due to a meter issue. Therefore, noise data is not available at this location after this date**.**

During the installation and collection of the noise monitoring equipment, the noise environment at this location was characterised by (from most dominant to least dominant noise):

- Road traffic along Royal Lane;
- Vehicle movement in the car park; and
- Pedestrians.

Figure 9-1 LT1 Noise Monitoring Location

LT2 – Southern Car Park

Carpark north of LT4, in close proximity to the new proposed A&E entrance. The microphone was placed approximately 1.5 m above ground level, attached to a signpost as shown in Figure 9-2.

During the installation and collection of the noise monitoring equipment, the noise environment at this location was characterised by (from most dominant to least dominant noise):

- Road traffic along Royal Lane;
- Breaking concrete (during equipment set-up);
- Distant construction works;
- Children shouting; and
- Birds.

Figure 9-2 LT2 Noise Monitoring Location

LT3 – The Greenacres Centre

Lamppost at the southern boundary carpark of the site. The microphone was placed approximately 3.5 m above ground level, attached to a signpost as shown in Figure 9-3.

During the installation and collection of the noise monitoring equipment, the noise environment at this location was characterised by (from most dominant to least dominant noise):

- Road traffic along Royal Lane;
- Sawing and road breaking from the south (during equipment set-up); and
- Sawing to the north (during equipment collection).

Figure 9-3 LT3 Noise Monitoring Location

LT4 – Groundskeeper's compound adjacent to ambulance station.

On a telescopic pole attached to the boundary fence between the groundskeeper's compound and ambulance station. The microphone was located at first floor height as shown in Figure 9-4.

During the installation and collection of the noise monitoring equipment, the noise environment at this location was characterised by (from most dominant to least dominant noise):

- Road traffic along Royal Lane;
- the ambulance station;
- car parling in the adjacent car park; and
- people in the back gardens of nearby residences.

Figure 9-4 LT4 Groundskeepers compound adjacent to Ambulance station

ST1 – Pield Heath Road

Signpost on the north-western boundary of the site, at the intersection of Royal Lane and Piled Heath Road.

The dominant noise source during day was traffic noise from Pield Heath Road. Other noise sources included buses pulling into the bus stop and pedestrians along the nearby footpath. An image of the noise monitoring set-up can be seen in Figure 9-5.

Figure 9-5 ST1 Noise Monitoring Location

B.2 Noise Monitoring Equipment

The calibrator and sound level meters used for the noise monitoring are listed in Table 9-1. Valid calibration certificates are available on request.

Table 9-1 Noise Monitoring Equipment

Location	Equipment	Manufacturer	Model	Serial number	Laboratory calibration date
LT1	Sound Level Meter	Rion	NL-32	840885	14/08/2020
LT2	Sound Level Meter	ACOEM	01dB DUO	12062	13/12/2019
LT3	Sound Level Meter	ACOEM	01dB DUO	12081	27/02/2020
LT4	Sound Level Meter	ACOEM	01dB DUO	12051	15/02/2022
ST1	Sound Level Meter	Rion	NL-32	840885	14/08/2020
All Locations	Sound level meter calibrator	B&K	4231	3006606	26/01/2021
LT4	Sound level meter calibrator	Rion	NC-74	35173436	06/01/2022

B.3 Meteorological Conditions

The weather during the survey period was noted at the beginning and the end of both the survey periods, as well as checked using online weather stations. Conditions at the beginning and end of the surveys were suitable for measurements i.e. no precipitation and wind speed not in exceedance of 5 m/s. High wind speeds of greater than 5 m/s did not occur during the measurement period. Precipitation occurred during the survey on the 3rd March 2021. Data obtained during this period of unsuitable meteorological conditions have been excluded from results.

B.4 Baseline Noise Monitoring Results

Table 9-2 to Table 9-6 present the detailed noise monitoring results for location LT1, LT2, LT3, LT4 and ST1 respectively. Detailed time history information for all long-term monitoring locations (LT) are presented in Figure B-1 to Figure B-4.

LT1 – Royal Lane Hospital Entrance

Table 9-2 LT1 Noise Monitoring Results

Date	Daytime			Night-time		
	Ambient $L_{Aeq,8h}$ dB	Typical Background $L_{A90,1h}$ dB	Average $L_{A10,18h}$ dB	Ambient $L_{Aeq,4h}$ dB	Typical Background $L_{A90,1h}$ dB	Typical L_{AFmax} dB
26/02/2021	64	50	66	56	41	79

LT2 – Southern Car Park

Table 9-3 LT2 Noise Monitoring Results

Date	Daytime			Night-time		
	Ambient $L_{Aeq,16h}$ dB	Typical Background $L_{A90,1h}$ dB	Average $L_{A10,18h}$ dB	Ambient $L_{Aeq,8h}$ dB	Typical Background $L_{A90,1h}$ dB	Typical L_{AFmax} dB
26/02/2021	70*	42*	56*	48	40	65
27/02/2021	67	40	54	46	36	64
28/02/2021	53	41	50	49	37	73
01/03/2021	59	44	54	49	35	75
02/03/2021	57	43	54	49	47	72

03/03/2021	57**	46**	55**	52	46	74
04/03/2021	60	48	55	49	34	72
05/03/2021	58*	46*	58*	-	-	-
Overall	**62**	**44**	**54**	**49**	**39**	**71**

* Incomplete monitoring period – equipment set up/collected
** Incomplete monitoring period – data excluded due to poor meteorological conditions

LT3 – The Greenacres Centre

Table 9-4 LT3 Noise Monitoring Results

Date	Daytime			Night-time		
	Ambient $L_{Aeq,16h}$ dB	Typical Background $L_{A90,1h}$ dB	Average $L_{A10,18h}$ dB	Ambient $L_{Aeq,8h}$ dB	Typical Background $L_{A90,1h}$ dB	Typical L_{AFmax} dB
26/02/2021	50*	46*	51*	46	41	59
27/02/2021	49	42	50	43	39	56
28/02/2021	50	43	49	44	37	60
01/03/2021	50	45	50	44	38	59
02/03/2021	51	46	51	44	39	60
03/03/2021	51**	46**	51**	45	39	59
04/03/2021	52	46	52	46	39	62
05/03/2021	53*	49*	52*	-	-	-
Overall	**51**	**45**	**51**	**45**	**39**	**59**

* Incomplete monitoring period – equipment set up/collected
** Incomplete monitoring period – data excluded due to poor meteorological conditions

LT4 – Groundskeeper's Compound

Table 9-5 LT4 Noise Monitoring Results

Date	Daytime			Night-time		
	Ambient $L_{Aeq,16h}$ dB	Typical Background $L_{A90,1h}$ dB	Average $L_{A10,18h}$ dB	Ambient $L_{Aeq,8h}$ dB	Typical Background $L_{A90,1h}$ dB	Typical L_{AFmax} dB
16/03/2022	53	50	54	51	47	64
17/03/2022	53	47	53	51	49	67
18/03/2022	53	47	53	50	43	64
19/03/2022	55	48	55	49	42	63
20/03/2022	49	44	50	50	43	64
21/03/2022	52	46	53	50	43	63
22/03/2022	52	49	54	-	-	-
Overall	**52**	**47**	**53**	**50**	**45**	**67**

ST1 – Pield Heath Road

Table 9-6 ST1 Noise Monitoring Results

Date	Duration,T	Average Ambient $L_{Aeq,T}$ dB	Background $L_{A90,T}$ dB	$L_{A10,T}$ dB	Maximum $L_{AFmax,T}$ dB
26/02/2021 12:25	1 hour	67	58	68	93
26/02/2021 13:25	1 hour	66	58	68	90
Overall		**66**	**58**	**68**	**92**

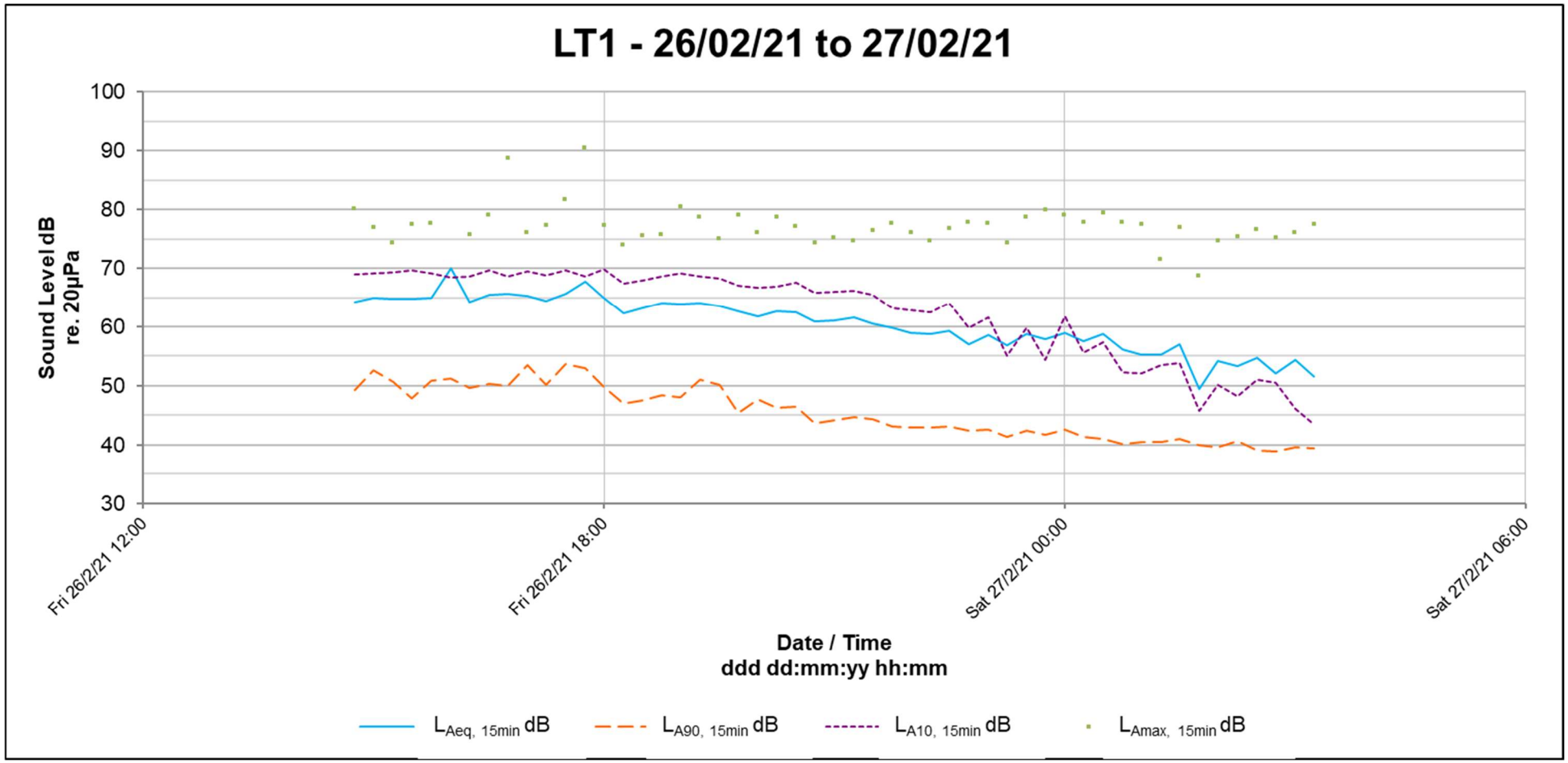

Figure B-1 LT1 Time History

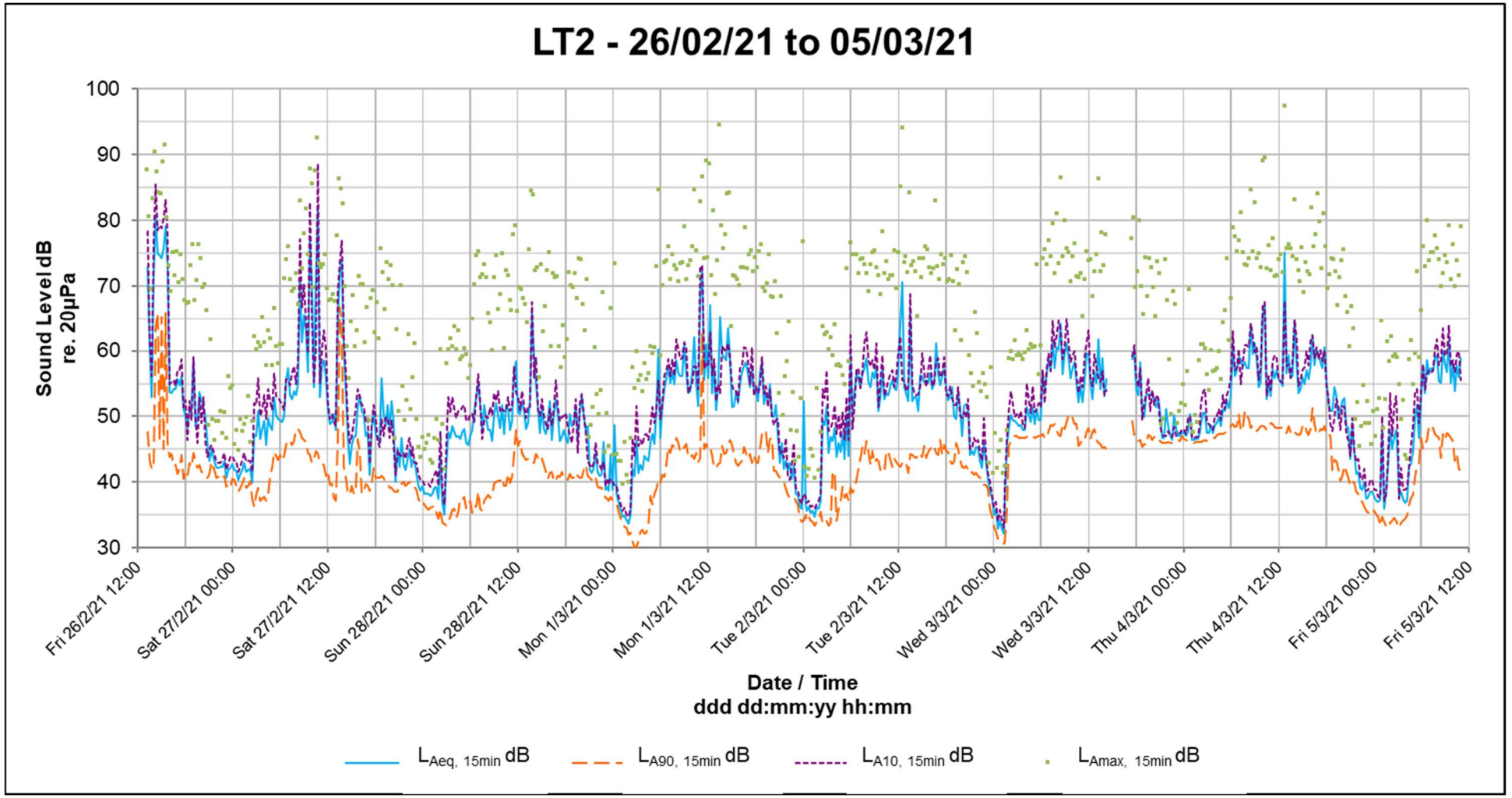

Figure B-2 LT2 Time History

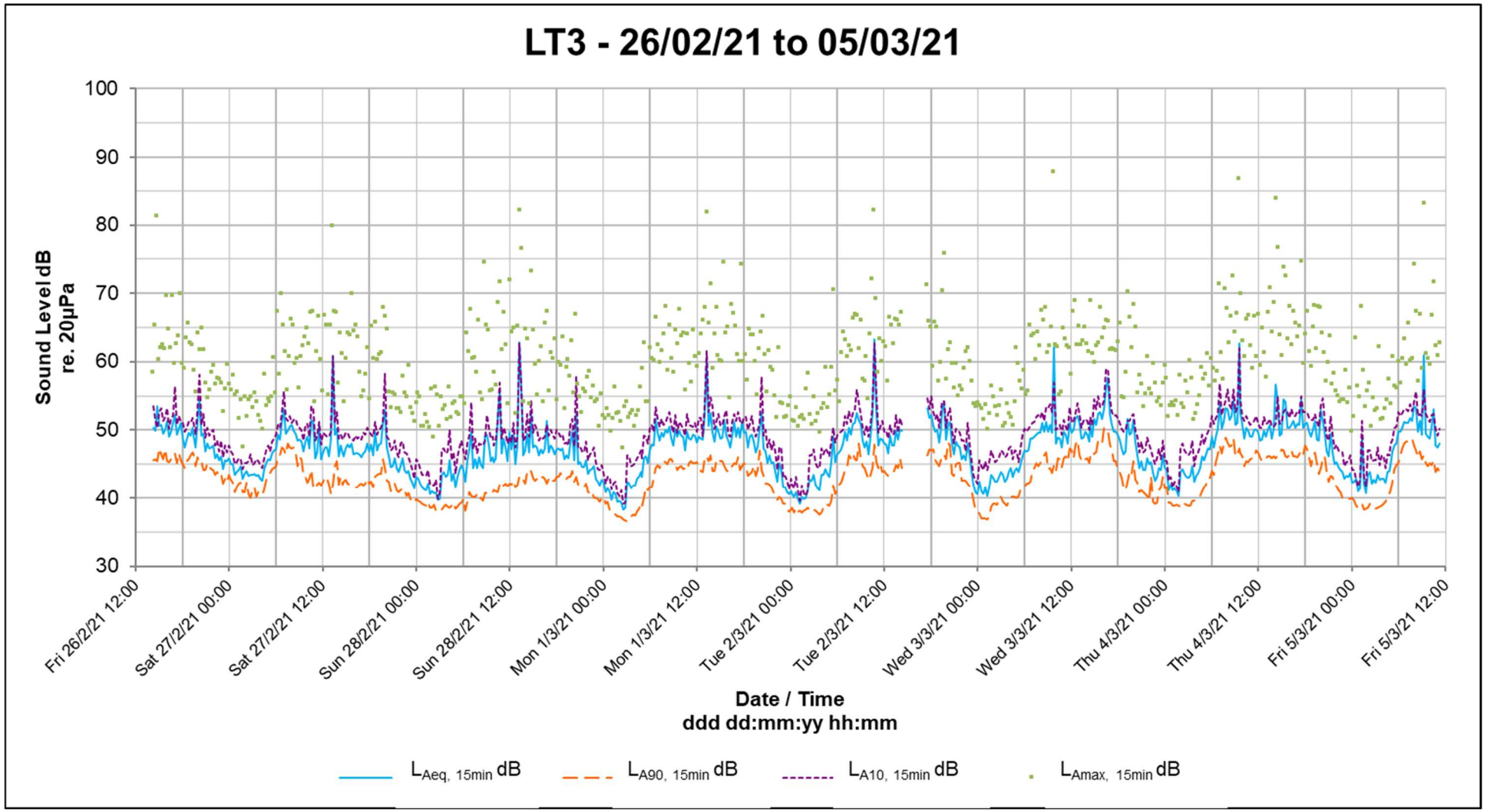

Figure B-3 LT3 Time History

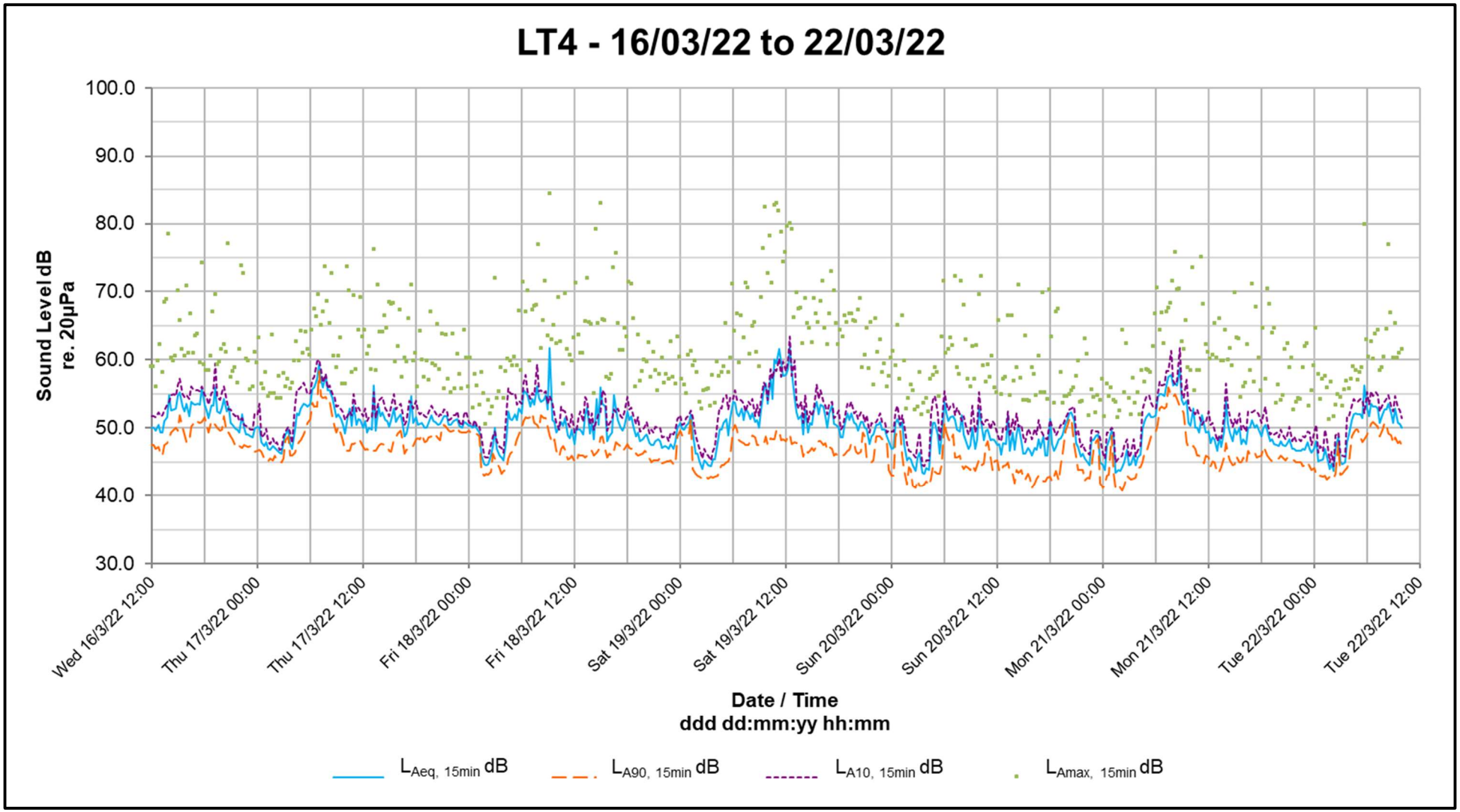

Figure B-4 LT4 Time History

Appendix C Construction Noise Assessment

	BS5228-1 Ref	Plant	SWL (dBA)
1	BS5228-1: Table C.5, Item 1	Backhoe mounted hydraulic breaker	116
2	BS5228-1: Table C.1, Item 3	Pulverizer mounted on excavator	108
3	BS5228-1: Table C.1, Item 10	Tracked excavator (loading dump truck)	113
4	BS5228-1: Table C.1, Item 12	Tracked excavator	110
5	BS5228-1: Table C.2, Item 10	Dozer	108
6	BS5228-1: Table C.2, Item 42	Hydraulic vibratory compactor (tracked excavator)	106
7	BS5228-1: Table C.3, Item 21	Crawler mounted rig (auger piling)	107
8	BS5228-1: Table C.3, Item 25	Concrete pump	106

	Distance (m)	
	Worst Case	Typical case
R1	25	55
R2	25	100
R3	25	100
R4	25	50
R5	100	280

	R1		R2		R3		R4		R5	
	Worst Case	Typical case	Worst Case	Typical case	Worst Case	Typical case	Worst Case	Typical case	Worst Case	Typical case
1	80	73	80	68	80	68	80	74	68	59
2	72	65	72	60	72	60	72	66	60	51
3	77	70	77	65	77	65	77	71	65	56
4	74	67	74	62	74	62	74	68	62	53
5	72	65	72	60	72	60	72	66	60	51
6	70	63	70	58	70	58	70	64	58	49
7	71	64	71	59	71	59	71	65	59	50
8	70	63	70	58	70	58	70	64	58	49

Appendix D Traffic Flow Data

			2025 Future Baseline Background Only	
Road	**From**	**To**	18-hour AAWT	AAWT %HGV
Pield Heath Road	Peel Way (W)	Kingston Lane (E)	9,045	5.9%
Kingston Lane	Pield Heath Road (S)	Celandine Route (N)	6,878	7.4%
Pield Heath Road	Kingston Lane (W)	Grove Lane (E)	13,170	4.7%
Royal Lane	Arklay Close (S)	Grove Lane (N)	2,886	2.0%
Royal Lane	Bradshawe Waye (S)	Pield Heath Road (N)	6,244	2.3%
Royal Lane	Violet Avenue (S)	Bryony Close (N)	5,707	2.6%
Royal Lane	Royal Close (S)	Violet Avenue (N)	2,625	2.7%
Pield Heath Road	Crispin Way (W)	Colham Green Road (E)	10,777	6.2%
Pield Heath Road	Copperfield Avenue (W)	Micawber Avenue (E)	9,672	5.4%
Colham Green Road	Violet Avenue (S)	Pield Heath Road (N)	6,457	7.8%
Colham Green Road	Violet Avenue (S)	Pield Heath Road (N)	6,491	8.4%
Colham Green Road	Moorcroft Lane (S)	Violet Avenue (N)	5,777	5.5%
A437 Harlington Road	Lees Road (S)	St Margarets Avenue (N)	15,128	6.5%
Lees Road	Aldenham Drive (S)	Bourn Avenue (N)	16,606	4.8%
A437 Harlington Road	B465 W Drayton Road (S)	Pield Heath Road (N)	30,632	5.3%
A408 Park View Road	Apple Tree Avenue (W)	Colham Roundabout (E)	16,948	5.5%
Apple Tree Avenue	Cherry Tree Avenue (S)	Birch Avenue (N)	4,884	8.0%
Church Road	Bosanquet Close (S)	Huxley Close (N)	7,796	4.2%

			2025 Future Baseline Background with Development	
			18-hour AAWT	AAWT %HGV
Road	**From**	**To**		
Pield Heath Road	Peel Way (W)	Kingston Lane (E)	10163	6.3%
Kingston Lane	Pield Heath Road (S)	Celandine Route (N)	8953	7.7%
Pield Heath Road	Kingston Lane (W)	Grove Lane (E)	16362	5.0%
Royal Lane	Arklay Close (S)	Grove Lane (N)	3460	2.3%
Royal Lane	Bradshawe Waye (S)	Pield Heath Road (N)	6779	2.7%
Royal Lane	Violet Avenue (S)	Bryony Close (N)	6242	2.9%
Royal Lane	Royal Close (S)	Violet Avenue (N)	2995	3.2%
Pield Heath Road	Crispin Way (W)	Colham Green Road (E)	15327	6.5%
Pield Heath Road	Copperfield Avenue (W)	Micawber Avenue (E)	13003	5.8%
Colham Green Road	Violet Avenue (S)	Pield Heath Road (N)	7884	9.7%
Colham Green Road	Violet Avenue (S)	Pield Heath Road (N)	7718	8.7%
Colham Green Road	Moorcroft Lane (S)	Violet Avenue (N)	6975	5.8%
A437 Harlington Road	Lees Road (S)	St Margarets Avenue (N)	15419	6.5%
Lees Road	Aldenham Drive (S)	Bourn Avenue (N)	16925	4.8%
A437 Harlington Road	B465 W Drayton Road (S)	Pield Heath Road (N)	31220	5.3%
A408 Park View Road	Apple Tree Avenue (W)	Colham Roundabout (E)	17177	5.5%
Apple Tree Avenue	Cherry Tree Avenue (S)	Birch Avenue (N)	5342	8.0%
Church Road	Bosanquet Close (S)	Huxley Close (N)	8759	4.2%

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