Royal Free Hospital 784-B070059



Noise Impact Assessment

Veolia

31st January 2025



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Appendix A – Acoustic Terminology

Appendix B – References

Acronyms/Abbreviations

Acronyms/Abbreviations	Definition
CADNA	Computer Aided Noise Abatement
DMRB	Design Manual for Roads and Bridges
HGV	Heavy Goods Vehicle
PPG	Planning Practice Guidance
UDP	Unitary Development Plan
UKAS	United Kingdom Accreditation Service

Executive Summary

This report presents the findings of a noise assessment has been undertaken in support of a planning application for the installation of Building Services Plant at Royal Free Hospital.

In addition to the plant proposed by Veolia, additional plant is also in proposal at Royal Free Hospital that falls outside of Veolia's scope. Therefore, this report presents two assessment scenarios that have been conducted: one including the proposed plant beyond Veolia's scope and another excluding it.

National and Local planning policy and appropriate guidance documents including 'BS 8233 – Guidance on Sound Insulation and Noise Reduction for Buildings' (2014) and 'BS 4142: 2014 Methods for Rating and Assessing Industrial and Commercial Sound' have been used to set criteria in accordance with The NPPG Noise Exposure Hierarchy.

Baseline Noise surveys were undertaken in November 2024 and the results used to verify predictions of the short-term and long-term effects of noise from the site.

CADNA noise modelling software has been used to model predicted noise emissions from the site using the ISO 9613-2 noise propagation methodology at the closest sensitive receptors.

The results of the assessment in accordance with BS4142, BS8233, a change in noise level assessment in accordance with IEMA 'Guidelines for Environmental Noise Impact Assessment' (2014) predict that noise associated with the proposed development would result in low impact at the existing sensitive receptors with the incorporation of the mitigation.

1.0 Introduction

1.1 Purpose of this Report

This report presents the findings of a noise assessment to support a planning application for a the installation of Building Services Plant at Royal Free Hospital. A description of the existing noise environment in and around the site is provided. Noise surveys have been undertaken and the results used to verify predictions of the short-term and long-term effects of noise.

A list of acoustic terminology used in this report is provided in Appendix A.

1.2 Legislative Context

This report is intended to provide information relevant to the local planning authority and their consultees in support of a planning application for the above proposed development. Policy guidance with respect to noise is found in the National Planning Policy Framework (NPPF), published in December 2024. With regard to noise and planning, the NPPF contains the following statement at Paragraph 198:

"198. 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 [...]

"200. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

"201. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

Planning Practice Guidance (PPG): Noise provides further guidance with regard to the assessment of noise within the context of Planning Policy. The overall aim of this guidance, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England (NPSE), is to "identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level for the given situation."

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the PPG and repeated below in **Table 1.1**.

Table 1.1: NPPG Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No Specific Measures Required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No Specific Measures Required
	Lowest Observed Adverse Effect Level (LO	AEL)	
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

The NPPF, NPSE and PPG do not, however, present absolute noise level criteria which define SOAEL, LOAEL and NOEL which is applicable to all sources of noise in all situations. Therefore, within the context of the Proposed Development, national planning policy and appropriate guidance documents including 'BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings' (2014) and 'BS 4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound' (2014) have been used. Section 2.0 presents the noise level criteria used as a basis of this assessment.

The PPG also states that neither the NPSE nor the NPPF (which reflects the Noise Policy Statement) expects noise to be considered in isolation, separately from the economic, social and other environmental dimensions of the proposed development.

Furthermore, the PPG: Noise identifies at Paragraph: 011 Reference ID: 30-011-20190722 the requirement for developments proposals to incorporate measures to mitigating the impact of noise on residential developments. In particular:

"Noise impacts may be partially offset if residents have access to one or more of:

- a relatively quiet facade (containing windows to habitable rooms) as part of their dwelling;
- a relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced if this area is exposed to noise levels that result in significant adverse effects;
- a relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or
- a relatively quiet, protected, external publicly accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minute walking distance).

Local & Regional Policy Context

The Camden Council's Local Plan (2017), contains policies relating to noise:

Camden Local Plan

Policy A4 Noise and Vibration

The Council will seek to ensure that noise and vibration is controlled and managed. Development should have regard to Camden's Noise and Vibration Thresholds (Appendix

3). We will not grant planning permission for:

a. development likely to generate unacceptable noise and vibration impacts; or

b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses. We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development

Camden Local Plan

Appendix 3: Noise Thresholds

The significance of noise impact varies dependent on the different noise sources, receptors and times of operation presented for consideration within a planning application. Therefore, Camden's thresholds for noise and vibration evaluate noise impact in terms of various 'effect levels' described in the National Planning Policy Framework and Planning Practice Guidance:

- NOEL No Observed Effect Level
- LOAEL Lowest Observed Adverse Effect Level
- SOAEL Significant Observed Adverse Effect Level

Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables.

The values will vary depending on the context, type of noise and sensitivity of the receptor:

• Green – where noise is considered to be at an acceptable level.

• Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.

• Red – where noise is observed to have a significant adverse effect.

1.3 Acoustic Consultants' Qualifications and Professional Memberships

The lead project Acoustic Consultant is Daisy Flatters. The report has been checked by Joe Nott and verified by Dawit Abaraham. Relevant qualifications, membership and experience are summarised in **Table 1.2**.

Name	Education	Experience in Undertaking Noise Assessments (Start date of working in noise & acoustics)	Attained Associate Membership of the Institute of Acoustics (date)	Attained Membership of the Institute of Acoustics (date)
Daisy Flatters	BA 2023	Jan 2024	-	-
Joe Nott	BSc 2016	Aug 2016	Aug 2017	-
Dawit Abraham	BSc 2008 MSc 2010	Oct 2010	Jan 2011	Jan 2015

Table 1.2: Acoustic Consultants' Qualifications & Experience

2.0 Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Table 2.1 presents equivalent noise levels and associated actions with the target noise level criteria identified. The noise level criteria detailed below have been derived from standards and design guidance:

- BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings Code of practice'
- BS4142:2014 'Method for rating industrial and commercial sound'
- BS5228:2009+A1:2014. Code of Practice for Noise and Vibration Control on Construction and Open Sites
- World Health Organisations (1999) 'Guidelines for Community Noise'
- IEMA 'Guidelines for Environmental Noise Impact Assessment' (2014)
- Camden Local Plan 2017

A full bibliography of documents referenced within this report is provided within Appendix B.

Table 2.1: Noise Level Criteria and Actions

Noise Sources	Noise Level Criteria	Justification for Effect Level- Action Required	
No Observed Adverse Effect Level (NOAEL)			
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level $(L_{Ar,T})$ dB and existing background level $L_{A90,T}$ dB is less than or equal to 0dB	Justification for Effect Level: Below low impact threshold in BS4142:2014 Action Required: None	
 Absolute internal noise criteria for the following noise sources with windows closed: Road traffic noise Goods vehicle deliveries and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Noise levels are below: Living Rooms: - 35 dBL _{Aeq,16hours} Kitchens, Dining Rooms, and Studies: - 40 dBL _{Aeq,16hours} Bedrooms: - 35 dBL _{Aeq,16hours} - 30dB L _{Aeq,8hr} - L _{AFmax,2min} noise levels do not exceed: 45dB L _{AFmax} based on 10 th highest L _{AFmax,2min} sample)	Justification for Effect Level: Less than threshold values in Table 4 in BS8233:2014 and Table 1 in World Health Organisation (1999) Guidelines on Community Noise Action Required: None	
 Change in noise levels for the following noise sources: Road traffic noise Goods vehicle deliveries including arrival and departure of vehicles and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Increase in ambient $L_{Aeq,T}$ due to contribution from proposed development of ≤ 1 dB.	Justification for Effect Level: Within negligible short-term impact classification range in Table 7.14 in IEMA 2014 guidance Guidelines for Environmental Noise Impact Assessment Action Required: None	
Lowes	st Observed Adverse Effect Level (L	OAEL)	
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level $(L_{Ar,T})$ dB and existing background sound level $L_{A90,T}$ dB is between 1-4dB.	Justification for Effect Level: Lower rating levels relative to measured background indicate it is less likely for adverse impacts to occur (depending on context). Action Required: Reduce to a minimum the exceedance over 0dB above background threshold through good acoustic design where practicable, or demonstrate contextual reasoning as to why adverse effects are not predicted	
 Absolute internal noise criteria for the following noise sources with windows closed: Road traffic noise Goods vehicle deliveries and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Noise levels are between: Living Rooms: - 35-40 dBL _{Aeq,16hours} Kitchens, Dining Rooms, and Studies: - 40-45 dBL _{Aeq,16hours} Bedrooms: - 35-40 dBL _{Aeq,16hours} - 30-35dB L _{Aeq,8hr}	Justification for Effect Level: Exceed threshold guidelines in Table 4 of BS8233:2014 and World Health Organisation (1999) Guidelines on Community Noise by no greater than 5dB to achieve <u>reasonable internal</u> <u>conditions</u> as defined by Note 7 to Table 1 in BS8233:2014	

	- L _{AFmax,2min} noise levels do not exceed 45dB L _{AFmax} based on 10 th highest L _{AFmax,2min} sample)	Action Required: Mitigate and reduce to a minimum the exceedance over the threshold
 Change in noise levels for the following noise sources: Road traffic noise Goods vehicle deliveries including arrival and departure of vehicles and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Increase in ambient L _{Aeq,T} due to contribution from proposed development of 1.0-2.9dB.	Justification for Effect Level: Within minor short-term impact classification range in Table 7.14 in IEMA 2014 guidance Guidelines for Environmental Noise Impact Assessment Action Required: Additional mitigation required to achieve effect of LOAEL or less.
Signific	ant Observed Adverse Effect Level	(SOAEL)
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level $(L_{Ar,T})$ dB and existing background sound level $L_{A90,T}$ dB is between 5-9dB.	Justification for Effect Level: Within adverse impact threshold in BS4142:2014. Action Required Additional mitigation required to achieve effect of LOAEL or less.
 Absolute internal noise criteria for the following noise sources with windows closed: Road traffic noise Goods vehicle deliveries and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Noise levels are between: Living Rooms: - 40-45 dBL _{Aeq,16hours} Kitchens, Dining Rooms, and Studies: - 45-50 dBL _{Aeq,16hours} Bedrooms: - 40-45 dBL _{Aeq,16hours} - 35-40dB L _{Aeq,8hr} - 45-55dB L _{AFmax,2min} based on 10 th highest L _{AFmax,2min} sample)	Justification for Effect Level: Exceeds BS8233:2014 L _{Aeq,T} reasonable criteria by 5dB or exceeds L _{AFmax,2min} (10 th highest sample) Action Required: Additional mitigation required to achieve effect of LOAEL or less.
 Change in noise levels for the following noise sources: Road traffic noise Goods vehicle deliveries including arrival and departure of vehicles and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Increase in ambient L _{Aeq,T} due to contribution from proposed development of 3.0-4.9dB.	Justification for Effect Level: Within moderate short-term impact classification range in Table 7.14 in IEMA 2014 guidance Guidelines for Environmental Noise Impact Assessment Action Required: Additional mitigation required to achieve effect of LOAEL or less.
Unaccept	able Observed Adverse Effect Leve	I (UOAEL)
Fixed plant and equipment located externally or internally with louvered ventilation grilles	Difference between Rating Level $(L_{Ar,T})$ dB and existing background sound level $L_{A90,T}$ dB is equal to or greater than 10dB	Justification for Effect Level: Within significant adverse impact threshold in BS4142:2014 Action Required: Additional mitigation required to achieve effect of LOAEL or less.
Absolute internal noise criteria for the following noise sources with windows closed:Road traffic noise	Noise levels exceed: Living Rooms: - 45 dBL _{Aeq,16hours} Kitchens, Dining Rooms, and Studies:	Justification for Effect Level: Exceeds BS8233:2014 LAeq,T reasonable criteria by 10dB or exceeds LAFmax,2min (10 th highest sample) by 10dB or more.

 Goods vehicle deliveries and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	 50 dBLAeq,16hours Bedrooms: 45 dBLAeq,16hours 40dB LAeq,8hr LAFmax,2min noise levels exceeds 55dB LAFmax based on 10th highest LAFmax,2min sample) 	Action Required: Additional mitigation required to achieve effect of LOAEL or less.
 Change in noise levels for the following noise sources: Road traffic noise Goods vehicle deliveries including arrival and departure of vehicles and unloading of vehicles. Service yard noise including forklift truck movements. Car Parks 	Increase in ambient $L_{Aeq,T}$ due to contribution from proposed development of \geq 5.0dB.	Justification for Effect Level: Within major short-term impact classification range in Table 7.14 in IEMA 2014 guidance Guidelines for Environmental Noise Impact Assessment. Action Required: Additional mitigation required to achieve effect of LOAEL or less.

3.0 Assessment Methodology

3.1 Noise Modelling Methodology

Three-dimensional noise modelling has been undertaken based on the monitoring data to predict noise levels at a number of locations both horizontally and vertically. CADNA noise modelling software has been used. This model is based on ISO 9613-2 noise propagation methodology and allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios both horizontally and vertically. The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data and model settings as given in Table 3.1 have been used.

Parameter	Source	Details				
Horizontal distances – around site	Ordnance Survey	Ordnance Survey				
Ground levels – around site	DEFRA	LIDAR 1m DTM				
Building heights – around site	Tetra Tech Observations	 4.0m height for one-storey properties 8.0 m height for two storey properties 3.0m per additional storey 				
Receptor positions*	Tetra Tech	 1.5 m for ground floor properties 4.0m height for first-floor properties 2.8m per additional storey 				
Modelling Parameters	Tetra Tech	Ground Absorption: 0.5Order of Reflections: 2				
Proposed Plans	Veolia	 Drawing Title: Royal Free hospital – Roof layout sketch Drawing No: VEOP-00013682-210-8 				
*All receptors	*All receptors modelled 1.0m from building façade unless otherwise stated.					

Table 3.1: Modelling Parameters Sources and Input Data

It is acknowledged that a number of the values of parameters chosen will affect the overall noise levels presented in this report. However, it should be noted that the values used, as identified above, are worst-case.

3.2 Model Input Data

Information regarding noise emissions from Building has been determined using manufacturer data.

Data contained within Table 3.2 presents noise information for the proposed Building Services Plant.

			Octa	ve Banc	l Sound	Power	Level (L	-w (A))		Cound Douror	
Noise Source	Туре	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Level (L _w (A))	Source
Reversible air source heat pump / air cooled chiller	Average									90.5	VEOP-00013682-SCH-13 Rev.P2 Noise Equipment Schedule.xlsx
12 Fan Adiabatic Cooler	Average	64	73	78	80	81	77	73	66	86	Transtherm Cooling Industries Adiabatic Cooler TA90W/VEE- 264/GG07/2.0/72/2xDN80/S/D
10 Fan Adiabatic Cooler	Average	64	74	78	80	81	78	73	66	86	Transtherm Cooling Industries Adiabatic Cooler TA90W/VEE- 256/GG07/2.0/72/2xDN80/S/D
Adiabatic cooler shunt pump	Average	-	-	-	-	-	-	-	-	79.1	VEOP-00013682-SCH-13 Rev.P2 Noise Equipment Schedule.xlsx
LTHW main distribution pumps	Average	-	-	-	-	-	-	-	-	77.1	VEOP-00013682-SCH-13 Rev.P2 Noise Equipment Schedule.xlsx
CHW PHE shunt pump	Average	-	-	-	-	-	-	-	-	77.1	VEOP-00013682-SCH-13 Rev.P2 Noise Equipment Schedule.xlsx
6no. Air cooled chillers*	Average	-	-	-	-	-	-	-	-	65dB(A) at 1m	Assumed
4no. Dry air radiators*	Average	-	-	-	-	-	-	-	-	65dB(A) at 1m	Assumed

Table 3.2: Summary of Noise Input Data (Sound Power Levels)

*Plant items considered to be outside of Veolia's scope.

3.3 Modelling Inputs & Rating Corrections

Table 3.3 presents the model input information, on-time corrections and BS4142 rating penalty corrections applied to noise data presented within **Tables 3.2**. Rating corrections have been applied as +3dB for intermittent noise sources, and +2dB for tonal sources considered to be otherwise readily distinctive, as per guidance within BS4142 Section 9.2.

Noise Source	Hoight (m)		Operation Time per F	Reference Period (%)	PS4142 Poting Popular		
Noise Source		Source Type	Daytime	Night-Time	B34142 Railing Penalty		
Reversible air source heat pump / air cooled chiller	2.0	Point	100	100			
12 Fan Adiabatic Cooler	2.8	Point	100	100			
10 Fan Adiabatic Cooler	2.8	Point	100	100	+5		
Adiabatic cooler shunt pump	ooler shunt pump 1.5 Poin		100	100			
LTHW main distribution pumps	1.5	Point	100	100			
CHW PHE shunt pump	1.5	Point	100	100			

Table 3.3: Modelling Inputs & Rating Corrections

3.4 Sensitive Receptors

3.4.1 Existing Sensitive Receptor Locations

Table 3.4 summarises receptor locations that have been selected to represent worst-case sensitive receptors with respect to direct noise from the site. Façades of the nearest noise sensitive properties to the development site have been represented. The locations of the receptors are presented within **Figure 3.1**.

Ref.	Description	Type of Use	Height (m) Daytime / Night-time
R01	Belle Vue, Hampstead	Residential	28.0 / 28.0
R02	Belle Vue, Hampstead	Residential	19.0 / 19.0
R03	Argenta House, Aspern Grove	Residential	16.0 / 16.0
R04	Christie Court, 3 Aspern Grove	Residential	7.0
R05	19 Aspern Grove	Residential	6.8
R06	35 Aspern Grove	35 Aspern Grove Residential	
R07	The Grove Centre	Residential	25.0
R08	Anne Bryans House, 77 Fleet Road	Residential	40.0
R09	148 Fleet Road	Residential	1.5 / 4.0
R10	83 Fleet Road	Residential	22.0
R11	1 Elm Terrace	Residential	1.5 / 4.0
R12	37 Pond Street	Residential	1.5 / 4.0
R13	27-29 Pond Street	Residential	1.5 / 4.0
R14	17 Pond Street	Residential	1.5 / 4.0
R15	Hampstead Hill School	Educational	1.5 / N/A
R16	1 Rosslyn Hill	Residential	1.5 / 4.0

Table	3.4:	Existing	Sensitive	Receptor	Locations
			••••••		

Figure 3.1 Sensitive Receptor Locations



4.0 Noise Survey

4.1 Noise Survey Details

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels. Equipment used during the survey included:

Rion NL-52	Environmental Noise Analyser	s/n	843173
Rion NL-52	Environmental Noise Analyser	s/n	1176464
Rion NL-52	Environmental Noise Analyser	s/n	219904
Rion NL-52	Environmental Noise Analyser	s/n	253702
Rion NC-75	Sound Calibrator	s/n	34580543

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline monitoring survey was undertaken at five locations (as specified in **Table 4.1** and shown in **Figure 4.1**) from Wednesday 13th November 2024 to Monday 18th November 2024. Attended Short Term (ST) locations were measured at 2 locations during the day, evening and night periods, three additional long term (LT) locations were measured unattended over a 117-hour period and seven source noise measurements were taken of plant machinery on the roof of the building. The raw data collected from the long-term monitoring is available upon request.

Measurements were taken in general accordance with BS 7445-1:2003 The Description and Measurement of Environmental Noise: Guide to quantities and procedures. Weather conditions during the survey period were observed as being dry. Anemometer readings confirmed that wind speeds were less than 5 ms-1 at all times during the survey, with a predominant north-eastern wind direction during the survey.

Table 4.1 Noise Monitoring Locations

Ref	Description
LT1	Along the eastern façade of the main hospital building, the opposite side of the road to the Royal Free Recreation Club
LT2	In the centre of the Royal Free Hospital Staf Car Park, roughly 23 meters north of 13 Aspern Grove
LT3	To the most south-western corner of the Royal Free Hospital tower roof
ST1	Directly outside the gate of 33 Pond Street
ST2	Directly outside of 142 Fleet Road
SN1-SN7	Source Noise measurements at various active plants on the Royal Free Hospital roof

Figure 4.1: Noise Monitoring Locations



4.2 Noise Survey Results

The dominant noise sources found in the area include road traffic noise from Fleet Road and Pond Street and existing plant noise from Royal Free Hospital.

Ambient and background noise levels are usually described using the L_{Aeq} index (a form of energy average) and the L_{A90} index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the L_{A10} index (i.e. the level exceeded for 10% of the measurement period). For the long-term (LT) locations, the presented L_{Aeq,T} and L_{A10,T} are average noise levels whilst the L_{A90} is the modal noise level of each 5 minute measurement over the stated survey period.

Survey Location	Date & Time	Temperature (⁰C)	Wind Speed (m/s)	Wind Direction	Cloud Cover (Oktas)	Dominant Noise Source
ST2	13/11/24 20:00	11	0-1	-	3	Vehicles frequently passing and idling on adjacent Fleet Road. People occasionally walking past talking.
ST1	13/11/24 20:21	11	0-1	-	3	Vehicles frequently passing on adjacent Pond Street. People occasionally walking past talking. People occasionally heard talking above outside hospital entrance.
ST1	13/11/24 23:08	6	0-1	-	3	Vehicles occasionally passing on adjacent Pond Street. People occasionally talking nearby.
ST2	13/11/24 23:27	6	0-1	-	3	Vehicles occasionally passing on adjacent Fleet Road. Loud hum coming from east side of Royal Free Hospital.
ST1	14/11/24 10:20	11	1-2	West	3	Vehicles constantly passing on adjacent Pond Street. People occasionally walking past talking. People occasionally shouting nearby. Vehicles occasionally beeping nearby. Vehicles constantly entering / exiting / using hospital car park.
ST2	14/11/24 10:43	11	1-2	West	3	Vehicles constantly passing on adjacent Fleet Road. Nearby construction work banging. Vehicles occasionally beeping nearby. Loud hum coming from east side of Royal Free Hospital. People occasionally walking past talking.

Table 4.2 Meteorological Conditions During the Survey

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2×10^{-5} Pa).

Period	Duration (T)	Monitoring Date and Times	Location	L _{Aeq,T} (dB)	L _{Amax,T} (dB)	L _{Amin,T} (dB)	L _{A10,T} (dB)	L _{A90,T} (dB)
Weekday Daytime 07:00 - 23:00	43 hours	13/11/2024 – 18/11/2024		60.9	96.5	53.0	61.3	56.0
Weekday Night- time 23:00 – 07:00	24 hours	13/11/2024 – 18/11/2024	1 11	59.0	94.6	52.5	57.4	54.0
Weekend Daytime 07:00 - 23:00	32 hours	13/11/2024 – 18/11/2024	LII	59.1	87.6	52.6	59.4	55.0
Weekend Night- time 23:00 – 07:00	16 hours	13/11/2024 – 18/11/2024		58.4	84.0	52.5	57.2	54.0
Weekday Daytime 07:00 - 23:00	43 hours	13/11/2024 – 18/11/2024		52.2	87.3	47.1	52.7	49.0
Weekday Night- time 23:00 – 07:00	24 hours	13/11/2024 – 18/11/2024		50.4	78.2	47.3	50.8	50.0
Weekend Daytime 07:00 - 23:00	32 hours	13/11/2024 – 18/11/2024		51.3	78.5	47.5	51.8	49.0
Weekend Night- time 23:00 – 07:00	16 hours	13/11/2024 – 18/11/2024		50.8	74.7	47.9	51.4	50.0
Weekday Daytime 07:00 - 23:00	43 hours	13/11/2024 – 18/11/2024		58.5	82.8	55.4	59.1	57.0
Weekday Night- time 23:00 – 07:00	24 hours	13/11/2024 – 18/11/2024	1 72	57.1	75.3	55.2	57.6	56.0
Weekend Daytime 07:00 - 23:00	32 hours	13/11/2024 – 18/11/2024	LIS	58.1	92.6	55.4	58.6	57.0
Weekend Night- time 23:00 – 07:00	16 hours	13/11/2024 – 18/11/2024		57.2	78.0	55.1	57.6	56.0
Daytime	15 Mins	14/11/2024 10:20	ST1	66.8	85.7	54.5	64.6	62.0
07:00 - 19:00	15 Mins	14/11/2024 10:43	ST2	63.8	82.4	56.3	63.6	58.0

Table 4.3 Results	of Baseline Noise	Monitoring Surve	ev (Average Lev	els)
Table 4.5 Nesulis	of Dasenne Noise	womening Surve	су (листаус сеч	CI3

Period	Duration (T)	Monitoring Date and Times	Location	L _{Aeq,T} (dB)	L _{Amax,T} (dB)	L _{Amin,T} (dB)	L _{A10,T} (dB)	L _{A90,T} (dB)
Evening	15 Mins	13/11/2024 20:21	ST1	66.1	80.6	51.7	62.8	55.0
19:00 - 23:00	15 Mins	13/11/2024 20:00	ST2	62.9	77.7	55.1	62.2	57.0
			·	<u>, </u>	- -			-
Night-time	15 Mins	13/11/2024 23:08	ST1	62.3	80.0	48.8	57.8	50.0
23:00 - 07:00	15 Mins	13/11/2024 23:27	ST2	61.5	77.0	55.1	60.8	57.0

All values are sound pressure levels in dB re: 2x 10⁻⁵ Pa

4.3 Representative Background Noise Levels

Using the data collected during the baseline survey, representative background noise levels have been derived for all receptor locations presented in **Figure 3.1**. **Table 4.4** presents the representative background noise levels considered appropriate for the existing sensitive receptors within the area (the lower of the respective daytime and evening measurements have been used to represent daytime noise levels, where appropriate).

Receptors	Monitoring Location	Time Period	Representative Background Noise Level (<i>L</i> _{A90,T} dB)*			
D09 D10	1 1 1	Daytime (07:00 - 23:00)	56.0			
K00, K10		Night-time (23:00 - 07:00)	54.0			
R03, R04, R05, R06, R07		Daytime (07:00 - 23:00)	49.0			
	LIZ	Night-time (23:00 – 07:00)	50.0			
	LT3	Daytime (07:00 - 23:00)	57.0			
KUT, KUZ		Night-time (23:00 – 07:00)	56.0			
R12, R13, R14,	074	Daytime (07:00 - 23:00)	62.0			
R15, R16	511	Night-time (23:00 - 07:00)	50.0			
DO0 D11	сто.	Daytime (07:00 - 23:00)	58.0			
KU9, K11	512	Night-time (23:00 – 07:00)	57.0			
*Lowest LA90,T value selected from either Weekday or Weekend.						

Table 4.4: Representative Background Noise Levels (All Receptors)

The representative noise levels presented in **Table 4.4** have been used to inform the assessment presented in Section 5.0.

5.0 Assessment of Effects

5.1 Operational Phase

5.1.1 Building Services Plant Noise Assessment

This assessment has been undertaken to establish the proposed external noise levels from the proposed building services plant. This includes the BSP items, as described within **Table 3.2**.

The LTHW Main Distribution Pumps and CHW PHE Shunt Pumps have been modelled as being housed in a roofed enclosure with a reduction value of 20Rw.

In addition to the plant proposed by Veolia, additional plant is also in proposal at Royal Free Hospital that falls outside of Veolia's scope, as illustrated in **Figure 5.1**. Therefore, two assessment scenarios have been conducted: one including the proposed plant beyond Veolia's scope and another excluding it.

The results of the plant noise assessment are presented within **Table 5.1**, and the locations of plant units included within the assessment are presented within **Figure 5.1Error! Reference source not found.**

Figure 5.1: Assessed Plant Locations



Location	Existing Measured Background L _{A90}		Noise rating level from plant		BS 4142 Score	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	57	56	46	46	-11	-10
R02	57	56	37	37	-20	-19
R03	49	50	46	46	-3	-4
R04	49	50	46	46	-3	-4
R05	49	50	44	44	-5	-6
R06	49	50	43	43	-6	-7
R07	56	54	49	49	-7	-5
R08	56	54	51	51	-5	-3
R09	58	57	52	52	-6	-5
R10	56	53	60	60	4	7
R11	58	57	46	46	-12	-11
R12	62	50	46	46	-16	-4
R13	62	50	41	41	-21	-9
R14	62	50	35	35	-27	-15
R15	62	50	34	34	-28	-16
R16	62	50	36	36	-26	-14

Table 5.1: BS4142 Assessment - Including Proposed Plant Outside Veolia Scope

All values are sound pressure levels in dBA re: 2x 10⁻⁵ Pa.

All calculations used to derive the above table (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 para 8.6 the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

Location	Existing Measured Background L _{A90}		Noise rating level from plant		BS 4142 Score	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	57	56	36	36	-21	-20
R02	57	56	34	34	-23	-22
R03	49	50	46	46	-3	-4
R04	49	50	45	45	-4	-5
R05	49	50	45	45	-4	-5
R06	49	50	44	44	-5	-6
R07	56	54	52	52	-4	-2
R08	56	54	52	52	-5	-3
R09	58	57	47	47	-11	-10
R10	56	53	56	56	0	3
R11	58	57	44	44	-14	-13
R12	62	50	46	46	-16	-4
R13	62	50	33	33	-29	-17
R14	62	50	29	29	-33	-21
R15	62	50	27	27	-35	-23
R16	62	50	27	27	-35	-23

Table 5.2 BS 4142 Assessment - Excluding Proposed Plant Outside Veolia Scope

All values are sound pressure levels in dBA re: 2x 10⁻⁵ Pa.

All calculations used to derive the above table (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 para 8.6 the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

As demonstrated within **Table 5.1**, inclusive of the proposed plant outside of Veolia's scope, the results of the assessment indicate that the BS4142 Noise Rating Levels at sensitive façades of the existing noise sensitive properties are below the measured background noise levels at all properties, except for Receptor R10. Daytime and Night-time rating levels are predicted to be +4dB and +7dB respectively. As such, the majority of the receptors are predicted to result in No Observed Adverse Effect Level (NOEAL), Receptor 10 is predicted to result in a Significant Observed Adverse Effect Level (SOEAL).

As demonstrated within **Table 5.2**, when the proposed plant outside of Veolia's scope is not included in the assessment, again the results of the assessment indicate that BS4142 Noise

Rating Levels at sensitive façades of the existing noise sensitive properties are below the measured background noise levels at all properties, except for Receptor R10. However, just Night-time rating levels are predicted over criteria at +3dB respectively. As such, the majority of the receptors are predicted to result in No Observed Adverse Effect Level (NOEAL), Receptor 10 is predicted to result in a Lowest Observed Adverse Effect Level (LOEAL).

5.1.2 Noise Intrusion Assessment

Internal noise levels at sensitive receptor locations, from all noise sources including the noise sources, as described within **Table 3.2** have been assessed both with windows open where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of double glazing with a sound reduction of 30 dB R_{w+Ctr} has been used.

Results of the noise intrusion assessments for average daytime and night-time noise levels are presented within **Table 5.3**, **Table 5.4**, **Table 5.5** and **Table 5.6** respectively.

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}
R01	43.4	28.4	13.4	35
R02	40.0	25.0	10.0	35
R03	42.4	27.4	12.4	35
R04	40.1	25.1	10.1	35
R05	40.2	25.2	10.2	35
R06	39.0	24.0	9.0	35
R07	46.9	31.9	16.9	35
R08	47.0	32.0	17.0	35
R09	47.0	32.0	17.0	35
R10	54.5	39.5	24.5	35
R11	39.0	24.0	9.0	35
R12	42.2	27.2	12.2	35
R13	36.5	21.5	6.5	35
R14	31.4	16.4	1.4	35
R15	35.8	20.8	5.8	35
R16	31.0	16.0	1.0	35
All values are sound	pressure levels in dBA	re: 2x 10 ⁻⁵ Pa.		

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Table 5.3: Daytime Noise Intrusion Levels (with BSP Outside Veolia Scope LAeg, 1hour)

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}				
R01	43.4	28.4	13.4	30				
R02	40.0	25.0	10.0	30				
R03	42.4	27.4	12.4	30				
R04	40.1	25.1	10.1	30				
R05	40.2	25.2	10.2	30				
R06	39.0	24.0	9.0	30				
R07	46.9	31.9	16.9	30				
R08	47.0	32.0	17.0	30				
R09	47.0	32.0	17.0	30				
R10	54.5	39.5	24.5	30				
R11	39.0	24.0	9.0	30				
R12	42.2	27.2	12.2	30				
R13	36.5	26.5	6.5	30				
R14	31.4	21.4	1.4	30				
R15	35.8	25.8	5.8	30				
R16	31.0	21.0	1.0	30				
All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.								

Table 5.4: Night-time Noise Intrusion Levels (with BSP Outside Veolia Scope LAeq,1hour)

Table 5.5: Daytime Noise Intrusion Levels (excluding BSP Outside Veolia Scope)

LAeq,1hour)

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}					
R01	31.4	16.4	1.4	35					
R02	29.2	14.2	0.0	35					
R03	40.7	25.7	10.7	35					
R04	39.7	24.7	9.7	35					
R05	39.8	24.8	9.8	35					
R06	38.6	23.6	8.6	35					
R07	46.7	31.7	16.7	35					
R08	46.5	31.5	16.5	35					
R09	42.2	27.2	12.2	35					
R10	50.6	35.6	20.6	35					
R11	39.0	24.0	9.0	35					
R12	40.8	25.8	10.8	35					
R13	27.6	12.6	0.0	35					
R14	24.3	9.3	0.0	35					
R15	22.0	7.0	0.0	35					
R16	21.7	6.7	0.0	35					
All values are sound	All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.								

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}					
R01	31.4	16.4	1.4	30					
R02	29.2	14.2	0.0	30					
R03	40.7	25.7	10.7	30					
R04	39.7	24.7	9.7	30					
R05	39.8	24.8	9.8	30					
R06	38.6	23.6	8.6	30					
R07	46.7	31.7	16.7	30					
R08	46.5	31.5	16.5	30					
R09	42.2	27.2	12.2	30					
R10	50.6	35.6	20.6	30					
R11	39.0	24.0	9.0	30					
R12	40.8	25.8	10.8	30					
R13	27.6	17.6	0.0	30					
R14	24.3	14.3	0.0	30					
R15	22.0	12.0	0.0	30					
R16	21.7	11.7	0.0	30					
All values are sound	All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.								

Table 5.6: Night-time Noise Intrusion Levels (excluding BSP Outside Veolia Scope LAeg, 1hour)

As shown in **Table 5.3**, **Table 5.4**, **Table 5.5** and **Table 5.6**, when the proposed plant outside of Veolia's scope is included in the assessment, predicted noise levels are below the respective internal noise level criteria with windows open at the majority of receptors except for R07, R08, R09 and R10, however excluding the proposed plant outside of Veolia's scope, just receptors R07, R08 and R10 exceed. Internal noise level criteria with windows closed is met at all receptors for both daytime and night-time.

As such, installation of the BSP, both with and without the plant outside of Veolia's scope, is predicted to result in a Lowest Observable Adverse Effect Level (LOAEL).

5.1.3 Change in Noise Level Assessment

This assessment has been undertaken to compare worst-case representative noise levels from the 'existing ambient noise levels' (L_{Aeq}) to predicted ambient noise levels inclusive of the proposed scheme at existing sensitive receptors. The differences between the 'existing' and the 'proposed' development scenarios, during the daytime and night-time are presented in **Table 5.7**.

Def	Existin (Moni	g LAeq tored)	Proposed LAeq (Modelled)		Combined LAeq		Contribution from Proposed Scheme dB	
Ret	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time
R01	58.1	57.1	31.4	31.4	58.1	57.1	0.0	0.0
R02	58.1	57.1	29.2	29.2	58.1	57.1	0.0	0.0
R03	51.3	50.4	40.7	40.7	51.7	50.4	0.4	0.4
R04	51.3	50.4	39.7	39.7	51.6	50.4	0.3	0.4
R05	51.3	50.4	39.8	39.8	51.6	50.4	0.3	0.4
R06	51.3	50.4	38.6	38.6	51.5	50.4	0.2	0.3
R07	51.3	50.4	46.7	46.7	52.6	50.4	1.3	1.5
R08	60.9	58.4	46.8	46.8	61.1	58.4	0.2	0.3
R09	63.8	61.5	44.9	44.9	63.9	61.5	0.1	0.1
R10	60.9	58.4	51.7	51.7	61.4	58.4	0.5	0.8
R11	63.8	61.5	39.1	39.1	63.8	61.5	0.0	0.0
R12	66.8	62.3	40.9	40.9	66.8	62.3	0.0	0.0
R13	66.8	62.3	28.8	28.8	66.8	62.3	0.0	0.0
R14	66.8	62.3	25.2	25.2	66.8	62.3	0.0	0.0
R15	66.8	62.3	22.6	22.6	66.8	62.3	0.0	0.0
R16	66.8	62.3	21.9	21.9	66.8	62.3	0.0	0.0
All valu	ues are soun	d pressure le	vels in dBA r	e: 2x 10 ^{-₅} Pa				

Table 5.7: Change in Noise Assessment (including BSP Outside Veolia Scope)

Def	Existin (Moni	g LAeq tored)	Proposed LAeq (Modelled)		Combined LAeq		Contribution from Proposed Scheme dB	
Ret	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time
R01	58.1	57.1	31.4	31.4	58.1	57.1	0.0	0.0
R02	58.1	57.1	29.2	29.2	58.1	57.1	0.0	0.0
R03	51.3	50.4	40.7	40.7	51.7	50.8	0.4	0.4
R04	51.3	50.4	39.7	39.7	51.6	50.8	0.3	0.4
R05	51.3	50.4	39.8	39.8	51.6	50.8	0.3	0.4
R06	51.3	50.4	38.6	38.6	51.5	50.7	0.2	0.3
R07	51.3	50.4	46.7	46.7	52.6	51.9	1.3	1.5
R08	60.9	58.4	46.5	46.5	61.1	58.7	0.2	0.3
R09	63.8	61.5	42.2	42.2	63.8	61.6	0.0	0.1
R10	60.9	58.4	50.6	50.6	61.3	59.1	0.4	0.7
R11	63.8	61.5	39.0	39.0	63.8	61.5	0.0	0.0
R12	66.8	62.3	40.8	40.8	66.8	62.3	0.0	0.0
R13	66.8	62.3	27.6	27.6	66.8	62.3	0.0	0.0
R14	66.8	62.3	24.3	24.3	66.8	62.3	0.0	0.0
R15	66.8	62.3	22.0	22.0	66.8	62.3	0.0	0.0
R16	66.8	62.3	21.7	21.7	66.8	62.3	0.0	0.0
All valu	ues are soun	d pressure le	vels in dBA r	e: 2x 10⁻⁵ Pa				

Table 5.8: Change in Noise Assessment (excluding BSP Outside Veolia Scope)

As demonstrated in **Table 5.7** and **Table 5.8**, with the proposed plant outside of Veolia's scope either included or excluded from the assessment, the absolute noise level at the closest receptors is predicted to increase by <1dB at all receptors except for Receptor R07, for the majority of receptors this is indicative of a negligible impact as defined by the IEMA 2014 Guidelines for Environmental Noise Impact Assessment. As such, impacts due to the BSP are predicted to be within the No Observed Adverse Effect Limit (NOAEL). For Receptor R07 this is indicative of a minor impact as defined by the IEMA 2014 Guidelines for Environmental Noise Impact as defined by the IEMA 2014 Guidelines for within the No Observed Adverse Effect Limit (NOAEL). For Receptor R07 this is indicative of a minor impact as defined by the IEMA 2014 Guidelines for Environmental Noise Impact Assessment. As such, impacts at R07 are predicted to be within the Lowest Observed Adverse Effect Limit (LOAEL).

6.0 Site Design & Mitigation

6.1 Additional Mitigation

As the predicted unmitigated noise intrusion levels exceed the internal noise level criteria in BS8233 with windows open at a number of receptors and an exceedance is predicted in accordance with BS4142 assessment a number of mitigation measures have been assessed this includes noise barriers. **Figure 6.1** displays the layout of the mitigation in respect to the greater site, with an assessment of effects presented below in **Tables 6.1** to **6.3**.

Mitigation assessments and requirements have been separated between the two scenarios: including and excluding the proposed plant beyond Veolia's scope.

As requested, and previously stated in **Section 5.1.1**, the LTHW Main Distribution Pumps and CHW PHE Shunt Pumps have been modelled as being housed in a roofed enclosure with a reduction value of 20dB Rw.



Figure 6.1: Assessed Mitigation

Mitigated Building Services Plant Noise Assessment

This assessment has been undertaken to establish the maximum permissible external noise levels from the proposed building services plant. This includes the noise sources, as described within **Table 3.2**.

The results of the plant noise assessment are presented within **Table 6.1** and **Table 6.2**.

Table 6.1: Mitigated BS4142 Assessment Ir	ncluding Proposed Plan	t Outside Veolia
Scope		

Location	tion Existing Measured Noise rating level from plant		Existing Measured Background L _{A90}		BS 414	2 Score
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	57	56	48	48	-9	-8
R02	57	56	45	45	-12	-11
R03	49	50	47	47	-2	-3
R04	49	50	45	45	-4	-5
R05	49	50	45	45	-4	-5
R06	49	50	44	44	-5	-6
R07	56	54	52	52	-4	-2
R08	56	54	52	52	-4	-2
R09	58	57	48	48	-10	-9
R10	56	53	55	55	-1	+2
R11	58	57	43	43	-15	-14
R12	62	50	46	46	-16	-4
R13	62	50	35	35	-27	-15
R14	62	50	33	33	-29	-17
R15	62	50	40	40	-22	-10
R16	62	50	36	36	-26	-14

All values are sound pressure levels in dBA re: 2x 10⁻⁵ Pa.

All calculations used to derive the above table (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 para 8.6 the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

Table 6.2: Mitigated BS4142 Assessment Excluding Proposed Plant Outside VeoliaScope

Location	Existing Measured Background L _{A90}		Noise rating level from plant		BS 4142 Score	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
R01	57	56	36	36	-21	-20
R02	57	56	34	34	-23	-22
R03	49	50	46	46	-3	-4
R04	49	50	45	45	-4	-5
R05	49	50	45	45	-4	-5
R06	49	50	44	44	-5	-6
R07	56	54	52	52	-4	-2
R08	56	54	51	51	-5	-3
R09	58	57	47	47	-11	-10
R10	56	53	54	54	-2	+1
R11	58	57	43	43	-15	-14
R12	62	50	46	46	-16	-4
R13	62	50	32	32	-30	-18
R14	62	50	29	29	-33	-21
R15	62	50	27	27	-35	-23
R16	62	50	27	27	-35	-23

All values are sound pressure levels in dBA re: 2x 10⁻⁵ Pa.

All calculations used to derive the above table (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 para 8.6 the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

As demonstrated within **Table 6.1**, the results of the mitigated assessment where the proposed plant outside of Veolia's scope are included indicate that the BS4142 Noise Rating Levels at sensitive façades of the existing noise sensitive properties are below the measured background noise levels at all properties, except for Receptor R10. Night-time rating levels are predicted to be +2dB respectively. As such, with the addition of mitigation, the majority of the receptors are predicted to result in No Observed Adverse Effect Level (NOEAL), Receptor 10 is predicted to result in a Lowest Observed Adverse Effect Level (LOEAL).

As a sole entity, the plant within Veolia's scope has a +3dB exceedance at night-time, resulting in Lowest Observed Adverse Effect Limit (LOAEL) and does not strictly require mitigation, however a 2.5 meter barrier along the eastern side of the 12 fan Adiabatic

Coolers on the roof of the hospital, as demonstrated in **Figure 6.1**, would bring this exceedance down to +1dB during the night-time.

6.1.1 Mitigated Noise Intrusion Assessment

Internal noise levels at sensitive receptor locations, from all noise sources including the noise sources, as described within **Table 3.2** have been assessed both with windows open where a reduction from a partially open window of 15 dB has been used, and with windows closed where an assumption of double glazing with a sound reduction of 30 dB R_{w+Ctr} has been used.

Results of the mitigated noise intrusion assessments for average daytime and night-time noise levels are presented within **Table 6.3**, **Table 6.4**, **Table 6.4** and **Table 6.5** respectively.

S	Scope LAeq,1hour)									
	Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}					
	R01	43.3	28.3	13.3	35					
	R02	39.9	24.9	9.9	35					
	R03	42.4	27.4	12.4	35					
	R04	40.0	25.0	10.0	35					
	R05	40.2	25.2	10.2	35					
	R06	38.9	23.9	8.9	35					
	R07	46.8	31.8	16.8	35					
	R08	46.4	31.4	16.4	35					

27.0

34.0

23.1

25.7

14.2

13.2

12.0

19.0

8.1

10.7

0.0

0.0

5.4

0.8

Table 6.3: Mitigated Daytime Noise Intrusion Levels (with BSP Plant Out	utside Veolia
Scope LAeq,1hour)	

R15	35.4	20.4	
R16	30.8	15.8	
All values are sound	pressure levels in dBA	re [.] 2x 10 ⁻⁵ Pa	

42.0

49.0

38.1

40.7

29.2

28.2

R09

R10

R11

R12

R13

R14

35

35

35

35

35

35

35

35

Table 6.4: Mitigated Night-time Noise Intrusion Levels (with BSP Plant Outside Veolia Scope LAeq,1hour)

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}
R01	43.3	28.3	13.3	30
R02	39.9	24.9	9.9	30
R03	42.4	27.4	12.4	30
R04	40.0	25.0	10.0	30
R05	40.2	25.2	10.2	30
R06	38.9	23.9	8.9	30
R07	46.8	31.8	16.8	30
R08	46.4	31.4	16.4	30
R09	42.0	27.0	12.0	30
R10	49.0	34.0	19.0	30
R11	38.1	23.1	8.1	30
R12	40.7	25.7	10.7	30
R13	29.2	19.2	0.0	30
R14	28.2	18.2	0.0	30
R15	35.4	25.4	5.4	30
R16	30.8	20.8	0.8	30

All values are sound pressure levels in dBA re: 2x 10⁻⁵ Pa.

Table 6.5: Mitigated Daytime Noise Intrusion Levels (Excluding BSP Outside Veolia

Scope LAeq,1hour)

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}
R01	31.4	16.4	1.4	35
R02	29.2	14.2	0.0	35
R03	40.7	25.7	10.7	35
R04	39.7	24.7	9.7	35
R05	39.8	24.8	9.8	35
R06	38.6	23.6	8.6	35
R07	46.7	31.7	16.7	35
R08	46.2	31.2	16.2	35
R09	42.0	27.0	12.0	35
R10	49.0	34.0	19.0	35
R11	38.1	23.1	8.1	35
R12	40.7	25.7	10.7	35
R13	27.4	12.4	0.0	35
R14	24.3	9.3	0.0	35
R15	28.7	13.7	0.0	35
R16	30.9	15.9	0.9	35

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}			
All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.							

Table 6.6: Mitigated Night-time Noise Intrusion Levels (Excluding BSP Outside Veolia

Scope LAeq,1hour)

Location	External L _{Aeq}	Internal L _{Aeq} with windows open	Internal L _{Aeq} with windows closed	Criteria L _{Aeq}			
R01	31.4	16.4	1.4	30			
R02	29.2	14.2	0.0	30			
R03	40.7	25.7	10.7	30			
R04	39.7	24.7	9.7	30			
R05	39.8	24.8	9.8	30			
R06	38.6	23.6	8.6	30			
R07	46.7	31.7	16.7	30			
R08	46.2	31.2	16.2	30			
R09	42.0	27.0	12.0	30			
R10	49.0	34.0	19.0	30			
R11	38.1	23.1	8.1	30			
R12	40.7	25.7	10.7	30			
R13	27.4	17.4	0.0	30			
R14	24.3	14.3	0.0	30			
R15	22.0	12.0	0.0	30			
R16	21.7	11.7	0.0	30			
All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.							

As demonstrated within **Table 6.3** to **6.6**, predicted noise levels are below the respective internal noise level criteria with windows open at the majority of receptors except for R07, R08 and R10. It is worth noting that R07, R08 and R10 are subject to existing noise levels that exceed those predicted, as outlined in **Table 6.6**. Internal noise level criteria with windows closed is met at all receptors for both daytime and night-time, as such, installation of the BSP is predicted to result in a Lowest Observable Adverse Effect Level (LOAEL).

6.1.2 Mitigated Change in Noise Level Assessment

This assessment has been undertaken to compare worst-case representative noise levels from the 'existing ambient noise levels' (L_{Aeq}) to predicted ambient noise levels inclusive of the proposed scheme at existing sensitive receptors. The differences between the 'existing' and the 'proposed' development scenarios, during the daytime and night-time are presented in **Table 6.7** and **Table 6.8**.

Table 6.7: Mitigated Change in Noise Assessment (Including BSP Outside VeoliaScope)

Pof	Existing L _{Aeq} (Monitored)		Proposed L _{Aeq} (Modelled)		Combined L _{Aeq}		Contribution from Proposed Scheme dB	
Ret	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time
R01	58.1	57.1	43.3	43.3	58.2	57.3	0.1	0.2
R02	58.1	57.1	39.9	39.9	58.2	57.2	0.1	0.1
R03	51.3	50.4	42.4	42.4	51.8	51.0	0.5	0.6
R04	51.3	50.4	40.0	40.0	51.6	50.8	0.3	0.4
R05	51.3	50.4	40.2	40.2	51.6	50.8	0.3	0.4
R06	51.3	50.4	39.0	39.0	51.5	50.7	0.2	0.3
R07	51.3	50.4	46.8	46.8	52.6	52.0	1.3	1.6
R08	60.9	58.4	46.7	46.7	61.1	58.7	0.2	0.3
R09	63.8	61.5	43.0	43.0	63.8	61.6	0.0	0.1
R10	60.9	58.4	50.3	50.3	61.3	59.0	0.4	0.6
R11	63.8	61.5	38.2	38.2	63.8	61.5	0.0	0.0
R12	66.8	62.3	40.9	40.9	66.8	62.3	0.0	0.0
R13	66.8	62.3	29.9	29.9	66.8	62.3	0.0	0.0
R14	66.8	62.3	28.4	28.4	66.8	62.3	0.0	0.0
R15	66.8	62.3	35.4	35.4	66.8	62.3	0.0	0.0
R16	66.8	62.3	30.8	30.8	66.8	62.3	0.0	0.0
All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.								

Table 6.8: Mitigated Change in Noise Assessment (Excluding BSP Outside VeoliaScope)

Def	Existing L _{Aeq} (Monitored)		Proposed L _{Aeq} (Modelled)		Combined L _{Aeq}		Contribution from Proposed Scheme dB	
Ret	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time	Daytime	Night- Time
R01	58.1	57.1	31.4	31.4	58.1	57.1	0.0	0.0
R02	58.1	57.1	29.2	29.2	58.1	57.1	0.0	0.0
R03	51.3	50.4	40.7	40.7	51.7	50.8	0.4	0.4
R04	51.3	50.4	39.7	39.7	51.6	50.8	0.3	0.4
R05	51.3	50.4	39.8	39.8	51.6	50.8	0.3	0.4
R06	51.3	50.4	38.6	38.6	51.5	50.7	0.2	0.3
R07	51.3	50.4	46.7	46.7	52.6	51.9	1.3	1.5
R08	60.9	58.4	46.2	46.2	61.0	58.7	0.1	0.3
R09	63.8	61.5	42	42	63.8	61.5	0.0	0.0
R10	60.9	58.4	49	49	61.2	58.9	0.3	0.5
R11	63.8	61.5	38.1	38.1	63.8	61.5	0.0	0.0
R12	66.8	62.3	40.7	40.7	66.8	62.3	0.0	0.0
R13	66.8	62.3	27.4	27.4	66.8	62.3	0.0	0.0
R14	66.8	62.3	24.3	24.3	66.8	62.3	0.0	0.0
R15	66.8	62.3	22	22	66.8	62.3	0.0	0.0
R16	66.8	62.3	21.7	21.7	66.8	62.3	0.0	0.0
All values are sound pressure levels in dBA re: 2x 10 ⁻⁵ Pa.								

As demonstrated in **Table 6.7** and **Table 6.8**, the absolute noise level at the closest receptors is predicted to increase by <1dB at all receptors except for Receptor R07, this is indicative of a minor impact as defined by the IEMA 2014 Guidelines for Environmental Noise Impact Assessment. As such, impacts due to the BSP including and excluding the proposed plant outside of Veolia's scope are predicted to be below the Low Observed Adverse Effect Limit (LOAEL).

Despite the exceedance at receptor R07 when assessed in accordance with BS 8233, given the resulting change in noise level assessment, this should still be considered a Lowest Observed Adverse Effect Level (LOAEL) in accordance with the NPPF. With regards to the other identified sensitive receptors, it is considered that all locations will result in a No Observed Adverse Effect Level (NOAEL) in accordance with the NPPF.

7.0 Conclusion

A noise assessment has been undertaken in support of a planning application for the installation of Building Services Plant at Royal Free Hospital, assessing the proposed BSPs both within and beyond Veolia's scope of works.

A BS4142 assessment was undertaken and showed that during the daytime and night-time rating levels where above the measured background noise levels predicting that noise from the proposed site will result in a Significant Observed Adverse Effect Limit (SOAEL) at nearby existing receptors when the proposed plant outside of Veolia's scope was included in the assessment. A mitigation strategy including noise barriers and noise attenuators/quieter plant items was included in the assessment.

With mitigation in place a BS4142 assessment showed that during the daytime and nighttime rating levels where above the measured background noise levels predicting that noise from the proposed site will result in a Lowest Observed Adverse Effect Limit (LOAEL) at a nearby existing receptors. To provide a contextual element to the assessment a noise intrusion assessment was presented.

However, when just the proposed plant within Veolia's scope were assessed, only the nighttime rating levels were above the measured background noise levels, resulting in a Lowest Observed Adverse Effect Limit (LOAEL) at nearby existing receptors.

The indicative noise break-in calculations have been undertaken to determine likely impacts of noise upon existing sensitive receptors. Based on calculations undertaken, it is anticipated that internal noise level criteria outlined in Section 2 of this report are met at the majority of receptors. A change in noise level assessment was also undertaken and predicted that noise from the proposed site will result in the Lowest Observed Adverse Effect Limit (LOAEL) at nearby existing receptors.

Considering the assessments and that with context the effect of the proposed noise falls within the Lowest Observed Adverse Effect Level (LOAEL) in accordance with the NPPF, noise from the site is therefore also considered to be in accordance with Camden Council's Policy A4.

The NPPF provides test points against which the proposed development has been assessed. Considering these points, the following conclusions can be drawn:

NPPF paragraphs 198 and 201

Based upon the assessments presented, it is considered that the development does not adversely affect or put sensitive receptors at risk from noise pollution, and no significant adverse effects are predicted to occur.

NPPF paragraph 200

Considering the existing use of the site and wider development site, it is not considered that any existing businesses wanting to develop would be restricted by the proposals.

Planning Practice Guidance: Noise

It has been predicted that on-site operational noise effects associated with the Development will be below the Significant Observed Adverse Effect and therefore the development will have a low impact in relation to noise.

Appendices



Appendix A – Acoustic Terminology

Acoustic Terminology

- dB Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.
- dB(A) Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.
- L_{Aeq} Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq, 07:00 23:00}$ for example, describes the equivalent continuous noise level over the 16-hour period between 7 am and 11 pm. During this time period the L_{pA} at any particular time is likely to have been either greater or lower that the $L_{Aeq, 07:00 23:00}$.
- L_{Amin} The L_{Amin} is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.
- L_{Amax} The L_{Amax} is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.
- Ln Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say. 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the $L_{A10, 1 \text{ hr}} = x \text{ dB}$.

The L_{A10} index is often used in the description of road traffic noise, whilst the L_{A90} , the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. L_{A1} and L_{Amax} are common descriptors of construction noise.

R_w The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.



Appendix B – References

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