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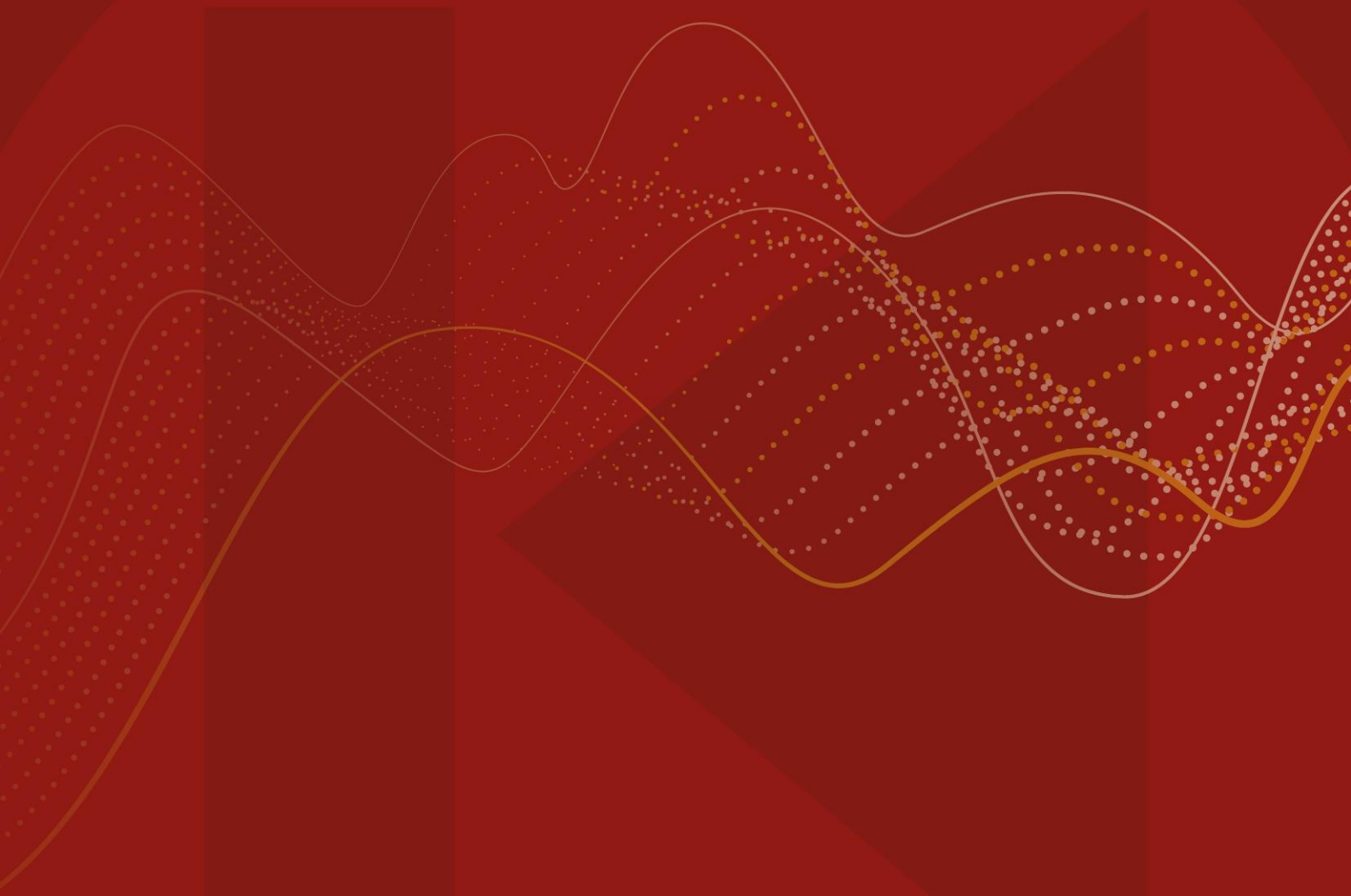

Environmental Noise Assessment

Proposed Residential Development
Wisloe Green, Gloucestershire

Reference: 7952/PR/BL
Date: October 2019

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Document Control

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1.1	Client Comments	17/1019	PR	BL

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1. Introduction

Ernest Cook Trust (ECT) and Gloucestershire County Council (GCC) appointed Acoustic Consultants Limited to carry out a noise impact assessment and an environmental noise survey to support a Local Plan Allocation for a mixed use development on land surrounding Wisloe Green, Cambridge, Gloucestershire.

The purpose of this assessment is to address the noise climate affecting the proposed development, specifically road, rail and commercial noise. At this stage the layout and number of dwellings associated with the scheme are not known. The aim of this assessment is to provide outline advice to demonstrate whether or not the site is suitable for a mixed use development.

A long term noise survey was completed on the site. Form the survey results a detailed noise model has been completed along with an [redacted] assessment has been completed in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG), British Standard 4142:2014 (BS4142), British Standard 8233:2104 (BS8233) and Local Authority guidance.

2. The Site

The site is to be located at Wisloe Green, Cambridge, Gloucestershire. The site is situated in a mostly rural area with two commercial sites in the immediate vicinity. There are also a number of busy main roads in the surrounding area. The M5 is to the south-east of the site, the A38 is to the north-west while the A4135 runs through the proposed site. Additionally, running along the south of the site is the Bristol to Birmingham railway line.

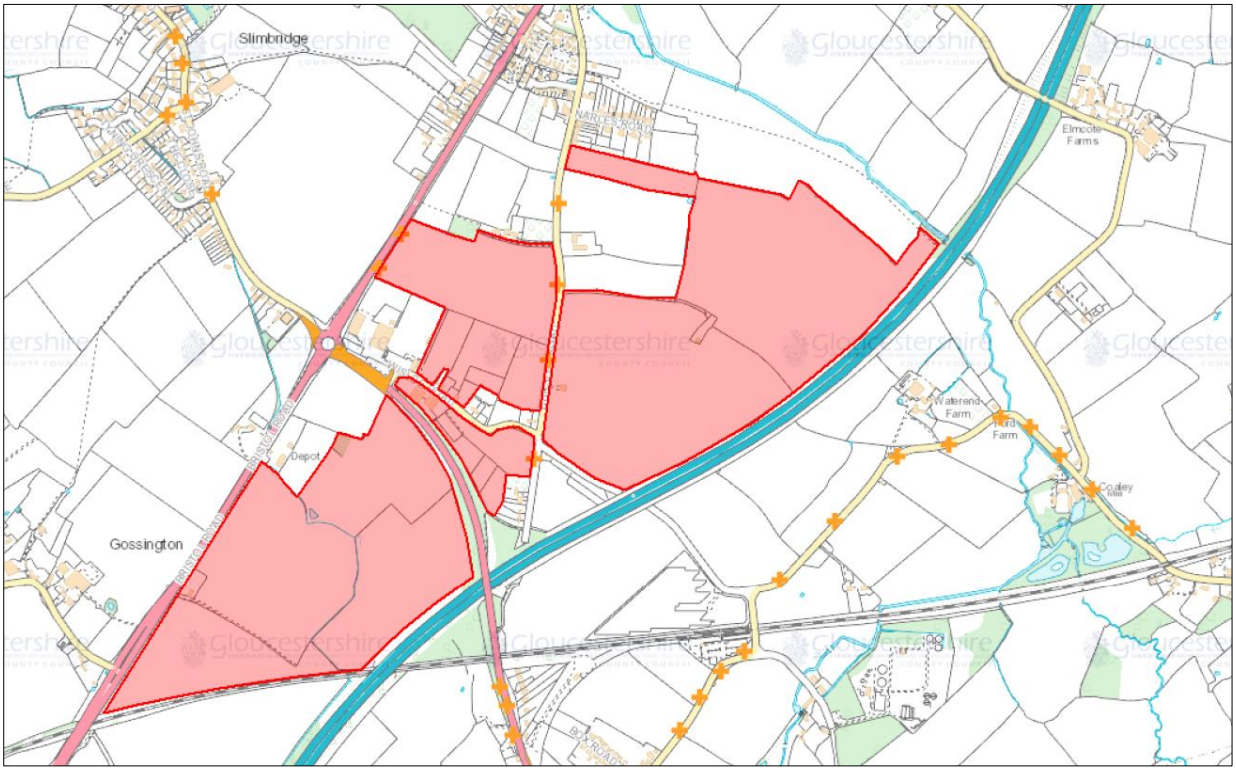
The proposal is for a mixed-use development including up to 1,500 new homes, as well as commercial and community facilities. The main source of noise affecting the site is road traffic and railway noise from the roads and railway line noted above. There is also commercial noise affecting the vicinity of the commercial premise, Rocket Rentals located at the corner between A38 and A4135.

[redacted]

The existing plan is shown below in Figure 1 below. No detailed proposed site plan is available at this moment in time including houses and plots locations. The approximate proposed site plan location is marked in red colour in Figure 2 below.

Figure 1: Approximate Existing Site Location Plan (Google map)

Figure 2: Approximate proposed site locations (marked in red)



3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was first published in March 2012 and revised in February 2019. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 170 states:

"170. 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 [redacted] into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 states:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[1]
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; and
c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise.

[1] *See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010*

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long term vision of Government noise policy. This long term vision is supported by three noise policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

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

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

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.

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

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

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits. The NPSE does, however, emphasise that in dealing with noise Local Planning Authorities are required to take a balanced approach in considering the benefits of development as against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise referred to here is based on the current version (January 2015) as provided on the Planning Guidance Website. It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

It provides generic guidance on how to determine the noise impact and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below:

Table 1: NPPG Noise – Perception of Effect Levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable 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
		Lowest Observed Adverse Effect Level	
Noticeable 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 some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable 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
Noticeable 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

The table does not provide any objective assessment which equates to the noted effect levels however the NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

4. Assessment Criteria

We would consider that where the below criteria can be achieved noise is below the Lowest Observed Adverse Effect Level (LOAEL) of the NPSE and NPPG, and also within the Stroud District Council requirements.

4.1. Local Authority Correspondence

Consultation with Stroud District Council Environmental Health Officer was undertaken via email on the 3rd September 2019 with regards to the assessment criteria and methodology.

It was agreed that the noise impact assessment would be carried out in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planni[redacted]ce ([redacted])

It was agreed the assessment of road and rail traffic affecting the dwellings to be considered in accordance with the criteria contained British Standard 8233:2014 (BS8233).

Industrial noise affecting the proposed dwellings has been assessed in accordance with British Standard 4142:2014 (BS4142).

Noise limits for employment use have been set based on British Standard 4142:2014 (BS4142).

4.2. British Standard 8233:2014

4.2.1. Internal Ambient Noise Levels

British Standard 8233:2014 entitled "Guidance on sound insulation and noise reduction for buildings" came into effect on 28th February 2014. Section 7.7.2 Table 4 of the British Standard 8233:2014 provides internal ambient noise levels for dwellings from noise sources 'without a specific character'. The British Standard guideline states that noise levels should not exceed those as noted in Table 4 of the British Standard and this is summarised below:

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16\ hour}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\ hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\ hour}$	30 dB $L_{Aeq,8\ hour}$

Section 7.7.2 Note 4 of the British Standard states *"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 $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".*

The British Standard provides no definitive criteria for maximum noise levels from individual events ($L_{Amax,F}$). Section 3.4 of the "Guidelines for Community Noise" published by the World Health Organisation in 1999 (WHO 1999) states *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)".*

4.2.2. External Amenity Space Noise Levels

BS 8233:2014 section 7.7.3.2 entitled 'Design criteria for external noise' states:

"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."

4.3. British Standard 4142:2014

British Standard 4142:2014 entitled 'Method for rating and assessing industrial and commercial sound' use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes. The principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'.

The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours).

Section 9 entitled 'Rating Level' states: "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location.

In Section 11 of the Standard, entitled 'Assessment of the Impacts', it states: *"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9) and consider the following.*

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *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."*

In all instances, the context needs to be considered when determining the overall impact and Observed Effect Level. In terms of context, British Standard 4142:2014 states: *"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.*

1) *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.*

2) *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure* ***good internal and/or outdoor acoustic conditions****, such as:*

   i) façade insulation treatment;
   ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
   iii) acoustic screening."

In terms of ***good internal and/or outdoor acoustic conditions***, BS4142 provides no further guidance, the most appropriate criteria would be that of BS8233.

5. Noise Monitoring

A partially attended noise monitoring exercise was conducted between the 12th September 2019 and 16th September 2019 to determine the noise levels affecting the proposed development.

5.1. Equipment

Sound Pressure Levels were measured using a sound level analyser with half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 entitled "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the Na[redacted]Th[redacted]as checked and calibrated as noted below.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, Cirrus Research, CR:171C	G068150	22/11/2016	243762
Microphone, Cirrus Research, MK224	204286A	22/11/2016	109157
Calibrator, Cirrus Research, CR:515	72878	22/11/2016	109156
SLM, NTI, XL2	A2A-13617-E0	13/09/2018	FL-18-082
Pre-Amp, NTI, MA220	7727	13/09/2018	FL-18-082
Microphone, NTI, MC230A	A16151	13/09/2018	FL-18-082
Calibrator, Larson Davis, CAL200	12605	27/08/2019	32690
SLM, NTI, XL2	A2A-13561-E0	25/07/2018	K354684
Pre-Amp, NTI, MA220	7606	25/07/2018	K354684
Microphone, NTI, MC230A	A15862	25/07/2018	K354684
Calibrator, Larson Davis, CAL200	15064	27/08/2019	32691
SLM, Svantek, 977A	69510	30/03/2018	n/a
Pre-Amplifier, Svantek, SV12L	62663	30/03/2018	n/a
Microphone, ACO Pacific, 7052R	70151	30/03/2018	n/a
Calibrator, Larson Davis, CAL200	13392	27/08/2019	32689
SLM, NTI, XL2	A2A-11053-E0	17/04/2018	28365
Pre-Amp, NTI, MA220	5871	17/04/2018	28365
Microphone, NTI, MC230A	9276	16/04/2018	28364
Calibrator, Nor-1251	35227	27/08/2019	32692

The measurement systems were checked before and after use with the noted calibrator, and no drift exceeding 0.2 dB was detected. This drift is considered acceptable and does not adversely affect the results.

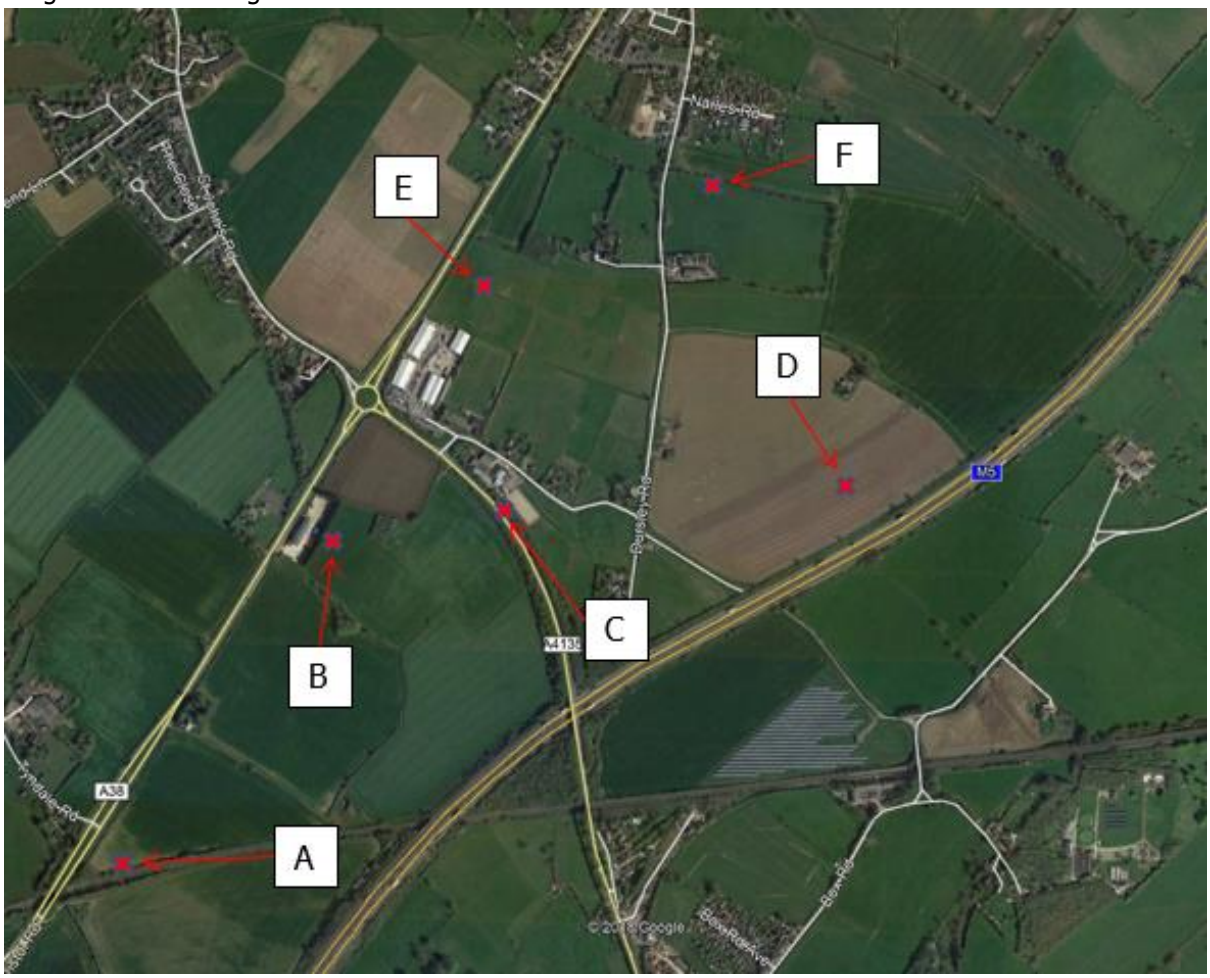
5.2. Weather Conditions

During the noise survey, the weather conditions were dry with an average air temperature of approximately 16 degrees Celsius, with a predominantly westerly or south-westerly wind, typically less than 5 metres per second. The weather conditions are not expected to have adversely affected the measured data and the wind direction is considered typical for the site and location.

5.3. Monitoring Procedure

Monitoring exercises were undertaken at the locations marked on the Figure 3 below. At all locations the meter was on a tripod 1.5 m above the ground and in a free-field position.

Figure 3: Monitoring locations



'Location A' was to the south-west of the site. The monitoring location was approximately 5 metres from the railway line and 60 metres away from the A38. The main source of noise at this location was road traffic from the A38 while noise from passing trains on the railway line determined the maximum noise levels. Traffic along the A38 was flowing freely during each attended period and times at which trains were passing were noted. Monitoring was generally unattended and was completed between 16:30 hours on 12th September 2019 and 10:30 hours on the 16th September 2019.

'Location B' was to the west of the site. The monitoring location was approximately 8 metres from the Rocket Rental industrial site and 58 metres away from the A38. The main noise source affecting this location was industrial noise from the existing Rocket Rentals operations. This location was also affected by road traffic noise along the A38. Traffic was flowing freely during each attended period. It is our understanding that the industrial depot operates from 07:30-17:30 Monday-Friday, 08:00-12:00 on Saturday and is closed for business on Sunday, based on the published hours. However, the Local Authority have advised that deliveries occur frequently from 6:00 hours in the morning. Monitoring was partially attended with audio set up. The monitoring was completed between 12:30 hours on 12th September 2019 and 11:00 hours on the 16th September 2019.

'Location C' was in the middle of the site. The monitoring position was approximately 3 metres away from the A4135. The barn located behind this monitoring location did not affect the measurements. The main source of noise at this location was dominant road traffic from the A4135. Traffic was flowing freely during each attended monitoring period. Monitoring was attended and completed over two separate days. The first monitoring exercise was completed on the 12th September 2019 between 13:45 and 15:15 hours. The second monitoring exercise was completed on 16th September 2019 between 11:00 hours and 11:45 hours.

'Location D' was to the east of the site. The monitoring position was approximately 50 metres away from the M5. The main source of noise at this location was dominant road traffic from the M5. Traffic along the M5 was flowing freely during each attended monitoring period. Monitoring was generally unattended and was completed between 15:00 hours on 12th September 2019 and 11:30 hours on the 16th September 2019.

'Location E' was to the north-west of the site. The monitoring location was approximately 65 metres from the A38 and 90 metres from the industrial site. The main sources of noise at this location were road traffic from the A38 and builder's merchant to the south of the monitoring location. Traffic was flowing freely during each attended monitoring period. It is our understanding that the building merchants operates from 07:30-17:00 hours Monday-Friday, 08:00-12:00 on Saturday and is closed for business on Sunday. Monitoring was generally unattended and was completed between 12:30 hours on 12th September 2019 and 10:45 hours on the 16th September 2019.

'Location F' was located to the north of the site. The monitoring location was approximately 50 metres from Dursley Road, 700 metres from the M5 and 660 metres from the A4135. The main source of baseline noise at this location was distant road noise from the M5 and A38 while the maxes were determined by passing traffic on Dursley road. Traffic was flowing freely during each attended monitoring period. Monitoring was generally unattended and was completed between 14:30 hours on 12th September 2019 and 11:30 hours on the 16th September 2019.

5.4. Measured Noise Levels

5.4.1. 'Location A' – Rail Traffic Noise / Road Traffic Noise (A38)

The main noise sources affecting the monitoring location were road traffic noise from the A38 and railway noise. The table below provides a summary of noise levels measured during rail traffic events.

Table 4: Measured Octave Band Design Noise Levels (free-field level)

Train Event	Monitoring Time (hh:mm)	Pass by Time (sec)	L_{AFmax} dB	L_{Aeq} dB	SEL dBA
1	16:55	00:00:20	92	80	93
2	17:04	00:00:17	86	77	89
3	17:24	00:00:30	86	74	89
4	17:31	00:00:24	83	71	85
5	17:34	00:00:18	79	71	84
6	17:40	00:00:25	86	75	89
7	17:54	00:00:17	88	78	90
8	18:05	00:00:15	85	76	88
9	18:26	00:00:17	87	78	90
10	18:39	00:00:21	88	76	89

A chart of the variation in noise levels (1sec log) with time is provided below. Events of trains passing have been marked with a red 'X'.

Chart 1: Log of noise levels (free-field level) at Location A

From the measured road (A38) and rail traffic noise data, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels, and maximum noise levels (due to train pass by) at the monitoring location:

Table 5: Measured Octave Band Design Noise (free-field) from A38 at 'Location A'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(16hr)}$	61	58	54	54	58	57	51	49	62
Night $L_{eq,(8hr)}$	54	50	47	49	51	50	45	43	56
Night $L_{max(F)}$	83	80	78	76	81	82	76	74	86

The measured range and modal background noise levels at Location A are as follows:

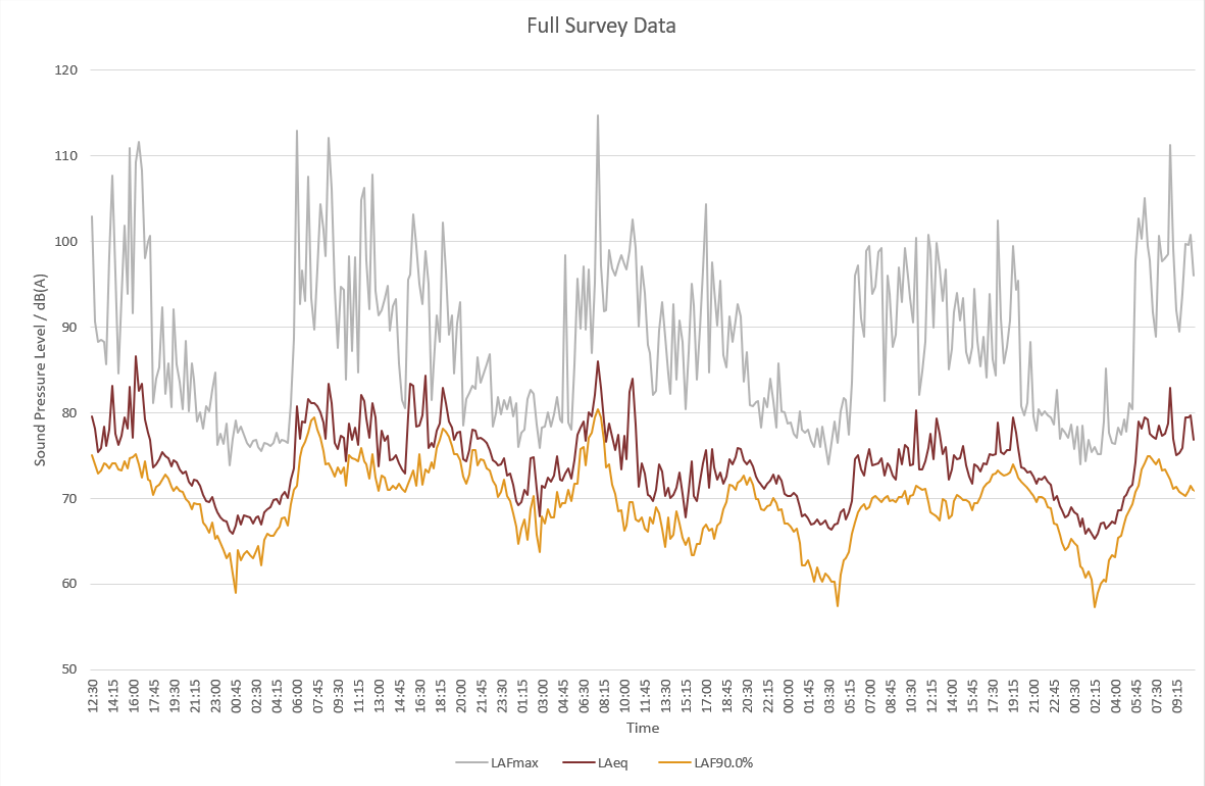
Table 6: Measured Background Sound Levels at 'Location A' (free-field level)

Parameter	L_{A90} (15 minutes) dB	
	Range	Modal
Daytime (07:00-23:00)	50-56	52
Night-time (23:00-07:00)	44-58	47

5.4.2. 'Location B' –Industrial Noise (Rocket Rentals)

The main noise sources affecting the monitoring location were industrial noise from the Rocket Rentals operations and road traffic noise along the A38. Chart 2 below provides the measured noise level over the measurement period for both.

Chart 2: Measured noise levels (free-field level) at Location B



From the measured data, we have determined the following free-field octave band 'daytime' and 'night-time' road traffic noise levels:

Table 7: Measured Octave Band Road Traffic Noise Levels (free-field level) at monitoring 'location B'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{Aeq,(16hr)}$	74	66	66	70	70	63	54	57	73
Night $L_{Aeq,(8hr)}$	71	59	59	66	66	57	44	38	68
Night $L_{max(F)}$	79	71	71	75	75	68	59	62	78

We have also determined the following industrial operational noise levels that will be used to assess the impact of the existing industrial operations across the proposed site during the daytime and night time period using BS4142 assessment methodology.

We have also determined the worst-case industrial operational noise levels during both, daytime $L_{Aeq,\ (1\ hour)}$ and night-time $L_{Aeq,\ (15\ min)}$ BS4142 assessment periods:

Table 8: Measured Industrial Operational Noise Levels at monitoring ´'location B' (worst Case)

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{Aeq,(1hr)}$	85	80	78	78	79	79	73	68	84
Night $L_{Aeq,(15min)}$	81	80	77	76	76	71	72	72	81

The measured range and modal background noise levels at 'Location B' are as follows:

Table 9: Measured Background Sound Levels at 'Location B' (free-field level)

Parameter	$L_{A90\ (15\ minutes)}$ dB	
	Range	Modal
Daytime (07:00-23:00)	71-79	74
Night-time (23:00-07:00)	59-77	64

5.4.3. 'Location C' – Road Traffic Noise (A4135)

The main noise source affecting the monitoring location was road traffic noise from the A4135. The measured level over the two days is provided below:

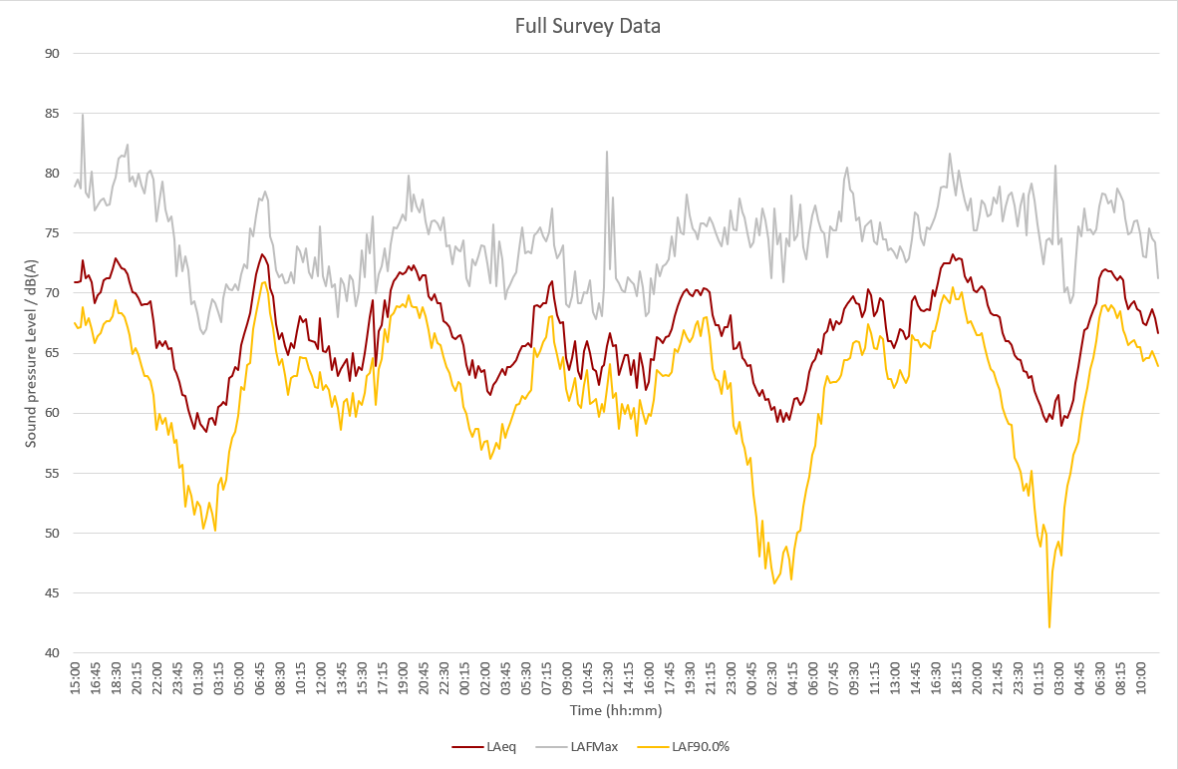
Table 10: Measured A4135 Road Traffic Noise at 'Location C'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day 1 $L_{eq,(1hr)}$	69	66	67	65	70	62	51	44	**72**
Day 1 $L_{10,(1hr)}$	70	69	71	69	75	65	54	45	**76**
Day 1 $L_{max(F)}$	89	83	81	79	83	77	71	65	**86**
Day 2 $L_{eq,(1hr)}$	68	66	66	64	69	61	50	47	**71**
Day 2 $L_{10,(1hr)}$	70	68	69	68	73	65	53	48	**75**
Day 2 $L_{max(F)}$	88	82	82	81	86	75	70	63	**88**

5.4.4. Location D – Road Traffic Noise (M5)

The main noise source affecting the monitoring location was road traffic noise from the M5. The below provides the measured noise level over the measurement period.

Chart 3: Measured M5 Road Traffic noise levels (free-field level) at 'Location D'



From the measured data, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels, and maximum noise levels at the monitoring location:

Table 11: Measured Octave Band Design Noise Levels (free-field level) at 'Location D'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(16hr)}$	67	63	57	59	68	60	44	29	69
Night $L_{eq,(8hr)}$	64	58	51	56	64	56	41	25	65
Night $L_{max(F)}$	69	64	55	63	75	62	46	30	75

The measured range and modal background noise levels at Location D are as follows:

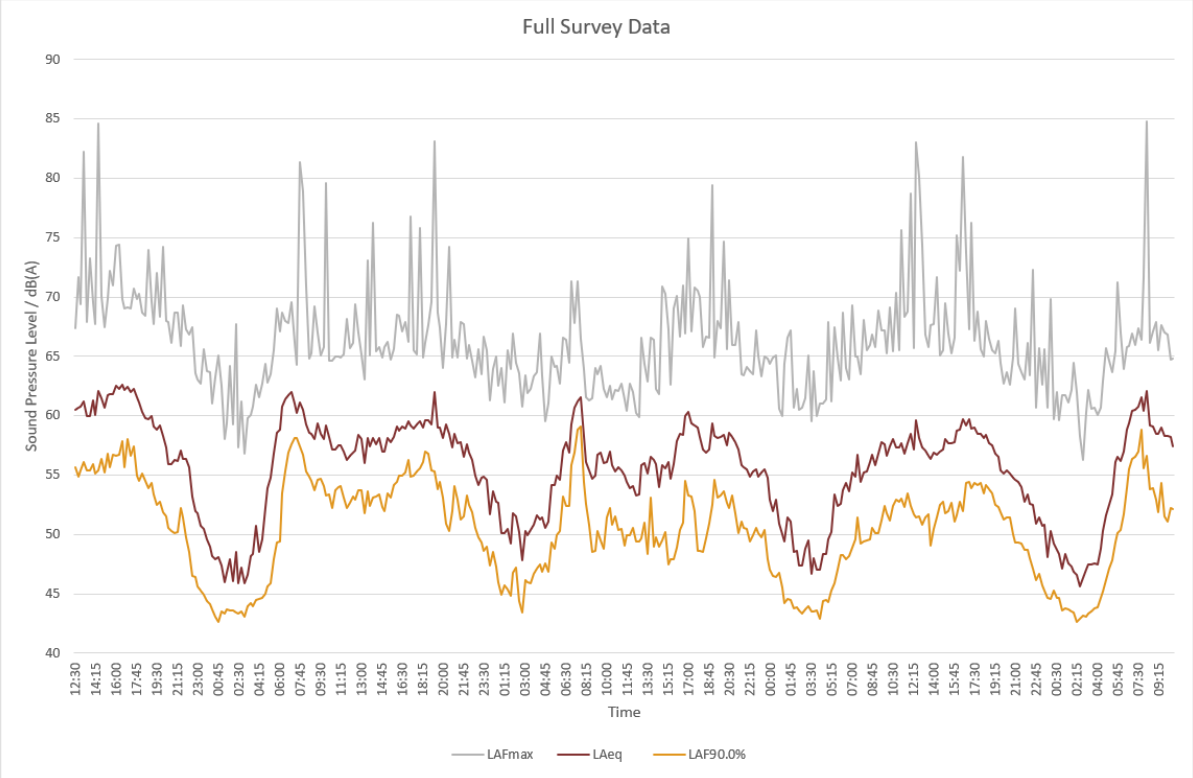
Table 12: Measured Background Sound Levels at 'Location D' (free-field level)

Parameter	$L_{A90\ (15\ minutes)}$ dB	
	Range	Modal
Daytime (07:00-23:00)	59-71	65
Night-time (23:00-07:00)	50-70	58

5.4.5. 'Location E' – Road Traffic Noise (A38)/ builder's merchant

The main noise sources affecting the monitoring location were road traffic noise from the A38. Industrial noise from the builder's merchant was considered insignificant when compared to the existing road traffic noise. The chart below provides the measured noise level over the measurement period.

Chart 4: Measured noise levels (free-field level) at 'Location E'



From the measured data, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels, and maximum noise levels at the monitoring location:

Table 13: Measured Octave Band Design Noise Levels (free-field level) at 'Location E'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(16hr)}$	34	37	37	48	57	50	39	37	58
Night $L_{eq,(8hr)}$	26	27	30	44	51	44	37	37	53
Night $L_{max(F)}$	43	41	42	59	67	59	46	43	68

The measured range and modal background noise levels at Location E are as follows:

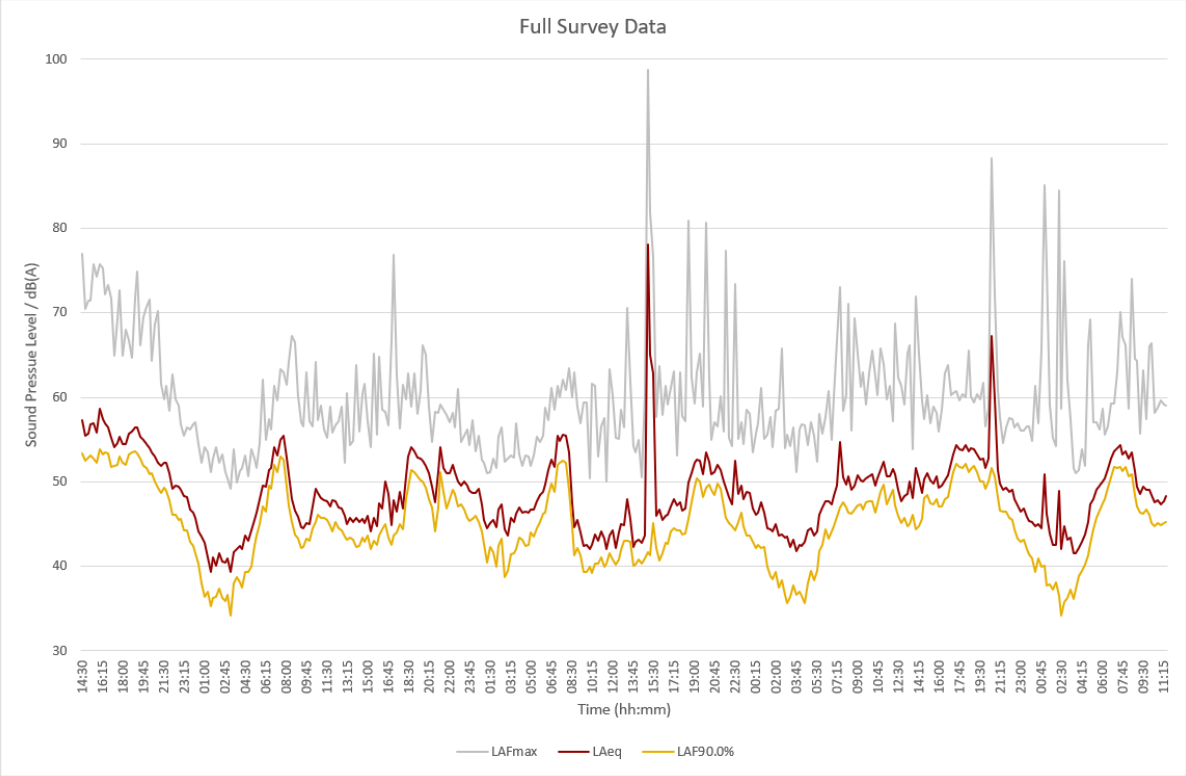
Table 14: Measured Background Sound Levels at 'Location E' (free-field level)

Parameter	$L_{A90\ (15\ minutes)}$ dB	
	Range	Modal
Daytime (07:00-23:00)	50-58	54
Night-time (23:00-07:00)	43-57	44

5.4.6. 'Location F' – Road Traffic Noise (M5 & A38) / Background Noise

The main noise sources affecting the monitoring location were road traffic noise from the M5 and A38. Dursley road traffic noise was considered much less noisy. The chart below provides the measured noise level over the measurement period.

Chart 5: Measured noise levels (free-field level) at 'Location F'



From the measured data, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels, and maximum noise levels at the monitoring location:

Table 15: Measured Octave Band Design Noise Levels (free-field level) at 'Location F'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(16hr)}$	72	65	59	53	54	54	43	38	56
Night $L_{eq,(8hr)}$	64	58	51	56	64	56	41	25	47
Night $L_{max(F)}$	56	51	42	50	62	49	33	17	62

This monitoring location was also determined to be the most representative of a typical background level for the site. The range and modal background noise levels are as follows:

Table 16: Measured Background Sound Levels at 'Location F' (free-field level)

Parameter	$L_{A90\ (15\ minutes)}$ dB	
	Range	Modal
Daytime (07:00-23:00)	39-54	45
Night-time (23:00-07:00)	34-51	42

6. Transportation Noise Assessment

6.1. Noise Modelling

6.1.1. Modelling Parameters

The noise modelling has been undertaken using the noise modelling software CadnaA (Computer Aided Noise Abatement) developed by Datakustik. The software undertakes its noise modelling predictions using the methodology of Calculation of Road Traffic Noise , 1988 (CRTN'88) and Calculation of Railway Noise, 1995 (CRN'95).

Measured noise levels were imputed into the CadnaA noise model in order to determine road and train traffic noise levels impacting on the proposed development. Daytime, night time average and maximum A weighted noise levels used for the model were those measured and determined above.

At 'Location C' traffic flows were very consistent and noise levels did not vary during the two hours of measurement data. We have corrected this data to 16 hour and 8 hour levels as per the method of *Calculation of Road Traffic Noise* (CRTN) and Method 3 within the TRL report: 'Converting the UK traffic noise index $L_{A10,\ 18h}$ *to EU noise indices for noise mapping (Abbot & Nelson, 2002).'*

The modelling parameters used are as follows:

- The noise model has been completed using the noise data measured and predicted at the above measured locations.
- The topography of the site and surrounding area has been determined from Environment Agency Lidar data and site-specific topographical survey. The DTM grid used was 2mx2m.
- The noise map was predicted at 4.5m above ground. This is considered representative of a first-floor level window. A noise map grid of 10mx10m was used.
- The ground is considered soft (G=1.0);
- Reflections are via the correction method of CRN/CRTN and not mirror sources.
- A verification model has been created to ensure the modelling and measured data are comparable; Some predicted noise levels at the above monitoring locations following calibration were determined to be higher than the site measured noise levels; this was however still considered acceptable from the assessment point of view.

6.1.2. **Modelling Results**

Figures below provide the noise modelling results across the proposed development based on the above calculation procedure.

The noise maps are colour coded to reflect the potential impact of noise on the residential amenity of the inhabitants and the impact of noise on the noise mitigation of the dwellings. The colour code is as follows:

Green	Daytime equivalent noise levels up to 50 dB $L_{Aeq(16\ hour)}$, night-time equivalent noise levels up to 45 dB $L_{Aeq(8\ hour)}$, maximum noise levels up to 60 dB L_{AFmax}. The walls and roof can be of a conventional construction with no specific noise attenuation measures incorporated into the design. These rooms can be ventilated via a partially open window.
Yellow	Daytime equivalent noise levels of between 50-65 dB $L_{Aeq(16\ hour)}$, night-time equivalent noise levels of between 45-60 dB $L_{Aeq(8\ hour)}$ and night-time maximum noise levels of between 60-75 dB L_{AFmax}. The walls and roof can be of a conventional construction with double glazed windows and attenuated ventilation in the form of acoustic trickle vents or a mechanical ventilation system. Windows may be opened for ventilation, but for noise control should normally be kept closed.
Blue	Daytime equivalent noise levels of >65 dB $L_{Aeq(16\ hour)}$, night-time equivalent noise levels >60 $L_{Aeq(8\ hour)}$ and night-time maximum noise levels >75 dB L_{AFmax}. The walls and roof can be of a conventional construction with double glazed windows and attenuated ventilation in the form of upgraded acoustic trickle vents or a mechanical ventilation system. Windows may be opened for ventilation, but for noise control should normally be kept closed.

Figure 4: Daytime $L_{Aeq(16hr)}$ Transportation noise affecting development (4.5 metres height map)

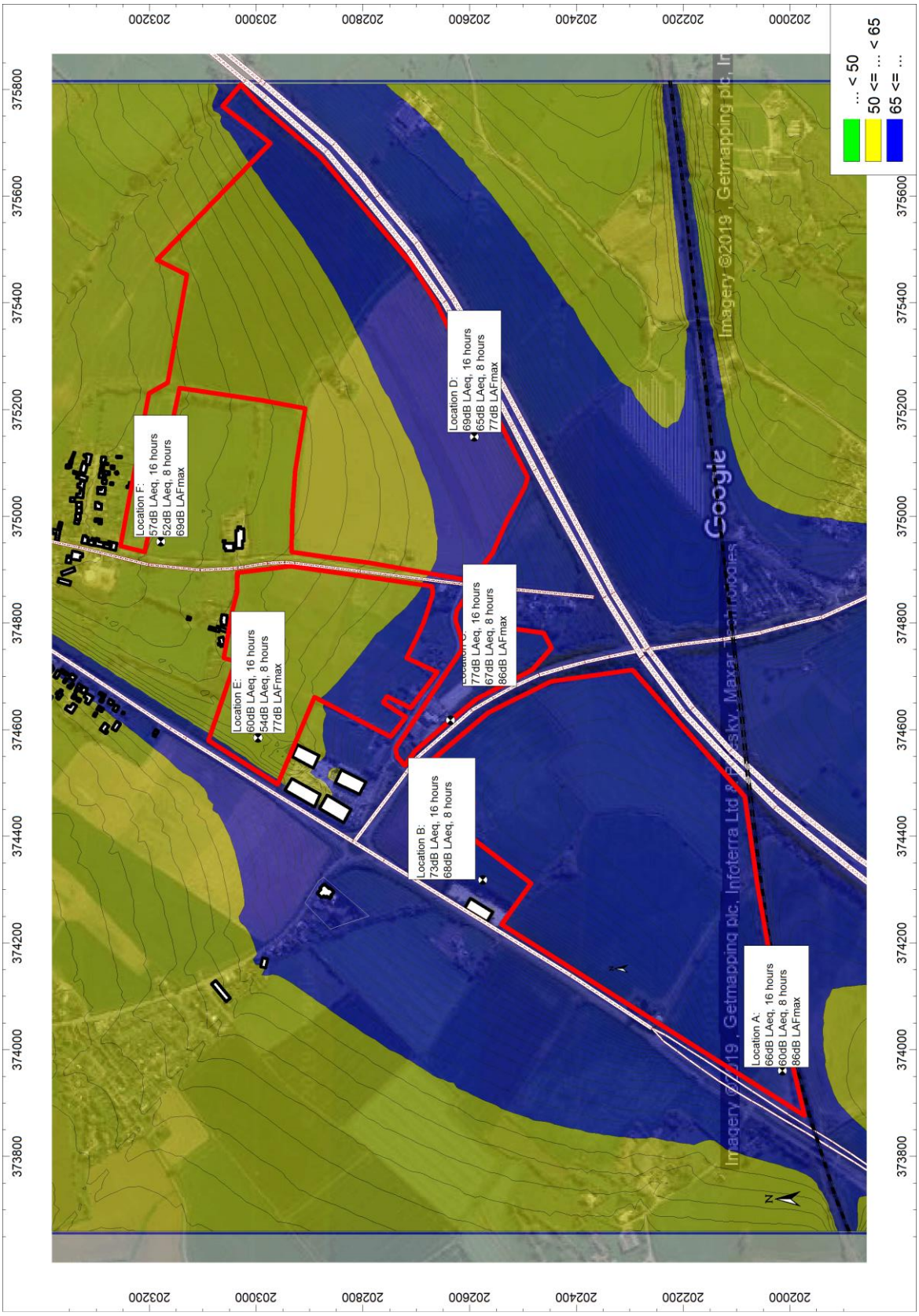


Figure 5: Night Time $L_{Aeq(8hr)}$ Transportation noise affecting development (4.5 metres height map)

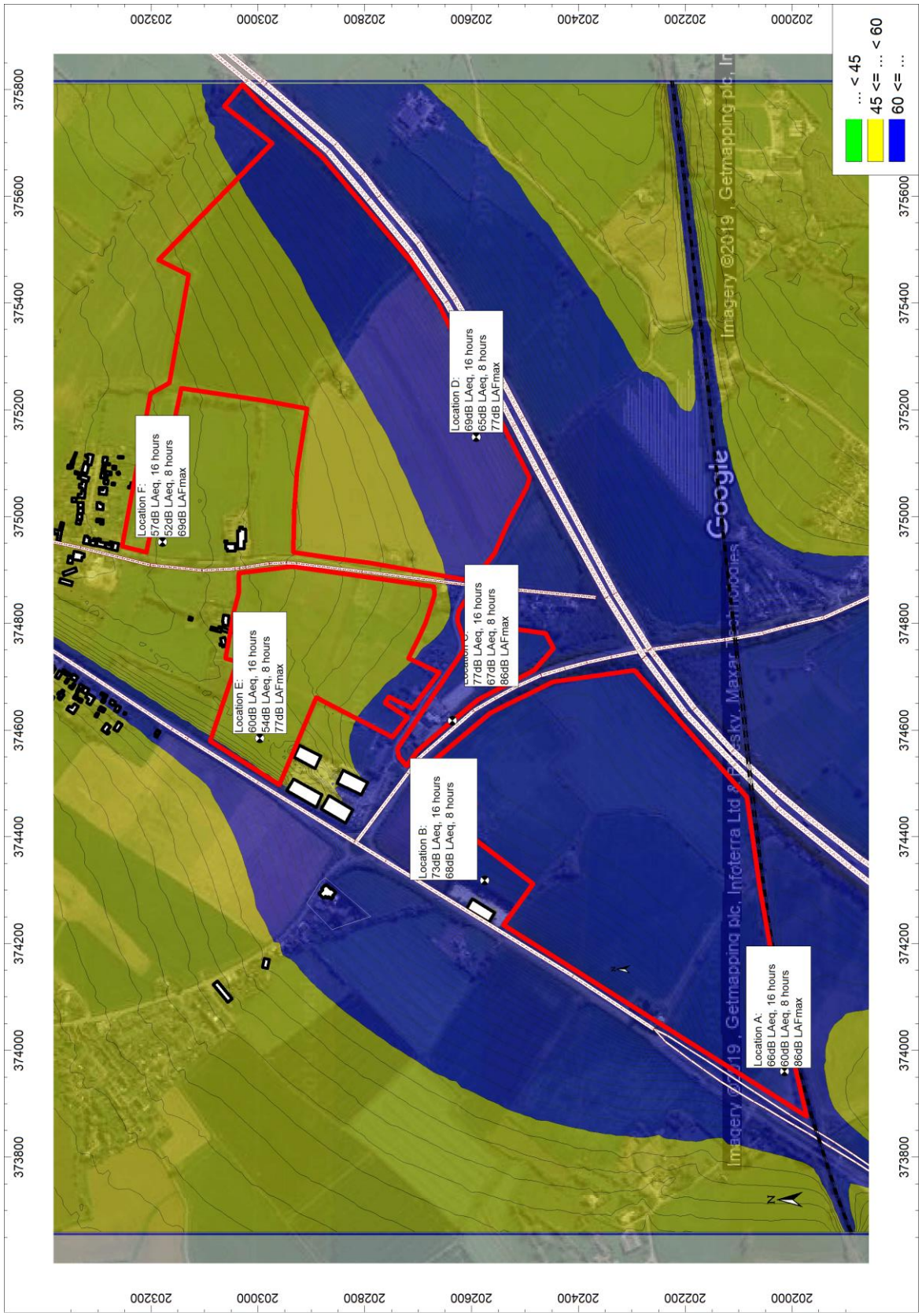
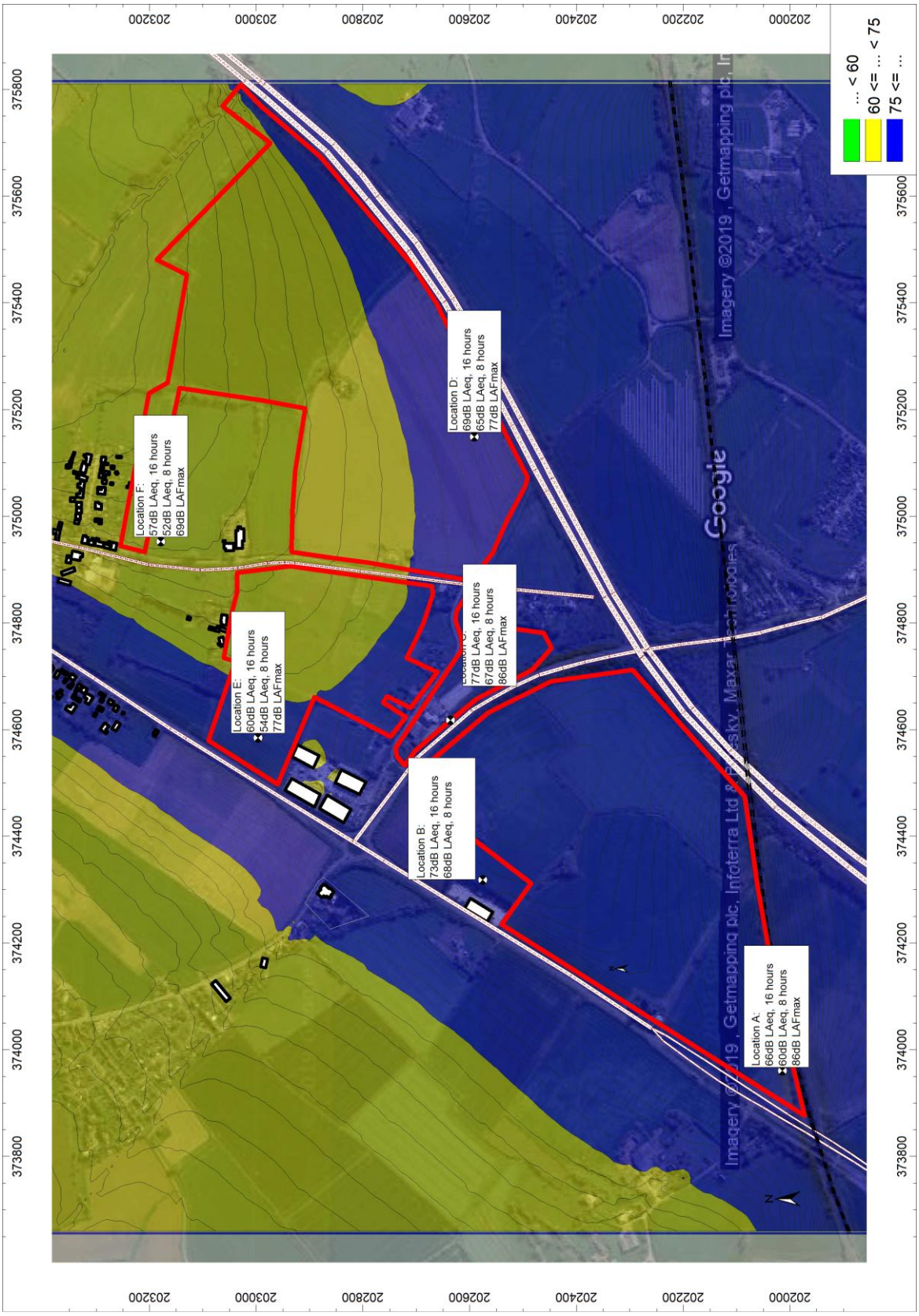


Figure 6: Night Time L_{AFmax} Transportation noise affecting development (4.5 metres height map)



6.2. Internal Ambient Noise Levels Assessment

A site layout has not yet been determined. The following guidance is based on the modelling results above and do not allow for any barrier attenuation formed by the development.

Calculations for the internal ambient noise levels due to road and rail traffic noise have been undertaken using the calculation method provided in Annex G Section G.2 of British Standard 8233:2014. The calculations assume the following:

- Room size: 16m^2 to daytime room and 9m^2 to bedrooms
- Windows: 4m^2 to daytime rooms and 2m^2 to bedrooms
- Vents: 2 to daytime rooms, 1 to night-time rooms. All vents are open.
- External walls and roof achieving minimum sound reduction index of 52 dB R_w. This can be achieved with standard construction techniques.

The window and ventilation measures below are provided for guidance, with the aim of demonstrating the site is suitably for residential use.

We have assessed the highest noise levels affecting the site per coloured area of noise map above. The measures below are not definitive, each phase of the scheme will need to be assessed once the site layout is known and the mitigation amended accordingly.

With the proposed fabric construction and suitable ventilation provisions, the predicted internal equivalent noise levels and maximum noise levels are within the criteria of British Standard 8233:2014 internally.

6.2.1. Windows

The windows on all elevations could be openable. However, they need to be sealed airtight to control external noise and adequate levels of ventilation should be provided with windows closed. The windows should be constructed from sturdy good quality frames with airtight compression seals. The sound reduction indices required of the windows are as follows:

Table 17: Required Minimum Sound Reduction Indices and R_w of Windows

Colour Code	Required Windows Sound Reduction Index (dB) per Octave Band (Hz)								R_w	Typical Constructions
	63	125	250	500	1k	2k	4k	8k		
Lower range	20	24	20	25	35	38	35	36	31	4/12/4
Higher range	20	25	22	33	40	43	44	44	36	10/12/4
Lower range	20	25	22	33	40	43	44	44	36	10/12/4
Higher range	22	27	29	36	41	42	52	50	39	10 /12/6.4

6.2.2. Ventilation Provisions

There should be no un-attenuated vents or openings in the building façades. There will need to be suitably attenuated ventilation provisions in the habitable rooms where specific noise mitigation measures are required. The ventilation provisions should include the necessary sound attenuation in order that the ingress of external noise is controlled to be compatible with the building fabric.

For the rooms we have assumed one vent open per space. The minimum performance for these vents is provided below.

Table 18: Required Minimum Sound Insulation Performance, $D_{n,e,w}$ of ventilators

Colour Code	Required Ventilator Sound Insulation Performance, $D_{n,e}$ per Octave Band (Hz)								$D_{n,e,w}$ (dB)	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
Lower range	30	35	35	36	34	29	33	34	32	Titon - XS13 4400 EA+XC13 412 Canopy (1)
Higher range	38	37	35	40	42	45	54	38	44	Titon - SF X V75 / SFSA C75 (1)
Lower range	30	37	37	36	47	49	55	61	44	Titon - SF X V75 / SFSA C75 (2)
Higher range	45	47	46	50	55	65	68	60	54	Greenwood Wall vent MA3051 / Mechanical Ventilation (1) (2)

1) The mitigation above which fall into the yellow are for typical standard vent specification. The other areas will require higher vents acoustic performances. In the most exposed areas within blue areas a mechanical ventilation system could be used installed instead of wall vents.

2) To be applied to buildings located at close proximity of the roads and site boundary. The selection of this ventilation system was based on the assumption that the future buildings will be subject to a maximum noise level of approximately 82dB(A). This also means that buildings facing the A4135 road and subject to this level will need to be located at approximately 15 metres from the road.

6.3. External Amenity Areas

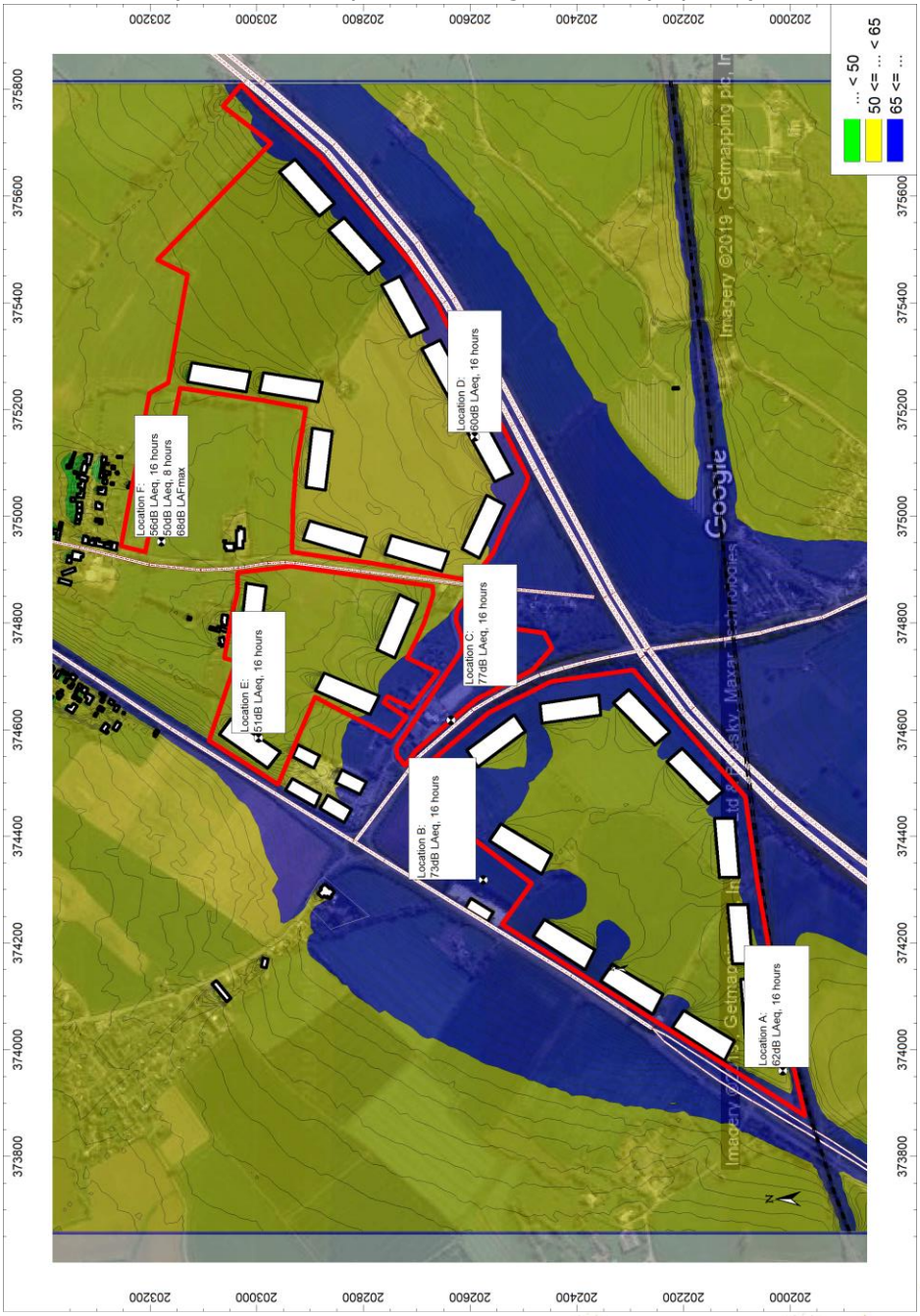
At this stage, the layout and number of dwellings associated with the scheme are not known. The aim of this assessment is to provide outline advice to guide the design of the residential development.

The layout of the site is not known however the modelling indicates that with a carefully designed layout, which includes gardens facing away from the noise sources, acceptable noise levels can be achieved within external amenity spaces across the site without the need for significant bunds or barriers.

We have introduced some buildings along the boundaries of the site to simulate the expected screening effect provided by these buildings to amenity spaces. Buildings are assumed to be at least 20 metres away from each approximate boundary marked in red in the noise map below.

In addition, proposed houses are also likely to include some rear timber board boundary fencing and this is likely to reduce further the noise levels within the amenity spaces. We have remodelled the daytime noise maps with some buildings along the southern boundary to. This are provided in Figure 7 below.

Figure 7: Remodelled Daytime Noise Map with Buildings – Amenity Space (1.5 metres height map)



Please also note that BS 8233:2014 section 7.7.3.2 entitled 'Design criteria for external noise' states:

"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."

7. Existing Commercial & Industrial Noise Assessment

Rocket Rentals Industrial site is located adjacent to the A38 just south of the existing roundabout. The site is understood to be used for tool hire and has deliveries from 6:00 hours and has an external plant/wheel washing facility as well as undertaking training for customers. However, the published operating hours are understood to be from 07:30-17:30 Monday-Friday, 08:00-12:00 on Saturday and is closed for business on Sunday.

7.1. Industrial Noise Levels

The industrial premise Rocket Rentals was operating during our site visit. The measured levels at 'Location B' consisted of workshop industrial noise sources including the following:

- Hammering metal / Grinding on metal / Drilling on metal
- Vehicle movements within yard including reverse beeping
- Metal hitting metal/ banging
- Loading/ unloading metal items

7.2. Industrial Modelling Parameters

To determine the industrial noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the data noted above. The software predicts industrial noise using the general method of calculation from 'ISO 9613-1'.

The modelling parameters used are as follows:

- The industrial noise model has been completed using the industrial noise shown above obtained at monitoring 'location B'.
- The topography of the site and surrounding area has been determined from Environment Agency Lidar data and site-specific topographical survey. The DTM grid used was 2x2.
- The noise map was predicted at 4.5m above ground. This is considered representative of a first-floor level window. A noise map grid of 10mx10m was used.
- The ground is considered semi soft (G=1.0).
- Order of reflexion was considered equal to one
- A verification model has been created to ensure the modelling and measured data are comparable.
- A 3.0metres high noise control barrier was introduced along the southern and eastern boundary of the industrial site.

7.3. **Industrial Modelling Results**

The figures below provide the daytime ($L_{Aeq,\ 1hrs}$) and night-time ($L_{Aeq,\ 15min}$) equivalent noise levels due to industrial noise (Rocket Rentals) operations.

Figure 8: Daytime $L_{Aeq(1hr)}$ Industrial noise affecting development (4.5 metres height map)

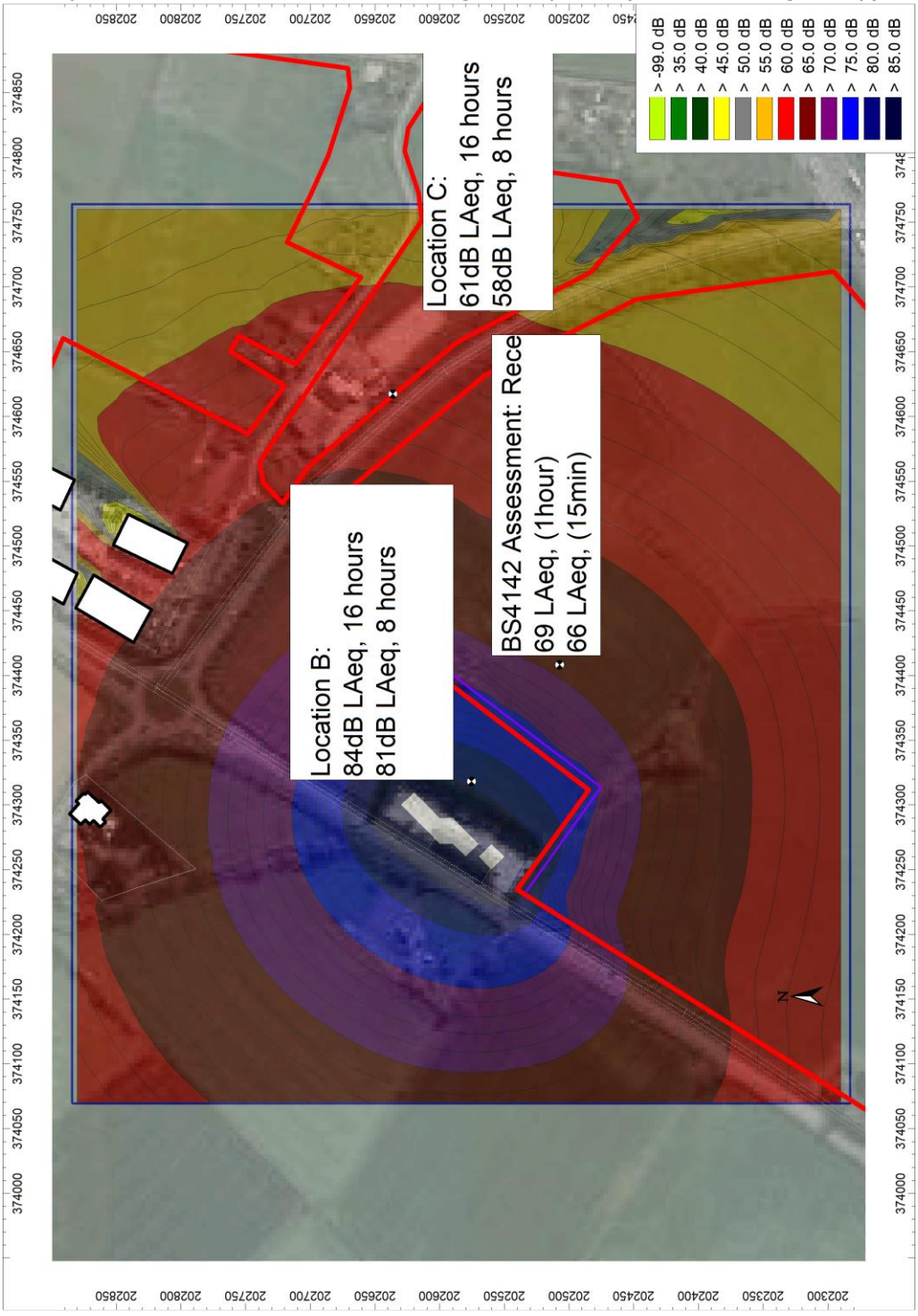
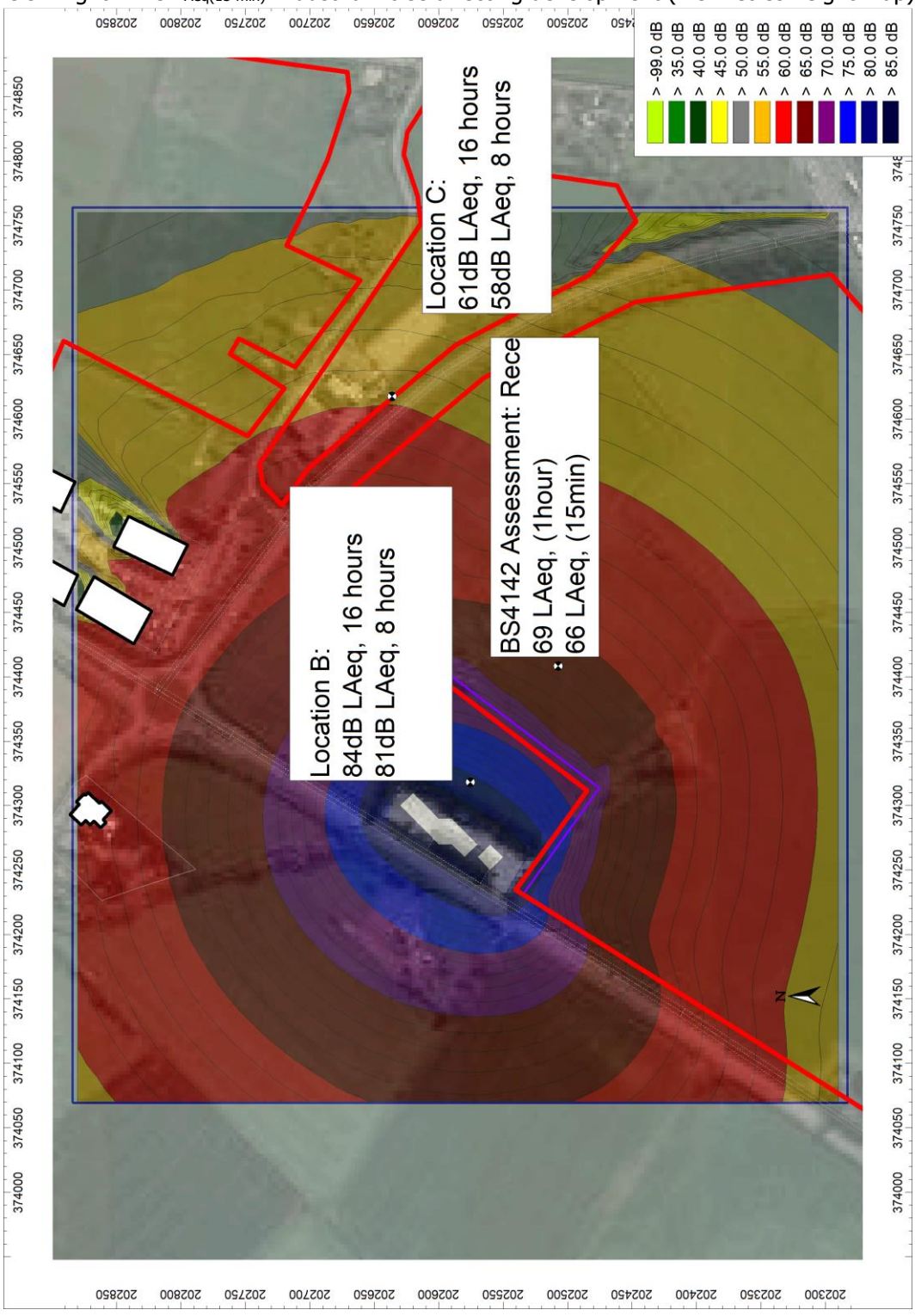


Figure 9: Night Time $L_{Aeq(15\ min)}$ Industrial noise affecting development (4.5 metres height map)



7.4. Industrial Noise Assessment

It is considered appropriate to assess the impact of the existing industrial operations in accordance with the methodology of British Standard 4142:2014.

7.4.1. Specific Sound Level

The cumulative specific sound level at the considered receiver is as noted above in the noise map and was determined to be 69 to 66dB $L_{Ar,\ T}$, Daytime and Night Time respectively (without the influence of the existing industry). This is the level determined at the noise sensitive receivers without any character corrections applied.

7.4.2. Background Noise Level

From the measured data obtained at 'location F', we have determined a typical design background sound level to 71 dB $L_{A90\ (1\ hour)}$ during the daytime and 59 dB $L_{A90\ (15\ min)}$.

7.4.3. Character Corrections

Character corrections should be added to the "specific sound level" if the "specific sound level" exhibits any *tonality, impulsivity, other specific characteristics and/or intermittency* at the assessment location. The character corrections to be applied are as follows:

Tonality – the site was not considered to have a tonality feature; nevertheless, we have applied a correction of +2dB for a tone that is just perceptible at the noise receptor.
Impulsivity – the site was considered to be impulsive and a correction of +3dB for impulsivity that is just perceptible at the noise receptor was considered.
Intermittency – the industrial site noise was not considered to be intermittent
Other Sound Characteristics – We do not believe a character correction is necessary for other sound characteristics.

7.4.4. Initial Estimate of Impact

Therefore, the British Standard 4142:2014 initial estimate of impact is as follows:

Table 19: British Standard 4142:2014 Assessment

Parameter	**Worse Case Receiver**	
Assessment Period	**Daytime**	**Night Time** Night
Background Sound Level, $L_{A90\ (15\ minutes)}$	71 dB	59 dB
Specific Sound Level	69 dB $L_{Aeq\ (1hours)}$	66 dB $L_{Aeq\ (15\ min)}$
Acoustic Character Correction	+5 dB	+5 dB
Rating Sound Level L_{Ar}	74 dB $L_{Ar\ (1hours)}$	71 dB $L_{Ar\ (1hours)}$
Difference between rating and background level	+3 dB	+12 dB

With reference to Table 19 above, the cumulative industrial rating noise levels are likely to be +3dB and +12dB above the daytime and night time background noise levels respectively. BS 4142:2014 notes that where the noise level from the assessed source exceeds the background noise levels by around 10dB or more, this is likely to be an indication of a significant adverse impact, depending on the context.

7.4.5. Context

Section 11 of BS4142:2014, entitled 'Assessment of the Impacts', states the following regarding context. We would consider this section to be most relevant for a new residential use next to an industrial site.

"*Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including (…) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*

i) facade insulation treatment;
ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
iii) acoustic screening."

The development will *"incorporate design measures that secure good internal and/or outdoor acoustic conditions",* and consequently the impact could be considered to be low; see below:

Noise complaints generally occur during the night-time or early morning period. All plots overlooking this industrial building will have an upgraded façade and attenuated ventilation to control road traffic noise. With the above upgraded measures and 3.0 noise control barrier, the internal levels are expected to be controlled to within the BS8233 guidelines for most industrial use such as early morning/ daytime operations.

Therefore, we would consider that the development will *incorporate design measures that secure good internal and/or outdoor acoustic conditions,* and the impact would be considered to be low in terms of BS 4142:2014.

7.4.6. Summary of Industrial Noise Impact

The internal rating sound levels have been predicted in accordance with the method of Annex G.2 of British Standard 8233:2014 using the derived specific sound level with character correction and the sound reduction indices of any upgrade measures.

The predictions for worst-case bedrooms are shown below:

Free Field Level at Façade

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\ hour)}$	75	70	68	68	69	69	63	58	74
Night $L_{eq\ (8hour)}$	72	71	68	67	67	62	63	63	72
Night-time $L_{max(fast)}$	0	0	0	0	0	0	0	0	7

Building Façade Construction

External Element		63	125	250	500	1000	2000	4000	8000
Wall Vent - Greenwood MA3051 – 54 Dnew	D_{ne}	45	47	46	50	55	65	68	60
	Number of	1							
		0.00005	0.00003	0.00003	0.00001	0.00000	0.00000	0.00000	0.00000
2x100mm block plastered/render both sides 100mm void, 1880 Kg/m3 + 400 kg/m3 - 52 Rw		31	38	46	45	55	66	77	70
	Area	6							
		0.00064	0.00013	0.00002	0.00003	0.00000	0.00000	0.00000	0.00000
Double Glazed: 10/12/6.4 - 39 Rw		22	27	29	36	41	42	52	50
	Area	2							
		0.00126	0.00040	0.00025	0.00005	0.00002	0.00001	0.00000	0.00000

Mecanical Ventilation

Calculations to BS EN 12354

	63	125	250	500	1000	2000	4000	8000
Sum	0.00189738	0.000525844	0.00027188	7.55359E-05	1.84164E-05	1.28201E-05	1.27788E-06	0.00000208
10log sum	-27.218463	-32.79143145	-35.65622461	-41.21846305	-47.34795572	-48.92108662	-58.93511019	-56.81936665
10log S/A	-0.01733713	-0.017337128	1.222448322	2.355747741	3.080348972	1.027395567	-0.125560369	-0.125560369
correction factor +3	3	3	3	3	3	3	3	3

Mecanical Ventilation

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\ hour)}$	50.8	40.2	36.6	32.1	27.7	24.1	6.9	4.1	**35**
Night $L_{eq\ (8hour)}$	47.8	41.2	36.6	31.1	25.7	17.1	6.9	9.1	**33**

Trickle Vents/ Wall vents

Calculations to BS EN 12354

	63	125	250	500	1000	2000	4000	8000
Sum	0.00194469	0.000555694	0.000305372	8.88693E-05	2.2731E-05	1.32046E-05	1.4892E-06	3.41333E-06
10log sum	-27.1115057	-32.55164657	-35.15170797	-40.51248323	-46.43382052	-48.79273588	-58.27048174	-54.66821298
10log S/A	-0.01733713	-0.017337128	1.222448322	2.355747741	3.080348972	1.027395567	-0.125560369	-0.125560369
correction factor +3	3	3	3	3	3	3	3	3

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\ hour)}$	51	40	37	33	29	24	8	6	**35**
Night $L_{eq\ (8hour)}$	48	41	37	32	27	17	8	11	**34**

8. Proposed Commercial use Noise Limits

There is commercial and employment use associated with the development. Noise from these schemes will need to be suitably controlled. As such, we have provided plant noise limits over the based on the monitoring data obtained at Location F (worst-case) above, local authority criteria and British Standard 4142:2014.

The limits at the receivers are based on baseline noise levels and BS 4142:2014. Based on the above criteria and the assessment time periods stated, the maximum Rating Noise limits of noise from plant associated with the development are as follows. These limits should be determined at the façade of the development or existing sensitive receivers:

Table 20: Plant Noise Rating Level Limits

Time Period	**Limits at Noise Sensitive Receivers $L_{Ar(T)}$**
Daytime (07:00 to 19:00 hrs)	45 dB $L_{Ar(1\ hour)}$
Night Time (23:00 to 07:00 hrs)	42 dB $L_{Ar(15\ min)}$

The Rating Level of noise from the site is to include an acoustic feature correction as applicable in accordance with Section 9 of BS4142:2014 for any tonality, impulsivity, intermittency or other sound characteristics.

At the detailed design stage, a plant assessment should be completed to ensure the above noise limits are met.

9. Summary and Conclusions

Ernest Cook Trust (ECT) and Gloucestershire County Council (GCC) appointed Acoustic Consultants Limited to carry out a noise impact assessment and an environmental noise survey to support a Local Plan Allocation for a mixed-use development on land surrounding Wisloe Green, Cambridge, Gloucestershire.

The purpose of this assessment is to address the noise climate affecting the proposed development, specifically road, rail and commercial noise. At this stage, the layout and number of dwellings associated with the scheme are not known. The aim of this assessment is to provide outline advice to demonstrate whether or not the site is suitable for a mixed-use development.

The assessment has been completed in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG), British Standard 4142:2014 (BS4142), British Standard 8233:2104 (BS8233) and Local Authority guidance.

Mitigation measures will be required to control external noise at the proposed site. With the proposed fabric construction and suitable ventilation provisions noted above, the predicted internal equivalent noise levels are generally within the British Standard 8233:2014 criteria.

We would consider external noise to be suitably controlled within the habitable rooms of the future residential development and good internal conditions can be achieved.

The layout of the site is not known, however, the modelling indicates that with a carefully designed layout (which includes gardens facing away from the noise sources), acceptable external amenity space levels can be achieved across the site.

In addition, houses are likely to include timber fencing at the rear of their properties and this is expected to reduce the noise levels slightly within the amenity areas. This should also slightly reduce the indoor noise levels on both daytime and night time rooms.

With respect to industrial noise, it was concluded that with the inclusion of a noise control barrier along the industrial boundary and with the mitigation measures required to control road traffic noise (windows and ventilators acoustic specs specified above), the internal levels will be controlled to acceptable levels when context is considered.

Plant noise from any commercial and employment use schemes will need to be suitably controlled. As such, we have provided plant noise limits based on the monitoring data obtained at Location F (worst-case) above, local authority criteria and British Standard 4142:2014.

With suitable site layout and noise mitigation measures as outlined in this report, suitable noise levels can be provided for residential accommodation. As such, we would consider that external noise can be suitably controlled to below the LOAEL of the NPPG with appropriate planning conditions and that the site is, therefore, suitable for residential development.

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