SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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NHS Northwood and Pinner, Hillingdon

Hospital and residential planning noise report

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Version	Date	Comments	Author	Reviewer
A	27 May 20	First issue	Byron Davies	Daniel Stringer
B	1 Jul 20	Overheating updates	Byron Davies	Daniel Stringer
C	16 Mar 21	Planning comments update	Byron Davies	Daniel Stringer

Summary

Sandy Brown has been commissioned by NHS Property Services and NHS Hillingdon CCG to provide a noise assessment in relation to the proposed development at Northwood and Pinner Cottage Hospital, Pinner Road, HA6 1DE.

Proposals are for the refurbishment of an existing healthcare centre owned by the NHS and for two new residential blocks. The primary noise sources associated with the scheme are a series of air source heat pumps serving the residential building and VRF units serving the medical centre.

Due to the COVID-19 Pandemic, impact on travel and closure of many commercial premises, current noise levels are unlikely to be representative. As such, the baseline noise conditions have been established by using noise mapping databases and predictions based on traffic flow data.

The assessment undertaken provides a robust estimate of the environmental noise climate and is in line with the "*Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments*" produced by the Association of Noise Consultants and the Institute of Acoustics.

Based on the requirements of the London Borough of Hillingdon (LBH), all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed L_{Aeq} 40 dB during the daytime and L_{Aeq} 30 dB at night.

The predicted plant noise egress level will meet these limits and the requirements of LBH will be achieved.

An assessment has been carried out to determine the required building envelope sound insulation performance. This has been based on the predicted external facade noise levels and internal noise criteria defined by LBH for residential areas and by HTM 08 01 for the medical centre.

The facade sound insulation performance requirements have been determined across the site and range from R'_w+C_{tr} 16-34 dB. Guidance on suitable glazing configurations necessary to achieve the performance requirements is provided.

With windows open, internal noise levels in Block B and the north facing elevation of Block A may marginally exceed LBH guidelines but this is not expected to affect the amenity of residents. Internal noise levels in Block A may exceed these criteria by approximately 12-17 dB at the worst affected facade which is more significant.

When considering open windows for purposes of overheating control, a compromise between acoustic comfort and sustainability is often acceptable for limited periods. The current design incorporates blinds, MVHR units and external shading in the worst affected areas which reduces periods of overheating and the need for open windows as far as reasonably possible to approximately 4-13 days per year.

Contents

1 Introduction

Sandy Brown has been commissioned by NHS Property Services and NHS Hillingdon CCG to provide a noise assessment in relation to the proposed development at Northwood and Pinner Cottage Hospital, Pinner Road, HA6 1DE.

During normal circumstances, an environmental noise survey would be carried out to establish existing ambient noise levels to help determine:

- appropriate limits for noise egress from building services plant at adjacent nose sensitive premises
- building envelope sound insulation requirements necessary to achieve suitable internal noise criteria.

Due to the COVID-19 Pandemic, impact on travel and closure of many commercial premises, current noise levels are unlikely to be representative.

As such, the baseline noise conditions have been established by using noise mapping databases and predictions based on traffic flow data. This includes:

- Strategic noise mapping for roads in 2017 published by Defra
- Noise contour maps for Heathrow Airport published by the Civil Aviation Authority
- Noise contour maps for RAF Northolt published by the Ministry of Defence
- Calculation of Road Traffic Noise (CRTN) predictions based on traffic flow data

The assessment undertaken provides a robust estimate of the environmental noise climate and is in line with the "*Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments*" produced by the Association of Noise Consultants and the Institute of Acoustics.

This report presents the details of the various assessments. This includes noise limits and control of emissions from building services plant and building envelope sound insulation requirements. In all cases, these assessments are carried out is accordance with the requirements of the London Borough of Hillingdon (LBH).

2 Site description

2.1 The site and its surroundings

The site location in relation to its surroundings is shown in Figure 1. The site boundaries are highlighted in orange. The western portion of the site fronts onto Pinner Road (a busy A-road) and the eastern portion is accessed via Neal Close to the north and Waverley Gardens to the east. Both Neal Close and Waverley Gardens are local access roads.

The site is located approximately 15 km to the north of Heathrow Airport, and 5.6 km to the north of RAF Northolt.

Most of the existing buildings on site will be demolished, except for the Healthcare Centre highlighted in green which is being extended (orange sections). The proposed locations of the new residential Blocks A and B are highlighted in blue.

The approximate locations of the proposed building services plant are marked as P1-P3.

Figure 1 Aerial view of site showing proposed new development (courtesy of Google Earth Pro)

2.2 Adjacent premises

All buildings in the immediate area are residential.

Nearby noise sensitive receptors (R1-R5) are shaded in pink in Figure 1 and vary in height from 1 to 3 storeys.

3 Development proposals

The proposal is for the partial demolition, refurbishment and extension of the existing Cottage Hospital to provide a state of the art health centre and the comprehensive redevelopment of the remaining Site to provide residential (use class C3) accommodation and ancillary works including car parking, cycle parking, landscaping and associated works (phased)."

The primary noise sources associated with the scheme are 3 VRF units located externally to the refurbished healthcare centre, and 5 rooftop air source heat pumps each for Blocks A and B as shown in Figure 1.

4 Assessment criteria

4.1 NPPF and NPSE

The National Planning Policy Framework, February 2019 (NPPF) sets out the UK government's planning policies for England. It supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

> *'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> - *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.*
> - *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

and

> *'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.'*

The NPSE states that its aims are as follows:

> *'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
>
> - *Avoid significant adverse impacts on health and quality of life*
> - *Mitigate and minimise adverse impacts on health and quality of life and*
> - *Where possible, contribute to the improvement of health and quality of life.'*

As such, neither document sets out specific acoustic criteria for new residential developments, but they require consideration of the effect of existing noise on the new development and the effect of noise from the development on the surroundings.

4.2 ProPG

ProPG *Planning & Noise (Professional Practice Guidance on Planning & Noise), New Residential Development, 2017* provides guidance to the management of noise within the planning system in England. It is restricted to consideration of new residential developments that will be exposed predominantly to airborne noise from transport sources.

The two stages of the approach are given below

- Stage 1 – Initial noise risk assessment of the proposed development site
- Stage 2 – Systematic consideration of four key elements
    - Element 1 – Demonstrating a "Good Acoustic Design Process"
    - Element 2 – Observing internal "Noise Level Guidelines"
    - Element 3 – Undertaking an "External Amenity Area Noise Assessment"
    - Element 4 – Consideration of "Other Relevant Issues".

Following this approach, there are four possible recommendations, the choice of recommendation is as follows:

- Grant without conditions
- Grant with conditions
- Avoid
- Prevent.

Guidance provided in ProPG has been used to assess the proposed development site and recommend mitigation measures to reduce noise levels.

4.3 HTM 08 01

Healthcare buildings should be designed to meet the requirements of Department of Health's Health Technical Memorandum 08 01: Acoustics (HTM 08-01). A list of the criteria for noise intrusion from external sources taken from HTM 08-01, pertaining to the development proposals are presented in Table 1.

Table 1 Criteria for noise intrusion from external sources (HTM-08 2013)

Room type	Example	Criteria ($L_{Aeq,\ 1hr}$)
Small office-type spaces	Private offices, small treatment rooms, interview rooms, consulting rooms	40 dB
Circulation spaces	Corridors, hospital street, atria	55 dB
Public areas	Dining areas, waiting areas, playrooms	50 dB
Personal hygiene (public and staff)	Toilets, showers	55 dB
Large meeting rooms (> 35 m^2 floor area)	Lecture theatres, meeting rooms, board rooms, seminar rooms, classrooms	35 dB
Small meeting rooms (< 35 m^2 floor area)	Meeting rooms, seminar rooms, classrooms, board rooms	40 dB
Laboratories	Laboratories	45 dB

4.4 Noise egress

4.4.1 Standard guidance

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains 'attention catching features' such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

4.4.2 Local Authority criteria

The London Borough of Hillingdon (LBH) provide guidance on plant noise egress in their noise *Supplementary Planning Document – Development Control for Noise Generating and Noise Sensitive Development* (SPD). This document draws from BS 4142:2014 and provides the standards set out in Table 2.

Table 2 London Borough of Hillingdon external noise standards (Taken from Table 2 in their SPD)

Noise impact from relevant proposed industrial or commercial premises or Plant	Development outcome
Rating Level ($L_{Ar,Tr}$) is at least 5 dB(A) below the Background Level L_{A90}	Normally acceptable
Rating level ($L_{Ar,Tr}$) is no more than 5 dB(A) above the Background Level L_{A90}	Acceptable only if there are overriding economic or social reasons for the development to proceed
Rating level ($L_{Ar,Tr}$) is more than 5 dB(A) above the Background Level L_{A90}	Normally unacceptable

This document also states that in certain circumstances, a desktop noise assessment in the absence of a full acoustic report may be acceptable and provides the following guidance:

> "*The applicant will have to achieve either of the following requirements*
>
> > *1. MCS Planning Standards for permitted development installations air source heat pumps on domestic premises or*
> >
> > *2. Assume at least 5dB below background criteria to achieve compliance based on a daytime & night time background of 45 & 35dB LA90 respectively.*"

4.5 Noise ingress

4.5.1 British Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings*. The guidance limits are shown in Table 3.

These internal levels are based on annual average data and do not have to be achieved in all circumstances. It is normal to exclude occasional events, such as fireworks night or New Year's Eve.

Table 3 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level, L_{Aeq} (dB)	
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Living rooms	35	-
Dining room	40	-
Bedrooms	35	30[1]

[1] BS 8233 notes that individual noise events can cause sleep disturbance, and that a guideline value may be set depending on the character and number of events per night, although no specific limit is provided. For regular events, such as scheduled aircraft or passing trains, a guideline value may be set in terms of SEL or $L_{Amax,F}$. Sporadic noise events could require separate values.

The standard states that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

For external amenity areas, such as gardens and patios, the standard states:

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

4.5.2 ProPG

Internal noise ingress criteria in ProPG are the same as in BS 8233:2014 but additional guidance is provided. In relation to regular individual noise events the following additional guidance is provided:

> *'In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events*.'

4.5.3 Local Authority requirements

Guidance in the Hillingdon SDP aligns with that in BS8233 and ProPG detailed above, both in terms of the average (L_{Aeq}) and maximum (L_{AFmax}) internal noise levels. It also states that '*in certain circumstances, where external noise levels above WHO guidelines, but development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved*.'

5 Baseline noise conditions

Baseline noise conditions have been established using various noise mapping data sets and predictions as follows:

- Noise contour maps for Heathrow Airport published by the Civil Aviation Authority
- Noise contour maps for RAF Northolt published by the Ministry of Defence
- Strategic noise mapping for roads in 2017 published by Defra
- Calculation of Road Traffic Noise (CRTN) predictions based on traffic flow data using CadnaA noise mapping software

5.1 Noise contour maps for aircraft movements

5.1.1 Heathrow airport

In 2019, the Civil Aviation Authority published the *Heathrow Airport 2018 Summer Noise Contours and Noise Action Plan Contours EDCD Report 1901.* This document provides a comprehensive assessment of noise levels generated by aircraft local to and using Heathrow Airport. It includes several types of noise contour maps based on different operational conditions and measurement index. An example noise map showing the average daytime (L_{day}) noise contours is given in Figure 2. The noise contour maps indicate that the site is not significantly affected by aircraft movements.

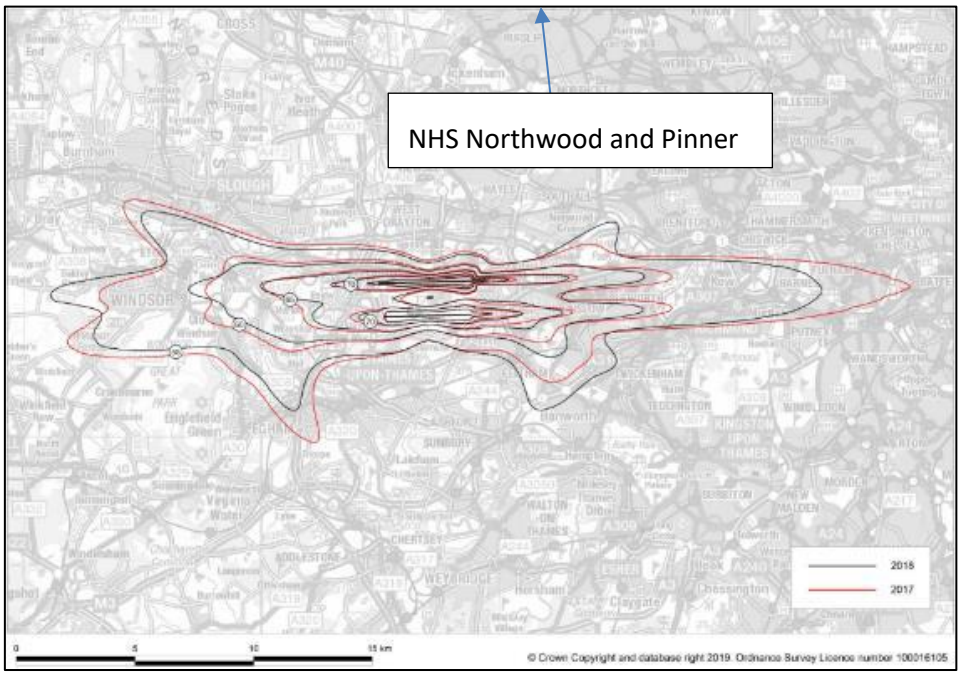


Figure 2 Heathrow 2018 and 2017 L_{day} noise contours (Figure B14 from EDCD Report 1901)

5.1.2 RAF Northolt airfield

The Ministry of Defence (MoD) released noise contour maps in 2001 illustrating the noise levels from aircraft movements from the RAF Northolt airfield. The daytime $L_{Aeq,16hr}$ limits are shown in Figure 3. The relevant noise contour maps indicate that the site is not significantly affected by aircraft movements.

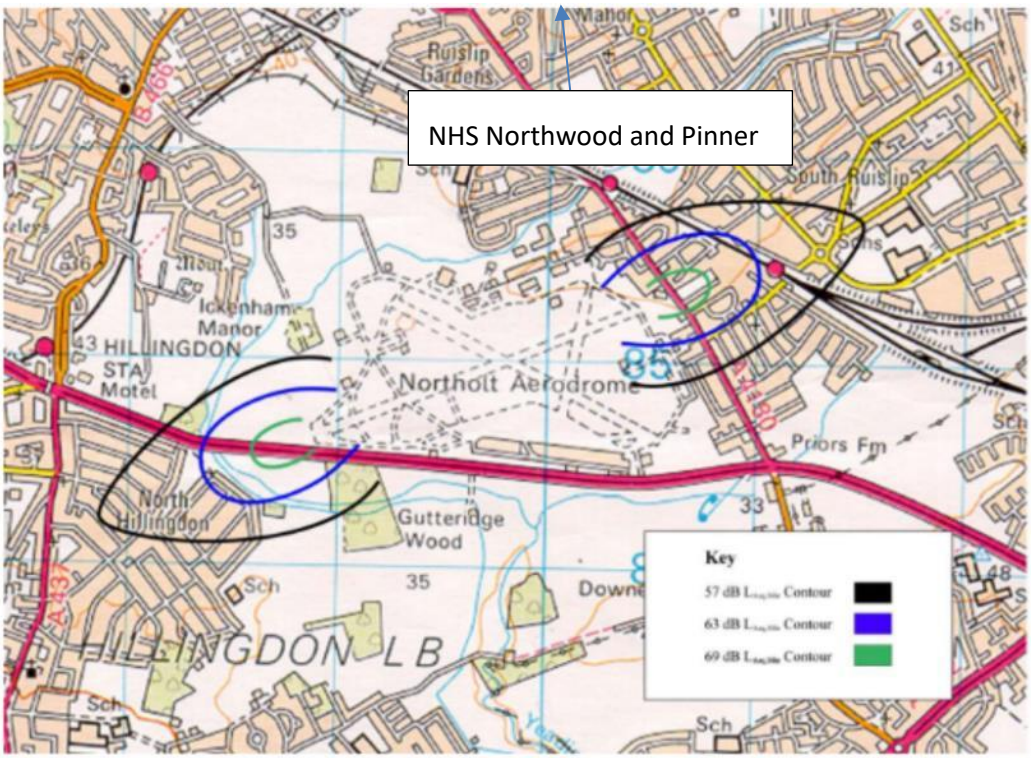


Figure 3 RAF Northolt daytime aircraft noise contours (MoD 2001)

5.2 Strategic noise mapping for roads in 2017 published by Defra

As part of implementing the Environmental Noise Directive, Defra published strategic maps of noise from major road and rail sources. The noise maps for the area showing the average 16-hour day ($L_{Aeq,16hr}$) and 8-hour night time ($L_{Aeq,8hr}$) levels are given in Figure 4 and Figure 5. This indicates the following external noise levels at the southwest elevation of the healthcare center, closest to the road:

- Daytime - $L_{Aeq,16hr}$ 65-70 dB
- Night-time - $L_{Aeq,8hr}$ 60-65 dB

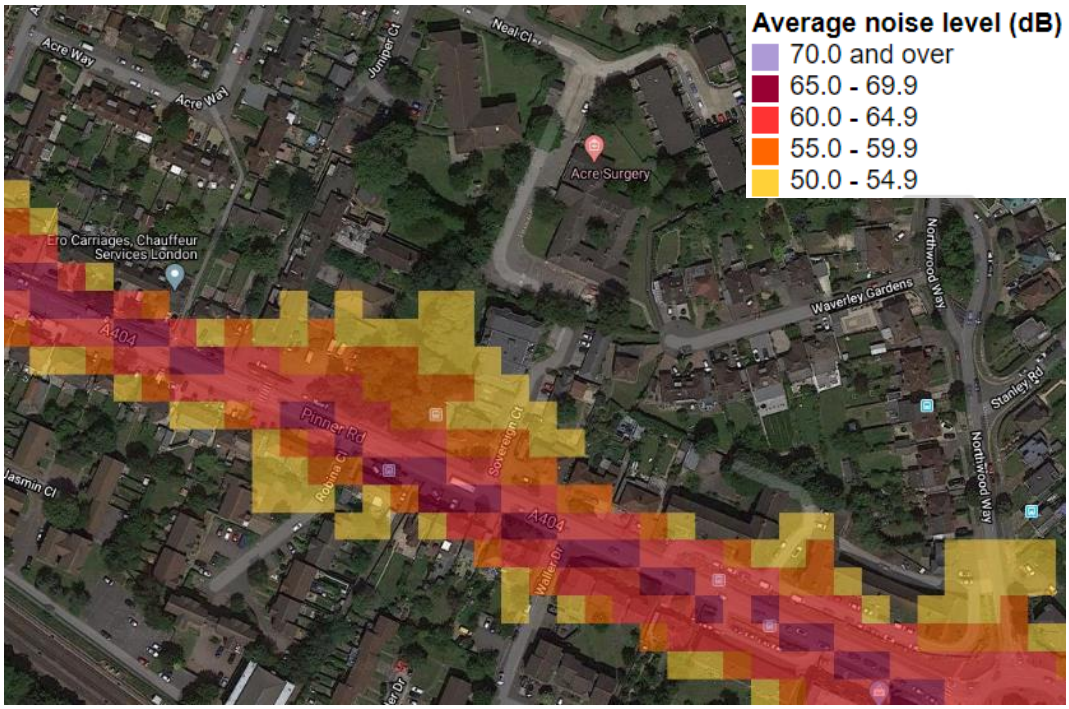


Figure 4 Defra night time road traffic noise map 23:00-07:00 $L_{Aeq,8hr}$ (dB)

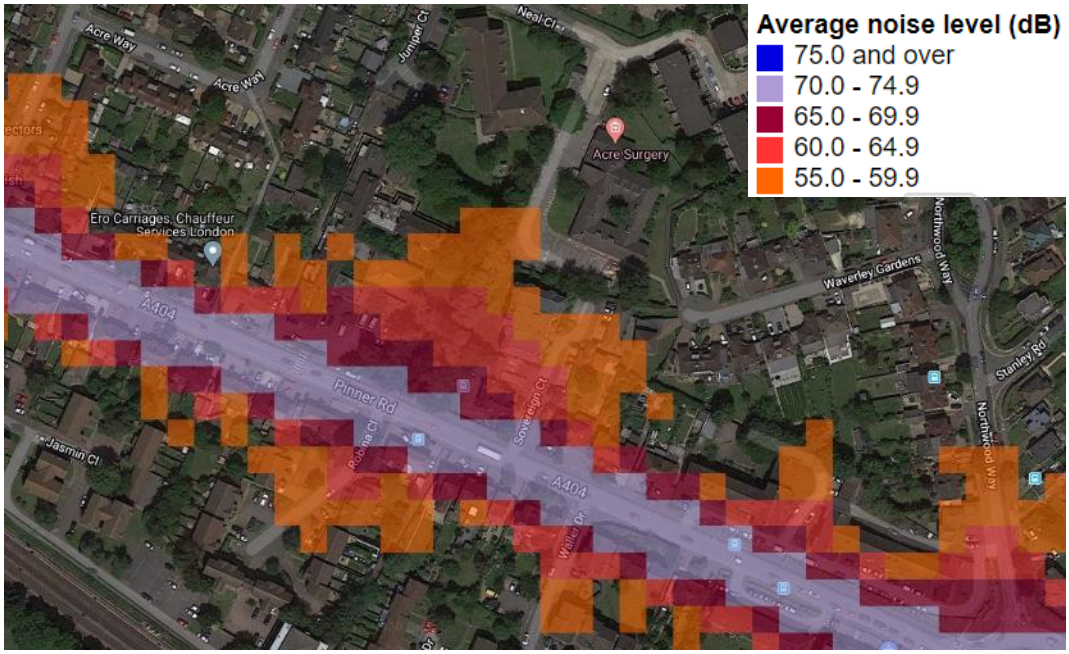


Figure 5 Defra day time road traffic noise map 07:00-23:00 $L_{Aeq,16hr}$ (dB)

5.3 CRTN predictions using CadnaA noise mapping software

CadnaA noise mapping software has been used to predict external facade noise levels. CadnaA models noise propagation from different sources and takes account of the effects of topography, reflections, screening and distance attenuation. In this case, predictions were derived in accordance with the calculation principles set out in Calculation of Road Traffic Noise (CRTN). The input data for this model was traffic flow data captured between 3 February and 11 March 2020 on Pinner road which occurred before traffic was significantly affected by the Covid 19 situation.

A screen shot of the CadnaA model in given in Figure 6.

Figure 6 CadnaA model representative of the proposed development

CRTN predicts road traffic noise in terms of an 18 hour L_{A10} (dB) but has been corrected to present a 16 hour daytime L_{Aeq} levels using the commonly accepted correction (as defined in PPG24) as follows:

- $L_{Aeq,16hour} = L_{A10,18hour} - 2$ dB

The worst case 1-hour traffic flow data indicates a level that is approximately 2 dB higher than the 18 hour average using the principles of CRTN. It is reasonable to assume that this +2dB correction can be applied to the 16 hour daytime L_{Aeq} to establish worst case 1 hour L_{Aeq}. This is needed for the Healthcare Centre facade sound insulation assessment discussed further in Section 7.

5.4 Discussion

At the worst affected southwest elevation of the site, the Defra noise maps indicate a daytime level of $L_{Aeq,16hr}$ 65-70 dB. The CRTN prediction, made using CadnaA, indicate a level of $L_{Aeq,1hr}$ 69 dB at this location which shows alignment and helps validate both approaches to noise level prediction. The CadnaA prediction is at top end of the Defra noise map range and is used herein to provide a conservative assessment.

To establish night-time noise levels, a 5 dB reduction to the daytime level has been applied which is commensurate with Defra noise map data. It is our experience that this is a conservative estimate and night-time levels are likely to be lower in practice.

Neither the Defra noise maps or CRTN predictions provide maximum traffic noise levels (L_{Amax}). Typically, road traffic noise L_{Amax} levels are 10 dB higher than the day-time average levels (L_{Aeq}) and this has been are assumed for the ongoing assessment.

Pinner Road is the dominant noise source at the site but there will be noise contributions from Neal Close, Waverley Gardens and other surrounding roads. For purposes of assessment, it is assumed that day and night time levels will not fall below $L_{Aeq,16hour}$ 50 dB and $L_{Aeq,8hour}$ 45 dB respectively anywhere on the site.

The above analysis robustly characterise the noise climate at the site and is used to define building envelope sound insulation requirements in Section 7.

6 Control of plant noise egress

6.1 Basic limits

The baseline noise assessment cannot be used to accurately determine the minimum background noise levels at the site. However, LBH makes provision for assuming a daytime and night time background noise level of L_{A90} 45 dB and L_{A90} 35 dB respectively (see Section 4.4.2).

Based on these assumed levels, the cumulative noise level from the operation of all new plant must not exceed the limits set out in Table 4.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive receptors (NSR) and are presented as facade levels. In this case, these limits would apply at the various residential premises identified in Figure 1.

Table 4 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, L_{Aeq} (dB)
Daytime (07:00-23:00)	40
Night-time (23:00-07:00)	30

6.2 Proposed installations

It is proposed that five air source heat pumps will be located within a semi enclosed plant space area at roof levels of both of residential Blocks (Locations P1 and P2 in Figure 1). A proposed section showing the Block A rooftop heat pump locations in relation to nearest affected residential at 72A Sovereign Court (R3) is given in Figure 7. The recessed roof cavity provides acoustic screening to the nearby NSRs.

Additionally, three outdoor VRF units are proposed north of the Healthcare Centre (locations P3 in Figure 1).

The distances between the different plant locations (P1-P3) and the nearest NSRs are shown in Table 5.

Table 5 Distance between plant locations and NSR

NSR	Distance between plant locations and NSR (m)		
	Plant location 1 (P1)	Plant location 2 (P2)	Plant location 3 (P3)
20 Acre Way (R1)	75	114	45
30 Juniper Court (R2)	60	38	26
72A Sovereign Court (R3)	26	39	56
14 Neal Close (R4)	110	45	104
10 Waverley Gardens (R5)	91	36	105

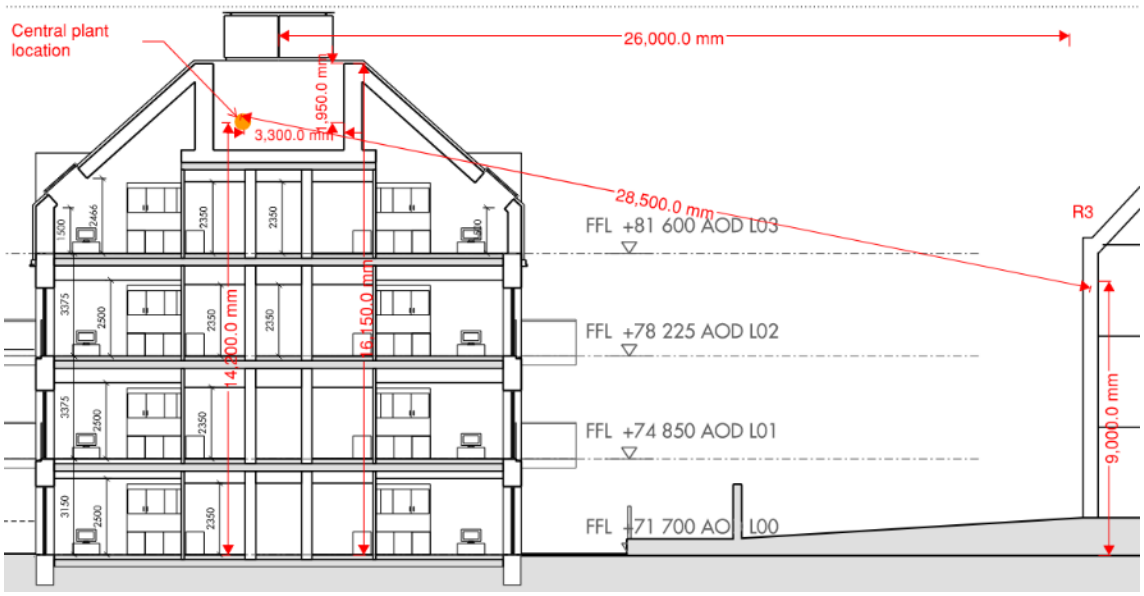


Figure 7 Proposed section showing rooftop heat pump locations in relation to nearest affected residential window

6.2.1 Hardware selections

Ten Mitsubishi CAHV-P500YA-HPB heat pumps are proposed, evenly split between Block A (P1) and Block B (P2). Each unit generates a sound pressure level of 59 dBA at 1 m. Manufacturer's octave band noise data is provided in Figure 8.

Additionally, three Mitsubishi PURY-EP350YLM-A1 VRF units are proposed at ground level in between the Healthcare Centre and Block A (P3). Each unit generates a sound pressure level of 62.5 dBA at 1 m. Manufacturers octave band noise data is provided in and Figure 9.

A 2.2 m height acoustic screen will be installed around the VRF units.

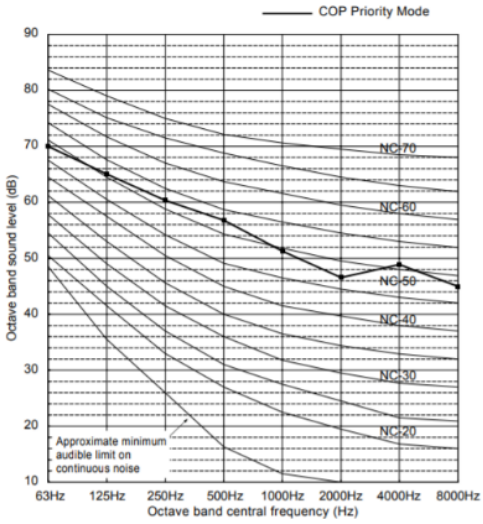
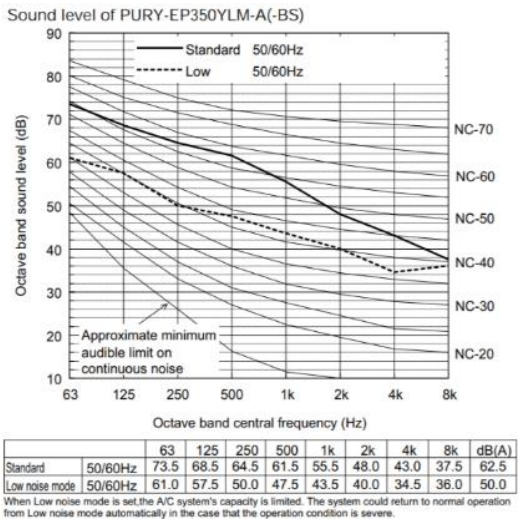


Figure 8 CAHV-P500YA-HPB Octave band



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	73.5	68.5	64.5	61.5	55.5	48.0	43.0	37.5	62.5
Low noise mode	50/60Hz	61.0	57.5	50.0	47.5	43.5	40.0	34.5	36.0	50.0

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

Figure 9 PURY-EP350YLM-A1 Octave band data

6.3 Predicted noise levels

The predicted cumulative plant noise egress levels at the nearest affected residential premises are shown in Table 6. Full calculation stages are provided in Appendix B.

Table 6 Predicted cumulative noise levels at NSRs

NSR	Octave centre band frequency (dB)								Overall (dB)
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	$L_{Aeq,\ 16hr}$
20 Acre Way (R1)	42	35	29	23	14	4	1	0	25
30 Juniper Court (R2)	47	40	34	28	19	9	6	2	30
72A Sovereign Court (R3)	45	38	30	25	16	8	8	4	28
14 Neal Close (R4)	39	32	25	19	11	2	3	0	22
10 Waverley Gardens (R5)	41	34	26	20	12	3	5	1	23

The predicted plant noise egress level achieves the day and night-time noise criteria defined in Section 4.4. Therefore, the requirements of LBH will be achieved at all times.

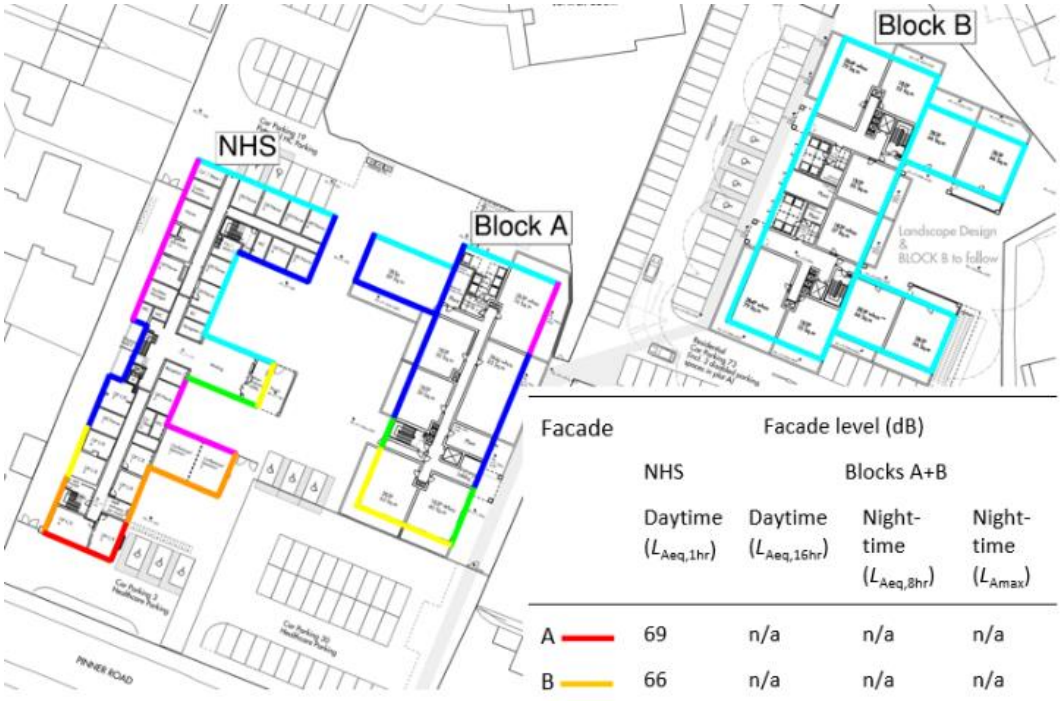
7 Facade sound insulation – noise ingress

This section describes the assessment of facade sound insulation to control noise ingress. The required facade specification largely depends on the external noise levels and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS 8233 and by LBH for residential premises and by HTM 08 01 for the medical centre, which are set out in Section 4.4.

7.1 External noise levels

Predicted external facade noise levels at the proposed development are shown in Figure 10. The levels are a based on the baseline noise conditions discussed in Section 5. The facade levels at the Healthcare Centre are expressed in terms of $L_{Aeq,1hr}$ while residential Blocks A and B are expressed in terms of $L_{Aeq,16hr}$, $L_{Aeq,8hr}$ and L_{AFmax} to match the different internal noise criteria for these building types.



Facade	Facade level (dB)			
	NHS	Blocks A+B		
	Daytime ($L_{Aeq,1hr}$)	Daytime ($L_{Aeq,16hr}$)	Night-time ($L_{Aeq,8hr}$)	Night-time (L_{Amax})
A	69	n/a	n/a	n/a
B	66	n/a	n/a	n/a
C	63	62	57	72
D	60	59	54	69
E	57	56	51	66
F	54	53	48	63
G	51	50	45	60

Figure 10 Typical floor plan showing external facade noise levels

7.2 Facade sound insulation

Minimum sound insulation requirements for the facades are given in Table 7. These have been determined to achieve the internal noise criteria for bedrooms and living areas for residential Blocks A and B, and the most onerous internal noise criteria in the Healthcare Centre using predicted external noise levels at the facades.

Table 7 Facade sound insulation performance requirements

Facade	Overall sound insulation performance, R_w+C_{tr} (dB)	
	Healthcare Centre	Residential Blocks A and B
A	34	n/a
B	31	n/a
C	28	27
D	25	24
E	22	21
F	19	18
G	16	15

7.3 Guidance on facade construction, glazing, and ventilation strategy

Examples of glazing configurations and ventilation strategies that could achieve the required sound insulation performances are set out in Table 8.

Table 8 Example glazing configurations and for overall facade sound insulation

Overall facade sound insulation, R'_w+C_{tr} (dB)	Example glazing configuration
≤25	4mm glass/15 mm/4mm glass
27-28	4mm glass/12 mm/6 mm glass
31	8mm glass/14 mm/6 mm glass
34	8.8 mm acoustic laminate/16 mm/10 mm glass

The performance required by each element will depend on the relative areas of glazed and non-glazed elements. As a guide, for a mechanically ventilated room with a 50% glazed facade, the glazing sound insulation requirement would typically be 3 dB lower than the overall facade sound insulation requirement. This is provided the non-glazed external wall elements provide at least 10 dB more sound insulation than the glazed elements. Where acoustically attenuated

passive ventilation is to be used, a more detailed facade assessment will be needed as the design develops to ensure the overall performance requirements are met.

7.3.1 Ventilation strategy

It is understood that MVHRs are being used to provide background ventilation for the residential blocks.

The attenuation of sound provided by an open window is typically in the region of 10 to 15 dB, depending on the open area. When windows are open, internal noise levels may exceed optimum criteria in some areas. However, for short periods, venting to purge smells or fumes eg, painting, this would not normally be considered an issue.

7.3.2 Overheating

Overheating is becoming an increasingly important issue in residential developments due to a combination of the improvements in thermal performance, increased areas of glazing and changes to the external climate.

Under the Standard Assessment Procedure (SAP), which is used as the basis for checking energy rating compliance for new dwellings with the UK Building Regulations, acceptable means of mitigating overheating include openable windows or increased air change rates using a boosted mechanical ventilation system in the absence of dedicated cooling systems.

With windows open, internal noise levels in Block B and the north facing elevation of Block A may marginally exceed WHO and BS8233 guidelines but this is not expected to affect the amenity of residents. However, internal noise levels may be approximately 12-17 dB higher than typical WHO and BS8233 guidelines at the worst affected facade in Block A. Noise at these levels may impact on reliable speech communication in the day and cause sleep disturbance at night.

When considering the use of open windows for purposes of overheating control, a compromise between acoustic comfort and sustainability is often acceptable for limited periods. Based on assessments carried out by the building services and sustainability consultant, it is understood that the windows across the Blocks A and B will need to be open between 4-13 days per year to mitigate overheating.

In relation to this, the building services and sustainability consultant has provided the following statement:

> *"The conflict between acoustics and overheating requires a compromise whereby our desire to avoid the installation of cooling equipment and the 'acceptable' noise limits within rooms are balanced in order to achieve the best overall solution. To this end we have included the installation of blinds and the use of continuous operation of MVHR units installed in each apartment in order to reduce as much as possible the number of hours for which certain rooms are overheating and hence reduce the reliance on the ability to open windows to overcome this. Furthermore, on a couple of the 'worst'*

overheating living rooms we are proposing the installation of external shading to limit the solar gains into these areas.

We believe that our design reduces the likelihood and severity of overheating events as far as reasonably possible (without the introduction of comfort cooling) whilst also acknowledging that due to the acoustic constraints, the complete elimination of overheating may not be possible without an elevated noise level being experienced within certain apartments. Furthermore it is included within our design that, due to the use of air source heat pumps for heating and hot water, the introduction of cooling to the apartments could be introduced at a later stage if the issue of overheating were to increase in the future as is predicted by the DSY2 and DSY3 weather files. The same equipment being installed initially could, with a cost uplift, be reconfigured to provide a limited amount of comfort cooling to the apartments. Finally, it should be noted that the majority of the overheating events will occur at times when it is reasonable to assume that a number of the residents will be at their place of work and hence will not be in their apartment to experience the elevated temperatures."

8 Conclusion

Noise emissions from 10 rooftop air source heat pumps and 3 VRF units have been predicted at the nearest effected existing residential premises. The predicted noise egress levels will meet day and night-time criteria based on LBH requirements and are not expected to result in adverse impact.

The facade sound insulation performance requirements have been determined across the site and range from R'_w+C_{tr} 16-34 dB. These values are based on achieving internal noise criteria recommended in BS 8233 and by LBH for residential premises and by HTM 08 01 for the medical centre.

Guidance on suitable glazing configurations necessary to achieve the performance requirements is provided.

With windows open, internal noise levels in Block B and the north facing elevation of Block A may marginally exceed WHO and BS8233 guidelines but this is not expected to affect the amenity of residents. However, internal noise levels may exceed these criteria by approximately 12-17 dB at the worst affected facade in Block A. Noise at these levels are likely to impact on reliable speech communication in the day and cause sleep disturbance at night.

When considering the use of open windows for purposes of overheating control, a compromise between acoustic comfort and sustainability is often acceptable for limited periods.

The design incorporates blinds, MVHR units and external shading in the worst affected areas and it is understood that this reduces periods of overheating and the need for open windows as far as reasonably possible. Based on assessments carried out by the building services and sustainability consultant, it is understood that the windows across the Blocks A and B will need to be open between 4-13 days per year to mitigate overheating.

Appendix A

Noise indexes

Noise indices used in this report included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.*

Appendix B

Plant noise calculations

Comments	Octave band centre frequency (Hz)								Rating 1		Rating 2	
	63	125	250	500	1k	2k	4k	8k				
Interpretation;												
3 plant locations												
5 NSRs identified												
Plant locations 1-3 operational in normal mode												
Facade correction applied												
Barrier calculations accounted for worst case (i.e. lowest amount of expected shielding)												
Barrier attenuation for P1 & P2 on basis of Z = 1.95m plant to barrier, X = 3.3 m to barrier, X = 26m to 3rd storey												
Barrier attenuation for P3 on basis of Z = 0.85m plant, Z = 2.2m barrier, X = 1 m from plant, X = 26 m to 3rd storey												
Distances are to closest façade of affected building												
Cumulative levels calculated for each 1m from the nearest window												
1. Plant noise data												
SPL Plant item 1 (heat pump Block A	70.0	65.0	60.0	57.0	52.0	47.0	49.0	45.0	L_A=	59.2	SPL	@ 1m
SPL Plant item 2 (heat pump Block B	70.0	65.0	60.0	57.0	52.0	47.0	49.0	45.0	L_A=	59.2	SPL	@ 1m
SPL Plant item 3 normal mode (heat	73.5	68.5	64.5	61.5	55.5	48.0	43.0	37.5	L_A=	62.5	SPL	@ 1m
2. Plant correction for N units												
Plant item 1; N = 5	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0				
Plant item 2; N = 5	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0				
Plant item 3; N = 3	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8				
3. Barrier attenuation												
Rooftop plant location (P1, P2)	9.7	12.1	14.9	17.9	20.9	23.9	24.0	24.0				
Ground level to Juniper Court (P3)	7.2	8.7	10.9	13.6	16.6	19.6	22.6	24.0				
4. Façade correction												
Correction for façade levels	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0				

Comments	Octave band centre frequency (Hz)								Rating 1		Rating 2
	63	125	250	500	1k	2k	4k	8k			
5. Distance attenuation corrections											
Calculations 1 - 4 applied in addition to distance correction for each plant location and receptor											
5A. Assessment @ R1 (20 Acre Way)											
P1 @ 75m	32.8	25.4	17.5	11.6	3.6	-4.5	-2.5	-6.5	L_A=	15.0	
P2 @ 114m	29.2	21.7	13.9	7.9	-0.1	-8.1	-6.1	-10.1	L_A=	11.3	
P3 @ 45m	41.0	34.5	28.3	22.6	13.6	3.1	-4.9	-11.8	L_A=	24.8	
5B. Assessment @ R2 (30 Juniper Court)											
P1 @ 60m	34.7	27.3	19.5	13.5	5.5	-2.5	-0.6	-4.6	L_A=	16.9	
P2 @ 38m	38.7	31.3	23.4	17.5	9.5	1.4	3.4	-0.6	L_A=	20.9	
P3 @ 26m	45.8	39.2	33.0	27.3	18.4	7.9	-0.1	-7.0	L_A=	29.6	
5C. Assessment @ R3 (72A Sovereign Court)											
P1 @ 26m	42.0	34.6	26.7	20.8	12.8	4.7	6.7	2.7	L_A=	24.2	
P2 @ 39m	38.5	31.1	23.2	17.2	9.2	1.2	3.2	-0.8	L_A=	20.6	
P3 @ 56m	39.1	32.6	26.4	20.7	11.7	1.2	-6.8	-13.7	L_A=	22.9	
5D. Assessment @ R4 (14 Neal Close)											
P1 @ 110m	29.5	22.1	14.2	8.2	0.2	-7.8	-5.8	-9.8	L_A=	11.6	
P2 @ 45m	37.2	29.8	22.0	16.0	8.0	0.0	1.9	-2.1	L_A=	19.4	
P3 @ 104m	33.8	27.2	21.0	15.3	6.4	-4.1	-12.1	-19.1	L_A=	17.6	
5E. Assessment @ R5 (10 Waverley Gardens)											
P1 @ 91m	31.1	23.7	15.9	9.9	1.9	-6.1	-4.2	-8.2	L_A=	13.3	
P2 @ 36m	39.2	31.8	23.9	17.9	9.9	1.9	3.9	-0.1	L_A=	21.3	
P3 @ 105m	33.7	27.1	20.9	15.2	6.3	-4.2	-12.2	-19.2	L_A=	17.5	
6. Cumulative SPL @ 1m from the nearest window for each receptor											
R1 (20 Acre Way)	**41.9**	**35.2**	**28.8**	**23.0**	**14.2**	**4.1**	**0.5**	**-4.1**	**L_A=**	**25**	
R2 (30 Juniper Court)	**46.9**	**40.1**	**33.7**	**27.9**	**19.1**	**9.1**	**6.1**	**1.5**	**L_A=**	**30**	
R3 (72A Sovereign Court)	**44.9**	**37.8**	**30.5**	**24.6**	**16.3**	**7.5**	**8.4**	**4.4**	**L_A=**	**28**	
R4 (14 Neal Close)	**39.3**	**32.2**	**24.9**	**19.0**	**10.7**	**1.9**	**2.7**	**-1.3**	**L_A=**	**22**	
R5 (10 Waverley Gardens)	**40.8**	**33.5**	**26.1**	**20.2**	**11.9**	**3.4**	**4.6**	**0.5**	**L_A=**	**23**	