

PROPOSED STOR FACILITY

Barnsley, Twibell Street – Noise Assessment
Prepared for: UK Capacity Reserve Ltd

SLR Ref: 404.03901.00006.004
Version No: Draft
July 2017



BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with UK Capacity Reserve (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

CONTENTS

1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	2
3.0 SCOPE	3
3.1 Consultation with Barnsley Metropolitan Borough Council	3
3.2 British Standard 4142:2014	3
3.3 British Standard 8233:2014	4
4.0 ENVIRONMENTAL SOUND SURVEY	5
4.1 Survey Date	5
4.2 Weather Conditions	5
4.3 Equipment.....	5
4.4 Monitoring Locations	5
4.5 Soundscape at the Monitoring Locations and Context	7
Twibell Street and Eaming View	7
Roche Close and receptors to the east.....	7
Burton Road and receptors to the north.....	7
5.0 NOISE MODEL AND PREDICTED SOUND LEVELS	9
5.1 Noise Model Assumptions	9
5.2 Noise Sources.....	9
5.3 Predicted Sound Levels	9
6.0 BS4142:2014 ASSESSMENT	11
6.1 Sound Penalties.....	11
6.2 Assessment Results.....	12
6.2.1 Daytime	14
6.2.2 Night-Time	14
7.0 BS8233:2014 NOISE ASSESSMENT	15
7.1 External Noise	15
7.2 Internal Noise.....	16
7.2.1 Daytime	16
7.2.2 Night-Time	17
8.0 SUGGESTED BOUNDARY NOISE LIMIT.....	18

9.0 CUMULATIVE ASSESSMENT.....	19
Cumulative BS4142:2014 Assessment.....	19
Cumulative Daytime.....	21
Cumulative Night-Time.....	21
10.0 CONCLUSION.....	23
10.1 STOR Development Assessment.....	Error! Bookmark not defined.
10.2 Daytime.....	23
10.3 Night-Time.....	23
10.4 Boundary Noise Limit.....	23

DOCUMENT REFERENCES

TABLES

Table 3-1 Summary of Noise Level Limited, dB.....	4
Table 4-1 Summary of Measured Noise Levels, free-field, dB.....	7
Table 5-1 Plant Details.....	9
Table 5-2 Predicted Sound Levels, free-field dB.....	10
Table 6-1 Character of Each Noise Source.....	11
Table 6-2 BS4142 Assessment, dB.....	13
Table 7-1 Predicted External Cumulative Noise Levels, Free-field, dB.....	15
Table 7-2 Predicted Internal Cumulative Noise Levels, Free-field, dB.....	16

FIGURES

Figure 4-1 Noise Monitoring Locations.....	6
--	---

APPENDICES

Appendix 01: Glossary of Terminology
Appendix 02: Proposed Development Site Drawing
Appendix 03: Sound Monitoring Equipment
Appendix 04: Full Survey Results
Appendix 05: Noise Models
Appendix 06: Report Limitations

1.0 Introduction

UK Capacity Reserve Limited (UKCR) has appointed SLR Consulting Ltd. to undertake a noise assessment for a Standard Temporary Operating Reserve (STOR) development located at Twibell Street, Barnsley, S71, 1JE.

The noise assessment of the proposals has been carried out in accordance with the guidance contained in British Standard 4142:2014 *Methods for rating industrial and commercial sound*, and as the development would only operate intermittently, British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*.

The assessment is based on the results of a baseline noise survey undertaken at locations representative of the noise environment at the nearest sensitive receptors to the proposed development over weekend daytime and night-time periods.

The noise predictions in this assessment have been undertaken using a proprietary software-based noise model, CadnaA, which implements the full range of UK calculation methods.

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix 01.

2.0 Site Description

The generators will be located on a parcel of land located at Twibell Street, Barnsley.

The site is bounded to the north by a wooded area with Burton Road beyond, to the east by a warehouse, to the south by open land with Twibell Street beyond, and to the west by open land with Harborough Hill Road beyond.

A plan showing the location of the proposed development site can be seen in Appendix 02.

In summary the proposed development will consist of:

- 14 containerised engines.
- HV/LV Switchroom.
- Aux. Transformer.
- Main Transformer Compound.
- Control Room.
- Bulk Lube Oil Storage Tanks.
- Store Room.
- DNO Metering Station.
- Gas Reception Kiosk.

The proposed development would typically operate during two windows per day, in the morning and the evening, with peak demand being typically between 17:00 and 19:00 hours on a weekday.

It is very unlikely indeed that the facility will be called upon to balance the electricity supply:

- During the night;
- At the weekend¹; and
- During late spring; summer, and early autumn.

¹ Despite this, the baseline sound survey has been requested to be undertaken during a weekend period as a worst case.

3.0 Scope

3.1 Consultation with Barnsley Metropolitan Borough Council

Barnsley Metropolitan Borough Council was consulted to confirm their views and policies on noise-related issues. It was confirmed in an email with an Environmental Health Officer (EHO) of the Council that:

- Noise from the development should be included in a noise assessment that should be carried out in accordance with the guidance contained in British Standard 4142:2014 *Methods for rating industrial and commercial sound*; and
- Baseline noise levels should be monitored at locations representative of the nearest sensitive receptors properties over a representative period to include a weekend.

Whilst not discussed with the EHO, as the development would only operate intermittently, BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* will also be referred to in this assessment.

A summary of the guidance mentioned above is given below.

3.2 British Standard 4142:2014

British Standard 4142:2014 *Methods for rating and assessing industrial and commercial sound* is intended to be used to assess the potential adverse impact of sound, of an industrial and/or commercial nature, at nearby sensitive receptor locations within the context of the existing sound environment.

Where the specific sound contains tonality, impulsivity and/or other sound characteristics penalties should be applied depending on the perceptibility. For tonality a correction of either 0, 2, 4 or 6dB should be added; for impulsivity a correction of either 0, 3, 6 or 9dB should be added and if the sound contains specific sound features which are neither tonal nor impulsive a penalty of 3dB should be added.

In addition, if the sound contains identifiable operational and non-operational periods, that are readily distinguishable against the existing sound environment, a further penalty of 3dB may be applied.

The assessment of impacts contained in BS4142:2014 is undertaken by comparing the sound rating level, i.e. the specific sound level of the source plus any penalties, to the measured representative background sound level immediately outside the sensitive receptor location. Consideration is then given to the context of the existing sound environment at the sensitive receptor location to assess the potential impact.

Once an initial estimate of the impact is determined, by subtracting the measured background sound level from the rating sound level, BS4142:2014 states that the following should be considered:

- typically, the greater the difference, the greater the magnitude of the impact;
- a difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- a difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. It is an indication that the specific sound source has a low impact

BS4142:2014 notes that:

“Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”

BS4142:2014 outlines guidance for the consideration of the context of the potential impact including consideration of the existing residual sound levels, location and/or absolute sound levels.

3.3 British Standard 8233:2014

BS8233:2014 is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations. The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 3-1.

Table 3-1
Summary of Noise Level Limited, dB

Activity	Location	07:00 to 23:00 $L_{Aeq,16hr}$	23:00 to 07:00 $L_{Aeq,8hr}$
Resting	Living Room	35.0	-
Dining	Dining room/area	40.0	-
Sleeping (daytime resting)	Bedroom	35.0	30.0

The standard is primarily intended to guide the design of new or refurbished buildings undergoing a change, rather than to assess the effect of changes in the external noise climate. However, as the proposed development would only operate intermittently, SLR considers that an assessment against the recommended noise limits presented in the standard would be appropriate, as, whilst a BS4142:2014 assessment may identify an impact, for the majority of the time the facility would not operate, so the impact, and any mitigation required, should be discussed with reference to the limits presented in BS8233:2014; limits that have been set to protect the internal and external noise environment of sensitive receptors.

With regards to the recommended limits, BS8233:2014 states that the recommended limits can be relaxed by up to 5dB “where development is considered necessary or desirable”.

Whilst it may be considered desirable to achieve the BS8233:2014 recommended internal noise levels with windows open, it is stated that where the limit cannot be met with an open window “there needs to be appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.”

It is therefore not essential that the recommended internal noise levels are achievable with open windows if suitable alternative means of ventilation can be provided.

With regards to external noise, Section 7.7.3.2 of BS8233:2014 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”.

4.0 Environmental Sound Survey

4.1 Survey Date

An environmental sound survey was undertaken by SLR on Sunday 21st May and during the early hours of Monday the 22nd May 2017.

4.2 Weather Conditions

During the survey the weather conditions were as follows:

Sunday daytime: The weather was dry and sunny with wind speeds of less than 5m/s⁻¹.

Sunday night-time: The weather was dry clear with wind speeds of less than 5m/s⁻¹.

4.3 Equipment

The sound monitoring equipment used during the assessment is detailed in Appendix 03. All measurement instrumentation was calibrated before and after the measurements. The calibration chain is traceable via the United Kingdom Accreditation Service to National Standards held at the National Physical Laboratory. No significant drift was observed.

4.4 Monitoring Locations

The survey locations and the proposed location of the development can be seen in Figure 4-1. The survey locations were selected as they were considered representative of the nearest sensitive receptor locations.

Figure 4-1 Sound Monitoring Locations



The baseline sound levels at the monitoring locations may be considered representative of the following receptors:

- Location 1: Twibell Street and Eaming View.
- Location 2: Roche Close and receptors to east.
- Location 3: Burton Road and receptors to north.
- Location 4: Belgrave Road and receptors to south (including those to the rear of Harborough Hill Road).
- Location 5: Lord Street and receptors to south-east.

At the monitoring locations the microphone was placed 1.5m above the ground in free-field conditions, i.e. at least 3.5m from the nearest vertical, reflecting surface, with the following noise level indices being recorded:

$L_{Aeq,T}$	The A-weighted equivalent continuous noise level over the measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise.
L_{A10}	The A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise.
L_{Amax}	The maximum A-weighted noise level during the measurement period

The measured baseline sound levels and the representative L_{A90} are shown in Table 4-1. The full survey results can be seen in Appendix 04 of this Report.

It must be noted that the L_{90} has been derived by calculating the median value from each relevant data set.

Table 4-1
Summary of Measured Sound Levels, free-field, dB

Location	Date	Period	$L_{Aeq,T}$	Derived L_{A90}	L_{Amax}
1: Twibell Street and Eaming View	21 st May 2017	Sunday Daytime	48.1	43.6	75.6
	21 st into 22 nd May 2017	Sunday Night-Time	48.4	39.2	71.6
2: Roche Close and receptors to east	21 st May 2017	Sunday Daytime	47.9	40.4	71.2
	21 st into 22 nd May 2017	Sunday Night-Time	32.1	29.3	60.2
3: Burton Road and receptors to north	21 st May 2017	Sunday Daytime	69.3	56.8	100.2
	21 st into 22 nd May 2017	Sunday Night-Time	57.9	36.1	81.6
4: Belgrave Road and receptors to south	21 st May 2017	Sunday Daytime	51.2	44.2	74.1
	21 st into 22 nd May 2017	Sunday Night-Time	38.4	37.4	50.4
5: Lord Street and receptors to south-east	21 st May 2017	Sunday Daytime	50.0	50.7	78.5
	21 st into 22 nd May 2017	Sunday Night-Time	36.6	39.4	53.7

4.5 Soundscape at the Monitoring Locations and Context

Twibell Street and Eaming View

Terraced houses located to the north-west of the proposed development.

The sound climate was characterised by local and distant road traffic. A hum from a Northern Powergrid transformer located on Twibell Street was also audible.

Roche Close and receptors to the east

Semi-detached properties located to the east of the proposed development.

The sound climate was characterised by local and distant road traffic.

Burton Road and receptors to the north

Terraced houses located to the north of the proposed development.

The sound climate was characterised by local and distant road traffic. A hum from a distant transformer was also audible as was occasional overhead aircraft.

Belgrave Road and receptors to the south

Detached and semi-detached properties located to the south of the proposed development.

The sound climate was characterised by local and distant road traffic. Noise from plant located at a nearby Leisure Centre was also audible.

Lord Street and receptors to the south-east

Terraced houses located to the south-east of the proposed development.

The sound climate was characterised by local and distant road traffic. Distant flowing water and sound from a light breeze in the trees was also audible.

5.0 Noise Model and Predicted Sound Levels

5.1 Noise Model Assumptions

The sound predictions in this assessment have been undertaken using a proprietary software-based noise model, CadnaA, which implements the full range of UK calculation methods. The calculation algorithms set out in ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation* have been used and the model assumes:

- A ground absorption factor of 0.5.
- A reflection factor of 2.
- A daytime receiver height of 1.5m and a night-time receiver height of 4.0m.

5.2 Noise Sources

At the time of writing this report SLR understands that the equipment to be installed at the site has not been finalised. The following three types of engine are under consideration:

- Cummins C2000 NSCB.
- Caterpillar EMO507.
- Jenbacher JGC 429 GS-N.L.

From a review of the data provided to SLR, and following discussions with the Client, SLR has included in this assessment the Jenbacher JGC 429 GS-N.L, as this would represent a worst case assessment.

The sound power level data used in the assessment, and presented in Table 5-1, has been provided by a third party, and when included within the noise model the predicted noise level at 10m from each containerised plant is 65dB(A).

Table 5-1
Plant Details

Plant	Sound Power Level dB(A)	Height (m)	Number of Plant
Containerised JGC 429 generators	83.0	3.0	14
Exhaust above roof level	90.0	7.25	14
Pipework to exhaust	88.0	7.0	14
Air Intake	83.0	2.5	14
Air Discharge	88.0	3.5	14
Table Cooler	85.0	4.0	14
Auxiliary Transformer	68.0	2.0	1
Main Transformer	85.0	3.0	1

5.3 Predicted Sound Levels

The predicted sound levels are shown in Table 5-2 below.

Daytime and peak period sound levels have been predicted to 1.5m above ground level the approximate height of ground floor window. Night-time sound levels have been predicted to 4m above ground level, the approximate height of a first floor bedroom window.

In addition to Locations 1 to 5, Harborough Hill Road has been included in the assessment at the request of the local authority.

Table 5-2
Predicted Sound Levels, free-field dB

Location	Period	Predicted Sound Level, $L_{Aeq,T}$
1: Twibell Street	Daytime	60.7
	Night-time	61.3
2: Roche Close and receptors to east	Daytime	41.3
	Night-time	41.7
3: Burton Road and receptors to north	Daytime	51.6
	Night-time	52.3
4: Belgrave Road and receptors to south	Daytime	24.9
	Night-time	25.9
5: Lord Street and receptors to south-east	Daytime	31.9
	Night-time	32.0
6: Harborough Hill Road	Daytime	38.6
	Night-time	40.6

6.0 BS4142:2014 ASSESSMENT

6.1 Sound Penalties

The character of each noise source, and the sound penalty that will be applied in the BS4142:2014 assessment are detailed in Table 6-1.

Table 6-1
Character of Each Noise Source

Location	Sound Tonal	Sound Impulsive	Sound Has Other Characteristic	Sound Intermittent	Comment
JGC 429 Generator	No	No	No	Yes	The generators would be containerised so any noise audible at the receptor locations would be mitigated by the structure of the container. The operation of the generators would be intermittent (3dB penalty).
Exhaust above roof level	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors further afield, tones may be just perceptible (2dB penalty). The operation of the exhausts would be intermittent (3dB penalty).
Pipework to exhaust	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors further afield, tones may be just perceptible (2dB penalty). The operation of the exhausts would be intermittent (3dB penalty).
Air Intake	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors further afield, tones may be just perceptible (2dB penalty). The operation of the air intakes would be intermittent (3dB penalty).
Air Discharge	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors further afield, tones may be just perceptible (2dB penalty). The operation of the air discharge would be intermittent (3dB penalty).
Table Cooler	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors further afield, tones may be just perceptible (2dB penalty). The operation of the table cooler would be intermittent (3dB penalty).
Auxiliary Transformer	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors

Location	Sound Tonal	Sound Impulsive	Sound Has Other Characteristic	Sound Intermittent	Comment
					further afield, tones may be just perceptible (2dB penalty). The operation of the transformer would be intermittent (3dB penalty).
Main Transformer	Possibly	No	No	Yes	Tones may be perceptible. At receptors within 100m (Twibell Street), tones may be clearly perceptible (4dB penalty), whilst at receptors further afield, tones may be just perceptible (2dB penalty). The operation of the transformer would be intermittent (3dB penalty).

Based on the data presented in Table 6-1 the following penalties will be applied to the specific sound level at each receptor:

- Twibell Street: 7dB.
- Roche Close: 5dB.
- Burton Road: 5dB.
- Belgrave Road: 5dB.
- Lord Street: 5dB.
- Harbrough Hill Road: 5dB.

6.2 Assessment Results

The penalties described in Table 6-1 above have been added to the predicted sound levels shown in Table 5-2 to derive the rating levels at each of the nearest noise-sensitive receptors.

The rating levels have then been compared to the derived background sound levels and assessed accordingly.

The results of the BS4142:2014 assessment are shown in Table 6-2. It must be noted that the rating levels and the representative background sound levels have been rounded to the nearest decibel.

A noise model showing the specific sound levels during the daytime and the night-time at each receptor can be seen in Appendix 05.

Table 6-2
BS4142 Assessment, dB

Receptor	Assessment	Predicted Specific Sound Level, $L_{Aeq,T}$	Predicted Rating Level, $L_{Ar,T}$	Derived Background Sound Level L_{A90}	Difference
1: Twibell Street	Daytime	61	68	44	+24
	Night-Time	61	68	39	+29
2: Roche Close and receptors to east	Daytime	41	46	40	+6
	Night-Time	42	47	29	+18
3: Burton Road and receptors to north	Daytime	52	57	57	0
	Night-Time	52	57	36	+21
4: Belgrave Road and receptors to south	Daytime	25	30	44	-14
	Night-Time	26	31	37	-6
5: Lord Street and receptors to south-east	Daytime	32	37	51	-14
	Night-Time	32	37	39	-2
6: Harborough Hill Road	Daytime	39	44	44	0
	Night-Time	41	46	38	+8

6.2.1 Daytime

The assessment results indicate that during the daytime period the rating levels at the receptors locations assessed are:

- 24dB(A) above the background sound level at Twibell Street.
- 6dB(A) above the background sound level at Roche Close.
- Equal to the background sound level at Burton Road.
- 14dB(A) below the background sound level at Belgrave Road.
- 14dB(A) below the background sound level at Lord Street.
- Equal to the background sound level at Harborough Hill Road.

With reference to BS4142:2014, the high rating level relative to the representative background sound level at Twibell Street, Roche Close, and Belgrave Road, indicate that the specific sound source will have an significant adverse noise impact at these receptors.

At the remaining receptors, as the rating sound level is equal to or less than 5dB(A) above the background sound level, any adverse noise impact would be marginal.

6.2.2 Night-Time

The assessment results indicate that during the night-time, a period during which it is very unlikely that the STOR would operate, the rating levels at the receptor locations assessed are:

- 29dB(A) above the background sound level at Twibell Street.
- 18dB(A) above the background sound level at Roche Close.
- 21dB(A) above the background sound level at Burton Road.
- 6dB(A) below the background sound level at Belgrave Road.
- 2dB(A) below the background sound level at Lord Street.
- 8dB(A) above the background sound level at Harborough Hill Road.

With reference to BS4142:2014, the high rating level relative to the representative background sound level at Twibell Street, Roche Close, Burton Road, and Harborough Hill, indicate that the specific sound source will have a significant adverse noise impact at these receptors.

At the remaining receptors, as the rating sound level is equal to or less than 5dB(A) above the background sound level, any adverse noise impact would be marginal.

However, as stated previously in this Report, it is very unlikely indeed that the STOR facility would operate at night.

7.0 BS8233:2014 Noise Assessment

In addition to the BS4142:2014 assessment, the predicted cumulative ambient noise levels at the assessment locations have been assessed in accordance with BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* with particular reference to the lower external noise limit for amenity areas (gardens) of 50dB(A).

As the proposed development would only operate intermittently, SLR considers that an assessment against the recommended noise limits presented in the standard would be appropriate, as, whilst the BS4142:2014 assessment has identified a number of significant adverse impacts, for the majority of the time the facility would not operate, so the impact, and any mitigation required, should be discussed with reference to the limits presented in BS8233:2014; limits that have been set to protect the internal and external noise environment of sensitive receptors.

7.1 External Noise

The existing baseline ambient noise level during the daytime and the night-time period is presented in Table 4-1. The specific sound level of the site during each assessment period is presented in Table 5-2. The total logarithmically calculated ambient noise level during each assessment period is shown in Table 7-1.

Table 7-1
Predicted External Cumulative Noise Levels, Free-field, dB

Location	Period	Measured Ambient Noise Level $L_{Aeq,T}$	Predicted On-Site Specific Sound Level $L_{Aeq,T}$	Cumulative Ambient Noise Level $L_{Aeq,T}$	Difference Compared with the Daytime Limit of 55dB $L_{Aeq,T}$
1: Twibell Street	Daytime	48.1	60.7	60.9	+5.9
	Night-Time	48.4	61.3	61.5	-
2: Roche Close and receptors to east	Daytime	47.9	41.3	48.8	-6.2
	Night-Time	32.1	41.7	42.2	-
3: Burton Road and receptors to north	Daytime	69.3	51.6	69.4	+14.4
	Night-Time	57.9	52.3	59.0	-
4: Belgrave Road and receptors to south	Daytime	51.2	24.9	51.2	-3.8
	Night-Time	38.4	25.9	38.6	-
5: Lord Street and receptors to south-east	Daytime	50.0	31.9	50.1	+4.9
	Night-Time	36.6	32.0	37.9	-
6: Harborough Hill Road	Daytime	51.2	38.6	51.4	-3.6
	Night-Time	38.4	40.6	42.6	-

It can be seen from Table 7-1 that during the operation of the STOR, the STOR will cause the BS8233:2014 upper limit of 55dB(A) to be exceeded at the following locations²:

- Twibell Street.
- Lord Street.

At Burton Road the limit is exceeded by the existing baseline noise climate.

7.2 Internal Noise

With regards to internal noise levels; Table 7-2 presents a comparison between the cumulative noise during each assessment period and the recommended internal noise limit presented in BS8233:2014. It has been assumed that an open window would reduce external noise levels by 15dB.

The cumulative internal noise levels have been rounded to the nearest decibel.

Table 7-2
Predicted Internal Cumulative Noise Levels, Free-field, dB

Location	Period	Cumulative Internal Noise Level $L_{Aeq,T}$	BS8233:2014 Noise Limit	Difference
1: Twibell Street	Daytime	45.9	35	+10.9
	Night-Time	46.5	30	+16.5
2: Roche Close and receptors to east	Daytime	33.8	35	-1.2
	Night-Time	27.2	30	-2.8
3: Burton Road and receptors to north	Daytime	54.4	35	+19.4
	Night-Time	44.0	30	+14.0
4: Belgrave Road and receptors to south	Daytime	36.2	35	+1.2
	Night-Time	23.6	30	-6.4
5: Lord Street and receptors to south-east	Daytime	35.1	35	+0.1
	Night-Time	22.9	30	-7.1
6: Harborough Hill Road	Daytime	36.4	35	+1.4
	Night-Time	27.6	30	-2.4

7.2.1 Daytime

It can be seen from Table 7-2 that during the operation of the STOR, the STOR will cause the BS8233:2014 daytime internal limit of 35dB(A) to be exceeded at the following locations³:

- Twibell Street.
- Lord Street.

² At the other locations the limit is either met or is already exceeded.

³ At the other locations the limit is either met or is already exceeded.

At Belgrave and Harborough Hill the limit is exceeded by the existing baseline noise climate.

7.2.2 Night-Time

It can be seen from Table 7-2 that during the operation of the STOR, the STOR will cause the BS8233:2014 night-time internal limit of 30dB(A) to be exceeded at the following locations⁴:

- Twibell Street.

At Burton Road the limit is exceeded by the existing baseline noise climate.

⁴ At the other locations the limit is either met or is already exceeded.

8.0 Suggested Boundary Noise Limit

It is evident from the predictions presented in this Report that at those times that the STOR will typically operate (during the daytime), based on the engine composition used in this report (see Table 5-1), the BS4142:2014 assessment has found that the high rating level relative to the representative background sound level at Twibell Street, Roche Close, and Belgrave Road, indicates that the specific sound source will have a significant adverse noise impact at these receptors.

However, out of these three adversely effected receptors, only at Twibell Street will the operation of the STOR cause the BS8233:2014 daytime external noise limit of 55dB(A), and daytime internal noise limit of 35dB(A) to be exceeded.

At Roche Close and Belgrave Road the operation of the STOR would not cause any BS8233:2014 limits to be exceeded. At Burton Road the limit is exceeded by the existing baseline noise climate.

As the STOR will operate intermittently, and normally only during the daytime, SLR consider that any mitigation required should be discussed with reference to the daytime limits presented in BS8233:2014; limits that have been set to protect the internal and external noise environment of sensitive receptors.

In order to prevent the daytime BS8233:2014 external and internal limits being exceeded at Twibell Street SLR would recommend that a noise limit at the southern boundary of the STOR is set to prevent the daytime BS8233:2014 limits being exceeded.

The existing baseline ambient noise level at Twibell Street is 48.1dB(A). On this basis, in order to prevent the operation of the STOR causing the ambient noise level exceeding 50dB(A) (an internal limit of 35dB(A) during the daytime), noise from the STOR must not exceed 45.5dB(A) at Twibell Street.

The nearest property on Twibell Street to the STOR is approximately 82.67m from the nearest engine container, and approximately 63.28m from the southern boundary of the STOR.

In order to meet the internal noise limit of 35dB(A) during the daytime, assuming that an open window would reduce external noise levels by 15dB(A), the noise level generated by the STOR at the southern boundary of the facility must not exceed 58.1dB(A)⁵.

If this limit is not exceeded the internal daytime noise limit at Twibell Street would not exceed 35dB(A) and the daytime external noise limit would not exceed 50dB(A).

⁵ Based on the engine composition used in this report the specific sound level at this boundary is currently 69.4dB(A).

9.0 Cumulative Assessment

In addition to the development detailed in this Report, UK Energy Reserve (an associated company of UK Capacity Reserve) has appointed SLR to undertake a noise assessment for a proposed electricity storage battery development, which is adjacent to the development assessed in this Report.

The BS4142:2014 assessment for the STOR is presented in SLR Report 404.03901.00006.003.

As it is anticipated that both sites may be in operation at the same time SLR has completed a cumulative BS4142:2014 assessment. This cumulative BS4142:2014 assessment is presented below.

Cumulative BS4142:2014 Assessment

The results of the cumulative BS4142:2014 assessment are shown in Table 9-1. It must be noted that the rating levels and the representative background sound levels have been rounded to the nearest decibel.

Table 9-1
Cumulative BS4142:2014 Assessment

Receptor	Assessment	Predicted Specific Sound Level, $L_{Aeq,T}$	Predicted Rating Level, $L_{Ar,T}$	Derived Background Sound Level L_{A90}	Difference
1: Twibell Street	Daytime	50	57	44	+13
	Night-Time	54	61	39	+22
2: Roche Close and receptors to east	Daytime	41	46	40	+6
	Night-Time	42	47	29	+18
3: Burton Road and receptors to north	Daytime	53	58	57	+1
	Night-Time	53	58	36	+22
4: Belgrave Road and receptors to south	Daytime	25	30	44	-14
	Night-Time	26	31	37	-6
5: Lord Street and receptors to south-east	Daytime	32	37	51	-14
	Night-Time	32	37	39	-2
6: Harborough Hill Road	Daytime	39	44	44	0
	Night-Time	41	46	38	+8

Cumulative Daytime

The assessment results indicate that during the daytime period the rating levels at the receptors locations assessed are:

- 13dB(A) above the background sound level at Twibell Street.
- 6dB(A) above the background sound level at Roche Close.
- 1dB(A) above the background sound level at Burton Road.
- 14dB(A) below the background sound level at Belgrave Road.
- 14dB(A) below the background sound level at Lord Street.
- Equal to the background sound level at Harborough Hill Road.

With reference to BS4142:2014, the low rating level relative to the representative background sound level at Burton Road, Belgrave Road, Lord Street, and Harborough Hill Road, indicate that the specific sound source will have a low noise impact at these receptors.

At Twibell Street, and Roche Close the operation of the STOR, and not the battery site, results in a high rating level relative to the background sound level. This indicates that the operation of the STOR would lead to an adverse noise impact at these receptors. To reduce the noise impact of the STOR a boundary noise limit is presented in Section 8 this Report.

This boundary noise limit has been calculated based on the battery development being absent. Should the battery development be permitted the boundary noise limit for the STOR may be higher as the proposed battery development would shield the most effected receptors to the south on Twibell Street.

Cumulative Night-Time

The assessment results indicate that during the night-time, a period during which it is very unlikely that the STOR would operate, the rating levels at the receptor locations assessed are:

- 22dB(A) above the background sound level at Twibell Street.
- 18dB(A) above the background sound level at Roche Close.
- 22dB(A) above the background sound level at Burton Road.
- 6dB(A) below the background sound level at Belgrave Road.
- 2dB(A) below the background sound level at Lord Street.
- 8dB(A) above the background sound level at Harborough Hill Road.

With reference to BS4142:2014, the low rating level relative to the representative background sound level at Belgrave Road and Lord Street indicate that the specific sound source will have a low noise impact at these receptors.

At Twibell Street, Roche Close, Burton Road, and Harborough Hill Road, the operation of the STOR, and not the battery site, results in a high rating level relative to the background sound level. This indicates that the operation of the STOR would lead to an adverse noise impact at these receptors. To reduce the noise impact of the STOR a boundary noise limit is presented in Section 8 of this Report.

This boundary noise limit has been calculated based on the battery development being absent. Should the battery development be permitted the boundary noise limit for the STOR may be higher as the battery development would shield the most effected receptors to the south on Twibell Street.

10.0 Conclusion

UK Capacity Reserve Limited has appointed SLR Consulting Ltd. to undertake a noise assessment for A Standard Temporary Operating Reserve (STOR) development located at Twibell Street, Barnsley.

The noise assessment of the proposals has been carried out in accordance with the guidance contained in British Standard 4142:2014 *Methods for rating industrial and commercial sound* and British Standard 8233:2014 *Guidance on sound insulation and noise reduction for buildings*.

The assessment has been based on the results of a baseline noise survey undertaken at a location representative of the noise environment at the nearest sensitive receptors to the proposed development over weekend daytime and night-time periods.

10.1 Daytime

The BS4142:2014 assessment has found that during the time period that the STOR is most likely to operate, during the daytime the high rating level relative to the representative background sound level at Twibell Street, Roche Close, and Belgrave Road, indicates that the specific sound source will have a significant adverse noise impact at these receptors.

However, out of these three adversely effected receptors, only at Twibell Street will the operation of the STOR cause the BS8233:2014 daytime external noise limit of 55dB(A), and daytime internal noise limit of 35dB(A) to be exceeded.

At Roche Close and Belgrave Road the operation of the STOR would not cause any BS8233:2014 limits to be exceeded. At Burton Road the limit is exceeded by the existing baseline noise climate.

10.2 Night-Time

The BS4142:2014 assessment has found that during the time period that the STOR is unlikely to operate, during the night-time, the high rating level relative to the representative background sound level at Twibell Street, Roche Close, Burton Road, and Harbrough Hill, indicates that the specific sound source will have a significant adverse noise impact at these receptors.

However, out of these four adversely effected receptors, only at Twibell Street will the operation of the STOR cause the BS8233:2014 night-time internal noise limit of 30dB(A) to be exceeded. At Roche Close, Burton Road, and Harbrough Hill Road, the operation of the STOR would not cause the BS8233:2014 limit to be exceeded.

10.3 Boundary Noise Limit

It is evident from the predictions presented in this report that at those times that the STOR will typically operate (during the daytime), based on the engine composition used in this report (see Table 5-1), the BS4142:2014 assessment has found that the high rating level relative to the representative background sound level at Twibell Street, Roche Close, and Belgrave Road, indicates that the specific sound source will have a significant adverse noise impact at these receptors.

However, out of these three adversely effected receptors, only at Twibell Street will the operation of the STOR cause the BS8233:2014 daytime external noise limit of 55dB(A), and daytime internal noise limit of 35dB(A) to be exceeded.

As the STOR will operate intermittently, and normally only during the daytime, SLR consider that any mitigation required should be discussed with reference to the daytime limits presented in BS8233:2014; limits that have been set to protect the internal and external noise environment of sensitive receptors.

In order to meet the internal noise limit of 35dB(A) during the daytime, assuming that an open window would reduce external noise levels by 15dB(A), the noise level generated by the STOR at the southern boundary of the facility must not exceed 58.1dB(A).

If this limit is not exceeded the internal daytime noise limit at Twibell Street would not exceed 35dB(A) and the daytime external noise limit would not exceed 50dB(A).

This limit may be achieved through the selection of quieter plant, changes to the site layout, and mitigation measures to include an acoustic fence at the southern boundary of the site.

APPENDIX 01

Glossary of Terminology

Appendix 01 – Glossary of Terminology

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

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

Table 01-1
Sound Levels Commonly Found in the Environment

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

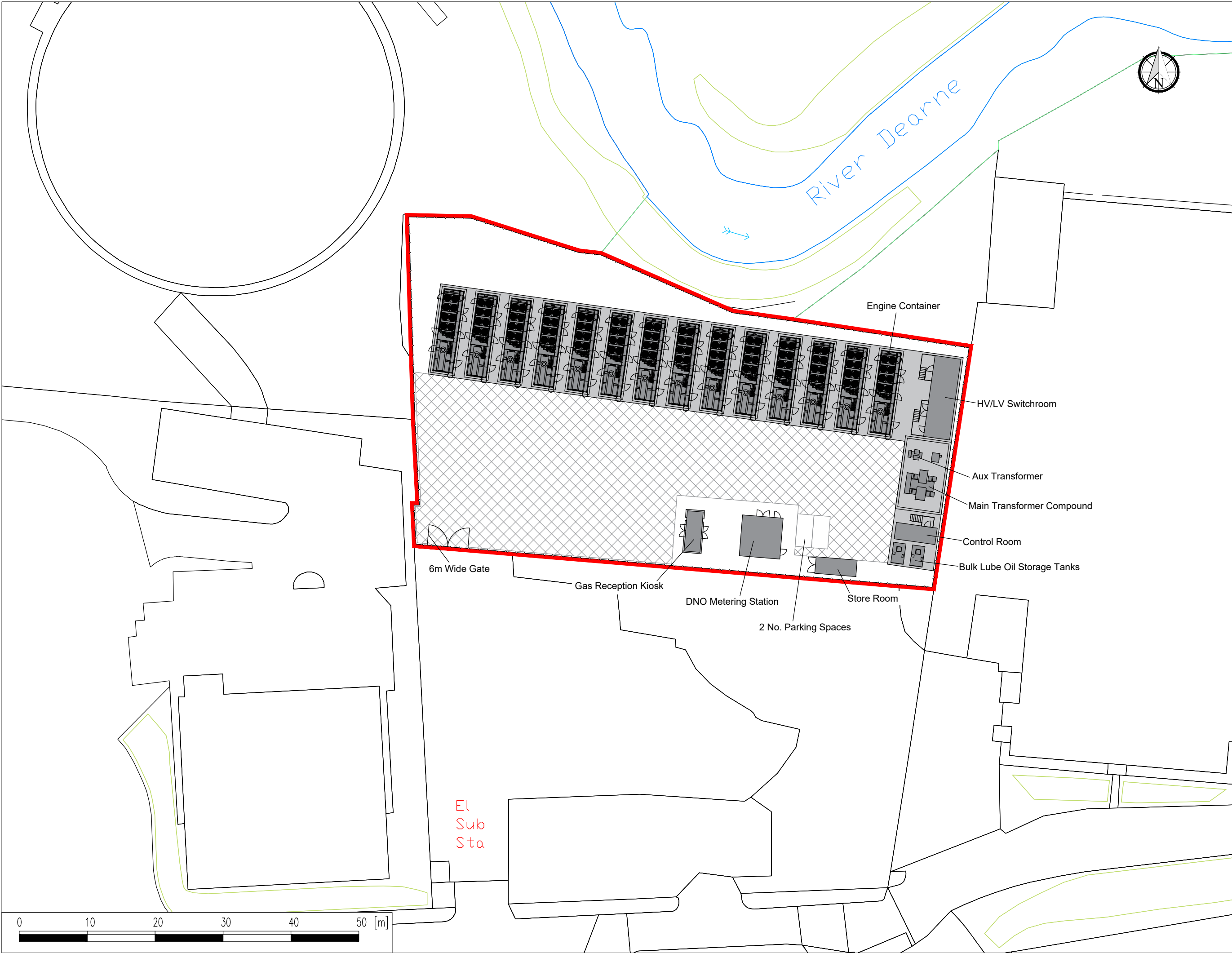
Acoustic Terminology

dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L_{Aeq}	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{Aeq} noise level but will still affect the noise

environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

APPENDIX 02

Proposed Development Site Drawing



Twibell Street,
Barnsley,
S71 1JE

Description:
Site Layout

Key:
Development Area
(0.34Ha):

2.4m High Security Fence:

To be made suitable for
commercial vehicles:



Concrete Slab:



Revision: 1

Scale:
1:500 @ A3

Drawing:
[17260.102](Twibell Street) Site
Plan (Rev.1)

Date:
02/05/2017

Drawn By:
PH

Reviewed By:

Plan not to be used for
construction

ukpowerreserve
SUPPORTING A RENEWABLE FUTURE

6th Floor, Radcliffe
House, Blenheim Court,
Solihull, West Midlands,
B91 2AA

APPENDIX 03

Survey Equipment

Appendix 03 – Survey Equipment

Table 03-1
Survey Equipment

Location	Equipment	Serial Number
1	Cirrus CR:171B type 1 sound level meter	G068726
	Cirrus CR:515 acoustic calibrator	72210
2, 3, 4, and 5	Norsonic 140 type 1 sound level meter	1403012
	Norsonic 1251 acoustic calibrator	31821

APPENDIX 04

Full Survey Results

Appendix 04 – Full Survey Results

Table 04-1
Twibell Street - Measured Noise Levels at the Measurement Position, free-field, dB

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
21/05/2017 10:15	00:05:00	47.7	43.9	50.5	56.6
21/05/2017 10:20	00:05:00	52.2	43.9	50.9	75.6
21/05/2017 10:25	00:05:00	48.0	44.8	50.1	58.2
21/05/2017 10:30	00:05:00	47.2	43.8	49.5	57.2
21/05/2017 10:35	00:05:00	47.7	44.4	49.9	58.8
21/05/2017 10:40	00:05:00	48.5	45.2	50.8	61.1
21/05/2017 10:45	00:05:00	48.1	44.0	50.3	63.5
21/05/2017 10:50	00:05:00	47.9	44.3	50.3	62.3
21/05/2017 10:55	00:05:00	47.0	43.4	49.3	59.8
21/05/2017 11:00	00:05:00	47.5	43.3	49.3	62.0
21/05/2017 11:05	00:05:00	46.8	44.4	48.6	59.5
21/05/2017 11:10	00:05:00	46.6	43.8	48.6	58.0
21/05/2017 11:15	00:05:00	48.2	43.9	50.9	57.4
21/05/2017 11:20	00:05:00	49.1	45.0	51.9	59.1
21/05/2017 11:25	00:05:00	50.4	45.4	53.3	63.9
21/05/2017 11:30	00:05:00	47.8	44.5	49.9	60.7
21/05/2017 11:35	00:05:00	48.2	45.0	50.3	58.8
21/05/2017 11:40	00:05:00	47.7	44.2	49.5	59.6
21/05/2017 11:45	00:05:00	46.8	44.0	48.8	58.9
21/05/2017 11:50	00:05:00	46.8	44.3	48.8	57.4
21/05/2017 11:55	00:05:00	46.5	43.1	49.2	57.8
21/05/2017 12:00	00:05:00	47.3	43.3	50.2	58.9
21/05/2017 12:05	00:05:00	49.5	44.5	52.8	61.5
21/05/2017 12:10	00:05:00	50.0	44.1	53.5	62.9
21/05/2017 12:15	00:05:00	49.6	43.9	52.6	62.0
21/05/2017 12:20	00:05:00	50.5	44.3	53.7	65.9
21/05/2017 12:25	00:05:00	48.0	43.2	50.4	62.9
21/05/2017 12:30	00:05:00	48.6	43.7	51.1	64.0
21/05/2017 12:35	00:05:00	49.7	44.4	52.2	63.1
21/05/2017 12:40	00:05:00	46.2	43.8	48.5	53.1
21/05/2017 12:45	00:05:00	46.6	44.0	48.8	55.1

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
21/05/2017 12:50	00:05:00	46.8	44.1	49.0	56.6
21/05/2017 12:55	00:05:00	48.7	44.2	51.7	58.3
21/05/2017 13:00	00:05:00	48.5	44.3	51.7	61.4
21/05/2017 13:05	00:05:00	51.2	45.5	54.1	67.3
21/05/2017 13:10	00:05:00	46.9	43.8	49.0	56.9
21/05/2017 13:15	00:05:00	46.5	43.7	48.8	56.1
21/05/2017 13:20	00:05:00	47.4	44.1	49.7	58.8
21/05/2017 13:25	00:05:00	46.7	43.7	48.5	58.4
21/05/2017 13:30	00:05:00	49.2	43.9	51.7	60.6
21/05/2017 13:35	00:05:00	49.5	44.2	52.7	61.0
21/05/2017 13:40	00:05:00	46.5	44.2	48.3	58.9
21/05/2017 13:45	00:05:00	45.9	43.5	47.5	60.3
21/05/2017 13:50	00:05:00	48.4	45.8	50.4	55.5
21/05/2017 13:55	00:05:00	49.1	45.4	51.2	61.0
21/05/2017 14:00	00:05:00	48.2	44.5	50.2	62.9
21/05/2017 14:05	00:05:00	49.4	43.3	51.5	65.7
21/05/2017 14:10	00:05:00	46.9	43.4	49.3	56.2
21/05/2017 14:15	00:05:00	47.4	43.6	49.4	62.0
21/05/2017 14:20	00:05:00	45.3	42.9	47.3	59.7
21/05/2017 14:25	00:05:00	48.9	43.3	51.5	63.0
21/05/2017 14:30	00:05:00	47.1	43.3	49.9	57.8
21/05/2017 14:35	00:05:00	49.6	43.9	52.6	64.8
21/05/2017 14:40	00:05:00	45.9	43.1	47.6	60.2
21/05/2017 14:45	00:05:00	45.7	42.8	48.0	60.3
21/05/2017 14:50	00:05:00	46.1	43.3	48.3	59.3
21/05/2017 14:55	00:05:00	45.8	42.9	48.1	58.9
21/05/2017 15:00	00:05:00	47.7	43.6	50.4	60.2
21/05/2017 15:05	00:05:00	46.5	43.3	48.8	55.0
21/05/2017 15:10	00:05:00	48.9	44.0	51.5	63.1
21/05/2017 15:15	00:05:00	47.0	43.7	49.6	58.7
21/05/2017 15:20	00:05:00	47.2	43.5	49.8	61.1
21/05/2017 15:25	00:05:00	47.7	43.3	50.6	59.8
21/05/2017 15:30	00:05:00	52.2	45.2	54.6	67.0
21/05/2017 15:35	00:05:00	50.4	44.4	53.8	62.9
21/05/2017 15:40	00:05:00	49.2	43.2	52.0	64.5

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
21/05/2017 15:45	00:05:00	46.6	41.9	49.7	61.0
21/05/2017 15:50	00:05:00	45.1	42.3	47.5	55.0
21/05/2017 15:55	00:05:00	46.2	43.8	47.9	55.0
21/05/2017 16:00	00:05:00	46.1	41.9	48.4	58.4
21/05/2017 16:05	00:05:00	45.0	42.7	46.6	57.1
21/05/2017 16:10	00:05:00	49.8	42.9	54.7	61.4
21/05/2017 16:15	00:05:00	45.6	42.5	48.0	56.0
21/05/2017 16:20	00:05:00	44.1	41.5	46.3	53.8
21/05/2017 16:25	00:05:00	47.2	42.7	49.0	62.0
21/05/2017 16:30	00:05:00	46.3	42.9	48.8	57.9
21/05/2017 16:35	00:05:00	50.7	43.7	53.7	66.2
21/05/2017 16:40	00:05:00	47.1	43.1	50.0	60.0
21/05/2017 16:45	00:05:00	46.5	42.3	49.3	56.5
21/05/2017 16:50	00:05:00	46.2	42.4	49.3	54.6
21/05/2017 16:55	00:05:00	44.9	42.3	46.9	54.7
21/05/2017 17:00	00:05:00	46.3	42.1	49.3	59.1
21/05/2017 17:05	00:05:00	45.5	42.7	48.0	57.0
21/05/2017 17:10	00:05:00	47.0	42.7	50.2	57.9
21/05/2017 17:15	00:05:00	44.9	41.7	47.3	54.5
21/05/2017 17:20	00:05:00	43.8	41.5	45.5	55.4
21/05/2017 17:25	00:05:00	45.8	42.6	48.4	55.9
21/05/2017 17:30	00:05:00	46.3	43.4	48.6	55.3
21/05/2017 17:35	00:05:00	46.1	42.7	49.1	55.9
21/05/2017 17:40	00:05:00	46.1	42.6	48.6	62.6
21/05/2017 17:45	00:05:00	48.3	42.0	51.6	61.2
21/05/2017 17:50	00:05:00	46.1	43.6	48.2	59.1
21/05/2017 17:55	00:05:00	45.5	42.9	47.7	53.3
21/05/2017 18:00	00:05:00	45.7	43.0	47.9	54.0
21/05/2017 18:05	00:05:00	46.0	43.0	48.4	54.2
21/05/2017 18:10	00:05:00	45.9	43.1	48.3	55.6
21/05/2017 18:15	00:05:00	46.0	43.2	48.3	57.2
21/05/2017 18:20	00:05:00	45.9	42.6	47.9	59.1
21/05/2017 18:25	00:05:00	46.2	42.7	48.8	56.6
21/05/2017 18:30	00:05:00	46.3	42.6	48.5	56.3
21/05/2017 18:35	00:05:00	46.8	43.2	49.6	57.0

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
21/05/2017 18:40	00:05:00	47.8	43.1	50.2	61.2
21/05/2017 18:45	00:05:00	46.2	42.8	48.2	60.6
21/05/2017 18:50	00:05:00	48.0	43.7	50.6	61.9
21/05/2017 18:55	00:05:00	49.3	43.4	52.4	64.3
21/05/2017 19:00	00:05:00	51.0	43.1	55.3	64.8
21/05/2017 19:05	00:05:00	48.0	43.0	49.1	66.8
21/05/2017 19:10	00:05:00	46.8	42.6	49.7	56.2
21/05/2017 19:15	00:05:00	46.3	42.6	48.9	56.4
21/05/2017 19:20	00:05:00	47.7	43.7	50.4	60.4
21/05/2017 19:25	00:05:00	47.0	42.3	50.4	56.9
21/05/2017 19:30	00:05:00	46.5	42.1	48.7	59.9
21/05/2017 19:35	00:05:00	46.2	42.4	48.9	54.3
21/05/2017 19:40	00:05:00	49.1	45.2	52.1	57.2
21/05/2017 19:45	00:05:00	47.0	44.0	49.3	54.9
21/05/2017 19:50	00:05:00	49.0	43.1	52.6	60.5
21/05/2017 19:55	00:05:00	48.0	43.6	50.6	61.4
21/05/2017 20:00	00:05:00	49.3	43.5	52.9	61.3
21/05/2017 20:05	00:05:00	48.2	44.6	50.8	57.7
21/05/2017 20:10	00:05:00	49.2	44.4	51.8	62.8
21/05/2017 20:15	00:05:00	51.1	44.6	54.3	64.3
21/05/2017 20:20	00:05:00	48.8	44.9	51.7	59.3
21/05/2017 20:25	00:05:00	47.5	43.0	50.4	58.7
21/05/2017 20:30	00:05:00	49.2	44.5	52.3	59.5
21/05/2017 20:35	00:05:00	49.5	44.1	53.0	64.0
21/05/2017 20:40	00:05:00	48.0	43.8	51.2	58.3
21/05/2017 20:45	00:05:00	48.0	43.8	50.7	62.9
21/05/2017 20:50	00:05:00	48.7	45.2	51.1	59.2
21/05/2017 20:55	00:05:00	47.9	43.3	50.6	59.1
21/05/2017 21:00	00:05:00	49.1	44.6	51.8	62.3
21/05/2017 21:05	00:05:00	50.4	46.1	53.0	62.3
21/05/2017 21:10	00:05:00	49.0	45.7	51.4	61.1
21/05/2017 21:15	00:05:00	50.9	45.8	52.5	69.0
21/05/2017 21:20	00:05:00	48.8	45.1	51.0	61.0
21/05/2017 21:25	00:05:00	51.7	45.1	55.2	64.7
21/05/2017 21:30	00:05:00	49.6	46.0	52.0	60.5

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
21/05/2017 21:35	00:05:00	52.4	45.9	54.3	70.5
21/05/2017 21:40	00:05:00	50.7	45.2	53.7	59.3
21/05/2017 21:45	00:05:00	50.5	43.8	53.6	66.7
21/05/2017 21:50	00:05:00	50.4	45.9	52.9	58.0
21/05/2017 21:55	00:05:00	46.7	43.2	48.8	55.8
21/05/2017 22:00	00:05:00	48.0	43.2	50.7	65.3
21/05/2017 22:05	00:05:00	46.7	44.1	48.1	55.6
21/05/2017 22:10	00:05:00	48.0	43.2	50.3	58.0
21/05/2017 22:15	00:05:00	46.1	41.3	48.5	57.4
21/05/2017 22:20	00:05:00	45.8	41.5	48.2	55.0
21/05/2017 22:25	00:05:00	48.1	41.9	52.4	57.3
21/05/2017 22:30	00:05:00	45.4	42.7	47.2	51.3
21/05/2017 22:35	00:05:00	45.7	43.1	47.3	57.7
21/05/2017 22:40	00:05:00	43.6	40.2	45.8	52.2
21/05/2017 22:45	00:05:00	50.7	43.8	54.1	64.0
21/05/2017 22:50	00:05:00	45.9	42.0	48.1	54.9
21/05/2017 22:55	00:05:00	43.3	39.2	46.1	53.5
21/05/2017 23:00	00:05:00	46.8	41.2	49.8	61.7
21/05/2017 23:05	00:05:00	43.5	38.4	46.0	53.8
21/05/2017 23:10	00:05:00	45.4	42.0	47.9	55.6
21/05/2017 23:15	00:05:00	45.2	38.8	47.7	57.1
21/05/2017 23:20	00:05:00	46.3	42.0	49.2	58.4
21/05/2017 23:25	00:05:00	44.9	39.4	47.9	56.1
21/05/2017 23:30	00:05:00	44.3	39.2	47.3	52.3
21/05/2017 23:35	00:05:00	42.7	39.7	45.0	55.4
21/05/2017 23:40	00:05:00	42.8	38.1	45.2	61.0
21/05/2017 23:45	00:05:00	43.8	39.3	46.0	59.9
21/05/2017 23:50	00:05:00	42.4	37.8	44.2	61.3
21/05/2017 23:55	00:05:00	43.2	38.5	46.3	59.5
22/05/2017 00:00	00:05:00	42.0	37.1	43.9	53.4
22/05/2017 00:05	00:05:00	42.7	39.1	45.2	55.4
22/05/2017 00:10	00:05:00	43.2	40.3	44.9	55.3
22/05/2017 00:15	00:05:00	45.2	39.7	48.2	54.1
22/05/2017 00:20	00:05:00	43.5	38.9	46.3	52.0
22/05/2017 00:25	00:05:00	40.6	36.2	43.1	51.8

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
22/05/2017 00:30	00:05:00	41.3	37.1	43.8	59.4
22/05/2017 00:35	00:05:00	41.6	38.9	43.6	55.8
22/05/2017 00:40	00:05:00	38.5	35.8	40.5	48.0
22/05/2017 00:45	00:05:00	40.4	35.8	42.9	56.1
22/05/2017 00:50	00:05:00	39.2	35.1	41.7	56.1
22/05/2017 00:55	00:05:00	42.5	36.0	45.0	58.2
22/05/2017 01:00	00:05:00	46.2	35.7	51.2	60.2
22/05/2017 01:05	00:05:00	40.0	35.5	42.6	52.0
22/05/2017 01:10	00:05:00	40.0	35.1	42.4	60.2
22/05/2017 01:15	00:05:00	39.8	34.5	43.1	49.7
22/05/2017 01:20	00:05:00	38.2	33.1	41.5	52.4
22/05/2017 01:25	00:05:00	37.9	34.4	40.1	48.4
22/05/2017 01:30	00:05:00	37.2	34.2	39.4	44.6
22/05/2017 01:35	00:05:00	37.3	34.7	39.7	49.1
22/05/2017 01:40	00:05:00	36.7	33.9	38.8	51.2
22/05/2017 01:45	00:05:00	41.8	33.7	44.2	58.3
22/05/2017 01:50	00:05:00	38.5	34.7	41.2	51.7
22/05/2017 01:55	00:05:00	39.2	34.2	42.1	53.5
22/05/2017 02:00	00:05:00	37.8	33.9	40.8	54.3
22/05/2017 02:05	00:05:00	39.1	34.4	41.7	49.3
22/05/2017 02:10	00:05:00	37.1	33.5	40.0	48.1
22/05/2017 02:15	00:05:00	39.2	33.1	42.8	53.0
22/05/2017 02:20	00:05:00	36.5	32.5	39.3	45.0
22/05/2017 02:25	00:05:00	35.0	32.5	37.6	41.9
22/05/2017 02:30	00:05:00	37.9	33.3	40.8	47.1
22/05/2017 02:35	00:05:00	34.5	32.4	36.2	52.5
22/05/2017 02:40	00:05:00	36.2	32.5	39.0	46.1
22/05/2017 02:45	00:05:00	34.0	31.7	35.8	44.2
22/05/2017 02:50	00:05:00	36.1	32.9	38.6	44.3
22/05/2017 02:55	00:05:00	36.5	33.3	38.6	52.0
22/05/2017 03:00	00:05:00	38.5	33.1	42.2	50.3
22/05/2017 03:05	00:05:00	38.5	33.9	41.3	53.0
22/05/2017 03:10	00:05:00	34.8	32.8	36.7	43.8
22/05/2017 03:15	00:05:00	36.8	33.1	39.0	51.2
22/05/2017 03:20	00:05:00	40.6	35.4	43.7	57.1

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
22/05/2017 03:25	00:05:00	42.5	38.6	44.8	51.2
22/05/2017 03:30	00:05:00	40.4	34.6	43.4	51.8
22/05/2017 03:35	00:05:00	43.1	34.9	44.3	67.3
22/05/2017 03:40	00:05:00	43.0	36.0	46.1	56.8
22/05/2017 03:45	00:05:00	48.2	40.1	52.2	59.8
22/05/2017 03:50	00:05:00	53.5	44.4	57.4	66.1
22/05/2017 03:55	00:05:00	55.3	46.9	59.1	66.2
22/05/2017 04:00	00:05:00	55.7	47.8	59.5	67.1
22/05/2017 04:05	00:05:00	55.8	48.8	59.0	68.1
22/05/2017 04:10	00:05:00	57.2	50.2	60.6	68.4
22/05/2017 04:15	00:05:00	54.0	48.8	56.7	65.8
22/05/2017 04:20	00:05:00	54.0	48.8	56.6	65.1
22/05/2017 04:25	00:05:00	52.2	47.3	54.8	59.5
22/05/2017 04:30	00:05:00	52.3	45.5	54.8	67.7
22/05/2017 04:35	00:05:00	51.7	45.5	53.8	66.5
22/05/2017 04:40	00:05:00	52.7	45.4	53.5	71.6
22/05/2017 04:45	00:05:00	49.3	43.3	52.1	62.1
22/05/2017 04:50	00:05:00	49.6	44.5	52.6	58.5
22/05/2017 04:55	00:05:00	50.0	45.0	52.8	59.0
22/05/2017 05:00	00:05:00	50.5	45.3	53.4	59.8
22/05/2017 05:05	00:05:00	50.7	45.1	53.2	65.3
22/05/2017 05:10	00:05:00	48.5	44.1	51.3	56.5
22/05/2017 05:15	00:05:00	49.4	45.1	52.1	59.4
22/05/2017 05:20	00:05:00	48.1	44.5	50.6	57.3
22/05/2017 05:25	00:05:00	48.8	44.5	51.7	59.6
22/05/2017 05:30	00:05:00	50.3	44.7	52.7	68.3
22/05/2017 05:35	00:05:00	50.2	45.4	52.0	69.1
22/05/2017 05:40	00:05:00	50.8	46.1	53.7	58.8
22/05/2017 05:45	00:05:00	49.5	45.1	52.4	58.2
22/05/2017 05:50	00:05:00	50.3	44.8	52.9	63.2
22/05/2017 05:55	00:05:00	49.1	44.8	51.9	60.3
22/05/2017 06:00	00:05:00	49.6	46.2	51.9	56.8
22/05/2017 06:05	00:05:00	49.5	45.9	51.9	59.2
22/05/2017 06:10	00:05:00	50.6	46.6	52.9	58.7
22/05/2017 06:15	00:05:00	50.7	46.0	52.8	60.8

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
22/05/2017 06:20	00:05:00	49.2	45.8	51.7	56.5
22/05/2017 06:25	00:05:00	48.8	46.0	50.9	58.6
22/05/2017 06:30	00:05:00	50.7	47.3	53.1	59.2
22/05/2017 06:35	00:05:00	49.9	46.2	52.6	58.4
22/05/2017 06:40	00:05:00	51.5	47.7	54.1	59.5
22/05/2017 06:45	00:05:00	50.7	46.3	52.3	65.5
22/05/2017 06:50	00:05:00	50.9	46.8	53.1	63.2
22/05/2017 06:55	00:05:00	52.2	46.7	56.0	61.1
22/05/2017 07:00	00:05:00	49.7	46.5	52.1	57.0
22/05/2017 07:05	00:05:00	49.3	46.0	51.7	56.6
22/05/2017 07:10	00:05:00	48.4	46.1	50.2	56.1
22/05/2017 07:15	00:05:00	49.0	46.4	51.1	56.4
22/05/2017 07:20	00:05:00	49.3	46.5	51.3	57.6
22/05/2017 07:25	00:05:00	50.7	46.8	53.2	62.5
22/05/2017 07:30	00:05:00	50.1	47.0	52.4	60.4
22/05/2017 07:35	00:05:00	49.9	46.1	52.2	63.3
22/05/2017 07:40	00:05:00	50.2	46.6	52.7	58.7
22/05/2017 07:45	00:05:00	48.4	45.9	50.2	57.0
22/05/2017 07:50	00:05:00	49.6	46.4	51.8	58.0
22/05/2017 07:55	00:05:00	49.0	46.3	51.1	58.1
22/05/2017 08:00	00:05:00	50.2	46.0	53.0	60.7
22/05/2017 08:05	00:05:00	51.0	47.5	52.6	65.6
22/05/2017 08:10	00:05:00	49.1	46.8	51.1	55.4
22/05/2017 08:15	00:05:00	49.3	46.3	51.6	56.2
22/05/2017 08:20	00:05:00	48.8	46.2	50.3	65.1
22/05/2017 08:25	00:05:00	49.5	46.5	51.7	60.1
22/05/2017 08:30	00:05:00	49.5	47.3	51.2	61.9
22/05/2017 08:35	00:05:00	48.7	46.7	50.3	56.6
22/05/2017 08:40	00:05:00	48.5	45.8	50.3	60.3
22/05/2017 08:45	00:05:00	49.0	46.4	51.0	58.5
22/05/2017 08:50	00:05:00	50.2	45.5	53.3	64.0
22/05/2017 08:55	00:05:00	48.7	45.2	51.5	57.1
22/05/2017 09:00	00:05:00	49.3	46.0	51.9	59.6
22/05/2017 09:05	00:05:00	47.5	45.1	49.4	55.5
22/05/2017 09:10	00:05:00	47.6	44.5	50.2	57.2

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
22/05/2017 09:15	00:05:00	47.9	45.1	50.3	55.8
22/05/2017 09:20	00:05:00	47.4	44.7	49.9	54.3
22/05/2017 09:25	00:05:00	50.1	45.4	53.3	62.0
22/05/2017 09:30	00:05:00	65.1	45.4	56.5	86.5
22/05/2017 09:35	00:05:00	47.5	45.2	49.0	58.0
22/05/2017 09:40	00:05:00	47.7	44.8	49.2	57.7
22/05/2017 09:45	00:05:00	48.4	45.2	50.7	60.4
22/05/2017 09:50	00:05:00	49.8	45.6	52.5	61.1
22/05/2017 09:55	00:05:00	47.6	45.2	49.3	55.5
22/05/2017 10:00	00:05:00	48.3	44.9	50.5	58.9
22/05/2017 10:05	00:05:00	48.2	45.3	50.6	56.8
22/05/2017 10:10	00:05:00	48.1	44.3	50.9	58.1
22/05/2017 10:15	00:05:00	48.6	44.5	51.2	60.5
22/05/2017 10:20	00:05:00	49.2	44.3	50.6	63.3
22/05/2017 10:25	00:05:00	49.3	45.8	51.6	59.8
22/05/2017 10:30	00:05:00	49.9	44.5	51.9	65.8
22/05/2017 10:35	00:05:00	46.6	44.1	48.4	56.6
22/05/2017 10:40	00:05:00	48.2	45.4	49.8	60.1
22/05/2017 10:45	00:05:00	48.5	45.9	50.5	57.2
22/05/2017 10:50	00:05:00	50.7	46.4	52.2	63.2
22/05/2017 10:55	00:05:00	49.1	44.8	52.0	60.5
22/05/2017 11:00	00:05:00	50.0	45.5	52.8	60.9
22/05/2017 11:05	00:05:00	49.2	46.0	51.3	63.2
22/05/2017 11:10	00:05:00	48.5	45.4	50.4	60.7
22/05/2017 11:15	00:05:00	49.5	45.8	51.5	65.0
22/05/2017 11:20	00:05:00	50.9	46.4	53.4	67.5
22/05/2017 11:25	00:05:00	48.4	45.0	50.5	61.7
22/05/2017 11:30	00:05:00	48.8	44.6	51.3	61.5
22/05/2017 11:35	00:05:00	50.0	45.0	53.4	61.0
22/05/2017 11:40	00:05:00	49.2	45.6	51.7	58.7
22/05/2017 11:45	00:05:00	48.7	44.6	51.2	60.8
22/05/2017 11:50	00:05:00	47.5	44.6	49.9	60.2
22/05/2017 11:55	00:05:00	48.1	45.4	49.8	60.0
22/05/2017 12:00	00:05:00	48.8	45.3	50.0	65.4
22/05/2017 12:05	00:05:00	46.5	44.1	48.3	56.5

Time	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFMax}
22/05/2017 12:10	00:05:00	47.8	44.9	49.7	59.4
22/05/2017 12:15	00:05:00	49.1	45.8	51.7	56.5
22/05/2017 12:20	00:05:00	48.3	45.3	50.5	57.6
22/05/2017 12:25	00:05:00	56.7	44.4	58.4	74.2
22/05/2017 12:30	00:05:00	46.5	44.0	48.7	54.1
22/05/2017 12:35	00:05:00	49.8	45.1	52.4	59.6
22/05/2017 12:40	00:00:27	50.7	47.1	51.6	62.2

Table 04-2
Roche Close - Measured Noise Levels at the Measurement Position, free-field, dB

Date	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFmax}
2017/05/21 10:57	15	50.4	41.5	52.2	69.7
2017/05/21 12:45	15	45.4	41.7	47.4	61.2
2017/05/21 14:23	15	46.3	39.3	48.8	62.8
2017/05/21 15:47	15	47.6	39.1	49.1	71.2
2017/05/22 02:26	5	33.5	29.2	34.5	55.4
2017/05/22 02:31	5	31.8	29.4	33.6	40.3
2017/05/22 02:37	5	31.7	29.6	33.3	41.9
2017/05/22 02:42	5	30.7	28.0	32.6	36.2
2017/05/22 02:47	5	30.6	29.0	32.4	35.6
2017/05/22 02:52	5	33.4	29.9	33.1	60.2

Table 04-3
Burton Road - Measured Noise Levels at the Measurement Position, free-field, dB

Date	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFmax}
2017/05/21 10:37	15	68.0	56.6	71.5	76.5
2017/05/21 12:26	15	67.9	59.5	71.1	81.5
(2017/05/21 14:04	15	68.1	55.0	71.1	84.0
2017/05/21 15:28	15	71.7	56.9	71.1	100.2
2017/05/22 03:00	5	56.0	36.4	55.0	76.7
2017/05/22 03:05	5	56.2	35.7	52.3	75.5
2017/05/22 03:10	5	36.6	35.4	37.6	41.0
2017/05/22 03:15	5	54.7	35.2	44.6	75.9
2017/05/22 03:20	5	62.2	37.2	65.1	81.6
2017/05/22 03:25	5	59.7	39.5	61.1	76.3

Table 04-4
Belgrave Road - Measured Noise Levels at the Measurement Position, free-field, dB

Date	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFmax}
2017/05/21 11:24	15	50.8	44.8	54.1	65.3
2017/05/21 13:21	15	51.5	45.9	54.4	74.1
2017/05/21 14:45	15	52.4	43.5	54	72.9
2017/05/21 16:08	15	49.4	43.1	52.7	66.9
2017/05/22 01:48	30	38.4	37.4	39.4	50.4

Table 04-5
Lord Street - Measured Noise Levels at the Measurement Position, free-field, dB

Date	Duration	L _{Aeq}	L _{A90}	L _{A10}	L _{AFmax}
2017/05/21 11:47	15	47.2	49.3	43.3	65.5
2017/05/21 13:42	15	49.3	51.4	44.2	72.6
2017/05/21 15:05	15	53.0	52.8	41.9	78.5
2017/05/21 16:34	15	47.9	49.9	41.4	67.1
2017/05/22 01:10	30	36.6	39.4	32.7	53.7

APPENDIX 05

Noise Models

Appendix 05– Noise Models

Figure 05-1
Daytime Specific Sound Levels Free-field dB(A)

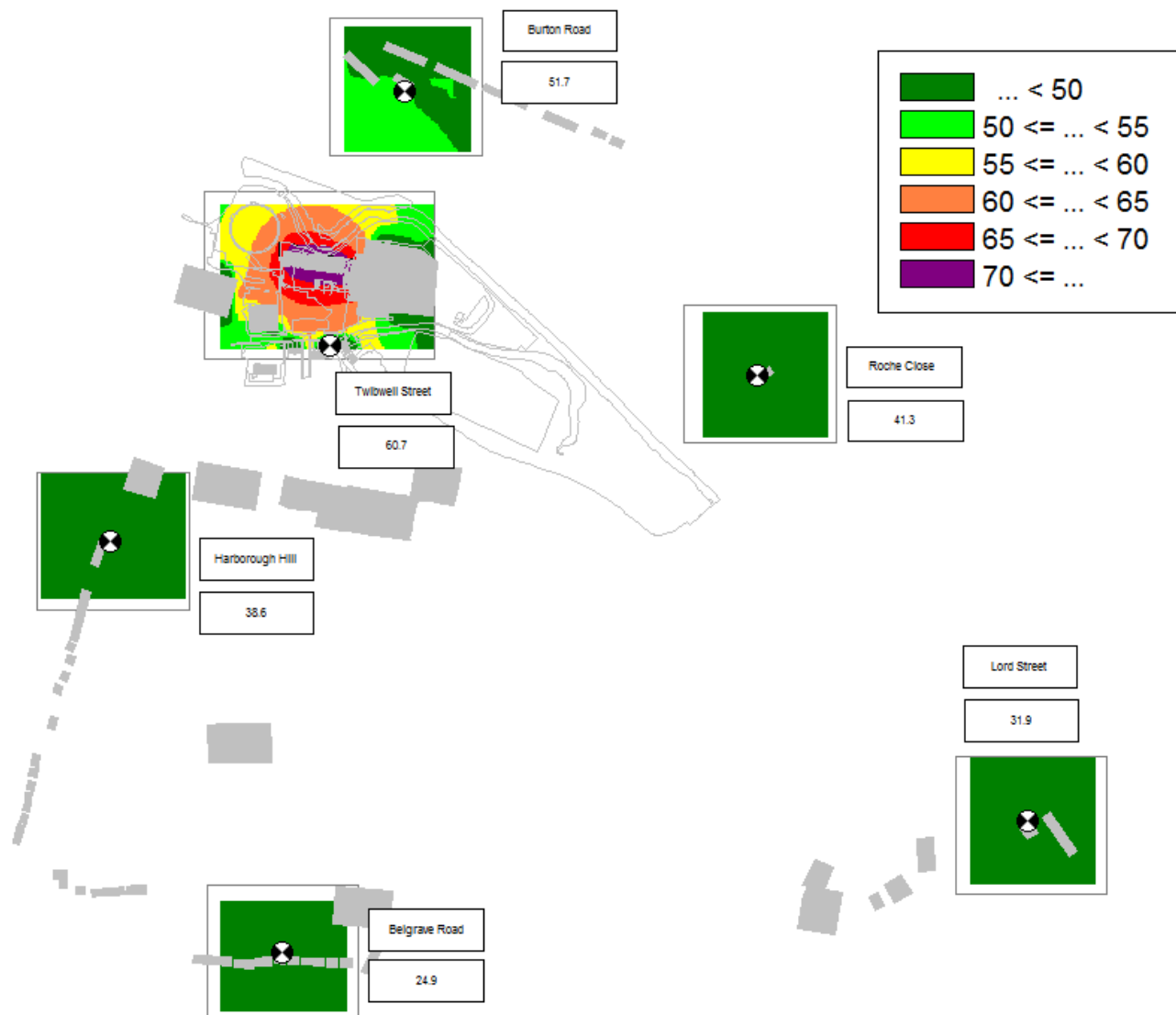
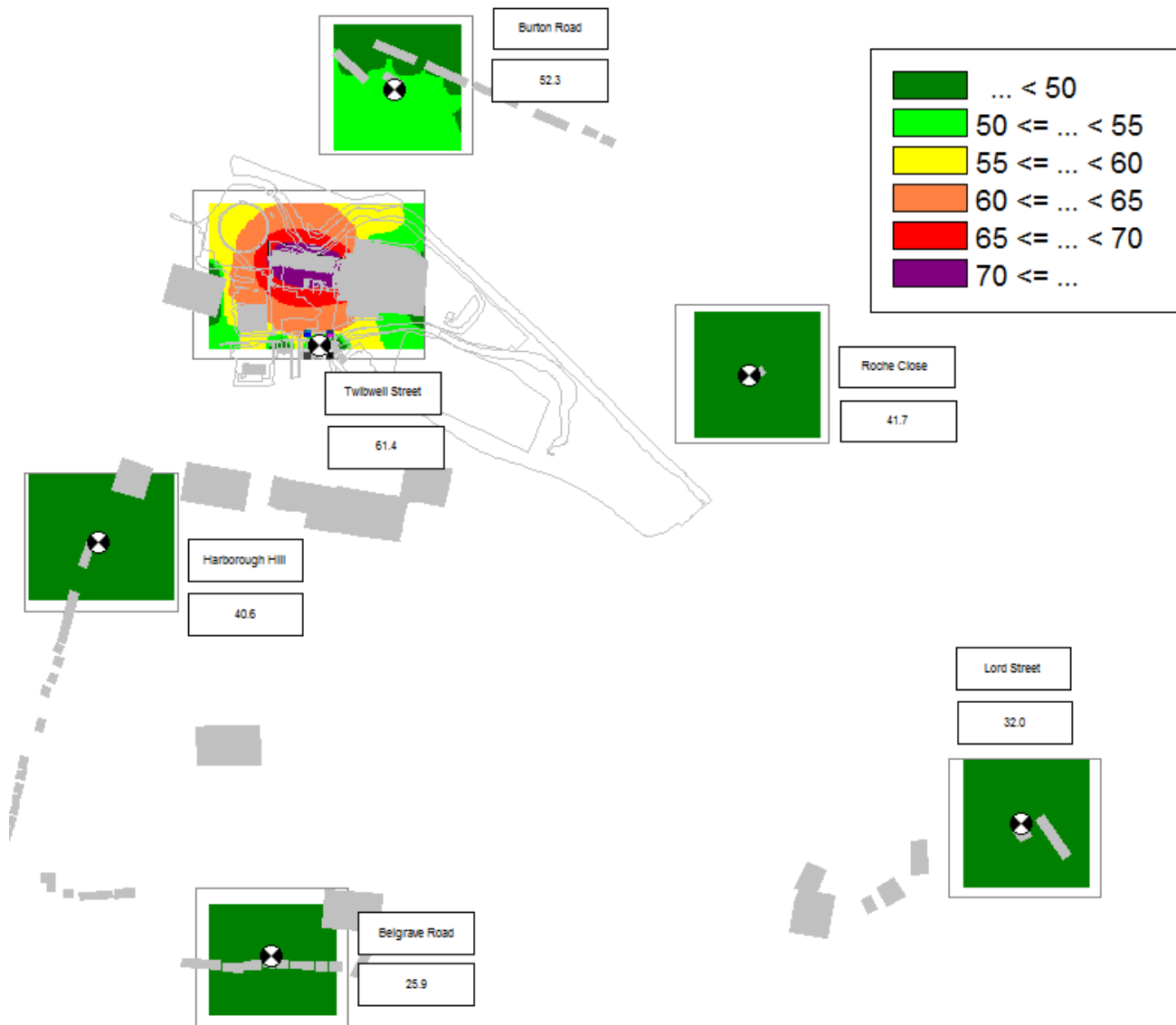


Figure 05-2
Night-Time Specific Sound Levels Free-field dB(A)



APPENDIX 06

Report Limitations

Appendix 06 – Report Limitations

This entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise affecting the site. The objectives of the investigation have been limited to establishing sources of noise material to carrying out an appropriate assessment.

The number and duration of noise measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise emitters. Furthermore, noise sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.

EUROPEAN OFFICES

United Kingdom

AYLESBURY

T: +44 (0)1844 337380

BELFAST

T: +44 (0)28 9073 2493

BRADFORD-ON-AVON

T: +44 (0)1225 309400

BRISTOL

T: +44 (0)117 906 4280

CAMBRIDGE

T: + 44 (0)1223 813805

CARDIFF

T: +44 (0)29 2049 1010

CHELMSFORD

T: +44 (0)1245 392170

EDINBURGH

T: +44 (0)131 335 6830

EXETER

T: + 44 (0)1392 490152

GLASGOW

T: +44 (0)141 353 5037

GUILDFORD

T: +44 (0)1483 889800

LEEDS

T: +44 (0)113 258 0650

LONDON

T: +44 (0)203 691 5810

MAIDSTONE

T: +44 (0)1622 609242

MANCHESTER

T: +44 (0)161 872 7564

NEWCASTLE UPON TYNE

T: +44 (0)191 261 1966

NOTTINGHAM

T: +44 (0)115 964 7280

SHEFFIELD

T: +44 (0)114 245 5153

SHREWSBURY

T: +44 (0)1743 23 9250

STAFFORD

T: +44 (0)1785 241755

STIRLING

T: +44 (0)1786 239900

WORCESTER

T: +44 (0)1905 751310

Ireland

DUBLIN

T: + 353 (0)1 296 4667

France

GRENOBLE

T: +33 (0)4 76 70 93 41