TECHNOLOGY HOUSE, DYSON WOOD WAY, BRADLEY BUSINESS PARK

PROPOSED CHANGE OF USE CLASS F1 DEVELOPMENT

Noise Impact Assessment

Prepared for: Pivot Academy Leeds Ltd

Client Ref: UK.135098

SLR Ref: 403.000017.00002
Version No: 1
February 2023

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CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

SLR Consulting Limited has been appointed by Pivot Academy Leeds Limited to undertake a noise impact assessment for a proposed change of use development at Technology House, Dyson Wood Way, Bradley, Huddersfield, HD2 1GN (the site).

This document has been prepared to support a prospective planning application within Kirklees Council (KC) for the redevelopment of the Site, to include material change of use from technical development/storage area (Sui Generis) to a special needs school under use class F1.

This assessment has been provided to inform noise impacts associated with the proposal and creation of educational use at the Site. The development has been considered noise sensitive, acknowledging the need for acoustic conditions and building sound insulation appropriate to the intended use. Furthermore, as potentially noise generating in external areas of the scheme with respect to the retainment of mechanical plant items and when proposed for ancillary teaching and/or recreational use.

The proposal has been viewed similar in nature to existing F1 Class use development in the immediate area at Salus House, Dyson Wood Way as approved by KC under application number 2021/62/90714/W. Relevant application commentary and approval notice for this scheme has provided an outline basis for assessment, including a likely restriction of daytime weekday usage hours 07:00 – 18:00.

An agreement has been established between respective SLR Clients to repurpose the measurement data within SLR document reference 403.000017.00001 as previously used in the assessment of industrial use development at the Site and submitted with KC planning application number 2022/62/94109/W.

This report has been prepared and checked by suitably qualified persons as defined in **Appendix 01**. Whilst reasonable effort has been made to make this report easily understandable, it is technical in nature. To assist the reader, a glossary of acoustic terminology has been included in **Appendix 02**.

2.0 SITE DESCRIPTION

The proposed development boundary of the Site has been noted of nominally 0.42 hectares to the south of the A1607 Bradley Road in Bradley, Huddersfield. The Site has been reviewed to include a technical development storage area at the front, with two-storey office, associated parking and site access to the rear, as accessible off Dyson Wood Way to the south.

The Site has previously operated under specific industrial use further to KC planning application reference 2009/62/93495/W2, of sui generis use class and technical development/storage. The current site approval has no usage restriction times associated with its permitted use.

2.1 Proposed Development

The proposal has included a material change of use from technical development/storage area (Sui Generis) use class to a special needs school under use class F1(a). The general design of the scheme has proposed a sports hall at the front with rear facing classroom and ancillary spaces and an external area to the west.

The development has proposed no changes to building form, layout, or other factors such as that introduction of mechanical plant, further to currently existing.

A recent planning approval in the area (e.g. KC application reference 2021/62/90714/W) applicable to Bradley House, as immediately south west of the Site, has been permitted with a similar F1 use class sought by the proposal and so has been considered to provide *some level* of planning precedence in the local area.

Use Class F1 has been read from Schedule 2 Part B of The Town and Country Planning (Use Classes) (Amendment) (England) Regulations 2020 and relevant to the proposal as *"any use not including residential use – (a) for the provision of education…"*.

2.2 Noise Sensitive Receptors

The Site has been noted within a mixed residential and commercial area. Noise sensitive receptors (NSRs) in the immediate vicinity to the proposals have been noted of educational use to the south off Dyson Wood Way, with residential dwellings to the west and north off Bradley Road. Surrounding industrial premises off Dyson Wood Way have not been considered noise sensitive to the proposals as comprising of approved industrial uses.

Those NSRs of note within this assessment have been referenced as:

A. Salus House. This property of former office use was converted to an independently registered school under KC planning application reference 2021/90714. Of relevance, the supporting environmental noise impact assessment to this application[1] did not consider extant commercial noise from the Site as part of its application and summated that road traffic noise impacts were prevailing. The usage times of this educational building have been restricted by conditional approval to 07:00 – 18:00 weekdays only.

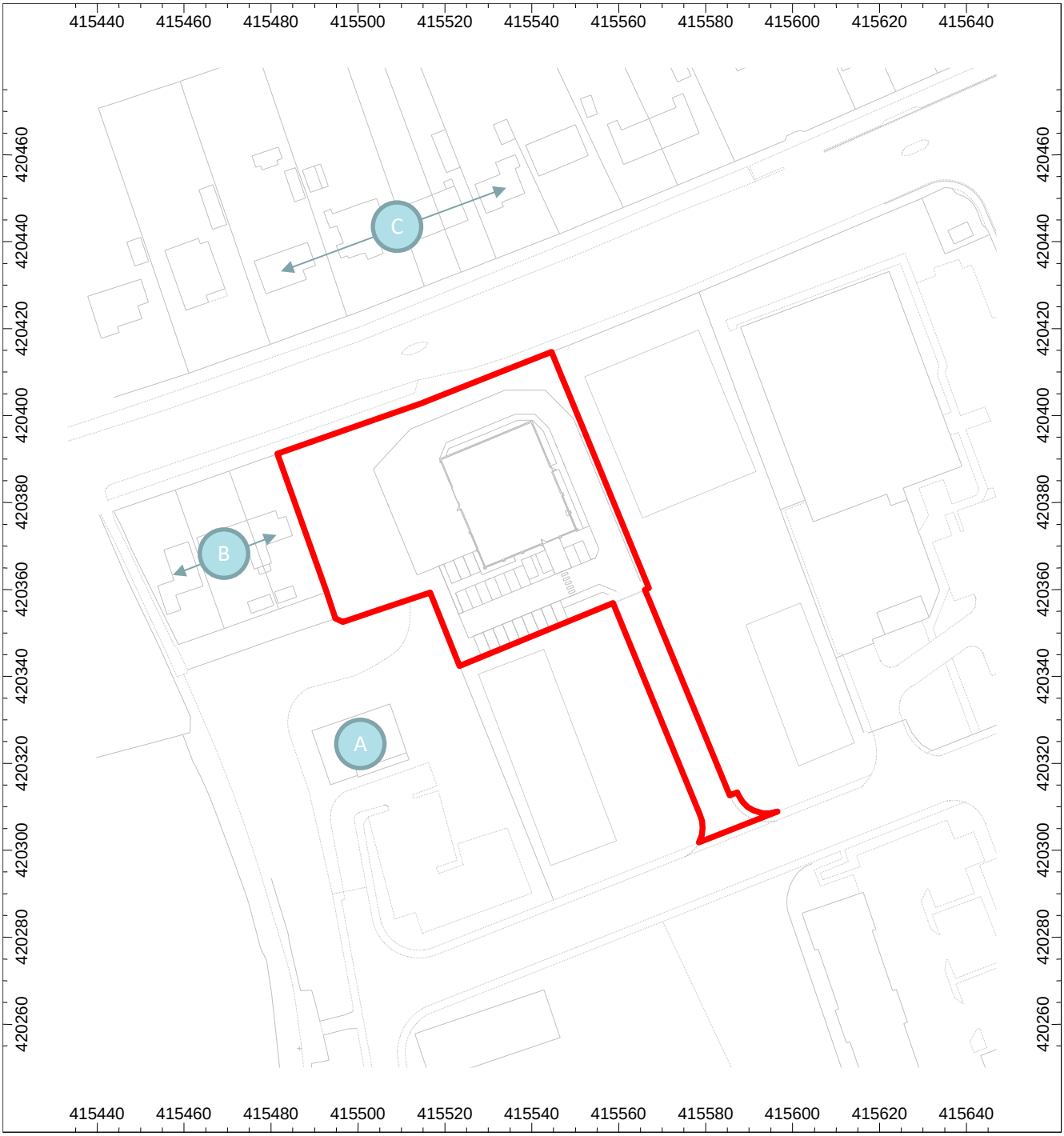
B. No. 333 – 337 Bradley Road. These three residential premises to the west of the Site have been noted at a higher land height (+155 AGL) in comparison to the Site (+150 AGL). The closest premise of No. 333 has been noted nominally 39 m from the existing industrial building and 24 m from the edge of the service yard, with an existing vegetation buffer between.

C. No. 390 – 382 Bradley Road. On the opposite side of the A6107 Bradley Road, these five residential dwellings have been noted nominally 50 m from the existing industrial building and at higher land height (+153 AGL) in comparison to the Site.

[1] Acoustic Design Technology Environmental Noise Impact Assessment 3219/ENIA. ADT, May 2021

All above-listed receptors have been identified within the site plan of Figure 2-1 below.

Figure 2-1
Location Plan and Identification of NSRs



3.0 PLANNING AND NOISE GUIDANCE

3.1 Noise Policy Statement for England (NPSE)

Inter alia, the NPSE *"seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise".* The aims and this statement apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. These noise types are qualified from the NPSE as follows:

- "Environmental noise" includes noise from transportation sources.
- "Neighbour noise" includes noise from inside and outside people's homes; and
- "Neighbourhood noise" which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.

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

It is recognised that the statement expresses the long-term desired policy outcome, whereby using the words of *"promote"* and *"good*" recognises that it is not possible to have a single objective noise-based measure that is either mandatory or applicable to all sources of noise in all situations.

The concept applicable to the *"effective management of noise"* applies to all types of noise and that the solution could be more than simply minimising the noise.

The NPSE provides definitions of health and quality of life as follows:

> *"2.12 The World Health Organisation defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, and recognises the enjoyment of the highest attainable standard of health as one of the fundamental rights of every human being.*
>
> *2.13 It can be argued that quality of life contributes to our standard of health. However, in the NPSE it has been decided to make a distinction between "quality of life" which is a subjective measure that refers to people's emotional, social and physical wellbeing and "health" which refers to physical and mental wellbeing.*
>
> *2.14 It is recognised that noise exposure can cause annoyance and sleep disturbance both of which impact on quality of life. It is also agreed by many experts that annoyance and sleep disturbance can give rise to adverse health effects. The distinction that has been made between 'quality of life' effects and 'health' effects recognises that there is emerging evidence that long term exposure to some types of transport noise can additionally cause an increased risk of direct health effects. The Government intends to keep research on the health effects of long-term exposure to noise under review in accordance with the principles of the NPSE."*

The policy promotes the effective management and control of noise, within the context of Government policy on sustainable development and includes three aims to:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvements of health and quality of life.

This Statement adopts established concepts from toxicology that are currently being applied to noise impacts. This concept details effect levels, at which an exposure may be classified into a specific category. The classification categories as detailed within the NPSE are as follows:

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

The second aim of the NPSE to "*mitigate and minimise adverse impacts on health and quality of life"* refers to the situation where noise impact lies somewhere between the LOAEL and SOAEL. This requires that all reasonable steps are taken to mitigate adverse effects on health and quality of life while accounting for the guiding principles of sustainable development. The NPSE states *"this does not mean that such adverse effects cannot occur"*.

In defining the upper limit of SOAEL the NPSE states that *"it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all source of noise in all situations. Consequently, the SOAEL is likely to be different for difference noise sources, for different receptor and at different times…".* Consequently, values of SOAEL will differ between sources and situations.

3.2 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) was introduced by The Department for Communities and Local Government in March 2012, with the latest revision dated July 2021.

The NPPF defines the Government's planning policies for England and sets out the framework, within which local authorities must prepare their local and neighbourhood plans, reflecting the needs and priorities of their communities. The Government's stated purpose in producing the NPPF was to streamline policy, so the planning process is less restrictive, to give a more easily understood framework for delivering sustainable development.

Under the heading of Section 15 conserving and enhancing the natural environment, the NPPF (July 2021) states the requirement to prevent unacceptable environmental impacts including noise:

> *"174. Planning policies and decisions should contribute to and enhance the natural and local environment by: …*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability…"*

Paragraph 185 of the NPPF further provides commentary on noise as follows:

> *"185. 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 life65*
>
> *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…"*
>
> *Foot Note 65 - See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).*

The NPPF acknowledges that there is a host of existing sources of national and international guidance which can be used, in conjunction with the Framework, to inform the production of Local Plans and decision making.

3.3 Planning Practice Guidance – Noise (PPGN)

PPGN provides guidance on how planning can manage potential noise impacts in new development, with interpretation and implementation of planning policy contained in the NPPF and NPSE. This was introduced in 2014 with the most recent version issued in July 2021.

The PPGN noise exposure hierarchy table introduces a new threshold of the NOAEL no observed adverse effect level, being between the NOEL and LOAEL and where the noise has no adverse effect where exposure to it does not cause any change in behaviour, attitude or other physiological response.

The PPGN clearly established whether noise is likely to be a concern, following policy statements and requirements of the NPSE and NPPF with additional categorisation and guidance as follows:

> *"At the lowest extreme, when noise is not perceived to be present, there is by definition no effect. As the noise exposure increases, it will cross the 'no observed effect' level. However, the noise has no adverse effect so long as the exposure does not cause any change in behaviour, attitude or other physiological responses of those affected by it. The noise may slightly affect the acoustic character of an area but not to the extent there is a change in quality of life. If the noise exposure is at this level no specific measures are required to manage the acoustic environment.*
>
> *As the exposure increases further, it crosses the 'lowest observed adverse effect' level boundary above which the noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard. The noise therefore starts to have an adverse effect and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).*
>
> *Increasing noise exposure will at some point cause the 'significant observed adverse effect' level boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is predicted to be above this level the planning process should be used to avoid this effect occurring, for example through the choice of sites at the plan-making stage, or by use of appropriate mitigation such as by altering the design and layout. While such decisions must be made taking account of the economic and social benefit of the activity causing or affected by the noise, it is undesirable for such exposure to be caused.*
>
> *At the highest extreme, noise exposure would cause extensive and sustained adverse changes in behaviour and / or health without an ability to mitigate the effect of the noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be avoided."*

Use of toxicology thresholds of NOEL, LOAEL and SOAEL for the assessment of noise impacts is reinforced within PPGN, which includes a noise exposure hierarchy table to define human perception at these effect levels, as titled *"when noise could be a concern"*.

Table 3-1
Planning Practice Guidance Noise Exposure Hierarchy Table

Response	Example of Outcomes	Increasing Effect Level	Action
NOEL – No observed effect level			
Not present	No effect	NOEL	No specific measures required
No observed adverse effect level			
Present and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
LOAEL – Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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 sleep disturbance. Affects acoustic character of the area and creates a perceived change in quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
SOAEL – Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour and/or attitude, 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 and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

It is qualified further to the above statements that the word "level" does not necessarily refer to a single value of noise exposure and that several factors may need to be considered to determine what noise would amount to an adverse or significant adverse effect. Specifically stating:

> "*Although the word 'level' is used here, this does not mean that the effects can only be defined in terms of a single value of noise exposure. In some circumstances adverse effects are defined in terms of a combination of more than one factor such as noise exposure, the number of occurrences of the noise in a given time period, the duration of the noise and the time of day the noise occurs.*"

PPGN also provides additional guidance in what is required from the agent of change following circumstances described by Paragraph 187 of the NPPF. It states that the agent of change must *"define clearly the mitigation being proposed to address any potential significant adverse effects that are identified".*

The guidance also provides there are four broad types of mitigation including:

- *"engineering: reducing the noise generated at source and/or containing the noise generated;*
- *layout: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose built barriers, or other buildings;*
- *using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise levels differentiating as appropriate between different times of day, such as evenings and late at night, and;*
- *mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a building."*

3.4 Local Planning and Noise Requirements

The following information has been read from local planning responses from KC Environmental Health Department in relation to the creation of educational use in the local area (and with relevance to KC application reference 2021/62/90714/W). These local requirements and conditions have been understood of relevance to the proposal whereby similar industrial uses have been proposed.

Requirement NA1 has defined the requirement for a noise impact assessment to be submitted prior to development by a suitably competent person, describing the function of this report.

> ***NA1 Noise Report Required Before Determining the Application (new noisy development near existing residential)***
>
> *Before the application can be determined, details of a noise assessment by a suitably competent person must be submitted in writing to the Local Planning Authority. The report shall include:*
>
> *a) an assessment of all noise emissions from the proposed development*
>
> *b) details of existing background and predicted future noise levels at the boundary of the nearest noise sensitive premises*
>
> *c) a written scheme of how the occupants of the above-mentioned noise sensitive premises will be protected from noise from the proposed development with noise attenuation measures as appropriate*
>
> *d) a written scheme of any necessary noise attenuation measures and demonstrate how nearby residents will be protected from noise from the proposed development*
>
> *The assessment shall be appropriate for all times of day and night when the development will operate. The report should include any supporting calculations. If the levels predicted in the report are unacceptable, it may be necessary to refuse the application. Otherwise, it may be necessary to specify attenuation measures as conditions of consent.*

The definition of a competent person has otherwise been noted to state the following, as satisfied by the author of this document.

> ***NF4 Competent Person - Footnote***
>
> *All noise assessments should be carried out by a competent person. Developers may wish to contact the Association of Noise Consultants http://www.association-of-noiseconsultants.co.uk/ (020 8253 4518) or the Institute of Acoustics http://www.ioa.org.uk (0300 999 9675) for a list of members.*

While the development does not propose any modifications to plant or equipment at the Site, the following local noise condition NC10, as applied to neighbouring industrial uses, has provided a basis of acceptability for noise impacts. This has referred to the technical methodology of BS 4142 with a rating level no greater than the background sound level at all times of operation.

NC10 - Noise from Fixed Plant & Equipment - Condition

The combined noise from any fixed mechanical services and external plant and equipment shall be effectively controlled so that the combined rating level of noise from all such equipment does not exceed the background sound level at any time. "Rating level" and "background sound level" are as defined in BS 4142:2014+A1:2019.

Reason: To ensure the proposed development does not cause harmful noise pollution within neighbouring noise sensitive locations, in the interest of amenity, to comply with the aims and objectives of Policies LP24 and LP52 of the Kirklees Local Plan and Chapters 12 and 15 of the National Planning Policy Framework.

Further detail has been reviewed regarding the potential opening hours for customer, deliveries and dispatches as stated in Condition HUC4 below.

HUC4 Hours of Use Combined - Open for Employees/Pupils, Deliveries and Dispatches – Condition

The use hereby permitted shall not be open to customers outside the hours of:

- *0700hrs to 1800hrs Monday to Saturday*
- *and at no time on Sunday and Bank Holidays*
- *and there shall be no deliveries to, or dispatches from the premises outside these hours.*

Reason: To ensure that the proposed use(s) does not give rise to the loss of amenity to nearby residential properties, by reason of noise or disturbance at unsociable hours, to accord with the aims of Policies LP24 and LP52 of the Kirklees Local Plan and Chapters 12 and 15 of the National Planning Policy Framework.

Further detail has been noted with respect to construction working times where notably restricted to daytime hours. However with relevance to the proposal, no construction work would be proposed for the development.

CSC1 Construction Site Working Times - Condition

Noisy construction related activities shall not take place outside the hours of:

- *0800hrs to 1830 hrs Mondays to Fridays*
- *0800hrs to 1300 hrs Saturdays*
- *With no noisy activities on Sundays or Public Holidays*

Reason: To safeguard the amenities of the occupiers of nearby properties in accordance with part 15 of the NPPF and LP52 of the Local Plan

CSF1 Construction Sites working times – Footnote

Kirklees Council has powers under Section 60 of the Control of Pollution Act 1974 to control noise from construction sites and may serve a notice imposing requirements on the way in which construction works are to be carried out. It has additional powers under Sections 80 of the Environmental Protection Act 1990 to prevent statutory nuisance including noise, dust, smoke and artificial light and must serve an abatement notice when it is satisfied that a statutory nuisance exists or is likely to occur or recur. Failure to comply with a notice served using the above-mentioned legislation would be an offence for which the maximum fine on summary conviction is unlimited.

4.0 ENVIRONMENTAL SOUND SURVEY

The details within this section have been repurposed from SLR document reference 403.000017.00001 for this assessment, as previously used for assessment of industrial use development of Technology House.

To establish the prevailing sound climate at the Site, a baseline survey was undertaken over weekday and weekend periods between Thursday 15th and Monday 19th December 2022.

The period of surveying coincided with reasonable measurement conditions for environmental surveying. This survey has included the deployment of a weather station as demonstrating compliance with BS 4142 for most of the time, with average windspeeds falling in the range of 0 – 1.5 m/s for the survey duration. Limited periods of rainfall were noted Saturday morning and Sunday night. In the avoidance of doubt, this assessment has removed any periods of adverse weather conditions as highlighted in **Appendix 03**.

4.1 Equipment and Measurements

Sound pressure level measurements were carried out using the following equipment listed in Table 4-1, confirming to Class 1 acoustic accuracy for sound level meters and matched calibrators.

The sound level meters were calibrated before the measurements using the handheld acoustic calibrator and the calibration was checked upon completion of the survey. No significant drift was observed with calibration offsets of ≤ 0.2 dB. The calibration chain of equipment has been maintained to traceably to national standards, no greater than one year for sound calibrators and two years for sound level meters.

Table 4-1
Sound Monitoring Equipment

Location	Description	Serial No.
Location 1	Cirrus CR:831B Class 1 Sound Level Meter	G400059
	Cirrus CR:511E Acoustic Calibrator	99960
	Davis Instruments 6250UK Vantage Vue Weather Station	MT211213028

Location 1 was chosen in a clearing within bare vegetation buffer to the west of the Site, nominally 35 m set back from the A6107 Bradley Road. The purpose of this location was to directly appraise the existing sound climate without the development in operation and at the rear of the nearest NSR B nominally 5 m adjacent.

The microphone was located 1.5 m above ground level and at least 3.5 m from an adjacent façade, as to represent free field conditions.

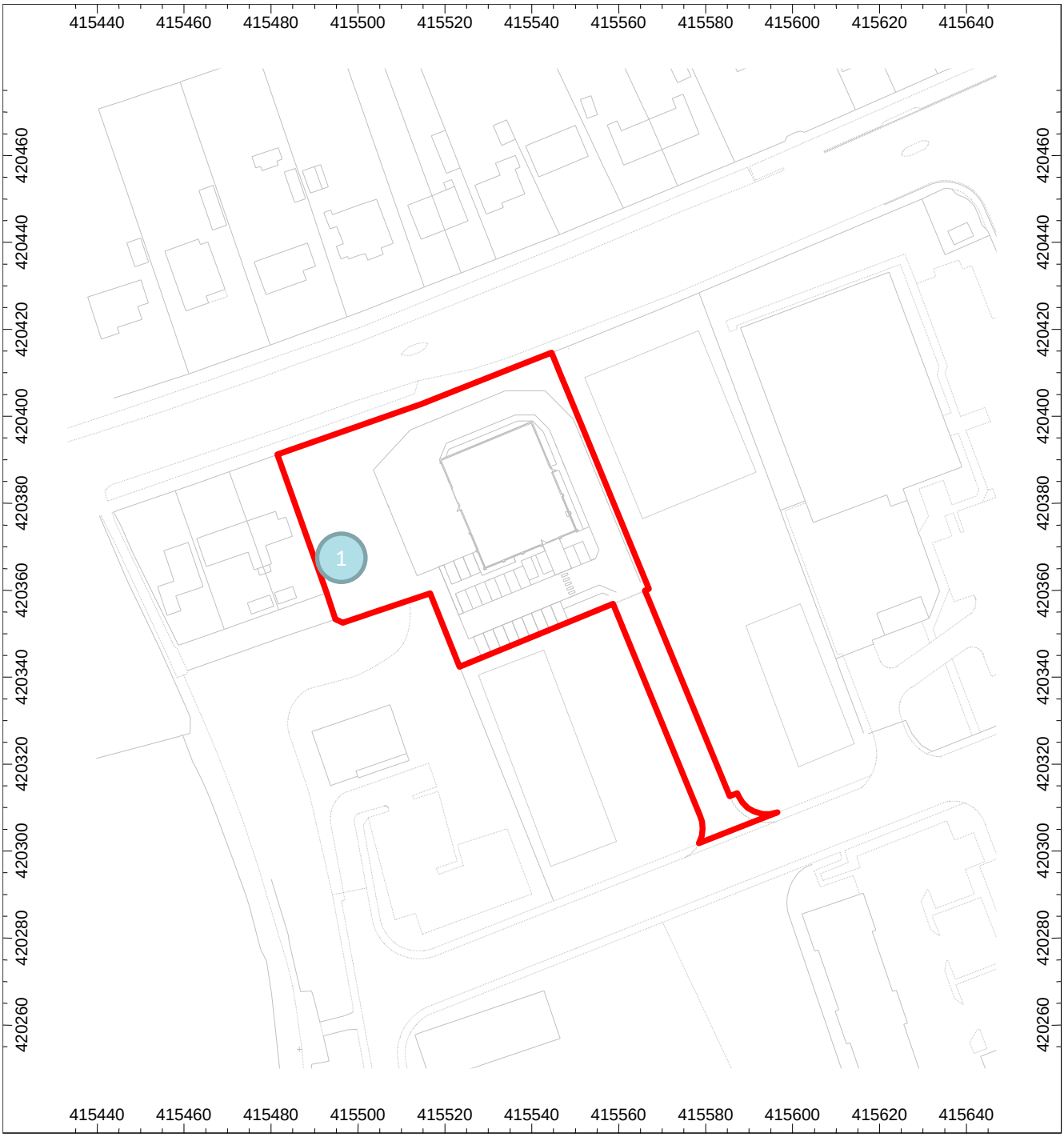
The monitoring protocol consisted of substantially unattended readings over the survey period with attendance at the start and end of the monitoring periods, covering a nominal week.

The following noise level indices have been reported at 15-minute intervals, in decibels (dB):

- $L_{Aeq,T}$ – The A-weighted equivalent continuous noise level over the measurement period.
- $L_{A90,T}$ – The A-weighted noise level exceeded for 90% of the measurement period.
- $L_{A10,T}$ – The A-weighted noise level exceeded for 10% of the measurement period.
- $L_{Amax(F)}$ – The maximum A-weighted noise level during the measurement period.

Full survey results describing unattended monitoring periods have been provided for the above-listed metrics within **Appendix 03**.

Figure 4-1
Monitoring Location



4.2 Sound Climate

The sound climate at the measurement location consisted mainly of constant road traffic movements along the local network, including local traffic of the A6107 Bradley Road and distant traffic from major routes. The unattended time history of data recorded has generally reflected an expected, diurnal pattern of these road traffic sources.

The Site was not in operation at the time of measurement therefore providing a representative baseline for the purposes of assessment. Other activities were noted in the area as including use of an external playing area associated with Bradley House to the south and birdsong. Industrial and/or commercial noise was not viewed to be present or prevailing at the measurement location. Similarly, there was no movement of bare trees such that interference has not been expected from placement of the equipment amongst a clear area of vegetation.

There was no mechanical plant in the vicinity of the monitoring location such that road traffic has been considered to describe the prevailing sound climate.

4.3 Residual and Background Sound Levels

The 'typical' background sound levels have been reported in this section in accordance with BS 4142 as established from histograms of the recorded dB $L_{A90,15min}$ data at Location 1, shown in **Appendix 03**. The measurement location has been used to describe the underlying sound climate at NSRs during proposed operating periods.

In line with Section 8.1.4 of BS 4142, the monitoring duration should reflect the range of background sound levels for the period assessed. In practice, there is no single level for background sound as this is a fluctuating parameter, although a representative value of the period should be used. Note this has not been either the lowest or mean average value of dB $L_{A90,T}$ according to the assessment standard.

Table 4-2
Summary of Measured Sound Levels

Measurement Details				Residual sound level dB $L_{Aeq,15min}$		Background sound level dB $L_{A90,15min}$	
Date Range	Location	Period	Time HH:MM	Range	Typical*	Range	Typical*
Thursday 15/12/2022 – Monday 19/12/2022	1	Day	07:00 – 19:00	51 – 61	59	42 – 59	54
		Evening	19:00 – 23:00	51 – 60	57	39 – 57	49
		Night	23:00 – 07:00	45 – 60	50	37 – 56	42
** Typical values of background sound level have been established from counts of data from Appendix 03. Typical residual sound levels have been equated at times of typical background sound.*							

4.4 Octave Band Sound Levels

For the purposes of noise break-in calculations, the following dB $L_{Aeq,30min}$ octave band sound pressure level summary in Table 4-3 below has been derived at Location 1.

In following of The Acoustics of Schools: a design guide (2015) and prospective usage hours for the Site, the data has considered the representative level of sound recorded during the normal school day, as reviewed between the hours of 08:00 and 18:00 across the survey.

Table 4-3
Octave Band Summary at Location 1

Measurement Details			Sound pressure level dB re. 20 µPa, per octave band centre, Hz						Total dB(A)
Location		Metric	125	250	500	1000	2000	4000	
1	08:00 – 18:00 Daytime	dB $L_{eq,T}$	59	54	53	57	51	39	59
		dB $L_{A1,T}$	69	63	60	61	56	46	64

The data in Table 4-3 has been provided as a baseline for assessment of environmental noise from road traffic, in the estimation of external and internal ambient noise levels the proposed school use.

5.0 MECHANICAL PLANT NOISE IMPACT ASSESSMENT

The impact of noise from the proposed development on the surrounding environment will depend on several factors, including (but not limited to) the time of day, frequency of occurrence and nature of sound source. Development activities will naturally pose greater noise risk where permissible during noise sensitive periods of the evening and night where the likelihood of annoyance or sleep disturbance increases. Human response to noise depends on sociological factors, attitudes and perceptions which can be difficult to define and account for any individual case.

While the development does not propose any modifications to plant or equipment at the Site, it has been noted that local noise condition NC10 has been applied to neighbouring use class F1 development and provided a basis of acceptability for noise impacts from mechanical plant. As an informative to development, noting the requirements of this local condition, the noise from proposed use of mechanical plant items has been considered during operating hours of the scheme.

The recognised methodology for assessment of mechanical plant impacts has been taken from BS 4142:2014 + A1:2019 *Methods for rating and assessing industrial and commercial sound.* This standard has been noted to include consideration of sound from industrial processes such as fixed plant installations.

5.1 BS 4142:2014 +A1:2019

The British Standard BS 4142:2014 +A1:2019 *Methods for Rating and Assessing Industrial and Commercial Sound* (BS 4142) notably describes methods for rating and assessing sound of an industrial or commercial nature. It has been referenced where required in policy and guidance documents to assess the potential impact of sound of an industrial and/or commercial nature, at existing and proposed noise-sensitive receptor locations within the context of the existing sound environment.

In this assessment, industrial/commercial sources have been present on the Site with respect to proposed development emission, where the onus lies with the developer to mitigate any associated impacts arising from existing and proposed sources of commercial noise.

Certain acoustic features can increase the significance of impact from a comparison of the specific sound level to the background sound level where these features are likely to affect perception and response. Where such features are present at the assessment location, a character correction (or penalty) to the specific sound level is made to obtain the rating level. This can be approached from subjective, objective and reference methods.

- Tonality: A correction of 0 dB to + 6 dB for sound ranging from not tonal to prominently tonal.
- Impulsivity: A correction of up to + 9 dB can be applied for sound that is impulsive.
- Intermittency: A penalty of + 3 dB can be applied if on/off conditions are readily distinctive within the reference time interval over the period of the greatest amount of on-time.
- Other characteristics: A penalty of + 3 dB can be applied in the absence of all other defined characteristics, where the specific sound contains a distinctive feature in the residual acoustic environment.
- The rating sound level is equal to the specific sound level if there are no acoustic features present or expected to be present.

The significance of sound depends upon both the margin by which the rating level exceeds the background sound level and the context in which the sound occurs. An initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level.

- Typically, the greater the difference, the greater the magnitude of the impact;

- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of 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 level, this is an indication that the specific sound source will have a low impact, depending on the context.

BS 4142 has stipulated that context is important when assessing the impact of sound of a commercial and/or industrial nature. Amongst a range of advocated considerations, this can include mitigation, residual sound levels, location and absolute sound levels in the consideration of context.

The scope of BS 4142 recognises that human response to sound can be subjective as affected by many factors, both acoustic and non-acoustic. The significance of its impact can depend on various factors such as the exceedance to the background level, its absolute level, time of day and change in environment, as well as local attitudes to the source of sound and character of the neighbourhood.

5.2 Specific Sound Level Calculations

The quantification of noise impacts has been applied to weekday daytime (07:00 – 19:00) periods in this report, to include the proposed operating hours of the school (08:00 – 18:00).

Sound levels referenced in this section have been provided in summary of octave bands in **Appendix 04**. Where reference has been made to single figure values, such as sound power level, in all cases the provided spectral values have been used.

The type of external plant has been considered to remain as 3 No. external condensers immediately south of the loading area and unchanged in current form. A baseline sound power level of 65 dB L_{wA} has been assumed for each unit as to generally cater for the nature of plant existing to the west of the building, or modern replacements of a similar variant.

Table 5-1
Definition of Plant to West of Each Proposed Unit

Plant	Quantity	On time, %	Time of Day	Input Sound Power Level, dB L_{wA}
West of Units	3	100	Opening Hours	65

To understand specific sound levels for the purposes of assessment, a noise model has been created using CadnaA with all sources modelled at their existing and proposed locations and at provided maximum duties.

The modelling process has followed the technical requirements of ISO 9613 Parts 1 and 2, accounting for all items at their developed location. The format of calculations has included all noise sources at least 1 m above ground with receptor locations of 1.5 m and +3.0 m per upper floor as appropriate to the receptor, following propagation over mixed ground (G = 0.5) with a reflection order of 2.

The following specific sound levels have been estimated from this process, with results tabulated in Table 5-2 and illustrated in Figure 5-1. Results have highlighted the highest level on the façade, at either ground or upper floor level appropriate to the receptor.

Table 5-2
Model Outputs of Specific Sound Levels, Highest at Building Façade

NSR Reference	NSR Street Name	Model Predicted Sound Pressure Level dB $L_{Aeq,T}$
A	Salus House	≤ 31
B	No. 333 – 337 Bradley Road	≤ 30
C	No. 390 – 382 Bradley Road	≤ 22

Figure 5-1
Model Outputs of Specific Sound Levels, Highest dB $L_{Aeq,T}$ at Building Façades

5.3 BS 4142 Assessment

The following numerical assessments have been provided in accordance with BS 4142 to provide a comparison between the highest-estimated rating sound levels of mechanical plant against the typical sound levels existing prior to development.

Table 5-3
BS 4142 Assessment of Proposed Development – Worst Case NSR A

Results	Day 07:00 – 19:00	Commentary
Residual sound level, dB $L_{Aeq,T}$	59	Representative residual and background sound levels from Location 1 of the assessment as directly representative of NSRs adjacent to the site relevant to daytime school use only.
Background sound level, dB $L_{A90,T}$	54	
Reference time interval	1-hour	
Specific sound level, dB $L_{Aeq,T}$	31	Highest off-site values established from Table 5-2 relevant to NSR A during relevant hours.
Acoustic feature correction, dB	+ 3	A 3 dB feature correction has been applied to account for a source that could have intermittent sound characteristics associated with mechanical plant on/off. The source has not been anticipated as having tonal, intermittent or other characteristics of sound.
Rating level, dB $L_{Ar,Tr}$	34	Specific sound level plus acoustic feature correction.
Excess of rating over background sound level	- 20	**Complies with Local policy for rating sound level to be at or below the representative background sound level at all times of proposed operation.**
Assessment indicates likelihood of **depending on context*	Low Impact*	Where the rating level does not exceed the background level, this is an indication that the specific sound source will have a low impact, depending on the context.
Uncertainty of the assessment	Given the excess of the background sound level over the rating sound level, uncertainty has not been viewed to have any significance to the outcome of the assessment. Uncertainty was otherwise minimised by measuring over an extended periods during suitable weather conditions, at a location directly relevant to the nearest NSRs.	

5.4 Context

It has been acknowledged that assessments in Table 5-3 need to be considered in context, following the requirements of BS 4142. The concept of "context" has been notably emphasised in Section 11 of BS 4142 when considering numerical impacts established from applying the standard.

An assessment of mechanical plant has been provided which in context, has already operated historically in its location, and its current form, without any known history of adverse noise impact. The planned proposal has provided some level of potential change associated with usage as a school however general operation of mechanical plant at the Site has not been proposed to change beyond that already permitted.

During provided operational hours, predictions have provided large differences (of at least 25 dB) between the residual sound level over the specific sound level, such that in context, the ambient sound level would not change by any perceptible degree due to the mechanical plant. It has subsequently been considered in context that significant masking will be afforded by the residual sound level comprising of road traffic.

It has been summarised that the assessment of low impact has been reinforced where context has been accounted for in the predictions. Mechanical plant impacts have not been deemed necessary to consider further or within in a cumulative appraisal given the predicted levels of sound during the day.

5.5 Statement of Uncertainty

Uncertainty has been considered as a limit to the accuracy of any noise assessment, including associated steps of measurement, calculation, or prediction. Factors have been considered to include (but not limited to) the following:

- The inherent accuracy limitation of methodology in Standards and guidance.
- Variability in meteorological conditions.
- The accuracy of sound source input data of a calculation.
- Use of noise modelling software.

It has been a requirement of the assessment standard BS 4142 to minimise uncertainty to a level commensurate with the intention of the assessment objective. Measures taken in this assessment to minimise uncertainty have included:

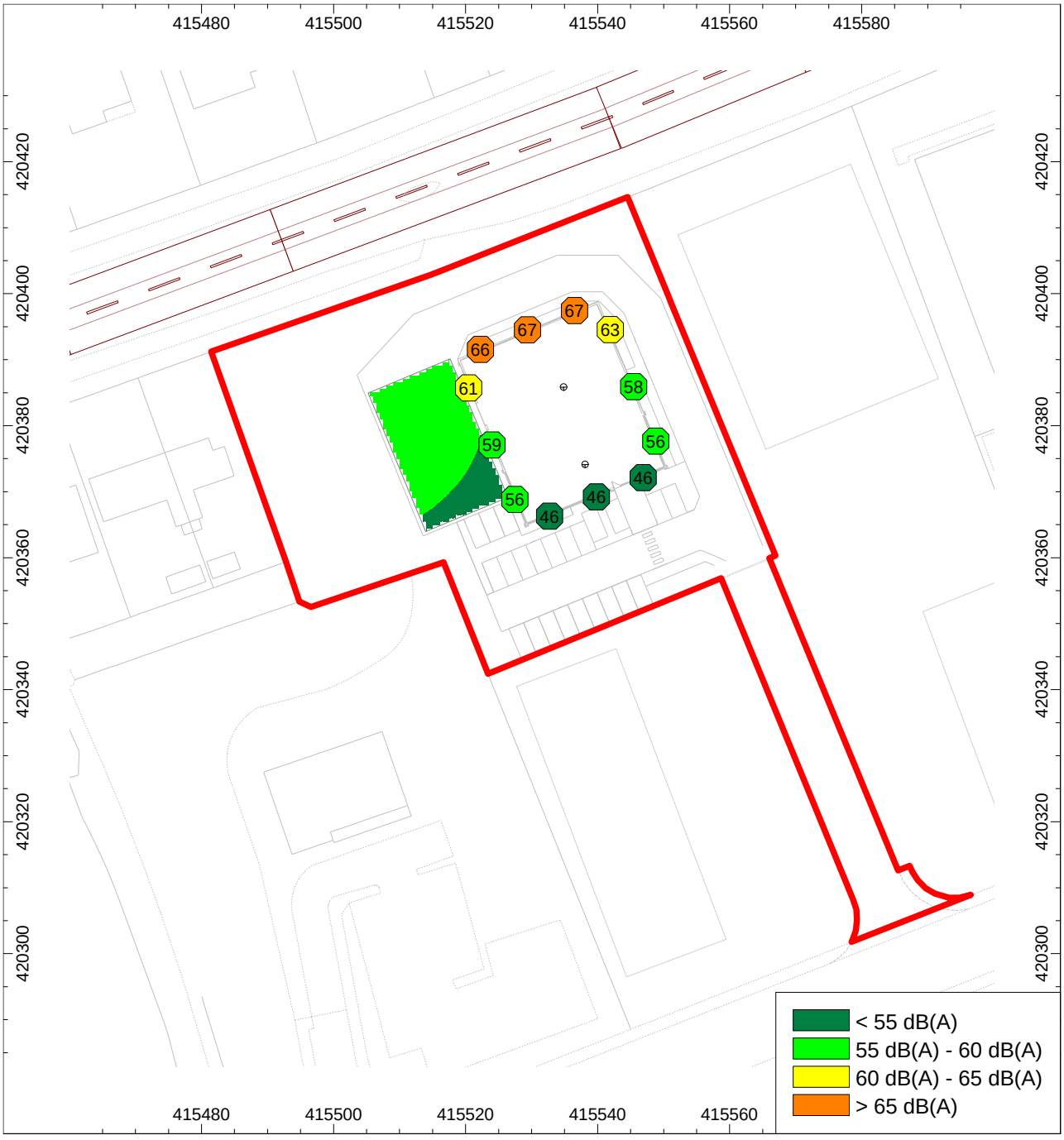
- Baseline sound levels have been measured over a reasonably long period and therefore provide a good indication of representative background and residual sound levels.
- Baseline sound level measurements undertaken in accordance with recognised Standards, using a tall environmental windshield and during acceptable weather conditions e.g. low wind speeds and precipitation.
- A direct measurement location was used to provide a representative basis for background sound levels at the nearest receiver locations.
- Field calibration checks were undertaken before and after measurements to record very low levels of equipment drift.
- A weather station was used to directly appraise in-situ weather climate and discount any periods of potential, adverse conditions.
- The calculations have been provided as conservative as not to under-predict the resulting impacts.

These measures have been considered to reduce uncertainty to a level considered not to have any significance to the outcome of this assessment.

6.0 USE OF EXTERNAL AREAS

CadnaA modelling software has been used to propagate road traffic noise of Bradley Road using the industry standard calculation method of The Calculation of Road Traffic Noise, Department of Transport Welsh Office (CRTN, 1988). The model was calibrated to data shown within Table 4-3 at 59 dB $L_{Aeq,30min}$ 35 m from Bradley Road. The output of Figure 6-1 has illustrated exposure with proposed external amenity space as a ground floor grid, 1.5 m above ground, with points representing the sound levels at upper floors of the building façade.

Figure 6-1
Predicted External Noise Levels, dB $L_{Aeq,30min}$ in External Areas and at Building Façades



6.1 External Area Noise Intrusion

Relevant guidance from the ANC/IOA The Acoustics of Schools: a design guide (2015) has provided that external outdoor recreation areas are *"generally considered to be of relatively low sensitivity to noise"*. The guidance has been noted to specifically recommend:

> *"For new schools, 60 dB $L_{Aeq,30min}$ should be regarded as an upper limit for external noise at the boundary of external areas used for formal and informal outdoor teaching and recreation… Noise levels in unoccupied playgrounds, playing fields and other outdoor areas should not exceed 55 dB $L_{Aeq,30min}$ and there should be at least one area suitable for outdoor teaching activities where noise levels are below 50 dB $L_{Aeq,30min}$. If this is not possible, due to a lack of suitably quiet sites, acoustic screening should be used to reduce noise levels in these areas as much as practicable, and an assessment of noise levels and options for reducing these should be carried out."*

It has been considered in summary Figure 6-1 that the external noise at the boundary of the outdoor area will not exceed with upper limit for external noise of 60 dB $L_{Aeq,30min}$ as alluding to the potential acceptability of external areas for the proposed outdoor use. No tolerance has been noted for situations of material change of use where the referenced guidance has specifically related to new school sites.

In following of the relevant guidance and above-quoted text, an investigation into the use of noise barriers has been carried out considering screening in two scenarios by positioning a proposed barrier:

- closer to the road per Figure 6-2, and;
- closer to the external area per Figure 6-3.

Due to the elevated nature of Bradley Road over the proposed amenity space, it has been illustrated that *greater benefit* could be achieved through screening the Site closer to Bradley Road using a nominal 2.0 m tall barrier structure. The overall acoustic effect has been considered slight and of 3-4 dB attenuation. Conversely close screening has only provided minimal attenuation of 0-1 dB which has subsequently been viewed impracticable.

Figure 6-2 below has illustrated that boundary screening to Bradley Road has the potential benefit of reducing most of the external amenity space below 55 dB $L_{Aeq,30min}$ and would therefore be advised to assist speech communication in outdoor areas of the scheme when used for teaching and/or recreational activities.

In its simplest form, a noise barrier can comprise of a solid structure of at least 10 kg/m^2 mass per area and imperforate form e.g. a close boarded-timber fence of nominally 20 mm thick panels. The acoustic benefit achieved by such a structure would then depend on factors of relative geometry (e.g. barrier height and length) between noise source and receiver. A nominal 2.0 m tall structure has been considered across an approximate 60 m length in Figure 6-2 to form a boundary screen to Bradley Road.

Boundary screening could be potentially achieved by replacing sections of the existing open-wire boundary fence with a suitable noise barrier boundary structure at the north west perimeter of the Site. Other practical and structural considerations would be necessary to consider alongside, such as the ability to replacing a fence within a mature landscaped area and the need for structural support against wind loading. Any adverse arboriculture modifications (e.g. in the extreme, the removal of foliage or a tree) for proper foundations or installation of the noise barrier could offset the minor acoustic benefit which in turn, may provide it as impracticable to attempt.

Boundary screening to Bradley Road has only therefore been considered an advisable based on the information within this section, to facilitate communication and reduce levels below 55 dB $L_{Aeq,30min}$ for most of the space and where practicable to do so. If no mitigation is practicably possible to instate at the scheme boundary, then external noise at the boundary of the outdoor area would not exceed an upper limit of 60 dB $L_{Aeq,30min}$ advocated in guidance for new schools.

The output of this modelling exercise has been illustrated further in Figure 6-2 and Figure 6-3 below.

Figure 6-2
Review of Boundary Screening to Bradley Road, dB $L_{Aeq,30min}$

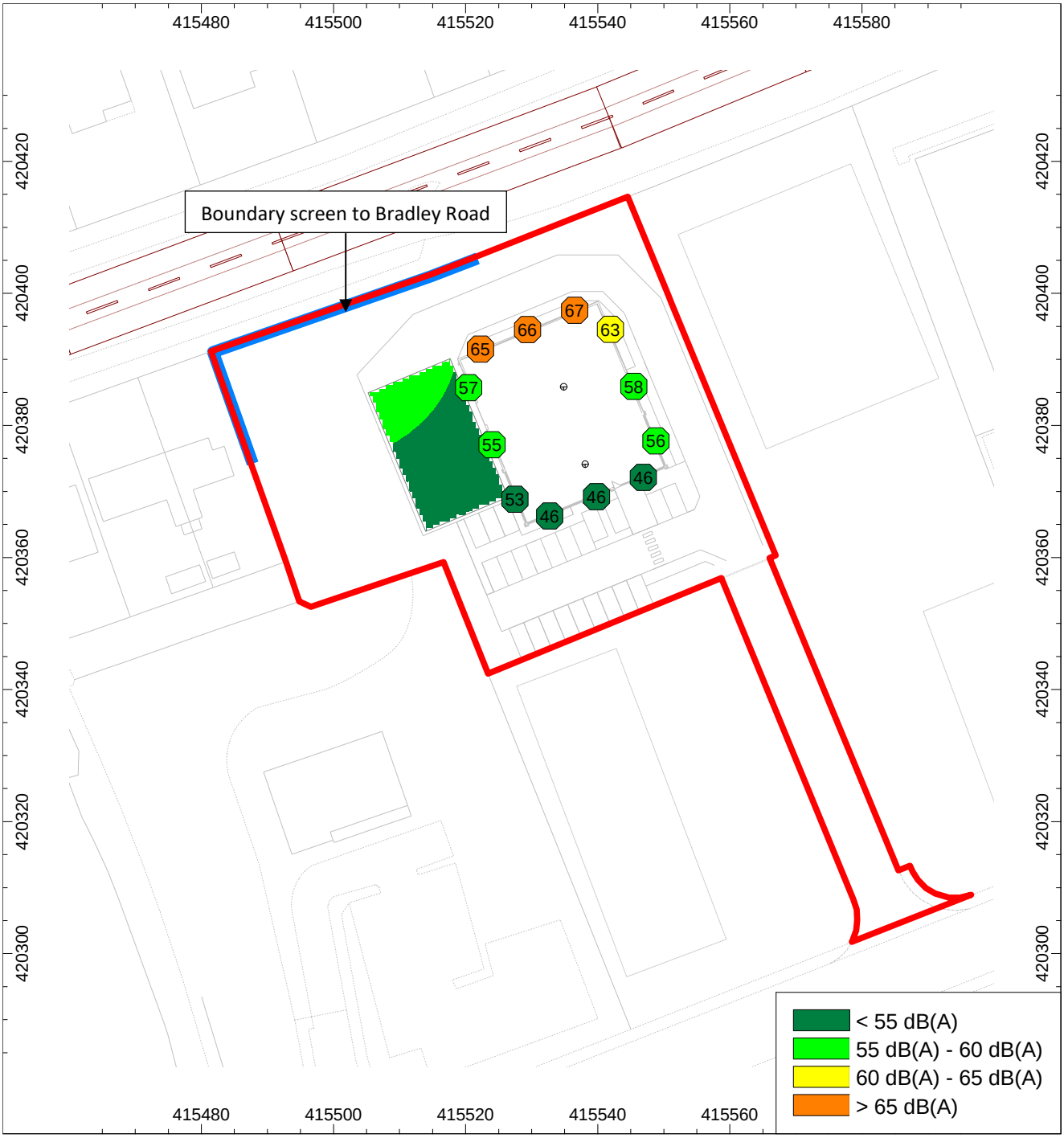
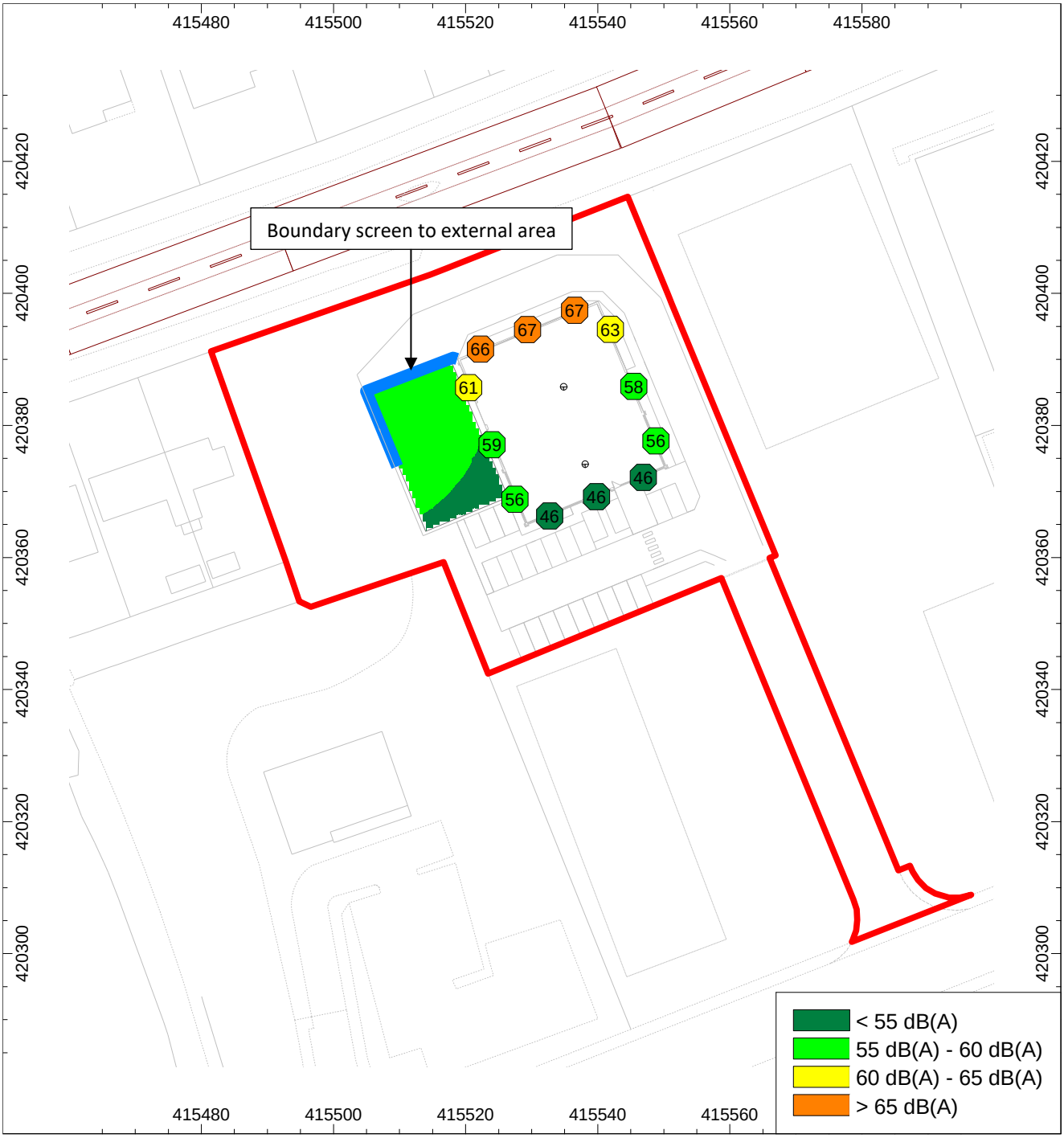


Figure 6-3
Review of Boundary Screening to External Area, dB $L_{Aeq,30min}$



6.2 External Area Noise Generation

It has been understood that external areas of the scheme would be occasionally used by up to 10 No. children under adult supervision, during discrete periods of the day and for teaching and/or recreational activities.

There has been no standard or guidance applicable to the nature of sound generated from external areas where it would be expected for sound to relate to people, or speech. BS 4142 has not been viewed an appropriate standard given the scope of the latest version excludes application to people, per Clause 1.3(f).

The ANC/IOA The Acoustics of Schools: a design guide (2015) has provided sound levels for normal voice, raised speech and shouting within the range of 60 – 80 dB(A) at 1 m when normally applied to the acoustic design of rooms for speech.

For the purposes of this assessment, use of the external area has been considered as noise generating from proposed capacity use of 10 No. people speaking in two scenarios:

- with normal vocal effort of 60 dB(A) at 1 m per Figure 6-4, and;
- with raised vocal effort of 68 dB(A) at 1 m per Figure 6-5.

Shouting would normally constitute rowdy or anti-social behaviour, such that noise assessment is not normally provided in this situation where management of the external activity would be necessary to avoid such behaviour. Furthermore, 50% of people speaking would be typical to consider given that two people do not speak simultaneously in a conversation. Notwithstanding, this section has considered a robust approach with speech applicable to the proposed use of the amenity space and 10 No. people.

The model previously used in this assessment has been adapted to provide the external amenity area as an equivalent area sound power level source following ISO 9613-2. The method used to define an equivalent area sound power level has been defined and summarised in single figures in Table 6-1:

- Octave band spectra have been taken from Table A6.2 of the IOA/ANC Guide guidance and provided in with **Appendix 04** relevant to normal to raised vocal effort of 60 – 68 dB(A).
- Sound pressure levels have been transposed into sound power levels of 71 – 78 dB(A) using a spherical pressure at 1 m to power correction of + 11 dB (i.e. directivity factor Q = 1).
- Sound power levels have been corrected in model space by 10 dB (i.e. 10 x log_{10} (10) = 10 dB) to account for the proposed occupancy.
- Sound power level has been divided over the proposed area of the amenity space of nominal 300 m^2 as to equate an equivalent power level 26 dB less (i.e. 10 x log_{10} (1/300) = -26 dB).

Table 6-1
Definition of Sound Power Levels Used for Speech from External Area

Scenario	Input Sound Pressure Level, L_{pA} at 1 m	Decibel Corrections, dB			Equivalent Area Sound Power Level, dB L_{wA}
		To Sound Power Level	Quantity of people (x 10)	Area of Space (300 m^2)	
Normal voice	60	+ 11	+ 10	- 26	55
Raised voice	68	+ 11	+ 10	- 26	63

The outputs of this modelling exercise have been illustrated in Figure 6-4 and Figure 6-5 then summarised in Table 6-2 below.

Figure 6-4
Review of Potential Noise Generation from External Areas – Normal Voices, dB $L_{Aeq,T}$

Figure 6-5
Review of Potential Noise Generation from External Areas – Raised Voices, dB $L_{Aeq,T}$

Table 6-2
Model Outputs of Speech Sound Levels, Highest at Building Façade

NSR Reference	NSR Street Name	Model Predicted Sound Pressure Level dB $L_{Aeq,T}$	
		Normal Voices	Raised Voices
A	Salus House	≤ 36	≤ 44
B	No. 333 – 337 Bradley Road	≤ 40	≤ 47
C	No. 390 – 382 Bradley Road	≤ 30	≤ 37

The comparison of Table 6-3 has been provided to show the level difference between pre-existing sound levels prior to development and proposed external area sound levels from normal and raised voices.

Table 6-3
Comparison of Pre-Existing and Proposed External Area Sound Levels

Pre-Existing Sound Level		Comparison to Proposed External Area Sound Level	
Metric	Level	Highest model predicted sound level for normal voices at 40 dB $L_{Aeq,T}$	Highest model predicted sound level for raised voices at 47 dB $L_{Aeq,T}$
Residual sound level	59 dB $L_{Aeq,T}$	- 19	- 12
Background sound level	54 dB $L_{A90,T}$	- 14	- 7

Table 6-3 has inferred that if normal or raised voices are used in the external area, resulting sound levels would have no effect on existing residual sound levels of 59 dB $L_{Aeq,T}$ where at least 10 dB lower. In combination, the ambient sound level would not change by any perceptible degree because of the influence of the external area (i.e. in the worst case, 47 dB + 59 dB = 59 dB).

Where residual sound levels have been shown in Table 6-3 above a range of 50 – 55 dB $L_{Aeq,T}$ this would inherently exceed common guidance criteria from BS 8233[2]. However the instatement of the development and external space would not make any pre-development impacts worse than currently existing, in terms of absolute level.

The background sound level would lie significantly higher than the proposed external area sound level by a margin of -7 to -14 dB, providing that for most of the time significant masking would be provided by road traffic noise. Speech has however been noted of different characteristics to road traffic and given that human perception is readily perceptible to speech, it has been considered that external area sound could be heard for some of the time, although could not be at a level to be considered readily audible, intelligible or intrusive.

In following of the toxicology approach of the NPSE and PPGN hierarchy of Table 3-1, sound from the external amenity area has been considered between the NOEL and LOAEL threshold. In the worst case, external amenity area noise could be heard but it would not cause any change in behaviour or attitude, it may slightly affect the acoustic character of the area but not to the extent that there could be a perceived change in the quality of life.

No mitigation measures have been deemed necessary to control external area noise beyond suitable management of the area to avoid unsociable or rowdy behaviour. Such provision would be expected from the instatement of a school facility and with staff attendance at all times of external area use during the day.

[2] Section 7.7.3.2. BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. BSI, 2014

7.0 ACOUSTIC CRITERIA FOR SCHOOL BUILDINGS

7.1 Approved Document E (ADE)

Approved Document E (2003 Edition incorporating 2004, 2010, 2013 & 2015 amendments) deals with the following requirements of Part E of Schedule 1 to the Building Regulations 2010.

Requirement E4 of this legislation describes the 'acoustic conditions in schools', as follows:

> *"Each room or other space in a school building shall be designed and construction in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use."*

These Regulations clarify that the normal way of satisfying Requirement E4 will be to meet the values of sound insulation, reverberation time and indoor ambient noise as provided within Building Bulletin 93 Acoustic design of Schools: Performance Standards, as published by the Department for Education.

7.2 Building Bulletin 93 (BB93)

BB93 provides a regulatory framework for the acoustic design of schools in support of the Building Regulations, giving supporting advice and recommendations for planning and design. The building regulations and hence the requirements of BB93 apply to Local Education Authorities and independent schools in England and Wales.

The requirements of BB93 Section 1 came into force on 1st July 2003 in line with those contained within ADE in support of the Building Regulations. Compliance with the acoustic performance standards in BB93 will satisfy both regulations for new schools.

BB93 aims to give supporting advice for the planning and designing of schools, by providing a comprehensive guide for those involved with the design processes. Section 1.1 of BB93 gives the performance standards for new school buildings to comply with the Building Regulations. These provide a good minimum standard for school design. The overall objective of the performance standards 1 is to provide acoustic conditions in schools that:

- Facilitate clear communication of speech between teacher and student, and between students, and;
- Do not interfere with study activities.

To achieve these objectives, performance standards are provided in BB93 on the following topics:

- Indoor ambient noise levels in unoccupied spaces;
- Airborne sound insulation between spaces;
- Airborne sound insulation between circulation spaces and other spaces used by students;
- Impact sound insulation of floors;
- Reverberation in teaching and study spaces;
- Sound absorption in corridors, entrance halls and stairwells;
- Speech intelligibility in open-plan spaces.

For the purposes of this assessment in the review of site suitability, only those factors that concern internal ambient noise level have been considered in following of BB93 performance standards.

The Acoustics of Schools: a design guide (2015) was published jointly by the Institute of Acoustics and the Association of Noise Consultants to provide further supporting guidance to BB93 and with additional guidance on external noise levels.

7.3 School Premises Regulations & Independent School Standards

The School Premises Regulations (SPR) and Independent School Standards (ISS) contain a similar statement to Requirement E4 of the Building Regulations and applies to both new and existing school buildings:

> *"The acoustic conditions and sound insulation of each room or other space must be suitable, having regard to the nature of the activities which normally take place therein."*

Beyond the requirements of the ADE and BB93, the SPR and ISS cover the performance in use as including speech intelligibility in classrooms. This factor provides that operational noise levels including equipment used in teaching and learning spaces will need to be suitable for the activities being undertaken. Furthermore, that any open plan teaching and learning spaces will need to provide suitable speech intelligibility.

7.4 Scope and Applicability

Material change of use (from non-school) buildings are covered by all acoustic criteria including ADE, BB93 and SPR and ISS. The main difference between these requirements is that ADE and BB93 apply to teaching and learning spaces whereas the SPR and ISS apply to all areas of schools.

BB93 Section 0.3.1 clarifies that ADE is not intended to cover the acoustic conditions in administration and ancillary spaces where they are not used for teaching and learning activities, *except* where they could affect acoustic conditions in neighbouring teaching and learning spaces. Administration and ancillary spaces therefore require suitable acoustic conditions to be considered with respect to adjoining teaching and learning spaces when provided within the same building. This remains applicable for material change of use buildings.

This document has not been provided as a full assessment for the design of the school buildings in accordance with the above-listed regulation and guidance, where school buildings must satisfy the requirements of regulation at the appropriate stage of development. Rather, in the assessment of material change of use to school buildings at planning stage, the sentiments of these regulations must be considered to determine the suitability of the proposed building (and if suitable acoustic conditions would result) as to advise scheme feasibility and strategies for improvement where necessary.

8.0 INTERNAL AMBIENT NOISE LEVELS IN UNOCCUPIED SPACES

8.1 Ventilation Strategy

Different types of ventilation strategy have been noted to exist in the current building where an assumption has been made for these to be maintained within the proposed school use. These have been understood of natural ventilation to offices and circulation spaces at the rear of the building, with centralised mechanical ventilation in the technical development storage area at the front and local mechanical extract ventilation within all WCs.

The normal condition for a ventilation system in natural or hybrid mode has been defined in BB93 as:

> *"…when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,500ppm with the maximum concentration not exceeding 2,000ppm for more than 20 consecutive minutes on any day. This would normally equate to a minimum ventilation rate of approximately 5l/s per person..."*

The normal condition for a ventilation system with a purely mechanical air supply has been defined in BB93 as:

> *"…when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,000ppm with the maximum concentration not exceeding 1,500ppm for more than 20 consecutive minutes on any day during normal school operating hours. This would normally equate to a minimum ventilation rate of approximately 8l/s per person…"*

The suitability of any proposed ventilation strategy has not been reviewed in following of BB101[3] where considered beyond the scope of this assessment.

8.2 Criteria

Criteria applicable to the upper level of indoor ambient noise level (IANL) have been provided in Table 8-1 below teaching and learning spaces undergoing material change of use. The 'refurbishment' performance standards have been duly applied in relevance to the proposal. All other areas as ancillary to educational uses have been noted of less onerous IANL requirements typically in the range of 45 – 55 dB $L_{Aeq,30min}$.

Table 8-1
Internal Ambient Noise Level Criteria

Room Type	BB93 IANL Upper Limit (Refurbishment Criteria) dB $L_{Aeq,30min}$	Ventilation Strategy
Classroom	≤ 40 [a]	Natural
Sports hall	≤ 45 [b]	Centralised mechanical

[a] *Where there is a natural system, noise ingress may exceed the IANL by up to 5 dB.*
[b] *Indoor ambient noise levels should not exceed 60 dB $L_{A1,30min}$ in spaces with IANL limits of ≥ 45 dB $L_{Aeq,30min}$.*

In the case of summertime ventilation, under local control of the teacher to prevent overheating and as allowable during the hottest 200 hrs of the year, the IANL upper limit for a natural system has been considered at ≤ 55 dB $L_{Aeq,30min}$. In the case of mechanical ventilation of the sports hall, these should not increase beyond Table 8-1 given the teaching and learning space has been proposed at 45 dB $L_{Aeq,30min}$ where 60 dB $L_{A1,30min}$ also applies.

[3] Building Bulletin 101: Ventilation, thermal comfort and indoor air quality. Education and Skills Funding Agency, 2018.

Alongside the internal ambient noise level criteria, it has been necessary to define the upper level of reverberation time applicable for the teaching areas under consideration. In following of BB93 Section 1.5, these have been defined in terms of the maximum mid frequency reverberation time T_{mf}, which is the upper level established from the arithmetic average of reverberation times between 500 Hz to 2 kHz octave bands, or 400 Hz to 2.5 kHz third octave bands.

Table 8-2
Reverberation Time Criteria for Teaching and Learning Spaces

Room Type	Maximum Mid Frequency Reverberation Time (Refurbishment Criteria) T_{mf}, s
Classroom	1.0
Sports hall	2.0

8.3 External Noise Level Appraisal

The calculation method used to confirm appropriate design criteria has followed Appendix 5 of BB93 and Section G2.1 of BS 8233, based on the method given in EN 12354-3. This has been provided further to the detail of external noise levels established in Figure 6-1, IANL requirements of Table 8-1 and T_{mf} values of Table 8-2.

In following, assumptions have been required to the form of the building for the purposes of noise break-in calculations. Table 8-3 has provided a summary further to the octave band detail of **Appendix 04**.

Table 8-3
Building Envelope Estimated Acoustic Properties

Building Element	Typical Sound Insulation Performance, dB R_w or $D_{ne,w}$	Estimated Construction
Masonry external wall	51 R_w	Cavity brick block construction
Steel external wall	24 R_w	Insulated sheet steel (conservative)
Composite external wall	*26 R_w*	*Composite of above (sports hall wall)*
Roof	25 R_w	Insulated sheet steel (conservative)
Glazing	30 R_w	4 mm standard double glazing
Trickle ventilators	27 $D_{ne,w}$	Non-acoustic trickle ventilators
Partially open window	18 $D_{ne,w}$	100,000mm^2 equivalent area

The existing building has been viewed as a metal clad structure about production areas to the north with a cavity brick block masonry lower section as surrounding the sports hall. The general sound reduction index of metal insulated roof, wall and façade systems has been referenced[4] from 23 – 58 dB R_w where baseline estimates of 24 dB R_w and 25 dB R_w have been conservatively used for steel wall and roof elements. A brick block cavity masonry wall has been estimated at 51 dB R_w where in combination, the composite insulation of walls surrounding the north of the building and proposed sports hall have been conservatively estimated at 26 R_w.

[4] Acoustic Performance Guide – Insulated Roof, Wall & Façade Systems. Kingspan, 2005.

Rear facing areas have been noted of double-glazed frontage about cavity masonry walls associated with former office uses to the south. Some windows have been noted to include trickle ventilators. Conservative estimates have been provided for these elements generally as 30 R_w for glazing and 27 $D_{ne,w}$ for non-acoustic trickle vents.

Attenuation figures for a partially opened window[5] have been obtained from a DEFRA research document assuming an element normalised value average across a range window types at 100,000 mm^2 equivalent area.

The calculations have considered two key ventilation states, as:

- normal ventilation provided at the building rate described by the requirements of BB101 Ventilation of School Buildings.
- the overheating rate during the hottest 200 hrs of the year with each window open in classrooms.

The calculations have considered the IANL from the building form with windows closed and ventilation in normal operation, as well as windows open for summertime conditions in classrooms. Given that floor plan layouts have not been reviewed, assumptions have been stated on room areas to generate the results of Table 8-4 below.

Table 8-4
IANL Results for Teaching and Learning Spaces

Room Details		Predicted IANL dB $L_{Aeq,30min}$ In Ventilation State	
Room Type	Volume, m^3	Normal Ventilation per BB101	Summertime Ventilation with Open Windows
Classroom	125	37	46
Sports hall	2,800	43* 50 dB $L_{A1,T}$	N/A**
**Requires suitably low mechanical noise levels.* ***Not applicable to areas with mechanical ventilation.*			

It has been established in Table 8-4 that suitable IANL conditions would be achieved from the building form to support proposed teaching and learning room functions. Compliance with BB93 has been estimated by detailed calculation in different ventilation states, as can be read in comparison of Table 8-1 and Table 8-4.

Further work will be required at the relevant stage of Building Control submission as to demonstrate that any mechanical ventilation system would not impinge upon cumulative sound levels in the sports hall when used in any ventilation state. At that stage, regulatory compliance would extend to the full detail outlined within Section 7.0 that lies beyond the scope of this assessment.

[5] DEFRA research document: Waters-Fuller, Tim, Lurcock, Daniel, MacKenzie, Richard and MacKenzie, Robin (2006) Open/closed window research: sound insulation through ventilated domestic windows.

9.0 PLANNING SUMMARY AND MITIGATION

The evaluated noise impacts in this report should be considered by the Kirklees Council mindful of the National Planning Policy Framework and Noise Policy Statement for England that define policy and decision-making requirements for planning and noise.

It has been provided within Section 3.0 of this report, that the NPSE suggests noise levels above the SOAEL should be avoided and that if noise levels fall between the LOAEL and SOAEL all reasonable steps should be taken to minimise and mitigate adverse effects, while considering guiding principles of sustainable development.

The range of noise impacts for the proposed F1 use class development have been deemed acceptable with respect to overarching requirements for planning and noise. Resulting impacts with suitable mitigation have been anticipated between the NOEL and LOAEL thresholds of the NPSE.

It is expected that the development sound will be largely unnoticeable, or just perceptible during the most noise sensitive periods of assessment. If it is possible for the sound to be audible, it is not expected to cause any change in behaviour or attitude. The development could marginally affect the acoustic character of the area but not to the extent that there is a perceived change in quality of life.

Commensurate measures have been considered to *"mitigate and minimise adverse impacts on health and quality of life"* which have been included within the detail of this assessment as:

- Restriction in line with proposed daytime opening hours (further to Local Condition HUC4).
- Control of any new plant and equipment not considered within this report, being constrained at a level no greater than existing background sound levels (further to Local Condition NC10 and Table 4-2 of this report).

Based on the results of this assessment it has not been viewed commensurate to impose other measures to further such as the instatement of boundary mitigation where potentially impracticable to attempt.

10.0 Conclusions

An assessment of environmental sound levels has been carried out for a proposed F1 Use Class development at Technology House in Huddersfield. Environmental sound levels have been referenced from a site survey at a location representative of the proposal and nearest noise sensitive receptors.

A noise impact assessment has been carried out in line with BS 4142 methodology by a suitably qualified acoustician. Cumulative rating sound levels have been predicted at the nearest sensitive receptors using noise modelling techniques of all known plant defined by quantitative noise emissions.

The numerical assessments in Section 5.0 have predicted worst-case rating levels significantly below the representative background sound levels during the worst-case times of the night. Predicted noise impacts during prospective operating times have been supported as low when considering the context of the site.

An assessment on external areas in Section 6.0 has acknowledged that upper limits of ambient noise level from road traffic to facilitate proposed use would not be exceeded without mitigation. Use of the external area has been acknowledged as noise generating however sound (in terms of normal or raised voices) has not been considered significant, between the NOEL and LOAEL threshold of the NPSE. In the worst case, external area noise could be heard but it would not cause any change in behaviour or attitude, it may slightly affect the acoustic character of the area but not to the extent that there could be a perceived change in the quality of life.

Further assessment has been provided in Section 8.0 considering suitable acoustic criteria in schools and internal ambient noise levels, based on the environmental noise incident on the proposal and anticipated building form. It has been provided that suitable acoustic conditions for teaching and learning can be achieved with no changes in building form other than where stipulated in regulation and at the relevant stages of proposed development.

It has been concluded from the findings of this assessment that any potential noise impact from the proposed material change of use would be low and in accordance with planning and noise guidance, including technical requirements from Kirklees Council. The Site has been appraised as able to provide suitable acoustic conditions aligning with the regulatory framework of BB93 for the acoustic design of schools in support of the Building Regulations.

There has been no prohibiting factor for noise that should reasonably deter the granting of planning approval of F1 use class at the Site. Commensurate mitigation has been viewed in the form of planning conditions, including the restriction of usage time and in the control of any new plant and equipment not considered within this report.

APPENDIX 01

Quality Assurance

	Name & Qualifications	Date
Prepared by:	S. Skingle BSc. (Hons) PgDip, MIOA MAES	24/02/2023
Reviewed and approved by:	M. Pratap BSc. (Hons) MIOA	27/02/2023

Revision	Date	Description	Prepared	Reviewed and approved
01	27/02/2023	First release	S. Skingle	M. Pratap
	Click or tap to enter a date.			

The assessment has required a suitable level of technical ability and has been undertaken by a Suitably Qualified Person (SQP). An individual with all the following credentials has been considered a SQP for this assessment:

- Has a minimum of three years' verifiable experience (within the last five years) of providing acoustic design advice for educational use developments. Such experience has clearly demonstrated a practical understanding of factors affecting acoustics in relation to educational use development and the built environment in general, including acting in an advisory capacity to provide recommendations and design advice, and;
- Holds a recognised acoustic qualification and membership of an appropriate professional body. The primary professional body for acoustics in the UK is the Institute of Acoustics.

This assessment has been led and managed by a SQP as defined above.

Where some elements of the assessment (e.g. measurements) have been carried out by an acoustician who does not meet the requirements above, this has been undertaken with the direct guidance and supervision of a SQP who has reviewed, agreed and overseen the measurement methodology and any results obtained.

The SQP confirms that the relevant measurements and calculations:

- Represent good industry practice in accordance with available guidance.
- Are appropriate given the building being assessed and scope of works proposed.
- Avoid invalid, biased and exaggerated claims.

The checker and author of this document confirm that they both comply with the definition of a SQP defined in this Appendix.

APPENDIX 02

Glossary of Terminology

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table 02-01
Sound Levels Commonly Found in the Environment

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 40 dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of Pain

Acoustic Terminology

dB (decibel) — The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (of 20 µPa).

dB(A) — A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

$L_{Aeq, T}$ — $L_{Aeq, T}$ is defined as the notional steady sound level which, over a stated period T, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

$L_{A10, T}$ & L_{A90} — If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.

$L_{Amax(F)}$ — $L_{Amax(F)}$ is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

APPENDIX 03

Survey Results

Table 03-01
15-minute Unattended Daytime History Results – Location 1, dB

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Thu 15/12/2022 13:15	59.9	56.6	62.2	69.2	
Thu 15/12/2022 13:30	60.2	56.4	62.2	74.6	
Thu 15/12/2022 13:45	61.0	54.9	62.7	76.8	
Thu 15/12/2022 14:00	59.8	55.6	62.1	68.6	
Thu 15/12/2022 14:15	59.2	55.0	61.7	65.4	
Thu 15/12/2022 14:30	60.8	55.7	62.4	79.3	
Thu 15/12/2022 14:45	59.9	56.4	62.1	68.5	
Thu 15/12/2022 15:00	59.2	55.8	61.3	67.2	
Thu 15/12/2022 15:15	57.3	55.2	59.2	63.6	
Thu 15/12/2022 15:30	60.7	57.8	62.4	71.6	
Thu 15/12/2022 15:45	60.8	58.2	62.6	66.1	
Thu 15/12/2022 16:00	59.9	56.9	61.9	66.4	
Thu 15/12/2022 16:15	59.7	57.1	61.5	64.5	
Thu 15/12/2022 16:30	59.8	56.9	61.7	68.9	
Thu 15/12/2022 16:45	58.4	56.0	60.5	64.0	
Thu 15/12/2022 17:00	56.9	55.4	57.8	70.5	
Thu 15/12/2022 17:15	59.0	56.0	61.5	65.7	
Thu 15/12/2022 17:30	60.0	56.8	61.7	73.3	
Thu 15/12/2022 17:45	60.2	56.9	62.3	66.9	
Thu 15/12/2022 18:00	60.8	57.2	63.1	66.9	
Thu 15/12/2022 18:15	60.1	56.3	62.4	67.4	
Thu 15/12/2022 18:30	60.5	56.9	62.6	69.4	
Thu 15/12/2022 18:45	60.6	57.6	62.5	65.9	
Thu 15/12/2022 19:00	60.3	56.5	62.6	66.1	
Thu 15/12/2022 19:15	60.1	56.6	62.2	66.1	
Thu 15/12/2022 19:30	59.8	55.9	62.0	78.9	
Thu 15/12/2022 19:45	60.2	56.3	62.8	67.3	
Thu 15/12/2022 20:00	60.0	56.0	62.3	71.1	
Thu 15/12/2022 20:15	58.9	54.8	61.4	65.3	
Thu 15/12/2022 20:30	58.3	53.2	61.3	65.8	
Thu 15/12/2022 20:45	57.8	53.1	60.3	67.6	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Thu 15/12/2022 21:00	58.4	53.1	61.3	67.0	
Thu 15/12/2022 21:15	57.2	51.4	60.2	65.8	
Thu 15/12/2022 21:30	57.0	51.5	59.9	65.0	
Thu 15/12/2022 21:45	57.1	51.8	60.2	65.9	
Thu 15/12/2022 22:00	57.2	51.4	60.1	71.2	
Thu 15/12/2022 22:15	56.0	49.6	59.4	65.1	
Thu 15/12/2022 22:30	56.8	50.9	60.1	66.5	
Thu 15/12/2022 22:45	54.9	49.1	57.9	70.5	
Thu 15/12/2022 23:00	54.8	49.3	58.1	65.5	
Thu 15/12/2022 23:15	54.2	49.4	57.5	64.4	
Thu 15/12/2022 23:30	53.2	48.6	56.6	62.5	
Thu 15/12/2022 23:45	52.0	47.3	55.3	62.6	
Fri 16/12/2022 00:00	53.1	45.8	56.3	69.6	
Fri 16/12/2022 00:15	50.9	45.0	54.3	63.6	
Fri 16/12/2022 00:30	50.0	45.5	53.0	62.6	
Fri 16/12/2022 00:45	50.8	44.0	53.2	67.4	
Fri 16/12/2022 01:00	50.2	44.2	53.7	63.2	
Fri 16/12/2022 01:15	49.7	42.3	53.6	61.9	
Fri 16/12/2022 01:30	50.2	43.7	54.4	65.1	
Fri 16/12/2022 01:45	50.4	44.2	54.0	66.2	
Fri 16/12/2022 02:00	48.7	43.5	50.8	61.9	
Fri 16/12/2022 02:15	50.0	43.8	52.9	67.4	
Fri 16/12/2022 02:30	48.8	43.4	51.1	62.4	
Fri 16/12/2022 02:45	51.4	45.0	53.2	65.8	
Fri 16/12/2022 03:00	48.9	42.8	51.8	61.8	
Fri 16/12/2022 03:15	50.7	45.4	53.4	64.2	
Fri 16/12/2022 03:30	48.8	42.5	50.9	64.1	
Fri 16/12/2022 03:45	47.2	42.6	49.1	59.3	
Fri 16/12/2022 04:00	48.5	43.0	51.5	61.6	
Fri 16/12/2022 04:15	49.8	43.4	52.4	64.0	
Fri 16/12/2022 04:30	50.2	45.1	51.9	62.8	
Fri 16/12/2022 04:45	51.7	46.0	55.5	66.4	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Fri 16/12/2022 05:00	51.9	45.3	56.0	63.0	
Fri 16/12/2022 05:15	52.5	46.7	56.9	64.7	
Fri 16/12/2022 05:30	56.2	49.6	59.3	67.2	
Fri 16/12/2022 05:45	56.9	48.7	60.3	65.7	
Fri 16/12/2022 06:00	58.0	50.9	61.5	65.3	
Fri 16/12/2022 06:15	57.9	52.3	60.9	65.1	
Fri 16/12/2022 06:30	59.1	53.0	62.0	69.1	
Fri 16/12/2022 06:45	60.4	56.1	62.9	66.4	
Fri 16/12/2022 07:00	60.8	57.2	62.8	67.9	
Fri 16/12/2022 07:15	60.4	56.3	62.9	71.0	
Fri 16/12/2022 07:30	60.7	57.1	62.9	67.9	
Fri 16/12/2022 07:45	61.2	57.8	63.4	67.1	
Fri 16/12/2022 08:00	61.2	58.3	63.2	71.8	
Fri 16/12/2022 08:15	61.1	58.6	62.8	71.4	
Fri 16/12/2022 08:30	58.3	55.7	60.1	69.1	
Fri 16/12/2022 08:45	60.5	56.6	62.8	69.1	
Fri 16/12/2022 09:00	60.5	56.2	62.8	73.0	
Fri 16/12/2022 09:15	60.0	56.0	62.4	70.1	
Fri 16/12/2022 09:30	59.8	55.0	62.2	66.5	
Fri 16/12/2022 09:45	60.2	55.1	61.7	81.6	
Fri 16/12/2022 10:00	59.3	54.6	61.8	66.9	
Fri 16/12/2022 10:15	59.6	54.4	62.3	66.8	
Fri 16/12/2022 10:30	59.5	55.2	62.0	69.6	
Fri 16/12/2022 10:45	59.2	54.5	61.8	69.5	
Fri 16/12/2022 11:00	59.1	54.8	61.5	65.2	
Fri 16/12/2022 11:15	59.0	54.1	61.6	68.5	
Fri 16/12/2022 11:30	59.9	55.0	62.7	66.8	
Fri 16/12/2022 11:45	59.8	55.3	62.3	67.5	
Fri 16/12/2022 12:00	60.1	55.9	62.3	70.2	
Fri 16/12/2022 12:15	58.8	54.7	61.2	72.2	
Fri 16/12/2022 12:30	59.5	55.5	61.9	66.2	
Fri 16/12/2022 12:45	59.8	55.3	62.2	70.6	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Fri 16/12/2022 13:00	59.4	55.8	61.8	65.7	
Fri 16/12/2022 13:15	56.4	53.2	58.5	65.6	
Fri 16/12/2022 13:30	57.2	52.5	58.8	75.5	
Fri 16/12/2022 13:45	57.8	52.7	60.8	72.2	
Fri 16/12/2022 14:00	59.6	55.7	61.9	65.7	
Fri 16/12/2022 14:15	58.9	54.0	61.3	70.5	
Fri 16/12/2022 14:30	58.7	53.6	61.2	70.3	
Fri 16/12/2022 14:45	59.1	54.4	61.5	72.8	
Fri 16/12/2022 15:00	58.9	54.1	61.3	69.4	
Fri 16/12/2022 15:15	58.1	52.8	61.0	67.0	
Fri 16/12/2022 15:30	57.7	52.8	60.5	66.6	
Fri 16/12/2022 15:45	58.4	53.3	61.4	66.7	
Fri 16/12/2022 16:00	57.7	52.4	60.7	64.5	
Fri 16/12/2022 16:15	58.7	53.6	61.2	74.5	
Fri 16/12/2022 16:30	58.2	53.7	60.9	67.2	
Fri 16/12/2022 16:45	59.6	53.7	61.3	75.4	
Fri 16/12/2022 17:00	59.7	55.7	61.8	69.4	
Fri 16/12/2022 17:15	59.3	55.2	61.6	67.8	
Fri 16/12/2022 17:30	59.3	56.0	61.7	64.6	
Fri 16/12/2022 17:45	60.1	56.2	62.2	70.8	
Fri 16/12/2022 18:00	60.2	56.3	62.2	68.4	
Fri 16/12/2022 18:15	60.0	56.1	61.9	70.6	
Fri 16/12/2022 18:30	59.6	54.4	61.7	75.4	
Fri 16/12/2022 18:45	59.4	55.3	61.6	70.3	
Fri 16/12/2022 19:00	58.6	54.1	61.1	66.7	
Fri 16/12/2022 19:15	58.4	53.3	61.1	67.2	
Fri 16/12/2022 19:30	58.4	53.6	61.1	66.2	
Fri 16/12/2022 19:45	57.6	52.8	60.2	64.1	
Fri 16/12/2022 20:00	57.8	52.6	60.4	66.3	
Fri 16/12/2022 20:15	57.5	52.3	60.5	69.3	
Fri 16/12/2022 20:30	56.5	49.8	59.6	66.5	
Fri 16/12/2022 20:45	56.4	50.0	59.6	69.8	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Fri 16/12/2022 21:00	56.2	49.4	59.3	69.5	
Fri 16/12/2022 21:15	56.7	49.3	60.1	67.5	
Fri 16/12/2022 21:30	56.0	49.2	59.6	64.8	
Fri 16/12/2022 21:45	56.2	48.3	59.9	64.8	
Fri 16/12/2022 22:00	56.3	49.3	59.5	69.2	
Fri 16/12/2022 22:15	56.8	49.3	59.5	75.4	
Fri 16/12/2022 22:30	56.5	48.8	59.7	64.9	
Fri 16/12/2022 22:45	55.7	48.8	59.2	66.7	
Fri 16/12/2022 23:00	55.2	48.3	59.0	65.9	
Fri 16/12/2022 23:15	55.2	48.9	58.8	63.7	
Fri 16/12/2022 23:30	55.0	48.4	58.5	64.3	
Fri 16/12/2022 23:45	55.0	48.2	58.9	65.6	
Sat 17/12/2022 00:00	54.6	46.2	58.7	69.5	
Sat 17/12/2022 00:15	54.5	47.2	58.3	67.6	
Sat 17/12/2022 00:30	53.2	45.8	57.0	64.9	
Sat 17/12/2022 00:45	53.0	46.1	57.2	67.0	
Sat 17/12/2022 01:00	52.4	44.9	57.1	63.0	
Sat 17/12/2022 01:15	51.5	44.1	55.7	65.4	
Sat 17/12/2022 01:30	51.2	43.7	55.2	66.1	
Sat 17/12/2022 01:45	49.2	41.8	54.2	60.1	
Sat 17/12/2022 02:00	50.2	42.3	54.7	63.0	
Sat 17/12/2022 02:15	49.9	42.7	54.7	66.3	
Sat 17/12/2022 02:30	49.4	41.8	53.1	63.3	
Sat 17/12/2022 02:45	50.5	43.1	54.8	64.2	
Sat 17/12/2022 03:00	49.3	41.5	54.3	61.5	
Sat 17/12/2022 03:15	47.0	42.1	49.0	60.3	
Sat 17/12/2022 03:30	47.6	42.6	49.1	59.7	
Sat 17/12/2022 03:45	47.9	42.8	49.4	65.6	
Sat 17/12/2022 04:00	49.2	43.2	52.1	62.0	
Sat 17/12/2022 04:15	50.4	44.0	52.6	69.3	
Sat 17/12/2022 04:30	47.6	43.7	49.0	61.5	
Sat 17/12/2022 04:45	48.5	42.8	51.6	61.5	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Sat 17/12/2022 05:00	49.7	43.4	53.1	66.8	
Sat 17/12/2022 05:15	50.9	44.5	55.3	63.4	
Sat 17/12/2022 05:30	52.5	45.6	56.7	62.2	
Sat 17/12/2022 05:45	52.0	46.3	56.0	63.3	
Sat 17/12/2022 06:00	52.5	47.5	56.8	65.6	
Sat 17/12/2022 06:15	53.3	47.5	57.3	62.7	
Sat 17/12/2022 06:30	53.5	48.2	57.2	63.5	
Sat 17/12/2022 06:45	54.3	48.4	57.8	65.9	
Sat 17/12/2022 07:00	55.3	49.3	58.7	68.2	
Sat 17/12/2022 07:15	56.5	50.1	59.9	69.4	
Sat 17/12/2022 07:30	56.5	50.9	59.8	65.8	
Sat 17/12/2022 07:45	56.4	51.6	59.5	63.5	
Sat 17/12/2022 08:00	57.8	53.5	60.5	65.9	
Sat 17/12/2022 08:15	58.8	53.5	61.7	67.8	
Sat 17/12/2022 08:30	58.5	53.7	61.1	72.5	* Rainfall
Sat 17/12/2022 08:45	58.5	53.3	61.3	64.8	* Rainfall
Sat 17/12/2022 09:00	59.3	53.9	61.6	68.6	
Sat 17/12/2022 09:15	59.5	54.3	62.3	74.1	
Sat 17/12/2022 09:30	59.0	54.2	61.6	65.6	
Sat 17/12/2022 09:45	59.3	54.9	62.0	67.6	
Sat 17/12/2022 10:00	60.0	55.2	62.3	69.9	
Sat 17/12/2022 10:15	59.7	55.4	62.0	67.1	
Sat 17/12/2022 10:30	59.8	56.0	62.1	64.9	
Sat 17/12/2022 10:45	60.5	56.4	62.5	70.3	
Sat 17/12/2022 11:00	60.4	57.7	62.3	67.9	
Sat 17/12/2022 11:15	60.8	57.5	62.7	67.2	
Sat 17/12/2022 11:30	61.1	58.1	63.1	67.5	
Sat 17/12/2022 11:45	60.8	57.0	62.8	66.6	
Sat 17/12/2022 12:00	61.2	58.0	63.0	74.1	
Sat 17/12/2022 12:15	60.4	56.9	62.4	65.6	
Sat 17/12/2022 12:30	60.5	56.7	62.5	66.3	
Sat 17/12/2022 12:45	60.4	56.3	62.7	70.4	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Sat 17/12/2022 13:00	60.0	55.4	62.4	66.1	
Sat 17/12/2022 13:15	60.7	57.5	62.7	66.1	
Sat 17/12/2022 13:30	59.6	55.6	61.9	64.6	
Sat 17/12/2022 13:45	60.1	55.8	62.3	66.5	
Sat 17/12/2022 14:00	59.8	55.8	62.2	65.9	
Sat 17/12/2022 14:15	60.8	57.6	62.7	67.2	
Sat 17/12/2022 14:30	60.2	56.0	62.3	67.2	
Sat 17/12/2022 14:45	59.6	56.0	61.7	65.6	
Sat 17/12/2022 15:00	60.1	56.4	62.1	72.1	
Sat 17/12/2022 15:15	60.0	56.4	62.0	67.9	
Sat 17/12/2022 15:30	59.8	55.8	62.0	68.1	
Sat 17/12/2022 15:45	59.2	55.2	61.4	65.4	
Sat 17/12/2022 16:00	59.7	55.8	61.8	69.0	
Sat 17/12/2022 16:15	59.0	55.1	61.3	64.9	
Sat 17/12/2022 16:30	59.3	55.6	61.6	66.0	
Sat 17/12/2022 16:45	59.4	55.0	61.5	67.9	
Sat 17/12/2022 17:00	59.5	55.5	61.6	67.7	
Sat 17/12/2022 17:15	59.2	55.5	61.7	66.8	
Sat 17/12/2022 17:30	58.6	54.3	60.9	64.7	
Sat 17/12/2022 17:45	59.1	54.7	61.4	65.2	
Sat 17/12/2022 18:00	58.8	53.9	61.6	67.2	
Sat 17/12/2022 18:15	58.4	52.8	61.1	64.8	
Sat 17/12/2022 18:30	58.0	52.3	60.9	72.1	
Sat 17/12/2022 18:45	58.2	53.0	60.8	67.7	
Sat 17/12/2022 19:00	58.4	53.5	61.0	66.7	
Sat 17/12/2022 19:15	57.3	50.9	60.2	65.5	
Sat 17/12/2022 19:30	56.5	49.6	59.7	63.8	
Sat 17/12/2022 19:45	57.0	51.2	59.9	64.0	
Sat 17/12/2022 20:00	57.4	50.0	60.0	74.3	
Sat 17/12/2022 20:15	56.4	49.8	59.5	65.0	
Sat 17/12/2022 20:30	56.5	50.8	59.8	69.6	
Sat 17/12/2022 20:45	56.0	49.6	59.4	66.0	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Sat 17/12/2022 21:00	55.6	49.6	58.8	63.3	
Sat 17/12/2022 21:15	57.6	50.7	59.4	80.2	
Sat 17/12/2022 21:30	55.2	48.9	58.2	69.4	
Sat 17/12/2022 21:45	55.2	48.1	58.4	70.0	
Sat 17/12/2022 22:00	55.8	48.7	59.1	65.8	
Sat 17/12/2022 22:15	54.7	48.4	58.0	64.4	
Sat 17/12/2022 22:30	54.7	46.8	58.5	66.0	
Sat 17/12/2022 22:45	54.2	45.2	58.6	63.5	
Sat 17/12/2022 23:00	54.2	45.2	58.3	66.4	
Sat 17/12/2022 23:15	54.2	43.8	58.2	67.5	* Rainfall
Sat 17/12/2022 23:30	54.0	45.8	58.0	64.7	* Rainfall
Sat 17/12/2022 23:45	54.6	45.0	58.4	69.5	* Rainfall
Sun 18/12/2022 00:00	54.6	43.4	58.3	70.8	* Rainfall
Sun 18/12/2022 00:15	53.3	42.3	58.0	64.2	* Rainfall
Sun 18/12/2022 00:30	51.1	41.5	55.7	62.9	* Rainfall
Sun 18/12/2022 00:45	52.8	41.0	56.6	67.9	* Rainfall
Sun 18/12/2022 01:00	52.3	40.6	57.0	66.8	* Rainfall
Sun 18/12/2022 01:15	50.7	40.0	55.8	61.4	
Sun 18/12/2022 01:30	51.2	38.4	55.3	66.9	
Sun 18/12/2022 01:45	51.7	41.6	55.3	70.5	
Sun 18/12/2022 02:00	50.3	42.4	55.1	62.5	
Sun 18/12/2022 02:15	48.7	41.8	52.2	63.5	
Sun 18/12/2022 02:30	48.3	37.4	52.6	61.2	
Sun 18/12/2022 02:45	49.4	38.5	53.9	64.1	
Sun 18/12/2022 03:00	49.2	42.8	52.4	63.4	
Sun 18/12/2022 03:15	45.7	40.5	47.3	60.4	
Sun 18/12/2022 03:30	46.0	41.6	46.5	60.0	
Sun 18/12/2022 03:45	47.9	40.3	51.0	62.3	
Sun 18/12/2022 04:00	49.8	42.6	52.5	63.5	
Sun 18/12/2022 04:15	49.6	42.0	52.2	63.5	
Sun 18/12/2022 04:30	48.2	40.4	50.6	62.8	
Sun 18/12/2022 04:45	47.5	39.8	51.3	63.6	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Sun 18/12/2022 05:00	46.8	40.0	50.3	61.0	
Sun 18/12/2022 05:15	49.2	42.4	52.9	64.0	
Sun 18/12/2022 05:30	49.4	43.1	53.5	61.7	
Sun 18/12/2022 05:45	52.2	42.9	56.5	72.7	
Sun 18/12/2022 06:00	50.6	41.6	55.1	62.8	
Sun 18/12/2022 06:15	50.5	41.8	54.2	67.2	
Sun 18/12/2022 06:30	50.3	40.6	54.7	64.1	
Sun 18/12/2022 06:45	51.2	42.1	55.4	63.6	
Sun 18/12/2022 07:00	51.8	43.4	56.5	65.7	
Sun 18/12/2022 07:15	51.2	43.9	55.3	64.7	
Sun 18/12/2022 07:30	51.8	43.1	55.8	62.2	
Sun 18/12/2022 07:45	51.3	42.4	55.3	66.5	
Sun 18/12/2022 08:00	52.0	43.7	56.5	62.3	
Sun 18/12/2022 08:15	52.4	44.2	56.4	64.0	
Sun 18/12/2022 08:30	54.5	45.3	58.1	70.4	
Sun 18/12/2022 08:45	54.9	48.0	58.6	63.7	
Sun 18/12/2022 09:00	55.8	48.4	59.1	66.0	
Sun 18/12/2022 09:15	55.7	47.9	59.4	66.9	
Sun 18/12/2022 09:30	56.9	49.8	60.1	65.3	
Sun 18/12/2022 09:45	57.7	50.0	60.9	65.9	
Sun 18/12/2022 10:00	57.3	50.9	60.4	65.5	
Sun 18/12/2022 10:15	58.1	50.4	60.9	76.2	
Sun 18/12/2022 10:30	58.1	52.0	61.0	67.6	
Sun 18/12/2022 10:45	58.0	51.6	60.8	65.4	
Sun 18/12/2022 11:00	57.9	51.3	60.8	68.0	
Sun 18/12/2022 11:15	57.8	51.1	60.8	67.3	
Sun 18/12/2022 11:30	57.9	50.6	61.0	64.7	
Sun 18/12/2022 11:45	58.2	52.8	61.0	68.8	
Sun 18/12/2022 12:00	58.8	53.9	61.3	67.1	
Sun 18/12/2022 12:15	60.8	53.5	61.5	80.9	
Sun 18/12/2022 12:30	58.6	53.4	61.2	66.2	
Sun 18/12/2022 12:45	59.2	54.2	61.8	65.6	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Sun 18/12/2022 13:00	58.7	53.5	61.2	70.9	
Sun 18/12/2022 13:15	59.5	55.0	61.9	66.0	
Sun 18/12/2022 13:30	59.8	55.2	62.4	68.9	
Sun 18/12/2022 13:45	59.5	54.5	62.1	67.1	
Sun 18/12/2022 14:00	60.0	53.9	62.6	72.8	
Sun 18/12/2022 14:15	59.6	54.3	62.2	66.7	
Sun 18/12/2022 14:30	59.4	54.7	62.0	65.6	
Sun 18/12/2022 14:45	59.6	53.3	62.2	66.1	
Sun 18/12/2022 15:00	59.3	53.1	62.1	66.0	
Sun 18/12/2022 15:15	58.2	51.0	61.2	66.5	
Sun 18/12/2022 15:30	58.2	50.6	61.0	66.9	
Sun 18/12/2022 15:45	57.8	51.6	60.8	64.7	
Sun 18/12/2022 16:00	58.3	52.7	61.0	66.4	
Sun 18/12/2022 16:15	58.3	51.6	61.3	72.7	
Sun 18/12/2022 16:30	57.9	50.1	61.2	74.1	
Sun 18/12/2022 16:45	57.2	50.5	60.5	64.9	
Sun 18/12/2022 17:00	58.0	51.6	61.1	74.9	
Sun 18/12/2022 17:15	58.0	53.2	60.9	75.6	
Sun 18/12/2022 17:30	58.3	52.8	61.1	77.3	
Sun 18/12/2022 17:45	57.2	50.1	60.4	72.0	
Sun 18/12/2022 18:00	58.0	51.5	61.1	66.6	
Sun 18/12/2022 18:15	58.4	52.9	61.3	72.1	
Sun 18/12/2022 18:30	58.3	52.4	61.2	68.2	
Sun 18/12/2022 18:45	58.0	51.8	61.0	72.9	
Sun 18/12/2022 19:00	57.1	49.7	60.4	65.2	
Sun 18/12/2022 19:15	56.4	48.9	59.3	63.6	
Sun 18/12/2022 19:30	56.0	48.4	59.3	65.2	
Sun 18/12/2022 19:45	57.2	47.0	59.1	76.1	
Sun 18/12/2022 20:00	55.7	46.4	59.2	66.4	
Sun 18/12/2022 20:15	54.5	45.0	58.4	65.5	
Sun 18/12/2022 20:30	54.5	45.6	58.3	62.9	
Sun 18/12/2022 20:45	55.0	47.0	58.5	64.3	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Sun 18/12/2022 21:00	53.9	45.6	57.3	64.6	
Sun 18/12/2022 21:15	55.3	46.2	58.9	65.9	
Sun 18/12/2022 21:30	54.4	44.7	58.1	65.2	
Sun 18/12/2022 21:45	53.3	41.9	57.4	67.8	
Sun 18/12/2022 22:00	52.3	40.8	56.4	66.1	
Sun 18/12/2022 22:15	53.7	42.4	57.5	70.3	
Sun 18/12/2022 22:30	51.8	40.2	56.4	65.6	
Sun 18/12/2022 22:45	51.4	39.2	56.0	64.4	
Sun 18/12/2022 23:00	52.8	45.3	56.4	72.3	
Sun 18/12/2022 23:15	52.7	45.1	56.5	70.1	
Sun 18/12/2022 23:30	54.0	46.4	57.1	71.7	
Sun 18/12/2022 23:45	56.0	49.7	58.9	73.2	
Mon 19/12/2022 00:00	53.5	48.7	56.4	70.1	
Mon 19/12/2022 00:15	52.3	47.5	55.9	71.0	
Mon 19/12/2022 00:30	52.3	47.5	54.6	72.3	
Mon 19/12/2022 00:45	50.8	44.4	53.4	72.0	
Mon 19/12/2022 01:00	46.9	42.6	48.8	66.1	
Mon 19/12/2022 01:15	46.9	40.8	49.6	60.2	
Mon 19/12/2022 01:30	47.7	42.2	50.7	70.6	
Mon 19/12/2022 01:45	48.3	41.0	50.3	69.5	
Mon 19/12/2022 02:00	48.1	41.6	50.2	60.7	
Mon 19/12/2022 02:15	47.2	40.7	49.4	61.6	
Mon 19/12/2022 02:30	48.0	41.2	49.0	66.8	
Mon 19/12/2022 02:45	45.6	40.6	46.3	61.2	
Mon 19/12/2022 03:00	45.7	40.8	46.7	61.5	
Mon 19/12/2022 03:15	47.3	41.4	49.9	60.1	
Mon 19/12/2022 03:30	46.7	41.0	45.2	67.1	
Mon 19/12/2022 03:45	44.5	40.1	45.6	58.9	
Mon 19/12/2022 04:00	46.7	40.8	50.8	61.9	
Mon 19/12/2022 04:15	47.2	41.5	50.5	60.3	
Mon 19/12/2022 04:30	48.3	42.4	50.1	62.9	
Mon 19/12/2022 04:45	49.9	43.6	53.8	63.4	

Date and Time	$L_{Aeq,15min}$	$L_{A90,15min}$	$L_{A10,15min}$	$L_{Amax(F)}$	Weather Excl.
Mon 19/12/2022 05:00	50.2	44.7	54.3	63.2	
Mon 19/12/2022 05:15	52.5	47.0	56.2	62.0	
Mon 19/12/2022 05:30	53.9	48.3	57.0	63.9	
Mon 19/12/2022 05:45	55.0	48.9	58.4	68.2	
Mon 19/12/2022 06:00	54.4	48.2	57.6	65.1	
Mon 19/12/2022 06:15	55.9	49.3	59.3	66.2	
Mon 19/12/2022 06:30	56.6	50.7	59.6	68.5	
Mon 19/12/2022 06:45	56.8	50.5	59.8	65.3	
Mon 19/12/2022 07:00	57.5	52.0	60.5	66.2	
Mon 19/12/2022 07:15	57.6	52.5	60.2	66.3	
Mon 19/12/2022 07:30	57.8	52.8	60.6	66.4	
Mon 19/12/2022 07:45	58.5	53.7	60.6	74.4	
Mon 19/12/2022 08:00	57.2	52.3	59.9	66.6	
Mon 19/12/2022 08:15	57.3	52.8	59.8	66.9	
Mon 19/12/2022 08:30	57.2	52.1	59.8	64.4	
Mon 19/12/2022 08:45	57.6	52.9	60.2	67.5	
Mon 19/12/2022 09:00	57.2	51.3	59.9	65.0	
Mon 19/12/2022 09:15	56.9	51.6	59.7	65.4	
Mon 19/12/2022 09:30	57.2	51.6	59.7	68.8	
Mon 19/12/2022 09:45	56.7	50.5	59.5	66.5	
Mon 19/12/2022 10:00	57.4	51.9	60.1	67.0	
Mon 19/12/2022 10:15	57.6	51.2	59.9	76.9	
Mon 19/12/2022 10:30	57.2	51.5	59.8	65.2	
Mon 19/12/2022 10:45	58.4	52.3	59.5	81.5	

Figure 03-01
Time History Graph – Location 1, dB

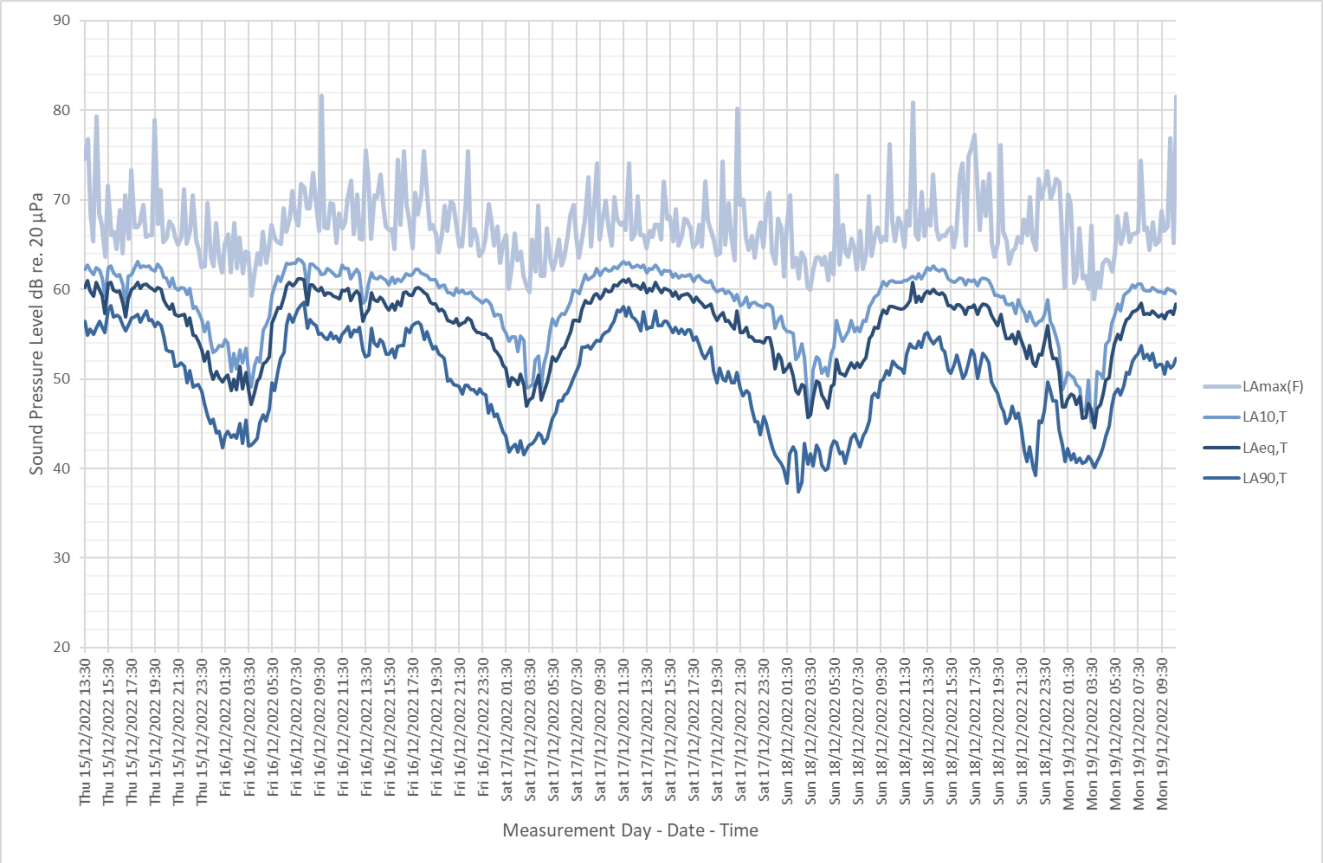


Figure 03-02
Background Sound Level Histogram – Day, Evening and Night – Location 1, Weather Filtered dB

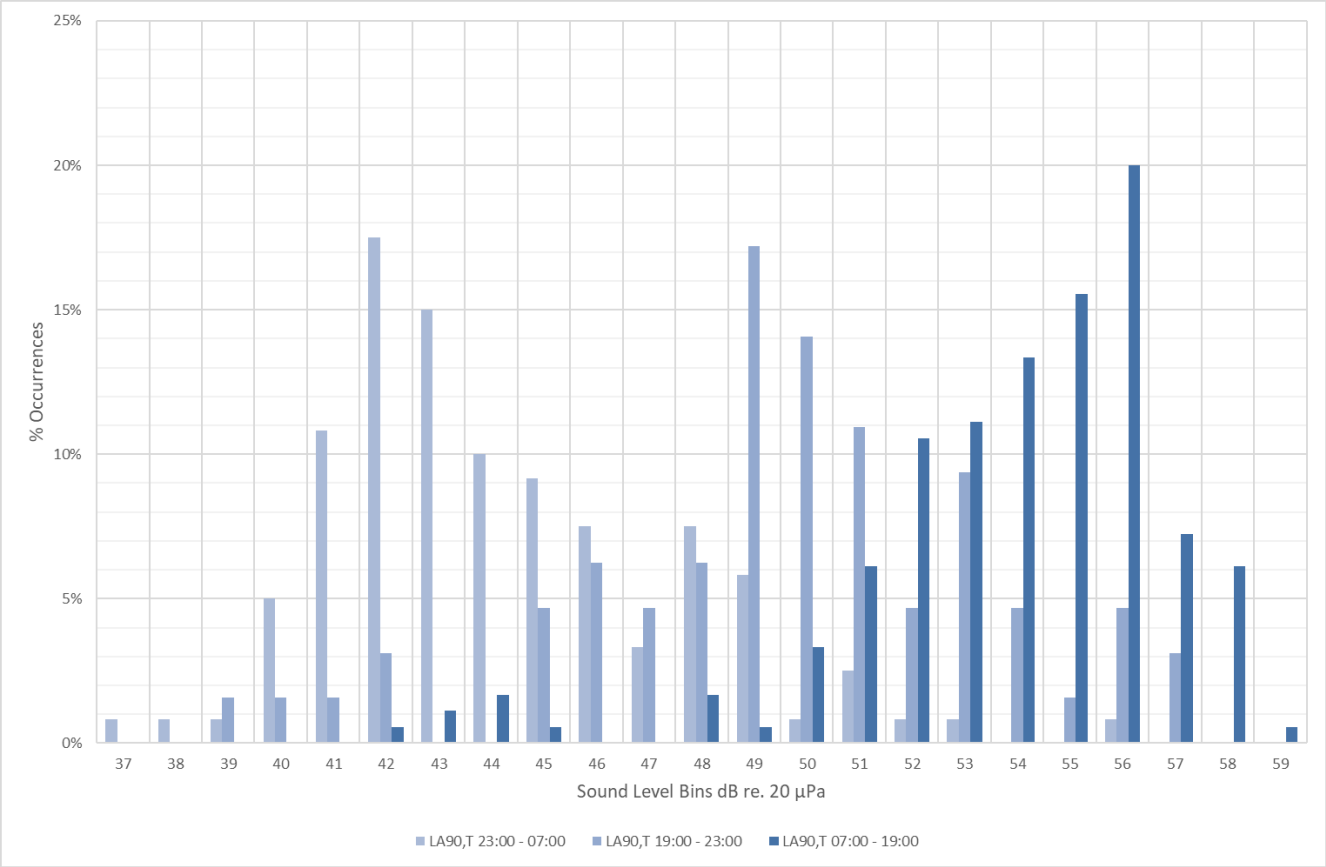
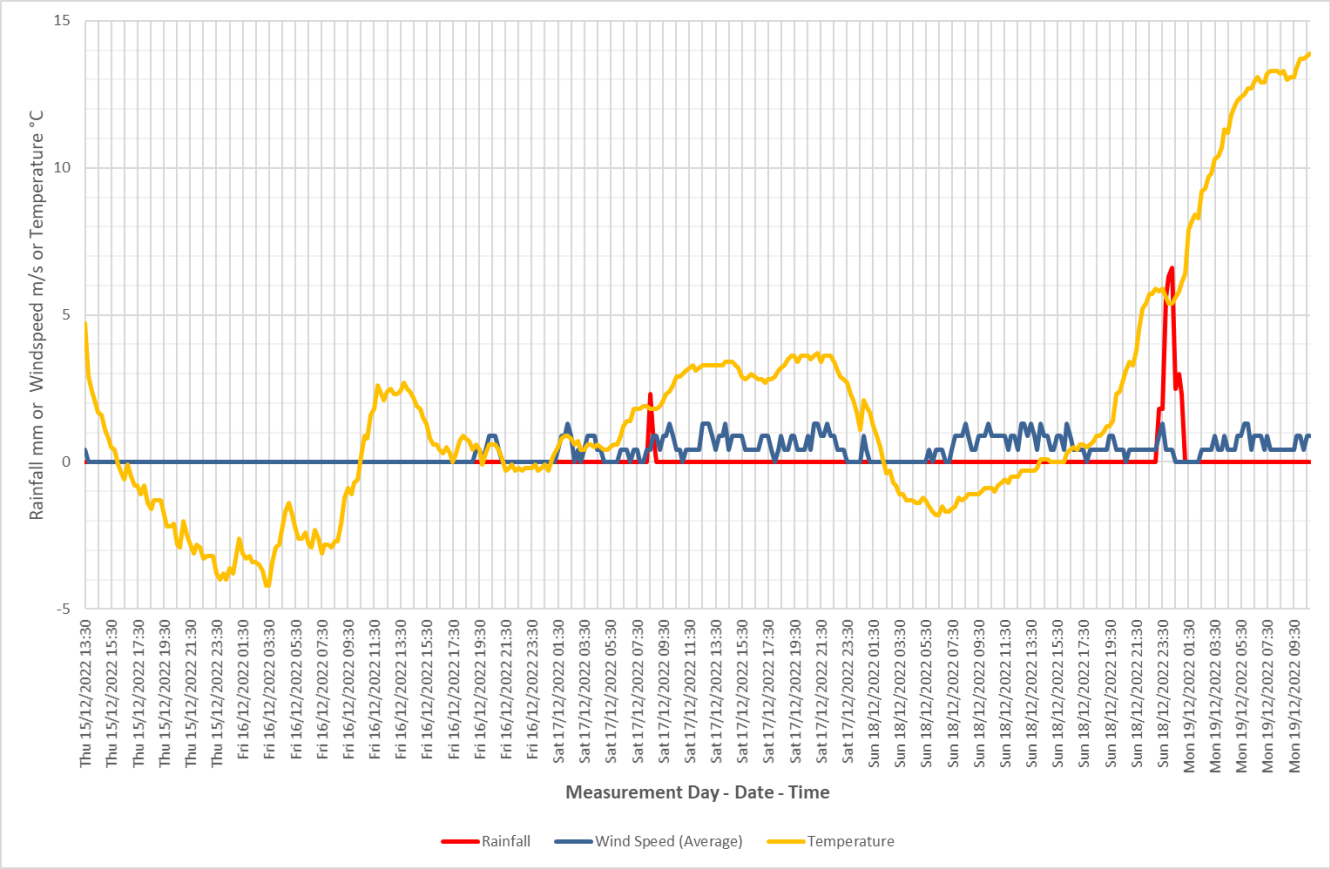


Figure 03-03
Weather Time History Graph – Location 1



APPENDIX 04

Model Input Octave Band Data

Table 04-01
Octave Band Data Used in Noise Modelling

Description	Data, dB	Sound Level dB per Octave Band Centre Frequency Hz								Sum dBA
		63	125	250	500	1000	2000	4000	8000	
Normal Voice	L_{pA} 1m	-	46.9	57.2	59.8	53.5	48.8	43.8	38.6	59.5
Raised Voice	L_{pA} 1m	-	51.0	61.5	65.6	62.3	56.8	51.3	42.6	66.5
Condenser	L_W	74.2	76.1	66.6	58.2	54.0	51.8	57.0	57.1	65.4

Table 04-02
Octave Band Data Used in IANL Predictions

Description	Data, dB	Sound Level dB per Octave Band Centre Frequency Hz								R_w or $D_{ne,w}$ dB
		63	125	250	500	1000	2000	4000	8000	
Wall (brick)	R	-	41	39	46	53	61	68	-	51
Wall (steel)	R	-	16	19	23	26	22	39	-	24
Wall (comp)	R	-	18	21	25	28	24	41	-	26
Roof (steel)	R	-	18	20	24	20	29	39	-	25
Window	R	-	21	20	27	38	41	37	-	30
Ventilator	$D_{n,e}$	-	31	29	31	28	25	28	-	27
Open window	$D_{n,e}$	-	16	17	18	15	19	21	-	18

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