now part of

# Pump and Bloor Farm, Lower Rainham

## Noise and Vibration Impact Assessment

On behalf of **A C Goatham & Son**

Project Ref: 44538/3003 | Rev: 00 | Date: October 2018

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## Document Control Sheet

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| | Name | Position | Signature | Date |
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| | | | | | |
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# 1 Introduction

## 1.1 Background

1.1.1 Peter Brett Associates LLP now part of Stantec (PBA) has been commissioned by A C Goatham & Son to provide a noise and vibration impact assessment to support an outline planning application for a proposed residential development, including a new school, at Pump and Bloor Farm, Lower Rainham.

1.1.2 This report assesses the current noise climate at the site and considers the suitability of the site for future residential use in accordance with the requirements in the National Planning Policy Framework (NPPF) and the Noise Policy Statement for England (NPSE).

## 1.2 Site Location and Description

1.2.1 The site is located in Lower Rainham and is bounded to the south by the Chatham Main Line railway, to the north by Lower Rainham Road, to the east by Lower Bloors Lane and to the west by Lower Twydall Lane.

1.2.2 An illustration of the site's location along with an indicative site boundary is provided in **Figure 1**.

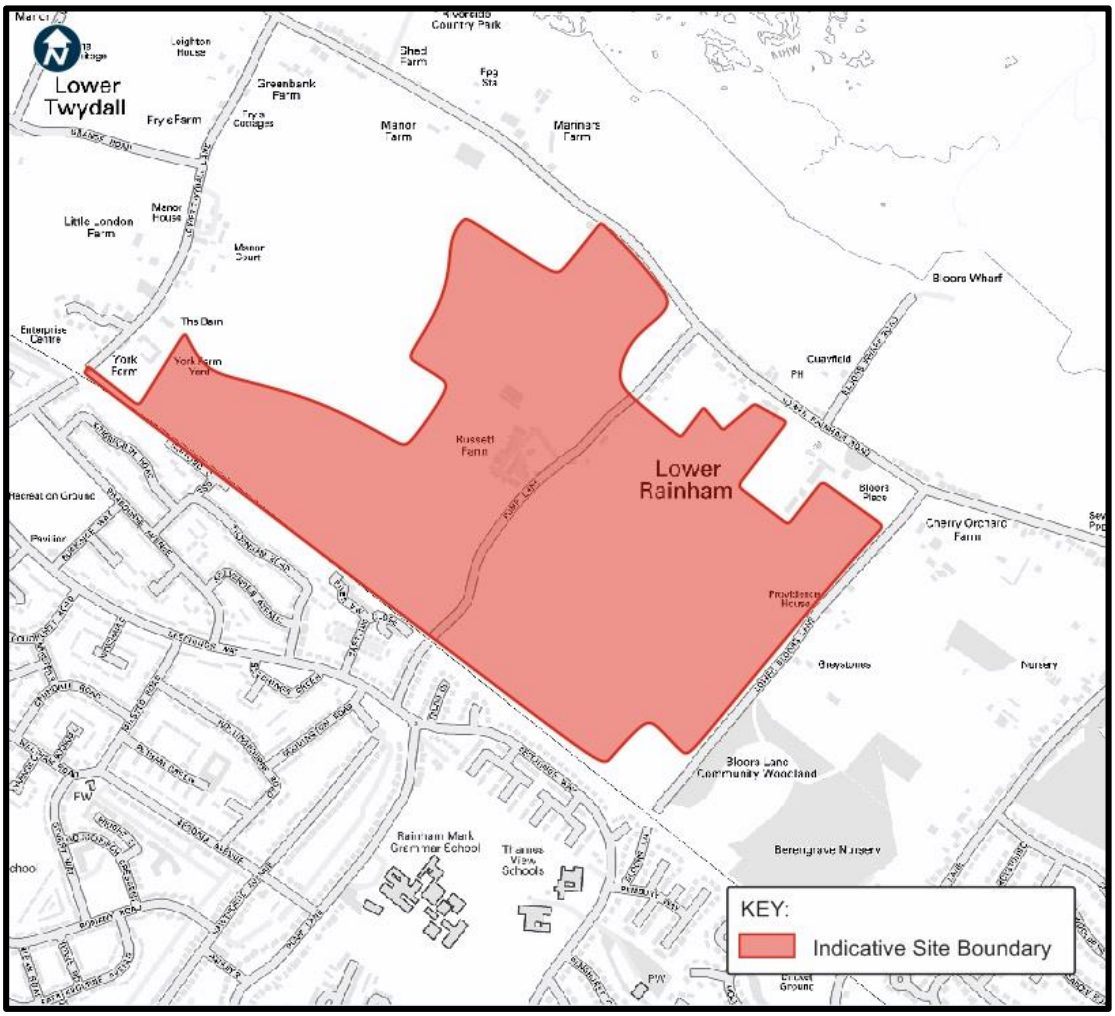



Figure 1: Site Location (Contains OS data © Crown Copyright and database right 2018)

## 1.3 Scope of Assessment

1.3.1 The purpose of this report is to assess the existing sound and vibration climate at the proposed development site in order to determine its suitability for residential development and for a new school, having regard to local planning policy and national and international guidance documents relating to environmental noise and vibration.

1.3.2 This report is technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in **Appendix A**.

# 2 Legislation, Planning, Guidance & Criteria

## 2.1 Consultation

2.1.1 The survey locations and duration were agreed with Stuart Steed, Environmental Protection Officer at Medway Council, on Monday 15 October 2018.

2.1.2 It was also agreed that the following policies and guidance would inform the assessment of the suitability of the site for residential development.

## 2.2 National Policy

### National Planning Policy Framework (NPPF)

2.2.1 The revised National Planning Policy Framework was published on 24 July 2018 and sets out the government's planning policies for England and how these are expected to be applied.

2.2.2 With respect to noise, Paragraph 170 states that:

*"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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;*

*[…]".*

2.2.3 Paragraph 180 of the NPPF states that:

*"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 and living conditions, as well as the potential sensitivity of 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 quality of life;*

*b) Identify and protect tranquil areas which may have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;*

*[…]."*

2.2.4 The NPPF goes on to advise, in Paragraph 182, that:

*"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a*

*significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed".*

## Noise Policy Statement for England (NPSE)

2.2.5 The Noise Policy Statement for England was published in March 2010. The document seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. It also sets out the long term vision of Government noise policy:

*"To promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."*

2.2.6 The NPSE clarifies that noise should not be considered in isolation of the wider benefits of a scheme or development, and that the intention is to minimise noise and noise effects as far as is reasonably practicable having regard to the underlying principles of sustainable development.

2.2.7 The first two aims of the NPSE follow established concepts from toxicology that are applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level - the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise; and

LOAEL – Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.

2.2.8 The NPSE extends these to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level - The level above which significant adverse effects on health and quality of life occur.

2.2.9 The NPSE notes "It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

## Planning Practice Guidance (PPG)

2.2.10 The Government's PPG on noise provides guidance on the effects of noise exposure, relating these to people's perception of noise, and linking them to the NOEL and, as exposure increases, the LOAEL and SOAEL.

2.2.11 As exposure increases above the LOAEL, the noise begins 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. As the noise exposure increases, it will then at some point cross the SOAEL boundary.

2.2.12 The LOAEL is described in PPG (Paragraph: 005 Reference ID: 30-005-20140306) as the level above which *"noise starts to cause 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 some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life."*

2.2.13 PPG identifies the SOAEL (Paragraph: 005 Reference ID: 30-005-20140306) as the level above which *"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."*

## 2.3 Guidance/ Best Practice

### British Standard 8233: 2014 'Guidance on Sound Insulation and noise reduction for buildings'

2.3.1 BS 8233, in relation to this planning application, sets out desirable guideline values in habitable rooms, such as living rooms and bedrooms.

2.3.2 The guideline values relate to steady external noise without a specific character, previously termed 'anonymous noise'. According to the standard, noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate. Examples of noise with a character may include tonal/intermittent plant noise emissions, music playback, and workshop noise. Examples of external steady noise sources may include environmental noise sources such as busy road traffic.

2.3.3 The desirable internal ambient noise levels for dwellings are presented in **Table 2.1**.

Table 2.1: BS 8233:2014 Desirable Internal Ambient Noise Levels for Dwellings

| Activity | Location | 07:00 to 23:00 hours | 23:00 to 07:00 hours |
|---|---|---|---|
| Resting | Living room | 35 dB $L_{Aeq,16h}$ | - |
| Dining | Dining room/area | 40 dB $L_{Aeq,16h}$ | - |
| Sleeping (daytime resting) | Bedroom | 35 dB $L_{Aeq,16h}$ | 30 dB $L_{Aeq,8h}$ |
| *Note 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax,f, depending on the character and number of events per night. Sporadic noise events could require separate values. | | | |
| Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative source of ventilation that does not compromise the façade insulation or the resulting noise levels. | | | |
| Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved. | | | |

*A selection of the available notes

2.3.4 The standard also provides advice in relation to desirable levels for external noise. It states that:

*"for traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable.*

*In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."*

## Professional Practice Guidance on Planning and Noise

2.3.5 The Professional Practice Guidance on Planning and Noise (ProPG) provides non-statutory guidance on the assessment and management of noise within the planning system in England.

2.3.6 The ProPG references the guidance on internal ambient noise levels detailed in BS8233:2014, as presented in **Table 2.1** above, and extends these through the following notes (selected):

*"NOTE 4: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{max,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.*

*NOTE 5: Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any facade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal $L_{Aeq}$ target levels should not normally be exceeded, subject to the further advice in Note 7.*

*NOTE 7: Where development is considered necessary or desirable, despite externa l noise levels above WHO guidelines, the internal $L_{Aeq}$ target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal $L_{Aeq}$ levels start to exceed the internal $L_{Aeq}$ target levels by more than 5 dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal $L_{Aeq}$ levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form."*

## British Standard 6472: 2008 Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources other than Blasting

2.3.7 BS 6472 contains a method for assessing the human response to vibration in terms of the vibration dose value. The advice contained in Section 3.5 of BS 6472 states:

*"The effect of building vibration on the people within is assessed by finding the appropriate vibration dose. Present knowledge shows that this type of vibration is best evaluated with the vibration dose value (VDV). The VDV defines a relationship that yields a consistent assessment of continuous, intermittent, occasional and impulsive vibration and correlates well with subjective response".*

2.3.8 The Vibration Dose Value is a single figure descriptor that represents the cumulative dose of transient vibrations, taking into account the frequency spectrum and duration of each event.

2.3.9 The measured values are weighted to account for the way in which people perceive building vibration, which is dependent on various factors, including the vibration frequency and direction.

2.3.10 The Vibration Dose Value is determined over a 16-hour daytime period or 8-hour night-time period, and the guidance in BS 6472 for residential buildings is as shown in **Table 2.2** below.

Table 2.2: Vibration Dose Value Ranges

| Time Period | Low Probability of Adverse Comment[(1)] $m/s^{-1.75}$ | Adverse Comment Possible $m/s^{-1.75}$ | Adverse Comment Probable[(2)] $m/s^{-1.75}$ |
|---|---|---|---|
| Daytime (07:00 – 23:00) | 0.2 – 0.4 | 0.4 – 0.8 | 0.8 – 1.6 |
| Night-time (23:00 – 07:00) | 0.1 – 0.2 | 0.2 – 0.4 | 0.4 – 0.8 |
| (1) Below these ranges, adverse comment is not expected<br>(2) Above these ranges, adverse comment is very likely | | | |

2.3.11 The above guidance relates to vibration measured at the point of entry into the human body, which is usually taken to mean the ground surface or at a point mid-span of an upper storey floor, rather than the point of entry into the building, for example at a foundation element.

2.3.12 Where the vibration is measured at another location, BS 6472 states that a transfer function should be applied; however, BS 6472 does not itself contain any guidance on suitable transfer functions.

## British Standard 4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound

2.3.13 BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in the standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.3.14 The standard is used to determine the rating levels for sources of sound of an industrial and/or commercial nature and the ambient, background and residual sound levels at outdoor locations. These levels could be used for the purposes of investigating complaints; assessing sound from the proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and assessing sound at proposed new dwellings or premises used for residential purposes. However, the determination of noise amounting to a nuisance is beyond the scope of the standard.

2.3.15 The procedure contained in BS 4142 assesses the significance of sound which depends upon the margin by which the rating level of the specific sound sources exceeds the background sound level and the context in which the sound occurs/will occur.

2.3.16 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level and considering the following:

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

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.3.17 Where the initial estimate of the impact needs to be modified due to the context, the following factors should be considered:

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

## 2.4 Proposed Assessment Criteria

2.4.1 Based on guidance documents detailed above, the following noise and vibration assessment criteria are proposed in **Table 2.3** and **2.4**.

Table 2.3: Proposed LOAEL and SOAEL Noise Levels

| Level | Internal Ambient Noise Levels | | External Noise Levels in Amenity Areas | |
|---|---|---|---|---|
| | Daytime (07:00 to 23:00 hours) | Night-time (23:00 to 07:00 hours) | Daytime (07:00 to 23:00 hours) | Night-time (23:00 to 07:00 hours) |
| LOAEL | 35 $L_{Aeq,16h}$ (dB) | 30 $L_{Aeq,8h}$ (dB)<br>45 dB $L_{Amax}$<br>10-15 times per night | 55 $L_{Aeq,16h}$ (dB) | 45 $L_{Aeq,16h}$ (dB) |
| SOAEL | 50 $L_{Aeq,16h}$ (dB) | 45 $L_{Aeq,8h}$ (dB) | 70 $L_{Aeq,16h}$ (dB) | 65 $L_{Aeq,8h}$ (dB) |

Table 2.4: Proposed LOAEL and SOAEL Vibration Levels

| Time Period | Vibration Dose Values ($m/s^{-1.75}$) | |
|---|---|---|
| | Daytime (07:00 to 23:00 hours) | Night-time (23:00 to 07:00 hours) |
| LOAEL | 0.2 | 0.1 |
| SOAEL | 0.8 | 0.4 |

2.4.2 Based on consultation with the Medway Council, building services plant will be limited to not exceed the typical background noise levels at the nearest noise sensitive receptors.

# 3 Environmental Sound Survey

## 3.1 Methodology

3.1.1 An environmental sound survey was undertaken between 02 and 03 October 2018 in order to establish the existing sound climate across the site.

3.1.2 Environmental sound level measurements were undertaken at three locations around the site. The three survey locations are described in **Table 3.1** below and are presented in **Figure 2**.

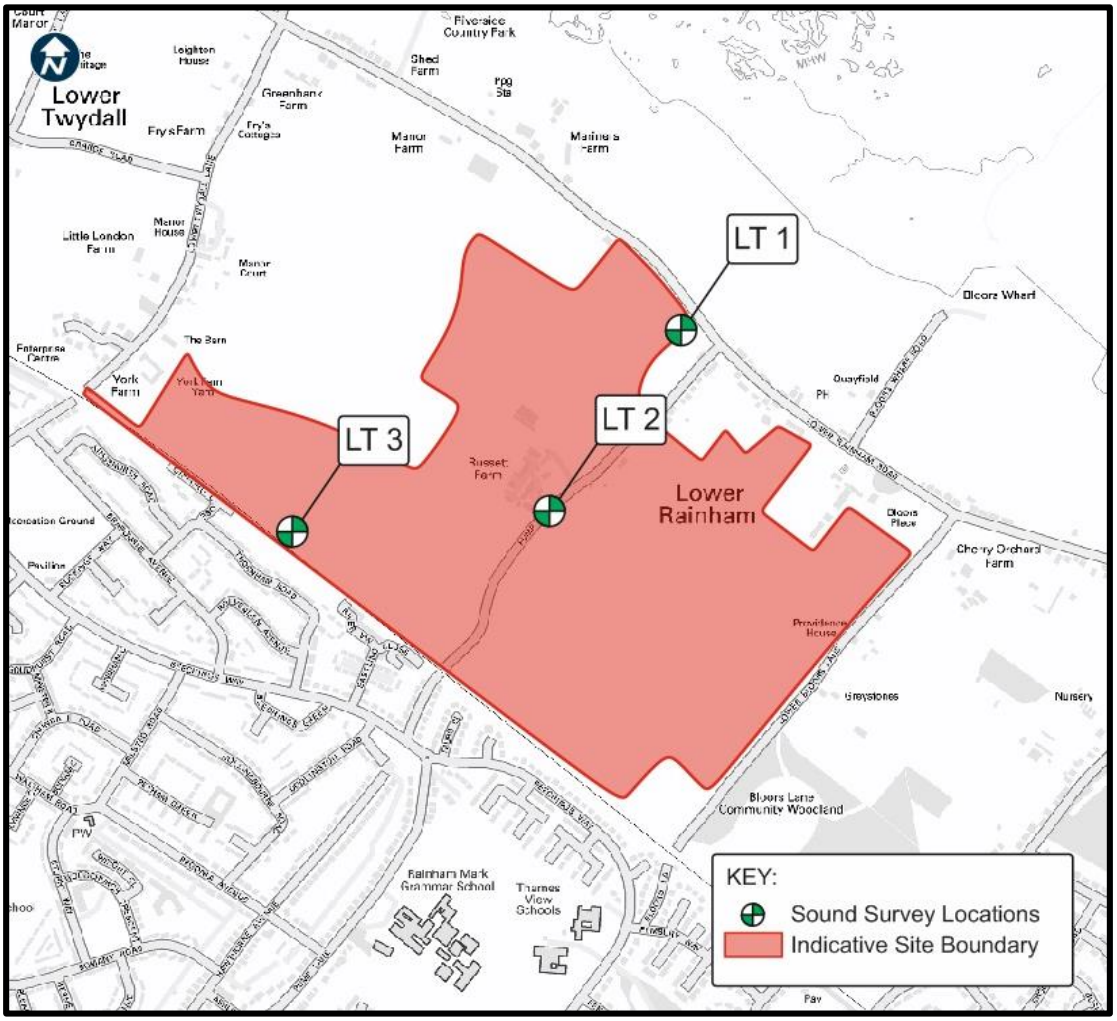



Figure 2: Sound Survey Locations (Contains OS data © Crown Copyright and database right 2018)

Table 3.1: Sound Survey Locations

| Survey Locations | Description | Dominant Sound Source |
|---|---|---|
| LT1 | Located at an approximate height of 1.5 m above ground level in a free-field position along the northeastern boundary of the site. Approximately 10 m from Lower Rainham Road. | Road traffic |
| LT2 | Located at an approximate height of 1.5 m above ground level in a free-field position along the southern boundary of the site. Approximately 5 m from Pump Lane. | Road traffic |
| LT3 | Located at an approximate height of 1.5 m above ground level in a free-field position along the western boundary of the site. Approximately 10 m from the Chatham Main Line railway line. | Road traffic and train pass-bys |

3.1.3 Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However, at the beginning and at the end of the survey period, the weather conditions were with average wind speed below 5 $ms^{-1}$.

3.1.4 Based on historical weather data for the survey period, there was no precipitation during the survey period. The average wind speed during the survey period was below 5 ms-1 and the average temperature was around 18 $^{o}C$. These meteorological conditions are considered suitable for obtaining representative environmental sound levels.

3.1.5 The noise instrumentation used during the survey has valid laboratory certification, which is available upon request. Field calibrations were performed before and after the measurements with no significant fluctuation recorded (<0.5 dB). The instrumentation used in the survey is listed in **Table 3.2**.

Table 3.2: Instrumentation

| Description | Manufacturer | Type | Serial Number | Laboratory Calibration Date |
|---|---|---|---|---|
| Sound Level Meter | Rion | NL-52 | 542903 | 17/02/2017 |
| Pre-amplifier | | UC-59 | 06480 | 17/02/2017 |
| ½" Pre-polarised microphone | | NH-25 | 42931 | 17/02/2017 |
| Sound Level Meter | Rion | NL-52 | 1043456 | 15/02/2017 |
| Pre-amplifier | | UC-59 | 7231 | 15/02/2017 |
| ½" Pre-polarised microphone | | NH-25 | 43485 | 15/02/2017 |
| Sound Level Meter | Rion | NL-52 | 542902 | 05/01/2018 |
| Pre-amplifier | | UC-59 | 07374 | 05/01/2018 |
| ½" Pre-polarised microphone | | NH-25 | 43580 | 05/01/2018 |
| Sound Calibrator | Rion | NC-74 | 34746691 | 17/07/2017 |

## 3.2 Description of Sound Climate

3.2.1 Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the sound climate throughout the entire survey period. However, at the beginning and end of the survey period, the dominant noise sources were noted to be vehicular movements on the surrounding road network and the train pass-bys on the railway line.

## 3.3 Assumptions/ Limitations

3.3.1 The survey was undertaken during weekdays and a weekend when typical traffic flows were expected.

3.3.2 This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

## 3.4 Baseline Sound Survey Results

3.4.1 A summary of the baseline sound survey results is presented in **Table 3.3**. Time history graphs detailing the full results of the unmanned sound survey is contained in **Appendix B**.

Table 3.3: Sound Survey Results

| Location | Period (T) | $L_{eq,T}$ | $L_{max,T}$* | Typical $L_{90,15mins}$ |
|---|---|---|---|---|
| LT1 | Daytime (07:00 – 23:00) | 64 | 80 | 42 |
| | Night-time (23:00 – 07:00) | 57 | 78 | 34 |
| LT2 | Daytime (07:00 – 23:00) | 51 | 74 | 38 |
| | Night-time (23:00 – 07:00) | 46 | 65 | 34 |
| LT3 | Daytime (07:00 – 23:00) | 61 | 84 | 36 |
| | Night-time (23:00 – 07:00) | 57 | 81 | 31 |

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

# 4 Environmental Vibration Survey

## 4.1 Methodology

4.1.1 A fully automated environmental vibration survey was undertaken along the railway line between 02 and 03 October 2018 in order to determine typical vibration levels considered representative of those likely to be incident on the development.

4.1.2 Measurements were taken of trains going in both directions. The 24-hour VDV was derived based on the measurements undertaken and an up to date timetable.

4.1.3 The measurement position is described in **Table 4.1** and presented in **Figure 3**.

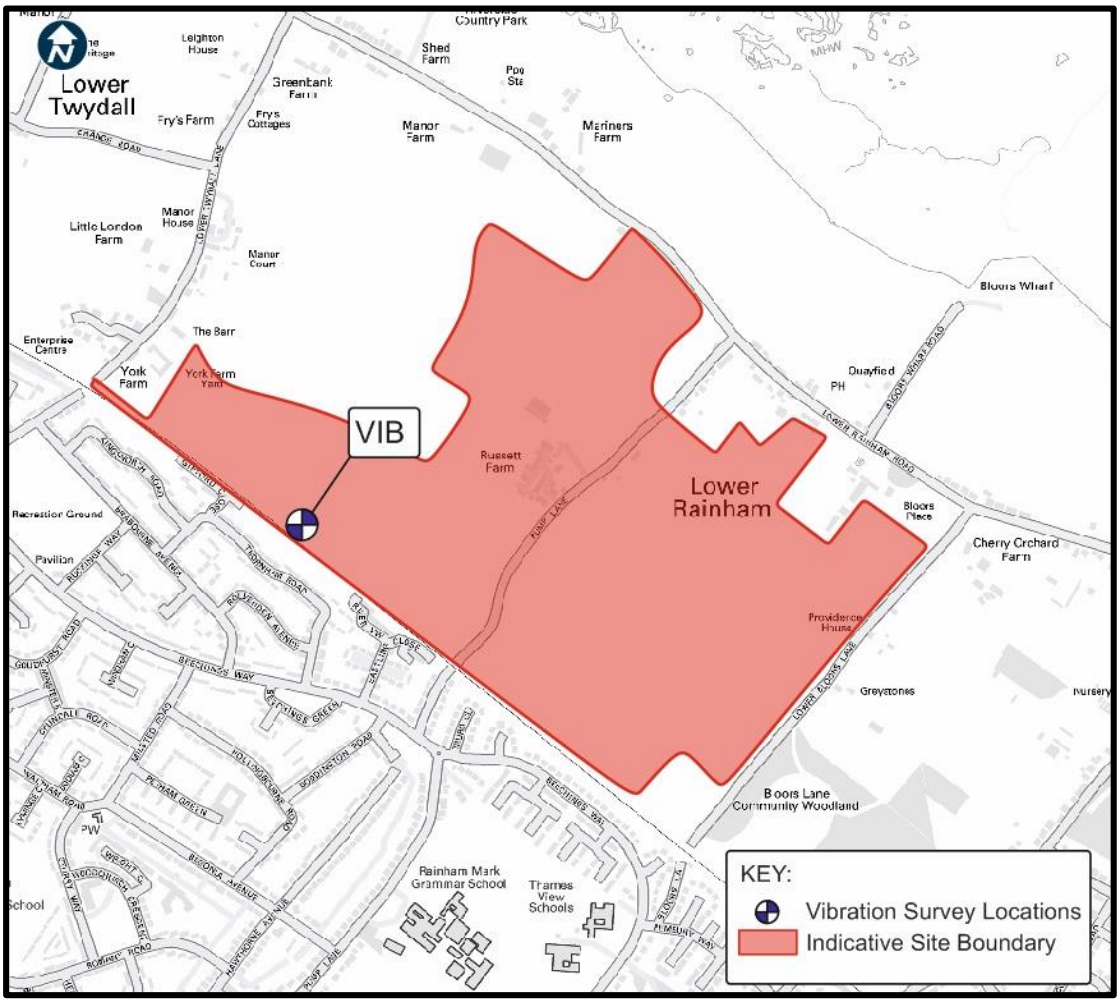



Figure 3: Vibration Survey Location (Contains OS data © Crown Copyright and database right 2018)

Table 4.1: Vibration Survey Position Descriptions

| Position Reference | Description |
|---|---|
| VIB | The accelerometer was located on the western boundary of site, approximately 10 m from the Chatham Main Line railway line. |

## 4.2 Environmental Vibration Survey Instrumentation

4.2.1 The instrumentation used during the environmental vibration survey is presented in **Table 4.2** below.

Table 4.2: Vibration Survey Instrumentation

| Description | Manufacturer | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| 3-Axis Vibration Meter | Rion | VM-54 | 01150113 | 20/10/2016 |

## 4.3 Environmental Vibration Climate

4.3.1 The dominant vibration source was noted to be ground borne vibration associated with train pass-bys on the adjacent railway line.

## 4.4 Assumptions/Limitations

4.4.1 The site engineer noticed nothing unusual in terms of the vibration climate at the time of setting up and collecting the survey equipment. This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

## 4.5 Environmental Vibration Survey Results

4.5.1 A summary of the vibration survey results is presented in **Table 4.3** below.

Table 4.3: Vibration Survey Results

| Axis | Measured Vibration Dose Value ($m.s^{1.75}$) | |
|---|---|---|
| | Daytime (07:00 to 23:00 hours) | Night-time (23:00 to 07:00 hours) |
| X | 0.055 | 0.033 |
| Y | 0.069 | 0.043 |
| Z | 0.361 | 0.223 |

# 5 Suitability of Site for Residential Development

## 5.1 Calculated Incident Sound Levels

5.1.1 Based on the results of the sound survey and the proposed site layout (Proposed Residential Development Masterplan Draft 3 drawing number SK003 dated October 2018), **Table 5.1** details the calculated incident sound levels at locations representative of the dwellings.

5.1.2 The table presents the worst case calculated sound levels at locations representative of the first row of dwellings fronting Lower Rainham Road (approximately 10 m away from the road), Pump Lane (approximately 5 m away from the road) and the Chatham Main Line railway line (approximately 25 m away from the railway line).

Table 5.1: Calculated Incident Sound Levels

| Dwelling Facade | Period | $L_{Aeq,T}$ dB | Typical* $L_{AFMax}$ dB |
|---|---|---|---|
| Row of dwellings directly fronting and adjacent to Lower Rainham Road | Daytime (07:00 – 23:00 hours) | 64 | - |
| | Night-time (23:00 – 07:00 hours) | 57 | 78 |
| Row of dwellings directly fronting and adjacent to Pump Lane | Daytime (07:00 – 23:00 hours) | 51 | - |
| | Night-time (23:00 – 07:00 hours) | 46 | 65 |
| Row of dwellings directly fronting and adjacent to the Chatham Main Line railway line | Daytime (07:00 – 23:00 hours) | 57 | - |
| | Night-time (23:00 – 07:00 hours) | 53 | 73 |

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

## 5.2 Internal Noise Levels

5.2.1 The calculated incident sound levels have been used to determine the likely internal sound levels in the proposed dwellings due to environmental sound.

5.2.2 The exact construction proposals are yet to be determined. However, a preliminary assessment has been undertaken based on typical construction details and their typical acoustic performance.

5.2.3 Preliminary calculations are based on background ventilation being provided through natural ventilation solutions in the form of trickle vents.

5.2.4 **Table 5.2** details the approximate reductions that could typically be expected from the assumed building fabric constructions.

Table 5.2: Typical Sound Reductions of Various Building Fabric Constructions

| Construction | Typical Attenuation (dB) |
|---|---|
| Conventional double glazing (4 / 16 / 4) | 30 |
| Hit and miss trickle ventilator | 30 |
| Brick/block cavity wall | 50 |
| Tiles on timber joists with plasterboard ceilings and thermal insulation | 40 - 45 |

5.2.5 Based on the environmental sound survey data, the calculated incident sound levels and the above typical construction details, **Table 5.3** sets out the likely resulting internal noise levels.

Table 5.3: Calculated Worst Case Internal Sound Levels

| Dwelling Façade | Daytime (07:00 – 23:00) $L_{Aeq,T}$ | Night-time (23:00 – 07:00) | |
|---|---|---|---|
| | | $L_{Aeq,T}$ | $L_{Max,T}$ |
| Row of dwellings directly fronting and adjacent to Lower Rainham Road | 34 | 27 | 48 |
| Row of dwellings directly fronting and adjacent to Pump Lane | 21 | 26 | 35 |
| Row of dwellings directly fronting and adjacent to the Chatham Main Line railway line | 27 | 23 | 43 |
| Proposed Criteria for Internal Noise (from Table 2.3) | 35 | 30 | 45 |

5.2.6 Based on the results of the sound survey and the assumed building fabric constructions, the proposed LOAELs for internal ambient noise levels are likely to be met during both the daytime and night-time periods across the majority of the site.

5.2.7 The proposed LOAELs for internal ambient noise levels are likely to be exceeded during the night-time periods at facades directly facing Lower Rainham Road.

5.2.8 To achieve the proposed criteria, enhanced acoustic glazing are likely to be required.

5.2.9 A detailed assessment should be undertaken at a later stage in order to ascertain the exact acoustic specification requirements for the various elements of the external building fabric. The final design proposals during the detailed stage may differ from the suggested constructions identified in **Table 5.2**.

## 5.3 Noise Levels in External Amenity Areas

5.3.1 Based on the calculated incident sound Levels presented in **Table 5.1**, noise levels in external amenity areas across the majority of the site are likely to fall below the proposed LOAEL of 55 dB $L_{Aeq,16h}$.

5.3.2 Noise levels in external amenity areas directly facing Lower Rainham Road and the Chatham Main Line railway line are likely to be up to around 64 dB $L_{Aeq,16h}$ and to exceed the proposed LOAEL.

5.3.3 Whilst the use of the site for residential purposes should not be determined on the basis of noise levels in external amenity areas; in keeping with the principles of good acoustic design, noise levels in external amenity areas should be reduced as far as practicable.

5.3.4 Therefore, as part of the development of the masterplan, the following design and mitigation measures should be considered:

- Locating external amenity areas behind dwellings fronting Lower Rainham Road and the Chatham Main Line railway line, so that they are screened by the buildings they serve; and
- Using suitably specified acoustic barrier to external amenity areas with a direct line of sight to Lower Rainham Road and the Chatham Main Line railway line.

5.3.5 It is considered that with careful orientation of dwellings and location of amenity areas along with the use of appropriate set-backs, noise levels in external amenity areas could be reduced so as to be below the proposed LOAEL.

5.3.6 Provided the site is designed so as to minimise noise levels in external amenity areas as far as practicable, the site should be considered suitable for residential use.

## 5.4 Vibration Levels

5.4.1 The results of the vibration survey, presented in **Table 4.3**, indicate that the daytime and night-time VDVs are likely to be above the proposed LOAEL.

5.4.2 A detailed assessment should be undertaken at a later stage in order to ascertain the exact mitigation requirements. However, it is likely that a setback distance of around 30 m from the railway line should reduce the VDV so as to be in the region of the proposed LOAEL.

# 6 Proposed School

## 6.1 Introduction

6.1.1 A primary school is proposed on site.

6.1.2 An assessment has been undertaken to determine the likely noise levels in external areas associated with the school, to support this outline planning application.

6.1.3 Internal noise levels in classroom areas etc. will be considered at the detailed design stage, once the construction details are known. In any event, building configurations will need to ensure compliance with the relevant Building Regulations. Whilst control of internal noise levels can be achieved in relatively noisy areas through the use of appropriately specified glazing, ventilation and building fabric, noise levels in external areas are harder to control.

6.1.4 We would highlight that the requirements of the Building Regulations with respect to noise do not apply to external noise levels.

## 6.2 Recommendations for External Noise Levels

6.2.1 Acoustics of School: A Design Guide (Institute of Acoustics & Acoustics and Noise Consultants, November 2015), provides supporting guidance and recommendations on the acoustic design of new schools.

6.2.2 The guidance states that:

*"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.*

*It may be possible to meet the specified indoor ambient noise levels on sites where external noise levels are as high as 70 dB $L_{Aeq,30min}$ but this will require considerable building envelope sound insulation, or screening.*

*Playgrounds, outdoor recreation areas and playing fields are generally considered to be of relatively low sensitivity to noise. Indeed, playing fields may be used as buffer zones to separate school buildings from busy roads where necessary. However, where used for teaching, for example sports lessons, outdoor ambient noise levels have a significant impact on communication in an environment which is already acoustically less favourable than most classrooms. 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. Noise levels can be reduced by up to 10 dBA at positions near an acoustic screen."*

6.2.3 Based on the results of the sound survey, it is likely that external noise levels will be up to around 55 dB $L_{Aeq,30min}$ and the recommended external noise levels are likely to be met.

6.2.4 However, further assessment will be undertaken at the detailed design stage when building and playground/outdoor teaching areas are known.

# 7 Plant Noise Emission Criteria

7.1.1 Fixed plant noise associated with the proposed development could impact on existing and future nearby dwellings.

7.1.2 Proposed items of fixed plant should therefore be designed so the cumulative plant noise emissions do not exceed the typical background noise level at nearby existing and proposed dwellings.

7.1.3 **Table 7.1** provides the suggested plant noise limit to be met at the nearest proposed dwelling based on the results of the environmental noise survey and the requirements of the local authority.

Table 7.1: Proposed Fixed Plant Noise Limits

| Location | Time Period | Propsoed Limit LAeq,T dB |
|---|---|---|
| Existing and proposed dwellings along Lower Rainham | Daytime | 42 |
| | Night time | 34 |
| Existing and proposed dwellings along Pump Lane | Daytime | 38 |
| | Night time | 34 |
| Existing and proposed dwellings along Chatham Main Line railway line | Daytime | 36 |
| | Night time | 31 |

7.1.4 The limits should apply to the cumulative noise emission from all plant items associated with the employment area and should include any corrections for acoustic features of the sound.

7.1.5 The above limits are subject to the approval of the local authority.

# 8 Conclusion

8.1.1 Peter Brett Associates (PBA), now part of Stantec, has been commissioned by A C Goatham & Son to provide a noise and vibration impact assessment to support an outline planning application for a proposed residential development at Pump and Bloor Farm, Lower Rainham.

8.1.2 An environmental sound and vibration survey was undertaken between 02 and 03 October 2018 in order to determine the current sound climate at the site.

8.1.3 Based on the results of the sound survey and the assumed building fabric constructions, the proposed LOAELs for internal noise levels are likely to be met during both the daytime and night-time across the majority of the site.

8.1.4 To achieve the proposed criteria at facades along Lower Rainham Road, enhanced acoustic glazing is likely to be required.

8.1.5 It is considered that with careful orientation of dwellings and location of amenity areas along with the use of appropriate setbacks, the proposed LOAEL for noise levels in external amenity areas are likely to be achieved.

8.1.6 With reference to BS 6472, and based on the results of the vibration survey, calculations indicate that the daytime and night-time VDVs are likely to be above the proposed LOAELs along the railway line. It is likely that a setback distance of around 30 m from the railway line should reduce the VDV so as to be in the region of the proposed LOAEL. A detailed assessment should be undertaken at a later stage in order to ascertain the exact mitigation requirements.

8.1.7 It is considered that provided the site is designed so as to minimise noise levels in outdoor teaching areas as far as practicable (through appropriate building orientation), the site should be considered suitable for use as a school; although further assessment will be required at the detailed design stage.

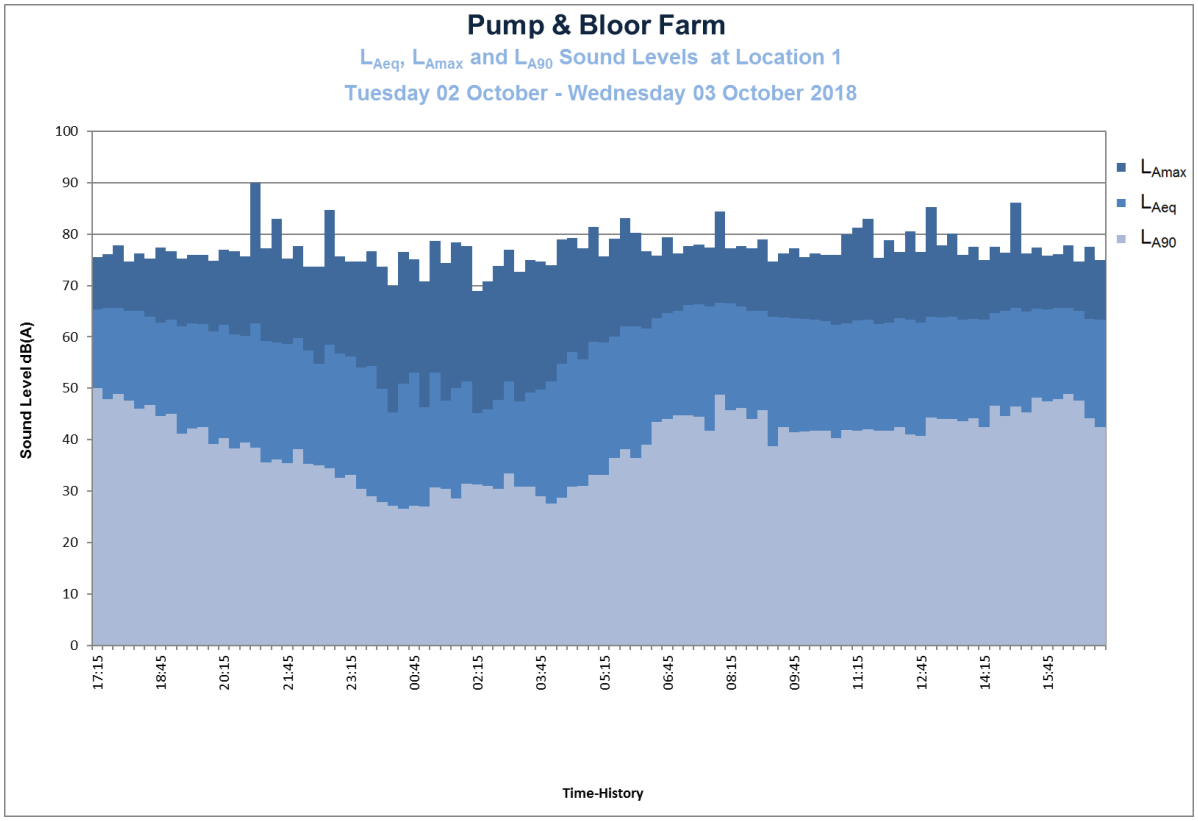
8.1.8 In summary, the assessment has demonstrated that, with effective appropriate mitigation, the site is considered suitable for residential development.

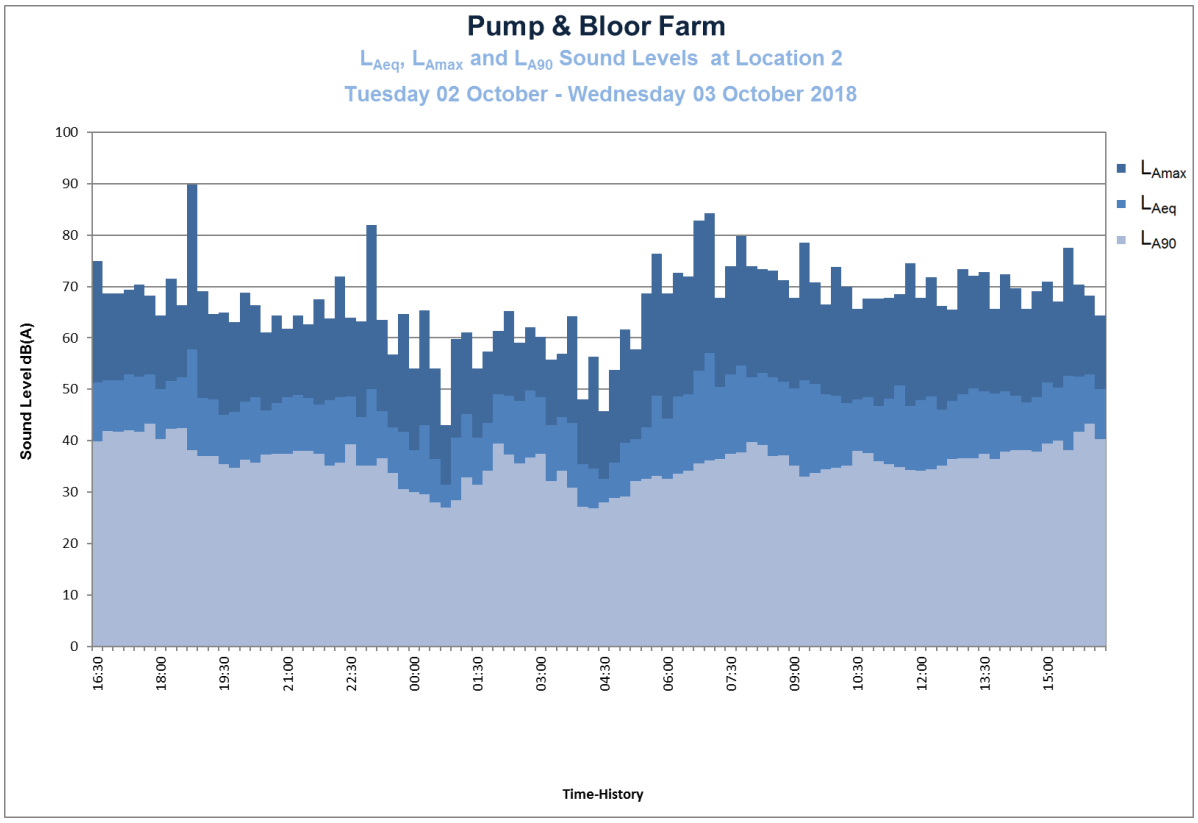
# Appendix A Glossary of Acoustic Terminology

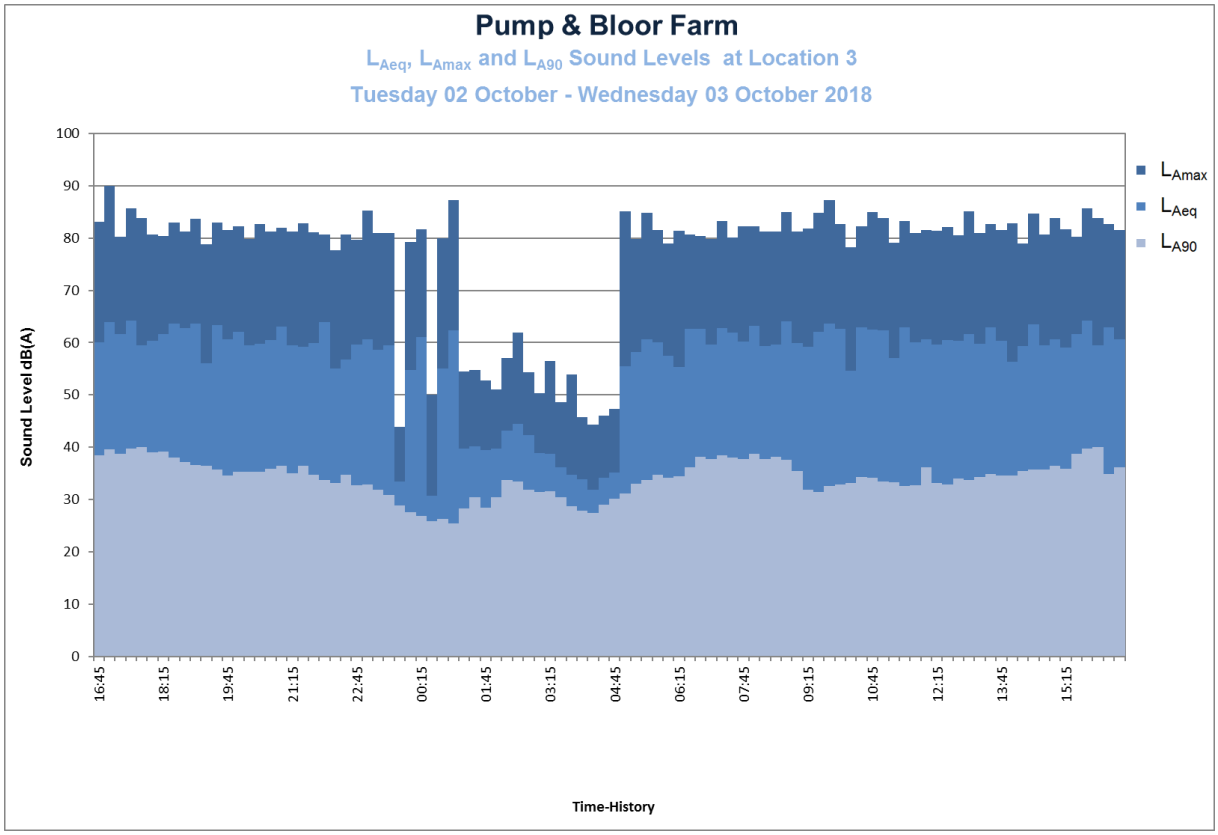
| Parameter | Description |
|---|---|
| Ambient Noise Level | The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$). |
| Daytime | The period 07:00-23:00 hours. |
| Decibel (dB) | A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds $s_1$ and $s_2$ is given by 20 $\log_{10}$ ($s_1/s_2$). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions. |
| dB(A), $L_{Ax}$ | Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A). |
| Fast Time Weighting | Setting on sound level meter, denoted by a subscript F, which determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds. |
| Free-field | Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres |
| Façade | Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade. |
| Insertion Loss | Insertion loss is the difference in sound pressure level at a single fixed position before and after a noise control element (e.g. enclosure, barrier etc) is installed. |
| $L_{AE}$ or SEL | A noise level which, if maintained for a period of 1 second, would cause the same A-weighted sound energy to be received as is actually received from a given noise event. |
| $L_{Aeq,T}$ | A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. |
| $L_{max,T}$ | A noise level index defined as the maximum noise level recorded during a noise event with a period T. $L_{max}$ is sometimes used for the assessment of occasional loud noises, which may have little effect on |

| | |
|---|---|
| | the overall $L_{eq}$ noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response. |
| $L_{10,T}$ | A noise level index. The noise level exceeded for 10% of the time over the period T. $L_{10}$ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A – weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00. |
| $L_{90,T}$ or Background Noise Level | A noise level index. The noise level exceeded for 90% of the time over the period T. $L_{90}$ can be considered to be the "average minimum" noise level and is often used to describe the background noise. |
| LOAEL | Lowest Observed Adverse Effect Level. This is the noise level above which adverse effects on health and quality of life can be detected. |
| Night-time | The period 23:00-07:00 hours. |
| NOEL | No Observed Effect Level. This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. |
| Noise Indices | Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out. |
| Rating Noise Level | The specific noise source plus any adjustment for the characteristic features of the noise, denoted by $L_{Ar,T}$. |
| SOAEL | Significant Observed Adverse Effect Level. This is the level above which significant adverse effects on health and quality of life occur. |
| Sound Pressure | Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure. |
| Sound Pressure Level, $L_p$ | The sound pressure level, $L_p$ is the sound pressure relative to a standard reference pressure of 20 μPa ($20x10^{-6}$ Pascals) on a decibel scale. |
| Specific Noise Level | The noise source under investigation for assessing the likelihood of complaints, measured as and $L_{Aeq,T}$ |
| Vibration Dose Value (VDV) | The Vibration Dose Value is a single figure descriptor that represents the cumulative dose of transient vibrations, taking into account the frequency spectrum and duration of each event. |

# Appendix B Time History Graph




Pump & Bloor Farm
LAeq, LAmax and LA90 Sound Levels at Location 3
Tuesday 02 October - Wednesday 03 October 2018
Sound Level dB(A)
100
90
80
70
60
50
40
30
20
10
0
16:45
18:15
19:45
21:15
22:45
00:15
01:45
03:15
04:45
06:15
07:45
09:15
10:45
12:15
13:45
15:15
LAmax
LAeq
LA90
Time-History