



Dunsbury Hill Farm – Plot 4a

Noise Impact Assessment

On behalf of **Portsmouth City Council**

Project Ref: 48359/3001 | Rev: 00 | Date: July 2020

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For and on behalf of Stantec UK Limited				

Revision	Date	Description	Prepared	Reviewed	Approved

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1 Introduction

1.1 Background

- 1.1.1 Stantec UK Ltd has been commissioned by Portsmouth City Council to provide a noise impact assessment to support the discharge of Condition B5 associated with the application for Plot 4a of a proposed development at Dunsbury Hill Farm in Havant.
- 1.1.2 The proposed development has been granted outline planning permission by Havant Borough Council, subject to several planning conditions (Ref No. APP/12/00338).
- 1.1.3 This report details the assessment of the existing sound climate at the site and considers mitigation measures relevant to meet the requirements of Planning Condition B5, in relation to protecting the existing residential development from noise associated with industrial sources.
- 1.1.4 An explanation of the acoustic terminology used in this report is included in Appendix A.

1.2 Objectives

- 1.2.1 The objectives of this report are as follows:
 - To establish, by means of a detailed 24-hour daytime and night-time environmental sound survey, the existing environmental sound levels at the closest noise sensitive receptors; and
 - To undertake a noise impact assessment associated with the operation of the proposed development in accordance with BS 4142:2014.

1.3 Site Description, Location and Noise Sensitive Receptors

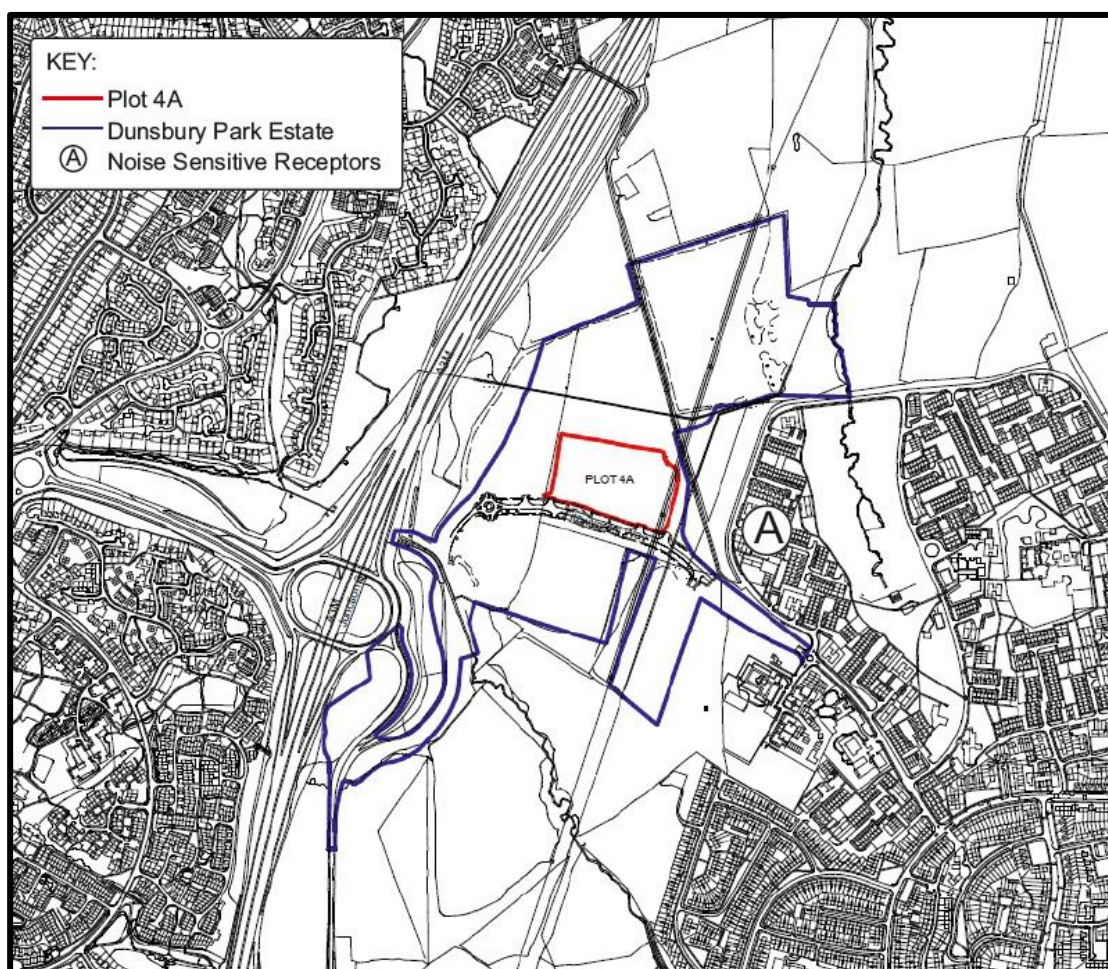
- 1.3.1 The proposed development site is located in the Dunsbury Park Business Site, approximately 3 km to the north west of Havant and falls within the jurisdiction of Havant Borough Council.
- 1.3.2 The site consists of open land. The site is bound by Park Lane and Calshot Road to the east and Fitzwygram Way to the south.
- 1.3.3 The proposal is for approximately 120,000 sq. ft. of B2 manufacturing space (B2 Use Class) on Plot 4a.
- 1.3.4 Receptors are those aspects of the environment sensitive to changes in baseline conditions. The sensitivity of a particular receptor depends upon the extent to which it is susceptible to such changes.
- 1.3.5 Residential receptors (both inside and outside) are considered to have a high sensitivity. Commercial and industrial receptors are considered to have a low sensitivity.
- 1.3.6 **Table 1.1** details the approximate location of the main noise sensitive receptors in proximity to the site. For clarity, individual receptors have been grouped where appropriate however in all cases where there are a number of grouped receptors impacts at the worst-case receptor within the group has been considered.

Table 1.1: Noise Sensitive Receptors

Receptor	Noise Sensitive Receptor	Type of Receptor	Sensitivity of Receptor
A	Properties off Calshot Road to the east of the Site	Residential	High

1.3.7 The location of the site and nearest noise sensitive receptors is detailed in **Figure 1**.

Figure 1: Site Location Plan



Source: Site Location Plan ref DHF-BMD-Z4A-XX-DR-A-10000 rev P01.0 dated 20/02/20 by BAM Design

2 Planning Policy, Standards and Guidance

2.1 Planning Condition B5

2.1.1 Condition B5 of the outline planning permission (Ref No. APP/12/00338) states that:

“Application for approval of each reserved matters for new buildings, structures or uses of land pursuant to this permission shall be accompanied by information and plans concerning the following other matters, unless otherwise agreed in writing by Local Planning Authority:

[...]

h. A noise assessment for any development for General Industrial purposes (Class B2) or Storage and Distribution purposes (Class B8).”

2.2 Guidance

British Standard 4142:2014 +A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound

- 2.2.1 BS 4142:2014 +A1:2019 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.
- 2.2.2 The standard is used to determine the rating levels for sources of sound of an industrial and/or commercial nature and the ambient, background and residual sound levels at outdoor locations. These levels could be used for the purposes of investigating complaints; assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and assessing sound at proposed new dwellings or premises used for residential purposes. However, the determination of noise amounting to a nuisance is beyond the scope of the standard.
- 2.2.3 The standard should not be used to assess sound from the passage of vehicles on public roads and railway systems; recreational activities; music and other entertainment; shooting grounds; construction and demolition; domestic animals; people; public address systems for speech and other sources falling within the scopes of other standards or guidance. The standard cannot be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.
- 2.2.4 The procedure contained in BS 4142 assesses the significance of sound which depends upon the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs/will occur. It is noted that a BS 4142 assessment is reliant on measuring relevant background sound levels.
- 2.2.5 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level and considering the following:
- Typically, the greater this difference, the greater the magnitude of the impact;
 - A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and

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

2.2.6 In order to consider the context, BS 4142 advises that the following factors should be considered:

- The absolute level of sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions such as:
 - Façade insulation treatment;
 - Ventilation and/or cooling that will reduce the need to have windows open to provide rapid or purge ventilation; and
 - Acoustic screening.

2.3 Proposed Assessment Criteria

2.3.1 Based on guidance provided within BS 4142:2014+A1 2019, the assessment criteria for industrial noise are proposed below.

Table 2.1: Proposed Criteria - Industrial Noise

Location	Period	Difference between the Rating Level ($L_{A,r,Tr}$) and the Background Sound Level ($L_{A90,15mins}$)
1 m from nearest noise sensitive premises	24 Hours	+5 dB

3 Baseline Environmental Sound Survey

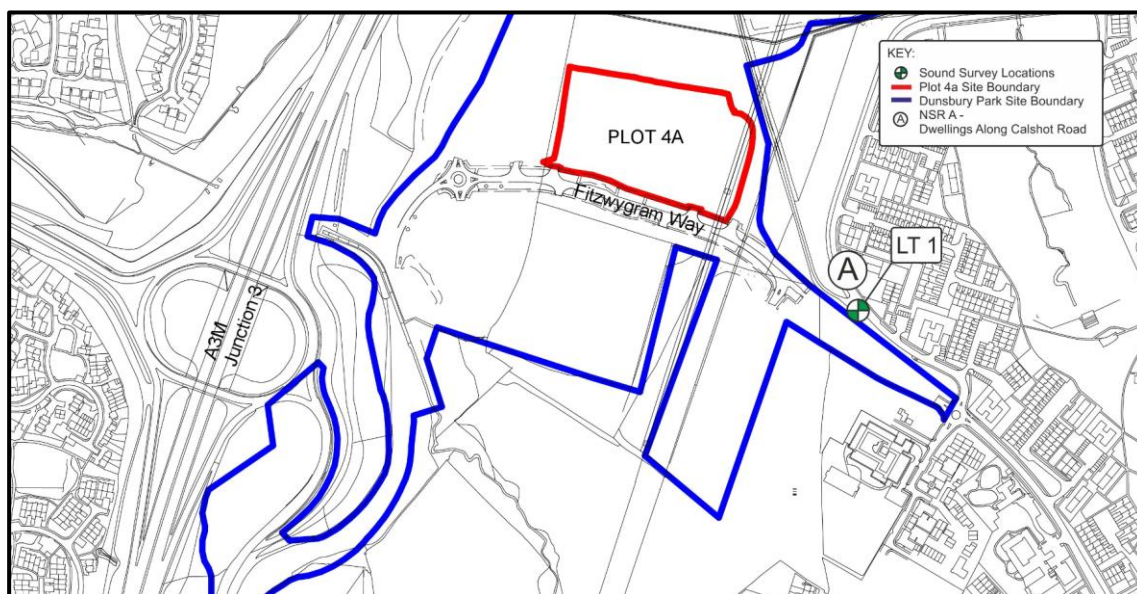
3.1 Procedure

- 3.1.1 An unattended environmental sound survey was undertaken between approximately 08:00 hours on Wednesday 4 March 2020 and approximately 12:00 hours on Thursday 5 March 2020 to determine the existing sound climate at a location considered representative of the nearest noise sensitive receptors located to the east of the site.
- 3.1.2 The survey was undertaken over a typical weekday period. Measurements were made over 15-minute periods of the L_{Aeq} , L_{A90} and L_{AFMax} sound levels.
- 3.1.3 The sound level meter was located in an environmental case. The microphone was connected to the meter via an extension cable and fitted with the manufacturer's windshield.
- 3.1.4 The instrumentation used in the survey (including calibration information) is listed in **Appendix B**.
- 3.1.5 Field calibrations were performed before and after the measurements with no significant fluctuations recorded (< 0.5 dB). Calibration certificates are available upon request.

3.2 Measurement Locations

- 3.2.1 Sound measurements were undertaken at one position at the site. The measurement position is detailed in **Figure 2** and described in **Table 3.1**.

Figure 2: Environmental Sound Measurement Location



Source: Contains Ordnance Survey data © Crown copyright and database right 2020

Table 3.1: Description of Measurement Location

Position	Description
LT1	The microphone was located to the east of the Dunsbury Park Business Park approximately 15 m to the north of Fitzwygram Way and 15 m to the south east of Calshot Road. The microphone was located approximately 45 m to the south of the residential dwellings No. 2-16 Calshot Road. The microphone was at a height of 1.5 m in free field conditions.

3.3 Meteorological Conditions

- 3.3.1 Due to the nature of the survey (i.e. unattended), it is not possible to accurately comment on the meteorological conditions throughout the entire survey period. However, based on a review of publicly available weather forecasts and observations at the beginning and end of the survey period, the weather conditions are detailed in **Table 3.2**.

Table 3.2: Meteorological Conditions

Description	Meteorological Conditions	
	04/03/2020	05/03/2020
Temperature (°C)	6	6
Precipitation (mm)	0	0
Wind Speed (m/s)	< 5	< 5

- 3.3.2 These conditions are considered suitable for obtaining representative sound level measurements.

3.4 Assumptions/Limitations

- 3.4.1 The engineer noticed nothing unusual in terms of the sound climate at the time of the survey. This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary. No warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

3.5 Environmental Sound Climate

- 3.5.1 Due to the nature of the survey (i.e. unattended), it is not possible to accurately comment on the dominant noise sources or specific noise events during the entire survey period. However, at the beginning and end of the survey period, it was noted that on-site sound levels were dominated by vehicular movements on the surrounding road network, specifically the A3(M) to the west of the site.

4 Environmental Sound Survey Results

4.1.1 The results of the survey are presented in the time history graph in **Appendix C**.

4.1.2 A summary of the survey results is detailed in **Tables 4.1**.

Table 4.1: Summary of Measured Environmental Sound Survey Results – LT1

Date	Period, T	Measured Sound Level (dB)		
		$L_{Aeq,T}$	Typical* L_{AFMax}	Typical** $L_{A90,T}$
04/03/2020 – 05/03/2020	Daytime (07:00 – 23:00 hours)	54	-	48
	Night-time (23:00 – 07:00 hours)	48	66	31

* Based on the 10th highest measured L_{Amax} level.

** Calculated based on the statistical distribution of background sound levels during the measurement period in general accordance with guidance in BS4142:2014.

5 BS 4142:2014 Assessment

5.1 Purpose of assessment

- 5.1.1 An assessment has been undertaken in general accordance with BS 4142:2014 + A1 2019 to determine the likely noise impact associated with the operations of the proposed development on the nearest existing noise sensitive receptors.

5.2 Noise Sensitive Receptor

- 5.2.1 The nearest noise sensitive receptors, identified as Receptor A in **Figure 1**, are located approximately 180 m to the east of the Site.

5.3 Background Sound Levels

- 5.3.1 For the purpose of this assessment background sound levels during the operational periods are derived from the environmental sound survey location LT 1 which is described in Section 4 of this report.
- 5.3.2 The daytime and night-time background sound levels have been calculated for measurement locations LT1 using the statistical analysis method as detailed in BS 4142. **Table 5.1** presents the typical background sound levels.
- 5.3.3 Deliveries during the night-time will only occur between 06:30 hours and 07:00 hours. Therefore, two assessments have been undertaken during the night-time. The first one with the internal and external fixed plant operating 24/7 and the second with the internal and external plant and delivery noise between 06:30 and 07:00.

Table 5.1: Typical Background Sound Level

Period	Comment	Typical L _{A90, 15 min} (dB)
Daytime (07:00 – 23:00)	External and internal plant and delivery plant noise	48
Night-time (23:00 – 06:30)	External and internal plant noise only	31
Night-time – delivery time (06:30 – 07:00)	External and internal plant and delivery plant noise	45

5.4 Proposed Site Layout

- 5.4.1 Our calculations and recommendations are based on the following drawings provided by BAM Design Ltd.

Table 5.2: Drawings and Documentations

Drawing Number	Title	Revision	Date
DHF-BMD-Z4A-00-DR-A-11000	Ground Floor Plan	P01.4	23/01/20
DHF-BMD-Z4A-01-DR-A-11001	First Floor Plan	P01.4	23/01/20
DHF-BMD-Z4A-02-DR-A-11002	Second Floor Plan	P01.4	23/01/20
DHF-BMD-Z4A-XX-DR-A-10000	Site Location Plan	P01.0	28/02/20
DHF-BMD-Z4A-XX-DR-A-12000	GA Elevations	P01.3	23/02/20
DHF-BMD-Z4A-XX-DR-A-12001	Site Elevation	P01.0	18/07/19
DHF-BMD-Z4A-XX-DR-A-17800	External Envelope Materials	P01.0	11/03/20
-	Chaffinch Equipment Location	-	19/05/20

5.5 Calculation Parameters

5.5.1 The following has been assumed:

- The primary proposed operational times are Monday – Friday between 06:30 and 18:30 hours, with 5 HGV movements per hour on average;
- The service yard is located on the eastern side of the building;
- The proposed units will be equipped with loading docks and all loading and unloading activities will happen inside the units;
- External equipment will be located on a concrete pad that runs along the north wall of the building and will be operational 24 hours a day. It will include:
 - 5 x Adiabatic process water coolers; and
 - 5 x Chillers for HVAC system.
- Internal equipment will be located on a mezzanine floor that runs along the internal north wall of the building. The equipment will run 24 hours a day and will include:
 - 25 x Material driers;
 - 5 x Material system vacuum pumps;
 - 4 x Compressors; and
 - 40 x Moulding Machines.
- The main building is to be constructed of a horizontally laid built-up wall cladding system with a lightweight, cladding style roof system.

5.6 Calculation Procedure

- 5.6.1 Calculations have been undertaken of the likely noise levels at the nearest noise sensitive receptor associated with the operation of the site during a worst-case one-hour operation period during the daytime (07:00 – 18:30 hours) and during a worst-case 15-minute period during the night-time period (23:00 – 07:00 hours).
- 5.6.2 Additional calculations of plant noise and delivery noise during the night-time have been undertaken during a worst-case 15-minute period between (06:30 – 07:00 hours). Calculations assume that all plant is in continuous operating for the duration of the assessment period.
- 5.6.3 There will be an average of five HGV movements during the one-hour assessment period during the daytime. For calculation purposes, it is assumed that there will be two HGV movements during the 15-minute assessment period during the night-time (06:30 – 07:00 hours).
- 5.6.4 Noise from the external plant, noise breakout from internal plant and the noise from deliveries have been calculated separately before being combined and compared to the background sound level, in accordance with BS4142.
- 5.6.5 **Table 5.3** details the activities associated with the delivery operations of the site. Unless otherwise stated, sound levels are based on measurements from our in-house database. °

Table 5.3: Noise Levels Associated with Deliveries

Measurement Description	Sound Pressure Level SEL (dB)	Source Level Measurement Distance (metres)
Lorry arriving	82	1
Reversing alarm	94	1
Lorry door slam	83	1
Lorry door slam	83	1
Lorry starting	89	1

- 5.6.6 The manufacturers' sound emission data of plant is detailed in **Error! Reference source not found..**

Table 5.4: Plant Sound Emission Data

Building Services Plant	Manufacturer / Model	Data Type	Manufacturer's Sound Levels (dB) at Octave Band Centre Frequency (Hz)							dB(A)
			63	125	250	500	1000	2000	4000	
Water cooler (external)	Piovan – AFCV290	L _p at 10 m	59	48	51	51	48	47	45	54
Chillers (external)	York – CH3	L _p at 10 m	71	63	57	46	41	36	30	47*
Material drier (internal)	Piovan – HRM 150	L _p at 1 m	-	-	-	-	-	-	-	80
Material system vacuum pumps (internal)	Piovan – F Series 5.5 kw	L _p at 1 m	-	-	-	-	-	-	-	73**
Compressors (internal)	SpiralAir – SPR 8T/10	L _p at 1 m	-	-	-	-	-	-	-	59**
Moulding machines (internal)	Krauss Maffei – PX Series	L _p at 1 m	-	-	-	-	-	-	-	65**

*At 20 °C ambient temperature

**The distance at which this data was measured was not available. For the purposes of our assessment we have assumed that the stated sound pressure level was measured at 1 m. We should be advised if this is incorrect.

- 5.6.7 The main building is to be constructed in a combination of composite & built-up insulated steel cladding, and curtain walling. We understand that the built-up insulated cladding would be similar to Euroclad system incorporating 19/1000 liner sheet, 220 mm Quattro brackets and Quattro bars, 220 mm thick rockwool quilt and 50/1000 halfround HPS200 top sheet.
- 5.6.8 The roof covering would be similar to a Euroclad built-up system. The liner sheet is MW5, 300 mm Quattro brackets and bars, 300 mm Rockwool insulation quilt and Euroclad 32/1000 HPS200 top sheet. Approximately 10% of the roof area will comprise integral polycarbonate rooflights.
- 5.6.9 Manufacturer's test data is not available for the proposed constructions. Test data for similar constructions has therefore been used in the assessment. **Table 5.5** details the assumed sound reduction performance values for each building element based on test data for similar systems.

Table 5.5: Assumed Sound Reduction Performances of Cladding System

Building Element	Description	Sound Reduction Index (R) at Octave Band Centre Frequency (Hz)							R _w
		63	125	250	500	1000	2000	4000	
Wall and roof	Lightweight cladding with mineral wool insulation and steel liner sheet	13	14	29	38	40	45	55	38
Rooflight	polycarbonate rooflights	7	10	13	17	19	19	27	19
Door	Roller door	8	10	13	14	15	15	15	15

5.7 Acoustic Feature Correction

5.7.1 Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound levels and the background sound level. The calculated specific sound level should therefore be modified in accordance with the following guidance as outlined in BS 4142:2014+A1 2019. Due to the type of assessment, the subjective method has been used to determine the type and level of acoustic feature corrections applied to each source.

5.7.2 BS 4142 offers the following guidance on the subjective assessment of acoustic feature corrections.

“Tonality

For sound ranging from not tonal to predominantly tonal the Joint Nordic Method gives a correction of between 0 dB and + 6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

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

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time... If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.”

Other Sound Characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

5.7.3 The sound emission data suggest that none of the fixed plant will be tonal.

- 5.7.4 Some of the noise sources have the potential to be impulsive (e.g. door slam). However, based on the survey results and the calculated levels at Receptor A, none of the source of noise will be individually distinguishable at Receptor A, 180 m away.
- 5.7.5 Based on the data provided and experience, none of the noise sources will be intermittent or will have other sound characteristics.
- 5.7.6 Therefore, no acoustic feature correction has been applied to the calculations presented in the next section.

5.8 BS 4142:2014 Assessment

- 5.8.1 **Table 5.6** details the results of the BS4142:2014 assessment of the proposed development.

Table 5.6: BS4142:2014 Assessment Results

Description	Operational Periods		
	Daytime (07:00 – 23:00 hours) T = 1 hour	Night-Time (23:00 – 07:00 hours) T = 15mins	Night-Time (06:30 – 07:00 hours) T = 15mins
Calculated Specific Sound Level from Delivery Yard	23	-	28
Calculated Specific Sound Level from Atmospheric Building Services	34	34	34
Calculated Specific Sound Level from Internal Operations	25	25	25
Calculated Rating Sound Level at Receptor A (dB L _{Af,Tr})	35	35	35
Background Sound Level (dB L _{A90,T})	48	31	45
Excess of Rating over Background Sound Level (dB)	-13	+4	-10
Assessment of Impact	Indication of a low impact, depending on the context	Indication of a less than adverse impact, depending on the context	Indication of a low impact, depending on the context

- 5.8.2 The difference between the rating level and the background sound level during both the daytime and the night-time is likely to be below the proposed criteria of +5 dB.

5.9 Context and Mitigating Factors

- 5.9.1 The above assessment details the results of the initial numerical assessment of sound levels at the nearest noise sensitive receptor. It is important to recognise context in the assessment of the likely noise impact on the proposed development site arising from the operation of the proposed development.
- 5.9.2 The following factors should be taken into consideration:
- The absolute sound level;
 - The character and level of the residual and specific sound levels; and
 - The sensitivity of the receptor.

Absolute Sound Levels

- 5.9.3 The calculated specific sound level at the worst affected façade of existing noise sensitive receptors, falls below the relevant criteria in World Health Organisation and BS8233 guidelines with respect to noise levels in external amenity areas. In addition, it is over 10 dB lower than the measured night-time residual sound level of 48 dB $L_{Aeq,8 \text{ hours}}$.

Character and Level of Residual and Specific Sound Levels

- 5.9.4 The proposed unit is part of a wider business park. The activities proposed reflect existing and future permitted activities which take place on site or will take place when the business park is fully operational. The character and level associated with the proposed activities is therefore considered to be similar to the character and level of the permitted activities.

Receptor Sensitivity

- 5.9.5 As presented in **Table 1.1**, Receptor A is a residential receptor with a high sensitivity to the potential noise impact.
- 5.9.6 The residential dwellings are fitted with double glazing windows and the majority of private amenity spaces face away from Dunsbury Park.

5.10 Uncertainty

- 5.10.1 Care has been taken to reduce uncertainty as far as reasonably possible. However, it should be recognised that in any environmental sound survey and assessment process uncertainty exists.

Measured Environmental Sound Levels

- 5.10.2 The assessment relies on the results of the environmental sound survey undertaken by Stantec. Uncertainty in measured background sound levels can occur due to variation in temporary/non-representative meteorological conditions however steps were taken to minimise the risk of meteorological conditions affecting the survey results.

Calculation and Assessment Procedure

- 5.10.3 Uncertainty in the sound power levels used in the assessment can occur due to variations in the sound emissions of the source and the operating conditions under which the source is expected to operate.
- 5.10.4 The assessment undertaken has been based on 24-hour operation and conditions provided to us. However, it should be recognised that there is a degree of uncertainty associated with the exact operating conditions if different from those assumed. Nevertheless, it is considered that the assessment undertaken is suitably robust in determining the likely noise impact of the proposed development.

5.11 Assessment Summary

- 5.11.1 The results of the preliminary assessment indicate that the level of impact associated with the operation of the proposed development during the daytime is likely to be an indication of having a low impact, depending on the context.
- 5.11.2 The results of the preliminary assessment indicate that the level of impact associated with the operation of the proposed development during the night-time is likely to be an indication of having a less than adverse impact, depending on the context.

- 5.11.3 It is also likely that the criterion would be met during both the daytime and the night-time.
- 5.11.4 Considering the results of the assessment and the contextual and mitigating factors detailed above, the operation of the proposed facility should be considered acceptable.

6 Conclusion

- 6.1.1 Stantec UK Ltd has been commissioned by Portsmouth City Council to provide a noise impact assessment to support the discharge of Condition B5 associated with the application for Plot 4a of a proposed commercial development at Dunsbury Hill Farm in Havant
- 6.1.2 An unattended environmental sound survey was undertaken between approximately 08:00 hours on Wednesday 4 March 2020 and approximately 12:00 hours on Thursday 5 March 2020 in order to determine the existing sound climate at a location considered representative of the nearest noise sensitive receptors located to the east of the site.
- 6.1.3 Assessment criteria have been proposed based on the requirements of planning Condition B5.
- 6.1.4 An assessment in general accordance with BS4142:2014 has also been undertaken to determine the likely impact associated with the proposed facility at the nearest noise sensitive receptors.
- 6.1.5 The assessment indicates that the operations are likely have a low impact during both the daytime and the night-time, at existing noise sensitive receptors.
- 6.1.6 The criteria detailed herein are likely to be achieved, without the need for specific mitigation measures.

Appendix A Acoustic Terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Daytime	The period 07:00-23:00 hours.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20 \mu\text{Pa}$. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound.
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
Insertion Loss	Insertion loss is the difference in sound pressure level at a single fixed position before and after a noise control element (e.g. enclosure, barrier etc) is installed.
L_{AE} or SEL	A noise level which, if maintained for a period of 1 second, would cause the same A-weighted sound energy to be received as is actually received from a given noise event.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

Parameter	Description
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$ or Background Noise Level	A noise level index. The noise level exceeded for 90 % of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
LOAEL	Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.
Night-time	The period 23:00-07:00 hours.
NOEL	No Observed Effect Level - the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise; and
Noise Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Rating Noise Level	The specific noise source plus any adjustment for the characteristic features of the noise, denoted by $L_{A,r,T}$.
SOAEL	Significant Observed Adverse Effect Level - The level above which significant adverse effects on health and quality of life occur.
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level, L_p	The sound pressure level, L_p is the sound pressure relative to a standard reference pressure of 20 mPa (20×10^{-6} Pascals) on a decibel scale.
Specific Noise Level	The noise source under investigation measured as and $L_{Aeq,T}$

Appendix B Instrumentation

Item	Type	Manufacturer	Serial Number	Laboratory Calibration Date
Sound Calibrator	NC-74	Rion	34746691	30/08/2019
Sound Level Meter	NL-52	Rion	542901	09/01/2020
Microphone	UC-59	Rion	06478	09/01/2020
Pre-Amplifier	NH-25	Rion	42929	09/01/2020

Appendix C Time History Graphs

