



Hardys Corner, 2 Vale Road

Noise Impact Assessment

297185-00(02)

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RSK

RSK GENERAL NOTES

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1 INTRODUCTION

1.1 Instruction

RSK Environment Ltd has been instructed by [REDACTED] to undertake a noise impact assessment for a proposed residential development at No.2 Vale Road, Northfleet, Gravesend.

A planning application for the development was previously submitted in January 2018 (Ref. 20180023), however, the submission was refused planning in April 2018, with noise being one of the concerns raised by Gravesham Borough Council (GBC). This noise impact assessment report seeks to address the issues raised by GBC and forms part of an appeal of the planning decision.

This report describes the assessment methodology, the baseline conditions currently prevailing across the application site, the effect of the noise levels on the proposed development and how a potential intensification of the industrial activities beyond the site boundary may influence the acoustic environment. Mitigation measures have been identified where necessary to achieve appropriate acoustic standards inside the proposed dwellings, and also within the associated external amenity areas.

1.2 Objectives

The aim of this noise assessment is detailed below:

- Collection of baseline noise data across the application site to establish the pre-development noise environment;
- Collection of source noise data from a proxy skip hire facility to inform the assessment;
- Assessment of site suitability for the proposed residential development; and
- Recommendations for acoustic mitigation measures where necessary to achieve appropriate acoustic standards inside the proposed dwellings and also within associated external amenity areas.

A glossary of acoustic terminology relevant to the assessment is included within Appendix 1.

2 REGULATORY FRAMEWORK

2.1 National Planning Policy Framework (NPPF): 2018

The National Planning Policy Framework (NPPF) (published March 2012 & updated July 2018) is the means by which noise is considered within the planning regime. The NPPF does not contain assessment criteria, instead providing a series of policies, giving local authorities the flexibility in meeting the needs of local communities. The NPPF states:

“Planning policies and decisions should contribute to and enhance the natural and local environment by [...] preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.”

“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;*
- 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.”*

“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.”

2.2 Noise Policy Statement for England (NPSE): March 2010

The Noise Policy Statement for England is published by the Department for Environment, Food and Rural Affairs (Defra) and sets out the approach to noise within the Government’s sustainable development strategy. There are two established concepts from toxicology that are currently being applied to noise impacts (for example, by the World Health Organisation). They are:

- *“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.*

Extending these concepts for the purpose of this NPSE leads to the concept of a Significant Observed Adverse Effect Level.

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

The three aims of the NPSE are stated as:

- avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;
- mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and
- where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

2.3 BS 7445 - Description and measurement of environmental noise

The three-part standard BS 7445 provides the framework within which environmental noise should be quantified. Part 1 (2003) provides a guide to quantities and procedures and Part 2 (1991) provides a guide to the acquisition of data pertinent to land use. Part 3 (1991) provides a guide to the application of noise limits.

BS 7445 also refers to a further standard, BS EN 61672, which prescribes the equipment necessary for such measurements. Whilst BS 7445-1 does not prescribe the meteorological conditions under which noise measurements should or should not be taken, it does (part 2, paragraph 5.4.3.3) recommend that in order:

"...to facilitate the comparison of results (measurements of noise from different sources), it may be necessary to carry out measurements under selected meteorological conditions which are reproducible and correspond to quite stable propagation conditions."

These conditions include:

- Wind speed not exceeding 5 m/s (measured at a height of 3 to 11 m above the ground);
- No strong temperature inversions near the ground; and
- No heavy precipitation.

2.4 BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

Guidance on the acceptable noise levels for living rooms and bedrooms within residential buildings is given in BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' (BS 8233). Advice is given on the design range of internal noise levels, depending on the use of each room and the sensitivity to noise of the operations expected to be conducted in the rooms. An extract of the indoor ambient noise levels for dwellings is reproduced in Table 2-1.

Table 2-1: Indoor Ambient Noise Levels for Dwellings

Activity	Location	Time period	
		07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

The guideline noise levels presented in Table 2.1 represent sources without a specific character, previously termed “anonymous noise”. Occupants of dwellings are usually more tolerant of noise without a specific character than, for example, that from neighbours which can trigger complex emotional reactions. BS 8233 states that lower guideline levels might be appropriate if noise has a specific character i.e. if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content.

The following statement is made in respect of the internal noise levels presented in Table 2-1:

‘Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.’

BS 8233 states the following in relation to noise levels within external amenity areas:

‘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.’

2.5 World Health Organisation Guidelines

The World Health Organisation (WHO) Guidelines for Community Noise was published in 2000 as a response to a need for action together with a generic need for improvements in legislation at a national level. Although not legislation, this document provides general guidance and guidelines which have been set for different health effects, using the lowest noise level that produces an adverse health effect in specific human environments. The guideline levels which are relevant to this assessment are set out in Table 2.2.

Table 2.2 WHO Guidelines for Community Noise Levels

Specific Environment	Critical health effect(s)	$L_{Aeq,T}$ (dB)	Time base, T (hours)	$L_{AF,max}$ (dB)
Outdoor Living Area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50		
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45 ^(a)

Specific Environment	Critical health effect(s)	$L_{Aeq,T}$ (dB)	Time base, T (hours)	$L_{AF,max}$ (dB)
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

(a) Should not exceed 45 dB $L_{AF,max}$ more than 10-15 times a night

The WHO Night Noise Guidelines (NNGL) was published in 2009 and may be considered as an extension to, as well as an update of the WHO Guidelines for Community Noise. The document presents the conclusions of the WHO working group responsible for preparing guidelines for exposure to noise during sleep to protect the public from adverse health effects. The NNGL presents proposed guidelines and interim targets which are reproduced in Table 2.3.

Table 2.3 Proposed Night Noise Guidelines and Interim Targets

WHO NNGL Target	$L_{night,outside}$ (dB) ¹
Interim target 1	55
Interim target 2	40
Night noise guideline	30

¹ The A-weighted average sound level over the 8-hour night period of 23:00 – 07:00 hours

The night noise guideline and the interim targets relate to the overall noise exposure of the population to environmental noise. The two interim targets are proposed in instances where the night noise guideline cannot be achieved in a short-term period.

2.6 International Standard ISO 9613:1996 - Acoustics – Attenuation of sound during propagation outdoors

International Standard: ISO 9613-2: 1996: 'Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation' provides a prediction methodology which is suitable for a wide range of engineering applications where external noise propagation is of interest. The noise source(s) may be moving or stationary and the method considers the following major mechanisms of noise attenuation:

- Geometrical divergence (also known as distance loss or geometric damping);
- Atmospheric absorption;
- Ground effect;
- Reflection from surfaces; and
- Screening by obstacles.

The method predicts noise levels under metrological conditions favourable to propagation from the sound source to the receiver, such as downwind conditions, or equivalently, propagation under a moderate ground-based temperature inversion as commonly occurs at night.

2.7 BS 4142:2014 - Methods for rating and assessing industrial and commercial sound

BS 4142 provides a method for rating industrial and commercial sound sources and assessing the resulting impacts upon people. The method is applicable to fixed plant installations, sound from industrial and manufacturing process and other associated activities.

The rating method takes into account specific source characteristic, such as tonality, impulsivity and intermittency, and this information can be used for assessing sound at proposed new dwellings.

2.8 Professional Planning Guidance on Planning and Noise (ProPG: Planning and Noise): 2017

The ProPG: Planning and Noise guidance document was published in May 2017 by the Association of Noise Consultants (ANC), the Institute of Acoustics (IoA) and the Chartered Institute of Environmental Health (CIEH).

The main objective of ProPG is to provide technical guidance regarding the management of noise affecting new residential developments in England. The document provides advice on good acoustic design and 'aims to protect people from the harmful effects of noise'.

The ProPG documents emphasise the importance of considering acoustics during the early stages of the design process; this approach should enable potential acoustic constraints and/or opportunities to be identified, thereby minimising the reliance on mitigation measures during subsequent design stages. The document also encourages undertaking early consultation with the Local Planning Authority to obtain appropriate feedback on the proposed acoustic methodology.

3 DEVELOPMENT LOCATION

3.1 Site Location and Description

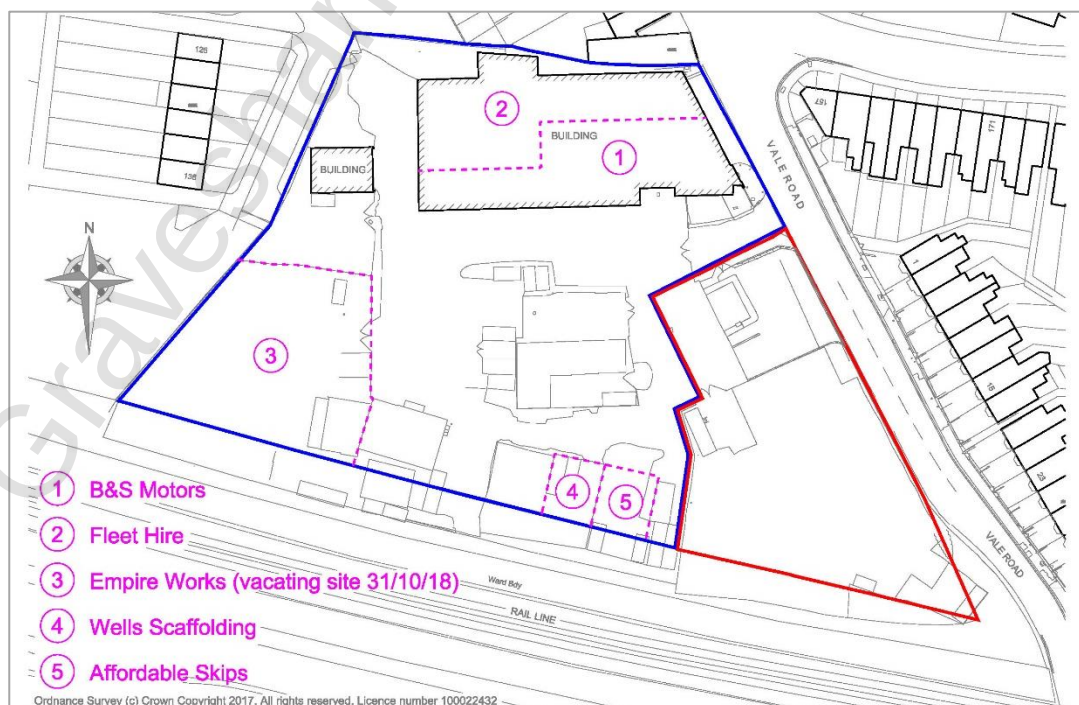
The application site is located at No.2 Vale Road, Northfleet which is situated approximately 2.8km west of Gravesend Town Centre. The site is centred on NGR 562810E, 173610N and covers an approximate area of 0.22 hectares.

The application site forms part of the Hardys Corner Industrial Estate and was previously occupied by a truck sales yard. The site is currently vacant and has been segmented from other parts of the industrial estate with perimeter hoardings. The applicant is the landowner for the industrial estate, as shown by the blue and redline boundaries in Figure 3.1, with the redline depicting the development site. The adjacent land uses to the application site are as follows:

- **North** – Access road for the Hardys Corner Industrial Estate, beyond which is an MOT garage and vehicle hire depot which form part of the industrial estate;
- **East** – Vale Road, beyond which are residential properties;
- **South** – Railway line located in a cutting; and
- **West** – Hardys Corner Industrial Estate which comprises of various land uses including a skip hire facility, scaffolding contractor's compound and a construction laydown area.

The skip hire facility is located adjacent to the application site, however, the plot is currently used as a long-term storage area, with only minimal associated activity. It is understood that all other businesses are utilising the industrial estate in line with their normal operating requirements. The operator of the construction laydown area (Empire Works) is due to vacate the industrial estate on the 31 October 2018.

Figure 3.1 Site Location Plan Including Current Tenants



4 ASSESSMENT METHODOLOGY

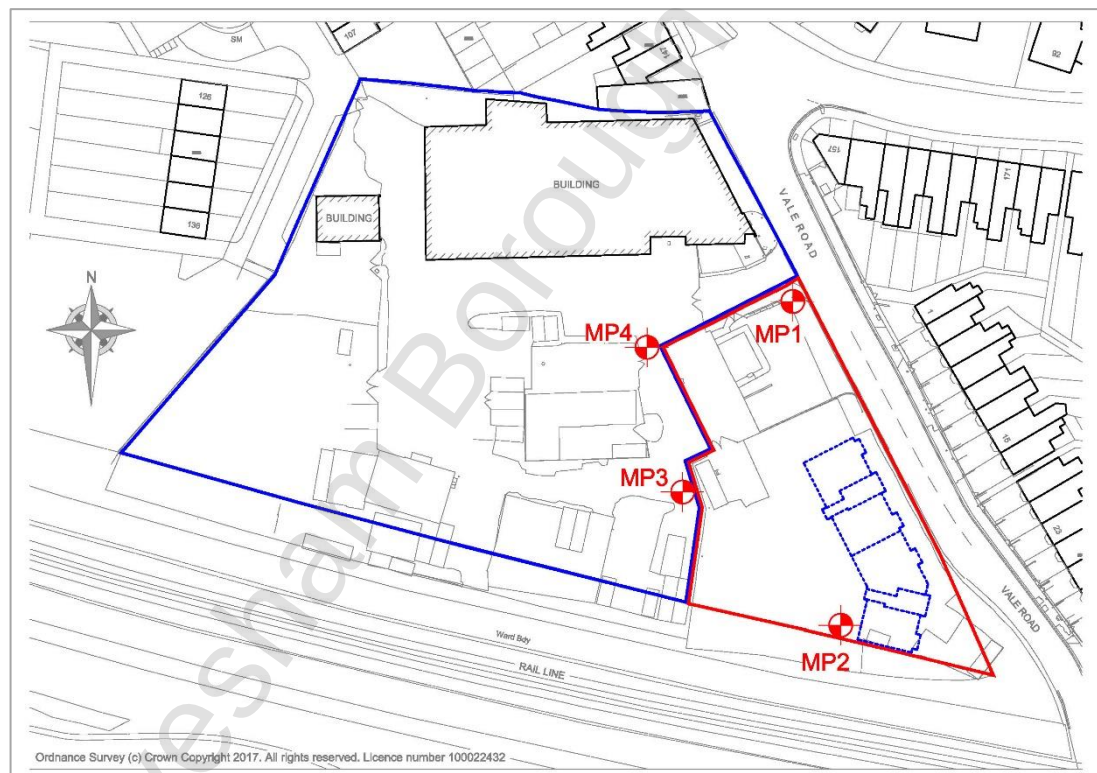
4.1 Baseline Noise Survey

A baseline noise survey has been undertaken to establish the pre-development noise levels across the site, with the resulting dataset used to inform the assessment. Noise monitoring comprised unattended measurements at four positions across the application site.

Prominent noise sources were noted during the deployment and collection of the monitoring equipment, and the meteorological conditions were recorded by means of an on-site weather station.

The monitoring positions are presented in Figure 4.1 and summarised in Sections 4.1.1 to 4.1.4.

Figure 4.1 Noise Monitoring Location Plan



Note: red line boundary denotes the application site, blue line covers other land owned by the applicant and the dashed blue lines present the proposed residential building.

4.1.1 Monitoring Position MP1 – North-Eastern Boundary, Vale Road

Monitoring position MP1 was located at the north-eastern corner of the application site, adjacent to Vale Road and the vehicular access/egress point into the wider industrial estate. The monitoring location was situated approximately 2.5m from the nearside kerb of Vale Road; the nearest façade of the proposed building is located approximately 3.5m from the kerb.

The monitoring installation was secured to a fence post sufficient to enable the microphone to clear the top of the perimeter timber palisade fence by approx. 0.5m.

Monitoring at MP1 was undertaken between Wednesday 4 July 2018 and Tuesday 17 July 2018. MP1 was primarily intended to measure the noise exposure attributable to:

- road traffic on Vale Road and Dover Road to the north;
- vehicle movements on the site access road; and
- the MOT garage to the north.

Figure 4.2 Photo of Monitoring Position MP1



4.1.2 Monitoring Position MP2 – Southern Boundary, Railway

Monitoring position MP2 was located close to the southern boundary of the application site, beyond which the rail line is situated within a cutting. The microphone at monitoring position MP2 was installed at an approximate height of 4m, with the intention of representing an upper floor window that has line of sight to the rail line.

Monitoring at MP2 was undertaken in two separate periods; the first of which was between Wednesday 4 July 2018 and Monday 9 July 2018, with the second period between Friday 13 July 2018 and Tuesday 17 July 2018.

Figure 4.3 Photo of Monitoring Position MP2



4.1.3 Monitoring Position MP3 – Western Boundary, Industrial Estate

Monitoring position MP3 was located centrally along the western boundary of the application site, where it borders the Hardys Corner Industrial Estate.

The microphone at monitoring position MP3 was installed at an approximate height of 3.5m; an elevated microphone height was adopted to clear the perimeter hoarding to ensure that the measurement incorporated contributions from dominant sources in the surrounding area in addition to the industrial activities, such as Vale Road and the rail line.

Monitoring at MP3 was undertaken between Wednesday 4 July 2018 and Tuesday 17 July 2018.

Figure 4.4 Photo of Monitoring Position MP3



During the deployment and collection of the noise monitoring equipment, it was noted that there were only limited activities taking place at the industrial estate. As noted previously, the industrial site use immediately adjacent to the western boundary of the application site comprises of a skip hire company, beyond which is a scaffolding contractor's compound.

It is understood that the skip hire facility primarily consists of a long-term storage area and is not actively used for the storage of skips.

4.1.4 Monitoring Position MP4 – North-Western Boundary, Site Access Road

Monitoring position MP4 was located at the north-western corner of the application site, adjacent to the internal access road for the wider industrial estate.

The microphone at monitoring position MP4 was installed at an approximate height of 3.5m; an elevated microphone height was adopted to clear the perimeter hoarding that has been erected adjacent to the access road.

Monitoring at MP4 was undertaken between Wednesday 4 July 2018 and Tuesday 17 July 2018.

Figure 4.5 Photos of Monitoring Position MP4



4.1.5 Noise Monitoring Equipment – Baseline Survey

The baseline noise monitoring was undertaken using the following equipment:

Table 4.1 Monitoring Equipment – Baseline Survey

Equipment	Type	Serial number	Calibration date
Class 1 Sound Level Meter	RION NL-52	00976225	29/11/2017
	RION NL-52	00976226	29/11/2017
	RION NL-52	00775938	18/08/2017
	RION NL-52	00453840	27/11/2017
Acoustic calibrator	Cirrus CR: 511E	41950	02/08/2017

The calibration of each sound level meter was field checked prior to commencing measurements and prior to removing the equipment from site upon completion; no significant calibration drift was noted.

The sound level meters conform to the requirements of BS EN 61672-1:2013 '*Electroacoustics. Sound level meter, Specifications*'. The calibrator used conforms to the requirements of BS EN IEC 60942:2018 '*Electroacoustics, Sound calibrators*'.

The equipment used has a calibration history that is traceable to a certified calibration institution. Calibration certificates are available on request.

4.1.6 Meteorological Conditions

Weather conditions during the baseline noise survey were established using an onsite weather station. The weather conditions throughout the duration of the baseline survey were considered suitable for environmental noise monitoring.

4.2 Attended Measurements at Proxy Skip Hire Facility

The industrial land use immediately adjacent to the western boundary of the application site comprises of a skip hire facility. The facility is currently used as a general storage area with only minimal activity taking place. To establish the typical noise emissions associated with skip movements, a series of attended noise measurements have been taken at a proxy facility.

Noise source measurements were taken whilst skips were being loaded/unloaded from wagons and placed onto a concrete hardstanding. The resulting dataset has been used to establish the typical noise emissions that would be generated in the event that the facility reverts to conventional skip hire use in the future.

The noise source measurements were taken on Monday 30 July 2018. The weather conditions during the survey were appropriate i.e. dry with wind speeds below 5 m/s.

The noise monitoring was undertaken using the following equipment:

Table 4.2 Monitoring Equipment – Source Measurements

Equipment	Type	Serial number	Calibration date
Class 1 Sound Level Meter	RION NL-52	00453840	27/11/2017
Acoustic calibrator	RION NC-74	34857331	06/06/2018

The calibration of the sound level meter was field checked prior to commencing measurements and upon completion; no calibration drift was noted. The equipment used has a calibration history that is traceable to a certified calibration institution. Calibration certificates are available on request.

Figure 4.6 Photo of Noise Monitoring at Proxy Skip Hire Facility



4.3 Noise Prediction Model – Site Intensification

As noted in Section 3.1, the Hardys Corner Industrial Estate is currently occupied by a number of different businesses which are utilising the industrial estate in line with their normal operating requirements. The exception is the skip hire facility which is not currently being utilised for its intended use. On this basis, if existing tenants were to intensify their use of the industrial estate, it is only expected to have a significant influence on the skip hire facility.

To account for a potential intensification of the industrial estate in the future, specifically the skip hire area situated immediately beyond the western boundary of the application site, a noise prediction model has been prepared to establish what the resultant noise levels would be if this were to occur. This exercise has been undertaken to ensure that the introduction of the residential properties does not serve to prohibit future development across the wider industrial estate i.e. appropriate acoustic mitigation measures are embedded as part of the base design.

The noise prediction model considers the potential site intensification during daytime hours only, rather than day and night. This is on the basis that the operational hours of the site will be restricted as part of the Planning Obligation Under Section 106, as noted below:

“There shall be no onsite deliveries or servicing movements undertaken on the Property on Sundays or Bank Holidays or outside of the following hours;

- 07:00 – 19:00: Monday – Friday
- 09:00 – 18:00: Saturday

No commercial or industrial practices upon this land may operate on Sundays or Bank Holidays or outside of the following hours;

- 08:00 – 20:00: Monday – Friday
- 09:00 – 18:00: Saturday”

For the purposes of the assessment, the following modelling scenario has been considered. It should be noted that this scenario is based on the site being used as a laydown area for skips rather than a waste processing facility, which would not be commensurate with the area of land that is available.

Daytime Modelling Scenario (1-hour reference time interval, T_1)

- Four skips deliveries/collections per hour, with each lifting activity having a duration of two minutes, in line with the source measurements; and
- Eight one-way skip wagon movements within the industrial estate, with wagon speeds not exceeding 15 mph (24 kph).

An overview of the modelling assumptions/settings are presented in Table 4.3.

Table 4.3 Modelling parameters

Item	Setting
Algorithms	International Standard: ISO 9613-2:1996 BS5228-1:2009+A1:2014
Ground Absorption	A hard, acoustically reflective ground surface has been assumed throughout.
Meteorological Conditions	10 degrees Celsius; 70% humidity; and Wind from source to receiver.
Façade Corrections	No corrections applied i.e. free-field equivalent values presented in the results tables throughout.
Receptor Height	Ground floor level set at 1.5m above external ground level. First floor level set at 4m above external ground level. Second floor level set at 6.5m above external ground level.
Source Modelling	Skip movements onto/off a wagon have been modelled as an area source with an overall sound power level of 100 dB(A), at a height of 1m above local ground level. This reflects the source data measured at the proxy site (Section 5.1.5 refers). Movement of skip lorries within the industrial estate have been modelled as a line source. A maximum drive-by sound power level of 106 dB(A) has been applied for the skip wagons, at a height of 0.5m above local ground level; the origin of the source data is BS 5228-1 Ref. C.8.21 – ‘Skip Wagon’. The source data noted above has been modelled with an appropriate on-time correction, in addition to an acoustic feature correction, in line with BS4142:2014.
Terrain	Flat terrain conditions have been applied between source and receiver positions.
Site Layout	Offset Architects drawing ref. 6223-PD-20 (Rev.A) ‘Proposed Site Plan, Street Scene, Site Section & Location Plan’.

5 NOISE MONITORING RESULTS

5.1.1 Unattended Monitoring Position - MP1

A summary of the measured noise levels at monitoring position MP1 are presented in Table 5.1. The table presents the daytime and night-time noise levels which cover the periods between 07:00 to 23:00 hrs and 23:00 to 07:00 hrs respectively. Refer to Appendix 2 for graphical outputs of the monitoring data.

Table 5.1 Noise Monitoring Results - MP1

Date	Time period	Measured noise levels ⁽¹⁾			
		L _{Aeq, T} dB	L _{AFmax, 15min} dB (min - max)	L _{A90, T} dB	L _{A10, T} dB
Wednesday 04/07/2018	Night-time	53.2	54.6 - 83.2	43.3	50.9
Thursday 05/07/2018	Daytime	61.7	72.4 - 102.2	46.1	63.6
	Night-time	53.3	56.0 - 79.8	43.6	50.8
Friday 06/07/2018	Daytime	61.6	72.7 - 98.4	44.0	63.9
	Night-time	52.3	51.3 - 84.8	41.1	49.5
Saturday 07/07/2018	Daytime	59.3	72.3 - 96.4	42.2	61.3
	Night-time	50.4	54.5 - 77.2	34.6	47.0
Sunday 08/07/2018	Daytime	59.5	72.0 - 99.5	39.8	60.0
	Night-time	53.1	53.7 - 78.5	39.4	48.6
Monday 09/07/2018	Daytime	61.2	71.9 - 100.6	44.4	63.2
	Night-time	52.3	45.8 - 79.6	36.1	47.0
Tuesday 10/07/2018	Daytime	61.0	73.3 - 95.4	45.0	63.7
	Night-time	53.0	45.5 - 80.1	36.7	48.2
Wednesday 11/07/2018	Daytime	62.6	72.3 - 101.6	44.6	63.8
	Night-time	52.8	53.2 - 79.0	36.9	49.7
Thursday 12/07/2018	Daytime	60.6	71.0 - 93.10	43.8	63.8
	Night-time	53.3	52.3 - 88.6	33.5	47.4
Friday 13/07/2018	Daytime	60.7	71.8 - 95.9	44.5	63.9
	Night-time	52.1	55.2 - 78.3	40.8	49.8
Saturday 14/07/2018	Daytime	61.4	72.3 - 106.3	43.7	61.8
	Night-time	52.2	56.2 - 81.6	44.0	50.3
Sunday 15/07/2018	Daytime	59.1	71.6 - 93.9	41.9	59.3
	Night-time	53.3	52.6 - 84.6	42.8	50.4
Monday 16/07/2018	Daytime	61.6	72.2 - 101.5	46.2	63.2
	Night-time	53.8	51.0 - 76.5	43.6	51.9

Date	Time period	Measured noise levels ⁽¹⁾			
		L _{Aeq, T} dB	L _{AFmax, 15min} dB (min - max)	L _{A90, T} dB	L _{A10, T} dB
Average ⁽²⁾	Daytime	60.9	-	43.6	62.5
	Night-time	52.7	-	39.4	49.2

⁽¹⁾ L_{Aeq, T} values are the logarithmic average of L_{Aeq, 15min} samples, and the L_{A10, T} and L_{A90, T} are the arithmetic average of L_{A10, 15min} and L_{A90, 15min} samples.

⁽²⁾ Arithmetic average of derived daytime 16hr and night-time 8hr values.

Notable L_{AFmax} values within the dataset are as follows:

- 05/07/18 – L_{AFmax} value of 102.2 dB occurred at approx. 18:00 hrs and was attributable to the site access gate being closed;
- 06/07/18 – L_{AFmax} value of 98.4 dB occurred at approx. 19:00 hrs and was attributable to the site access gate being closed;
- 09/07/18 – L_{AFmax} value of 100.6 dB occurred at approx. 18:00 hrs and was attributable to a manoeuvring van or truck in close proximity to the monitoring position;
- 11/07/18 – L_{AFmax} value of 101.6 dB occurred at approx. 18:00 hrs and was attributable to the site access gate being closed; and
- 14/07/18 – L_{AFmax} value of 106.3 dB occurred at approx. 18:00 hrs and was attributable to a siren from an emergency services vehicle.

5.1.2 Unattended Monitoring Position – MP2

A summary of the measured noise levels at monitoring position MP2 are presented in Table 5.2. The table presents the daytime and night-time noise levels which cover the periods between 07:00 to 23:00 hrs and 23:00 to 07:00 hrs respectively. Refer to Appendix 2 for graphical outputs of the monitoring data.

Table 5.2 Noise Monitoring Results – MP2

Date	Time period	Measured noise levels ⁽¹⁾			
		$L_{Aeq, T}$ dB	$L_{AFmax, 15min}$ dB (min - max)	$L_{A90, T}$ dB	$L_{A10, T}$ dB
Wednesday 04/02/2018	Night-time	51.4	49.8 - 75.1	43.7	50.0
Thursday 05/07/2018	Daytime	54.8	67.4 - 90.9	45.5	54.1
	Night-time	51.0	53.4 - 74.2	44.0	50.0
Friday 06/07/2018	Daytime	54.1	67.2 - 83.5	43.8	54.1
	Night-time	49.5	52.0 - 74.3	41.3	48.1
Saturday 07/02/2018	Daytime	53.6	65.2 - 81.6	42.8	52.8
	Night-time	47.7	48.7 - 82.1	36.3	45.0
Sunday 08/07/2018	Daytime	52.6	61.1 - 80.9	40.8	52.5
	Night-time	50.6	52.5 - 75.1	40.6	47.9
Monday ⁽³⁾ 09/07/2018	Daytime	54.8	68.3 - 78.0	43.2	54.6
Friday ⁽³⁾ 13/07/2018	Daytime	54.0	67.8 - 75.7	44.5	54.6
	Night-time	49.9	52.8 - 74.9	40.8	48.6
Saturday 14/07/2018	Daytime	53.2	60.1 - 84.6	43.6	52.9
	Night-time	48.7	52.3 - 74.2	43.3	48.9
Sunday 15/07/2018	Daytime	52.3	55.7 - 77.7	42.3	51.8
	Night-time	51.1	52.2 - 75.6	43.5	49.1
Monday 16/07/2018	Daytime	54.5	63.9 - 81.5	45.7	53.9
	Night-time	51.7	53.5 - 78.1	43.6	50.4
Average ⁽²⁾	Daytime	53.8	-	43.6	53.4
	Night-time	50.4	-	42.0	48.7

⁽¹⁾ $L_{Aeq, T}$ values are the logarithmic average of $L_{Aeq, 15min}$ samples, and the $L_{A10, T}$ and $L_{A90, T}$ are the arithmetic average of $L_{A10, 15min}$ and $L_{A90, 15min}$ samples.

⁽²⁾ Arithmetic average of derived daytime 16hr and night-time 8hr values.

⁽³⁾ Not full 16hr daytime measurements.

5.1.3 Unattended Monitoring Position - MP3

A summary of the measured noise levels at monitoring position MP3 are presented in Table 5.3. Refer to Appendix 2 for graphical outputs of the monitoring data.

Table 5.3 Noise Monitoring Results – MP3

Date	Time period	Measured noise levels ⁽¹⁾			
		L _{Aeq, T} dB	L _{AFmax, 15min} dB (min - max)	L _{A90, T} dB	L _{A10, T} dB
Wednesday 04/07/2018	Night-time	47.0	50.3 - 74.4	43.0	47.9
Thursday 05/07/2018	Daytime	52.0	55.0 - 87.4	43.9	51.5
	Night-time	47.4	51.4 - 68.7	43.3	48.2
Friday 06/07/2018	Daytime	48.7	54.8 - 84.9	41.6	50.2
	Night-time	45.1	49.4 - 63.3	40.9	46.1
Saturday 07/07/2018	Daytime	47.9	56.0 - 83.8	40.6	48.7
	Night-time	40.8	45.9 - 65.7	35.3	42.0
Sunday 08/07/2018	Daytime	47.9	54.8 - 77.6	39.0	49.6
	Night-time	45.2	48.9 - 62.5	39.8	45.5
Monday 09/07/2018	Daytime	49.1	55.5 - 79.3	42.0	51.1
	Night-time	42.8	43.6 - 68.6	36.5	42.3
Tuesday 10/07/2018	Daytime	51.6	55.5 - 88.7	43.0	51.9
	Night-time	42.8	42.9 - 68.2	36.8	42.2
Wednesday 11/07/2018	Daytime	53.5	56.6 - 91.2	41.8	52.1
	Night-time	43.7	49.3 - 67.1	37.5	45.1
Thursday 12/07/2018	Daytime	49.2	55.8 - 74.2	41.3	51.6
	Night-time	42.4	47.9 - 67.6	34.8	43.4
Friday 13/07/2018	Daytime	51.2	55.0 - 86.9	42.3	52.7
	Night-time	44.3	51.2 - 69.5	37.8	45.2
Saturday 14/07/2018	Daytime	48.6	55.4 - 77.7	42.3	50.4
	Night-time	46.8	50.6 - 86.4	43.4	48.0
Sunday 15/07/2018	Daytime	47.2	54.6 - 80.0	41.0	48.9
	Night-time	46.8	49.2 - 67.6	42.6	47.4
Monday 16/07/2018	Daytime	50.1	56.1 - 81.7	44.4	51.3
	Night-time	47.3	50.5 - 67.9	43.1	48.6
Average ⁽²⁾	Daytime	50.0	-	41.6	50.9
	Night-time	45.1	-	39.3	45.3

⁽¹⁾ L_{Aeq, T} values are the logarithmic average of L_{Aeq, 15min} samples, and the L_{A10, T} and L_{A90, T} are the arithmetic average of L_{A10, 15min} and L_{A90, 15min} samples.

⁽²⁾ Arithmetic average of derived daytime 16hr and night-time 8hr values.

5.1.4 Unattended Monitoring Position - MP4

A summary of the measured noise levels at monitoring position MP4 are presented in Table 5.4. Refer to Appendix 2 for graphical outputs of the monitoring data.

Table 5.4 Noise Monitoring Results – MP4

Date	Time period	Measured noise levels ⁽¹⁾			
		L _{Aeq,T} dB	L _{AFmax, 15mins} dB (min - max)	L _{A90,T} dB	L _{A10,T} dB
Wednesday 04/07/18	Night-time	49.0	50.6 - 87.0	44.2	49.3
Thursday 05/02/2018	Daytime	53.3	60.9 - 91.3	45.1	54.3
	Night-time	49.5	52.0 - 78.0	44.5	49.6
Friday 06/07/2018	Daytime	52.1	61.2 - 87.7	42.5	53.6
	Night-time	47.3	50.7 - 72.1	43.0	47.8
Saturday 07/02/2018	Daytime	50.6	60.5 - 84.8	41.4	51.7
	Night-time	42.7	45.7 - 71.5	36.7	42.6
Sunday 08/07/2018	Daytime	50.4	61.1 - 89.8	40.5	51.8
	Night-time	47.2	48.3 - 71.8	41.6	47.1
Monday 09/07/2018	Daytime	52.4	59.2 - 90.6	43.3	54.3
	Night-time	44.8	43.4 - 72.7	36.8	42.9
Tuesday 10/07/2018	Daytime	52.5	61.2 - 85.5	42.3	54.3
	Night-time	45.8	40.7 - 78.2	36.4	42.3
Wednesday 11/07/2018	Daytime	53.9	60.1 - 89.9	42.3	54.7
	Night-time	46.7	50.0 - 81.1	38.7	46.2
Thursday 12/07/2018	Daytime	52.1	60.2 - 83.1	42.4	54.7
	Night-time	45.7	50.3 - 82.5	36.9	45.0
Friday 13/07/2018	Daytime	52.6	60.4 - 88.4	43.4	55.1
	Night-time	47.2	51.1 - 70.4	42.7	48.5
Saturday 14/07/2018	Daytime	51.6	60.4 - 88.4	43.8	53.2
	Night-time	47.8	51.1 - 70.4	44.6	49.2
Sunday 15/07/2018	Daytime	49.5	59.1 - 82.8	42.6	51.0
	Night-time	48.1	52.1 - 73.1	43.4	48.5
Monday 16/07/2018	Daytime	52.9	60.9 - 87.3	45.6	54.2
	Night-time	48.6	50.2 - 78.2	43.8	49.2
Average ⁽²⁾	Daytime	52.2	-	42.9	53.6
	Night-time	47.2	-	40.8	46.7

⁽¹⁾ L_{Aeq,T} values are the logarithmic average of L_{Aeq,15min} samples, and the L_{A10,T} and L_{A90,T} are the arithmetic average of L_{A10,15min} and L_{A90,15min} samples.

⁽²⁾ Arithmetic average of derived daytime 16hr and night-time 8hr values.

5.1.5 Attended Measurements – Skip Delivery Activities

The source monitoring undertaken at the proxy skip hire facility consisted of several measurements, however, the samples presented in Table 5.5 are considered to be most representative of typical skip deliveries and have therefore been used for the purposes of informing the assessment.

Table 5.5 Overview of Proxy Skip Hire Facility Samples

Ref.	Source Activity	Measurement Info.	
		Distance	Duration
1	Depositing skip from lorry onto concrete hardstanding and then subsequently lifting it back onto the lorry (simulated complete lifting cycle for purpose of the survey). Note: measurement data incorporated other prominent noise producing activities taking place across the wider site.	7m from source	2 mins, 3 secs
2	Depositing skip from lorry onto concrete hardstanding. Note: measurement data incorporated other prominent noise producing activities taking place across the wider site.	5m from source	1 mins, 55 secs
3	Depositing skip from lorry onto concrete hardstanding and then subsequently lifting it back onto the lorry (simulated complete lifting cycle for purpose of the survey). Note: measurement data was taken away from other prominent noise producing activities and is therefore considered to capture the emissions from the skip lifting cycle only.	4m from source	1 mins, 19 secs

The resulting measurement data from the three samples is presented in Table 5.6.

Table 5.6 Measurement Results - Proxy Skip Hire Facility

Ref.	Octave Band Centre Frequency (Hz), dB								dB(A)
	63	125	250	500	1k	2k	4k	8k	
1	77	73	72	71	69	66	63	56	74
2	83	74	74	75	72	71	65	63	78
3	67	68	71	70	68	68	66	58	74

During the measurements, there was noted to be clearly perceptible impulsive characteristics associated with the lifting of skips from the skip lorries.

6 ASSESSMENT

6.1 Appraisal of Results

6.1.1 Roadside Façades (Monitoring Position MP1)

From the measurement data taken at Monitoring Position MP1, it is apparent that the front elevation (eastern façade) of the proposed building will be exposed to the noise levels set out in Table 6.1 below. The design specifications required to achieve the acoustic criteria based on these levels are defined in Section 6.2.

Table 6.1 Roadside Façades – Measured Noise Levels

Condition	Internal Criterion	Time Period	External noise level ⁽¹⁾
Internal noise levels within the proposed dwellings during daytime hours	35 dB $L_{Aeq,16hrs}$	07:00 – 23:00	61 dB $L_{Aeq,16hrs}$
Internal noise levels within the proposed dwellings during night-time hours	30 dB $L_{Aeq,8hrs}$	23:00 – 07:00	53 dB $L_{Aeq,8hrs}$
Internal noise levels within the proposed dwellings during night-time hours from individual events (>10-15 occurrences)	45 dB L_{AFmax}	23:00 – 07:00	77 dB L_{AFmax}

⁽¹⁾ Daytime and night-time $L_{Aeq,T}$ values are the average of the measured noise levels over the duration of the survey, taken from Table 5.1. The L_{AFmax} level in the table does not represent the highest measured level; it is indicative of a level that is unlikely to be exceeded more than 10-15 times during the night.

6.1.2 Railside Façades (Monitoring Position MP2)

From the measurement data taken at Monitoring Position MP2, it is apparent that the building elevations closest to the rail line will be exposed to the noise levels set out in Table 6.2 below. The design specifications required to achieve the acoustic criteria are defined in Section 6.2.

Table 6.2 Railside Façades – Measured Noise Levels

Condition	Internal Criterion	Time Period	External noise level ⁽¹⁾
Internal noise levels within the proposed dwellings during daytime hours	35 dB $L_{Aeq,16hrs}$	07:00 – 23:00	54 dB $L_{Aeq,16hrs}$
Internal noise levels within the proposed dwellings during night-time hours	30 dB $L_{Aeq,8hrs}$	23:00 – 07:00	50 dB $L_{Aeq,8hrs}$
Internal noise levels within the proposed dwellings during night-time hours from individual events (>10-15 occurrences)	45 dB L_{AFmax}	23:00 – 07:00	72 dB L_{AFmax}

⁽¹⁾ Daytime and night-time $L_{Aeq,T}$ values are the average of the measured noise levels over the duration of the survey, taken from Table 5.2. The L_{AFmax} level in the table does not represent the highest measured level; it is indicative of a level that is unlikely to be exceeded more than 10-15 times during the night.

6.1.3 Industrial Estate – General Activity (Monitoring Position MP3)

Based on the measured noise levels at Monitoring Position MP3, it is evident that the noise levels from the industrial estate in its current form are relatively low and hence openable windows could be used for ventilation purposes. However, a potential intensification of industrial activities close to the western boundary of the site will dictate the acoustic performance requirements if it were to occur.

Based on the modelling scenario defined in Section 4.3 of the report, the predicted unmitigated noise levels at the western façade of the proposed building (those which would be affected by the industrial estate) are presented in Table 6.3 and shown graphically in Figure 6.1.

The predicted noise levels presented in the table and contour plot include appropriate BS 4142 acoustic feature corrections. A +9 dB correction has been applied for the main skip yard area to account for the intermittent and impulsive nature of the skip deliveries. The correction is based on a +6 dB for impulsive sound that is clearly perceptible at the receptor, plus +3 dB for intermittency that is readily distinctive against the residual acoustic environment. A +3 dB feature correction has been applied to skip wagon movements within the industrial estate to account for intermittency.

Table 6.3 Industrial Estate Intensification – Predicted Noise Levels

Condition	Internal Criterion	Time Period	External noise level ⁽¹⁾
Internal noise levels within the proposed dwellings during daytime hours	35 dB $L_{Aeq,16hrs}$	07:00 – 23:00	65 dB $L_{Ar,1hr}$
Internal noise levels within the proposed dwellings during night-time hours	30 dB $L_{Aeq,8hrs}$	23:00 – 07:00	45 dB $L_{Aeq,8hrs}$
Internal noise levels within the proposed dwellings during night-time hours from individual events (>10-15 occurrences)	45 dB L_{AFmax}	23:00 – 07:00	65 dB L_{AFmax}

⁽¹⁾ The night-time noise levels have been taken from MP3; this is on the basis that the skip deliveries will not be taking place during the night as defined by the S106. The L_{AFmax} level in the table does not represent the highest measured level; it is indicative of a level that is unlikely to be exceeded more than 10-15 times during the night.

Figure 6.1 Unmitigated Noise Contour Plot at 1.5m A.G.L.¹

Contour plot accounts for intensification of industrial skip hire activities and road traffic noise



6.2 Acoustic Design Measures

6.2.1 External Amenity Noise Levels

It is evident that the BS 8233 / WHO criteria for external amenity spaces will be exceeded within the shared amenity spaces adjacent to the western façade of the building if there is an intensification of industrial activities, as modelled. The criteria will also be exceeded in the shared external amenity space located adjacent to Vale Road at the southern section of the site; this is due to a combination of road traffic and train noise. To address these exceedances, it is recommended that the following noise barriers are installed:

- 3m high reflective noise barrier along the western boundary of the application site in the vicinity of the proposed development building, to provide acoustic screening from the industrial estate;
- 2.5m high reflective noise barrier along the southern boundary of the application site to provide acoustic screening from the industrial estate as well as rail noise;
- 2.5m high reflective noise barrier along the western and northern boundary of the application site in the vicinity of the proposed play area, to provide acoustic screening from the industrial estate and associated internal access road; and
- 2.0m high reflective noise barrier to the perimeter of the shared amenity space situated adjacent to Vale Road.

The barriers will serve to reduce the noise levels within the proposed external amenity areas, in addition to reducing the noise exposure along the western façade of the proposed dwellings, particularly at ground floor level. Following the introduction of the proposed barriers, the noise levels within external amenity areas are predicted to achieve

¹ A.G.L – Above Ground Level

the upper guideline value of 55 dB $L_{Aeq,16hr}$ set out in BS 8233 / WHO criteria. The introduction of the noise barriers will not mean that the noise emissions from the industrial estate are inaudible.

The indicative alignment of the noise barriers is shown in Figure 6.2 and the residual noise levels are presented in Figure 6.3.

Figure 6.2 Image Showing Extent of Noise Barriers

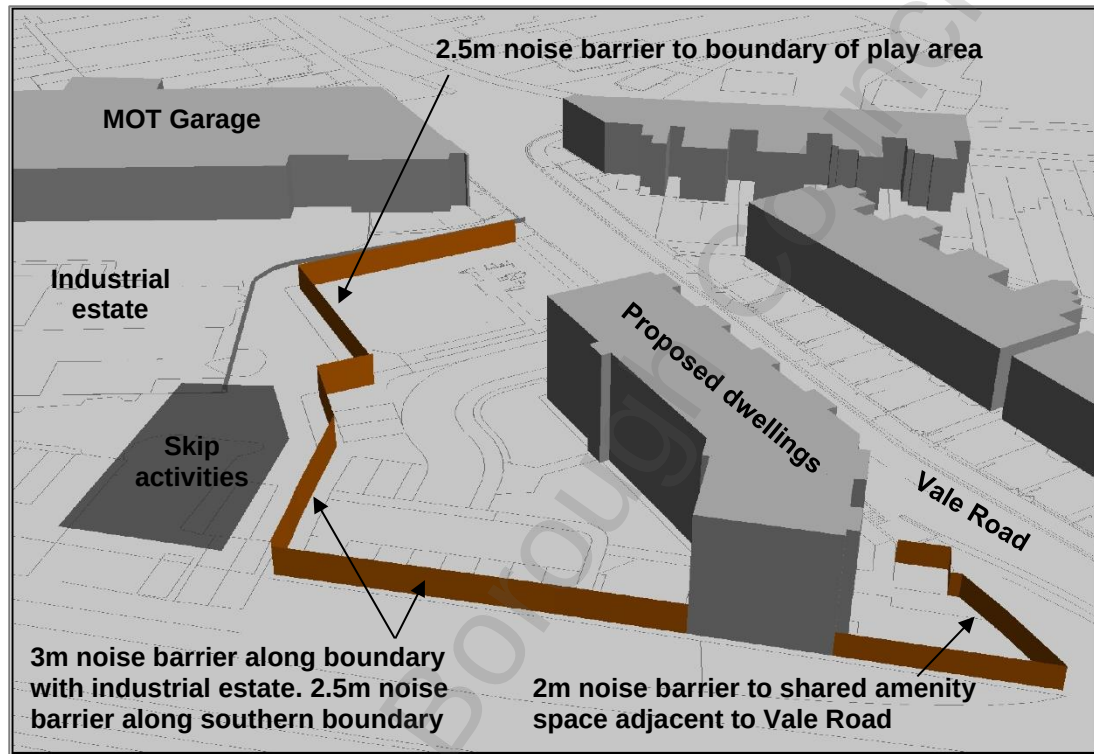


Figure 6.3 Mitigated Noise Contour Plot at 1.5m A.G.L.

Contour Plot accounts for intensification of industrial skip hire activities and road traffic noise



6.2.2 Internal Noise Levels

On the basis that a partially open window typically provides up to 15 dB of attenuation (BS 8233), it is apparent that the internal noise criteria set out in BS 8233 / WHO will not be achieved during a situation in which windows are partially open for ventilation purposes. This will be the case where the measured or predicted external noise levels at the façade of the properties exceed 50 dB $L_{Aeq,16hr}$ during the day and 45 dB $L_{Aeq,8hr}$ / 60 dB L_{AFmax} during the night.

An alternative ventilation strategy will therefore be introduced for the proposed dwellings that will enable windows to be kept closed. In all scenarios, the windows would remain openable at the occupant's discretion, allowing for overheating, rapid or purge ventilation.

To account for the prominent noise sources affecting the site, the internal layout of the dwellings has been configured to minimise potential noise impacts. These include:

- Locating bedrooms along the western façade of the building where practicable, thereby reducing exposure to road traffic noise during the night; there will be no noise producing activities associated with the industrial estate during the night-time; and
- Use of dual aspect rooms at second floor level where practicable, which will enable background ventilation to be provided via the quieter façade.

For the purposes of deriving appropriate acoustic specifications for the façade of the building, the following measured/predicted noise levels have been considered.

Table 6.4 Measured/Predicted Noise Levels

Building Façade	Floor Level	Measured/predicted Noise Levels		
		Daytime ambient, $L_{Aeq,16hr}$	Night-time ambient, $L_{Aeq,8hr}$	Night-time L_{AFmax}
Eastern	Ground	61	53	77
	First	61	53	77
	Second	61	53	77
Western	Ground	52	50	60-63
	First	55	50	65-72
	Second	58	50	65-72

Based on the measured/predicted façade noise levels presented above, it is recommended that the façades of the proposed dwellings incorporate the minimum acoustic specifications set out below in Table 6.5. The initial specifications are provided on the basis of ventilation being provided via trickle vents.

Table 6.5 Minimum Acoustic Performance Requirements

Building Façade	Dominant Source	Floor Level	Acoustic Requirements	
			Glazing	Ventilator ⁽¹⁾
Eastern Façade	Vale Road	Ground floor	$30 R_W + C_{tr}$	$33 D_{ne,W} + C_{tr}$
		First floor	$30 R_W + C_{tr}$	$33 D_{ne,W} + C_{tr}$
		Second floor	$30 R_W + C_{tr}$	$33 D_{ne,W} + C_{tr}$ (Living rooms) $38 D_{ne,W} + C_{tr}$ (Bedrooms)
Western Façade	Industrial Estate / Railway	Ground floor	$30 R_W + C_{tr}$	$33 D_{ne,W} + C_{tr}$ (Flat 1) $30 D_{ne,W} + C_{tr}$ (Other flats)
		First floor	$30 R_W + C_{tr}$	$33 D_{ne,W} + C_{tr}$ (Flat 3) $30 D_{ne,W} + C_{tr}$ (Other flats)
		Second floor	$30 R_W + C_{tr}$	$33 D_{ne,W} + C_{tr}$ (Flat 5 bedroom) $30 D_{ne,W} + C_{tr}$ (All other rooms)

⁽¹⁾ Specification provided for a single ventilator; where multiple ventilators are required for a particular internal area, the ventilator specification will need to be upgraded to suit.

It should be noted that the acoustic performance requirements set out in Table 6.5 are readily available via a number of different specifications. Notwithstanding this, the acoustic performance requirements will be confirmed at detailed design once the internal layouts are confirmed stage; this will include an appraisal of overheating where necessary.

7 CONCLUSIONS

RSK Environment Ltd has been instructed by Mr. R. Sangha to undertake a noise impact assessment for a proposed residential development at No.2 Vale Road, Northfleet, Gravesend. The noise impact assessment forms part of an appeal of the planning refusal.

A baseline noise survey has been undertaken to establish the pre-development noise levels across the site, with the resulting dataset used to inform the assessment. Noise monitoring comprised unattended measurements at four positions across the application site.

The dominant noise source across the application site are noted to be attributable to Vale Road and the rail line to the south of the application site. Other less prominent sources of noise included sporadic activities taking place at the Hardys Corner Industrial Estate, including vehicle movements on the internal access road.

The Hardys Corner Industrial Estate is currently occupied by a number of different businesses which are utilising the industrial estate in line with their normal operating requirements. The exception is the skip hire facility which is not currently being utilised for its intended use. On this basis, if existing tenants were to intensify their use of the industrial estate, it is only expected to have a significant influence on the skip hire facility.

To account for the low levels of noise associated with the Hardys Corner Industrial Estate during the baseline survey, the assessment of noise impacts has considered a theoretical situation in which there is an intensification of current industrial activities. This has been undertaken to ensure that the introduction of the residential properties does not serve to prohibit future development across the wider industrial estate.

The intensification of industrial activities has specifically considered noise associated with the skip hire facility located immediately beyond the western boundary of the application site. To inform this element of the assessment, noise source measurements were taken by RSK at a proxy skip hire facility.

A series of acoustic mitigation measures have been proposed to address the measured and predicted noise levels affecting the proposed development site. These measures include appropriate façade treatments in the form of glazing and ventilator specifications, in addition to the introduction of noise barriers.

Following the introduction of appropriate acoustic mitigation measures, the recommended acoustic conditions can be provided for the proposed dwellings, both internally and externally.

8 REFERENCES

- National Planning Policy Framework. Department for Communities and Local Government. March 2012.
- Noise Policy Statement for England (NPSE). DEFRA, 2010.
- British Standard 4142:2014, Methods for rating and assessing industrial and commercial sound, 2014.
- British Standard 7445, Description and measurement of environmental noise. Parts 1 to 3: Guide to quantities and procedures. British Standards Institution, 1991 to 2003.
- British Standard 8233:2014, Sound insulation and noise reduction in buildings – code of practice. British Standards Institution, 2014.
- Guidelines for community noise. World Health Organisation, 1999.
- Night Noise Guidelines for Europe. World Health Organisation, 2009.
- ISO 9613-2: 1996: Acoustics. Attenuation of sound during propagation outdoors. Part 2: General method of calculation. International Organization for Standardization, 1996.

APPENDIX 1: GLOSSARY

A.G.L – Above Ground Level

L_p - Sound Pressure Level

The basic unit of sound measurement is the sound pressure level, which is measured on a logarithmic scale and expressed in decibels (dB). The logarithmic scale makes it easier to manage the large range of audible sound pressures, and also more closely represents the way the human ear responds to differences in sound pressure:

$$L_p = 20 \log_{10} (p/p_0)$$

where p = RMS (root mean square) sound pressure; and

p_0 = reference sound pressure 2×10^{-5} Pa.

Frequency Weighting Networks

Frequency weighting networks, which are generally built into sound level meters, attenuate the signal at some frequencies and amplify it at others. The A-weighting network approximately corresponds to human frequency response to sound. Sound levels measured with the A-weighting network are expressed in dB(A). Other weighting networks also exist, such as C-weighting which is nearly linear (i.e. unweighted) and other more specialised weighting networks. Variables such as L_p and L_{eq} that can be measured using such weightings are expressed as L_{pA} / L_{pC} , L_{Aeq} / L_{Ceq} etc.

Time Weighting

Sound level meters use various averaging times for the measurement of RMS sound pressure level. The most commonly used are fast (0.125 s averaging time), slow (1 s averaging time) and impulse (0.035 s averaging time). Variables that are measures with time weightings are expressed as L_{AFmax} etc.

L_{Aeq} – Equivalent Continuous Sound Pressure Level

Sound levels tend to fluctuate, and as such an 'instantaneous' measurement like sound pressure level cannot fully describe many real-world situations. A summation can be made of the measured sound energy over a certain period, and a notional steady level can be calculated which would contain the same total energy as the fluctuating sound. This notional level is termed the equivalent continuous sound level L_{eq} . L_{eq} can be determined over any time period, which is indicated as $L_{eq,T}$ where T is the time period (e.g. $L_{eq,24h}$).

In mathematical terms, for n discrete sound level measurements, L_{eq} is given by:

$$L_{eq,T} = 10 \log_{10} (t_1 \times 10^{L_1/10} + t_2 \times 10^{L_2/10} + \dots t_n \times 10^{L_n/10})/T$$

where t_1 = time at level L_1 dB;

t_2 = time at level L_2 dB;

and T = total time

L_{max} - Maximum Sound Pressure Level or Maximum Noise Level

This is the maximum RMS sound pressure level occurring within a specified period. The time weighting is usually specified, such as in L_{Fmax} .

L_N - Percentile or Statistical Levels

Sometimes it is useful to calculate the level which is exceeded for a certain percent of a total period. Background noise is often defined as the A-weighted sound pressure level exceeded for 90% of the specified period T , expressed $L_{90,T}$. Road traffic noise is often characterised in terms of $L_{A10,18}$

Sound Exposure Level (SEL)

Sound exposure level abbreviated as SEL is the constant sound level from a single noise event that has the same amount of energy in one second as the original noise event.

Specific Sound Level ($L_{Aeq,Tr}$)

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T_r .

Rating Level ($L_{Ar,Tr}$)

Specific sound level plus any adjustment for the characteristic features of the sound.

Reference Time Interval (T_r)

Specified interval over which the specific sound level is determined (1 hour during the day 0700-2300 hrs and 15 minutes at night 2300 – 0700 hrs)

APPENDIX 2: NOISE MONITORING RESULTS

Gravesham Borough Council

Figure A2.1 MP1 Noise Monitoring Results

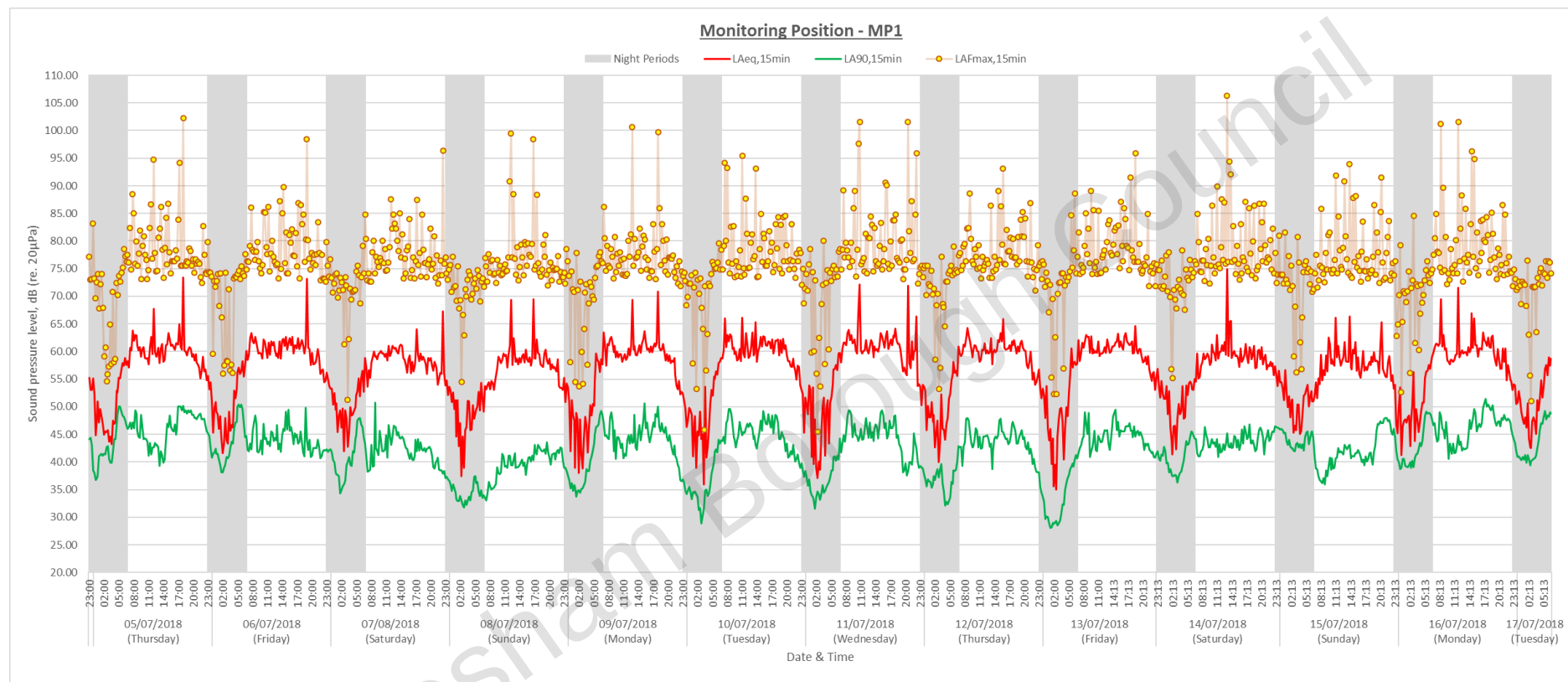


Figure A2.2 MP2 Noise Monitoring Results

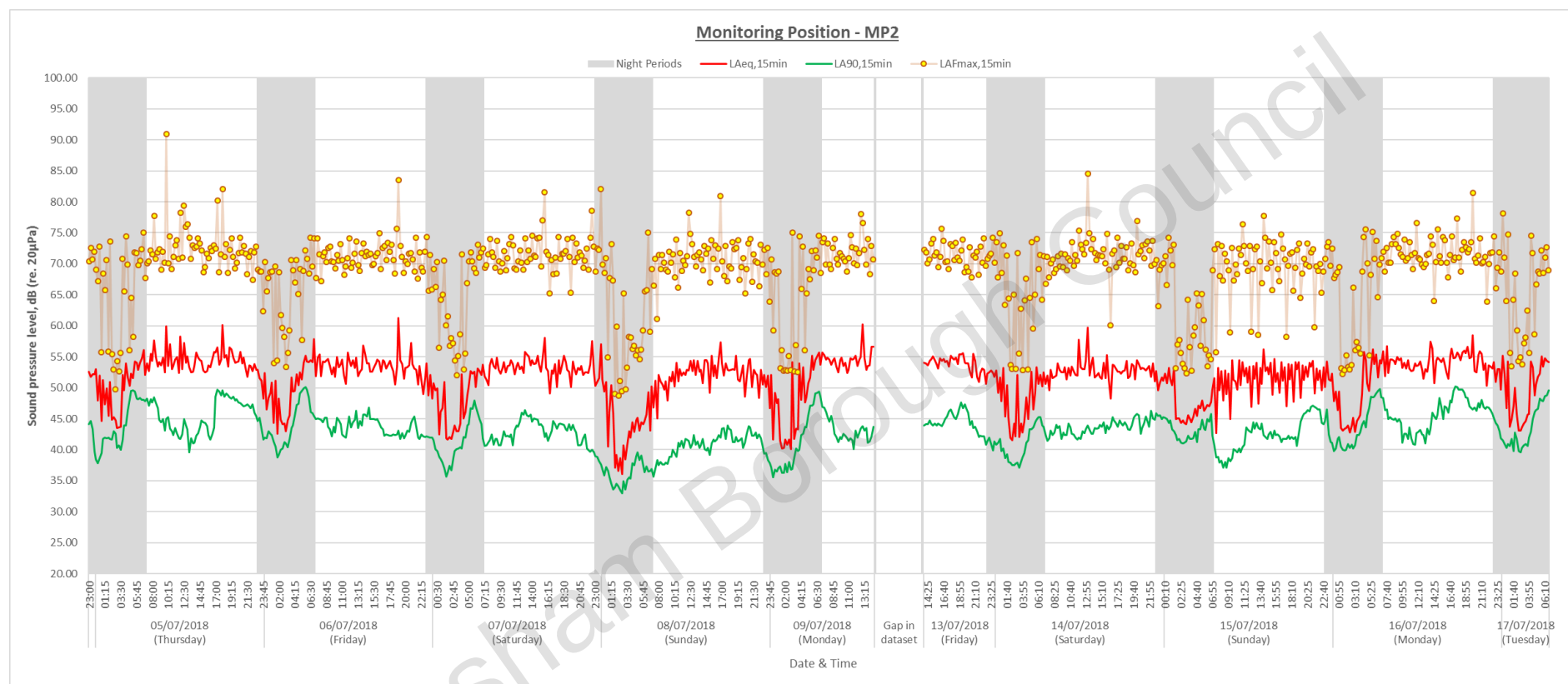


Figure A2.3 MP3 Noise Monitoring Results

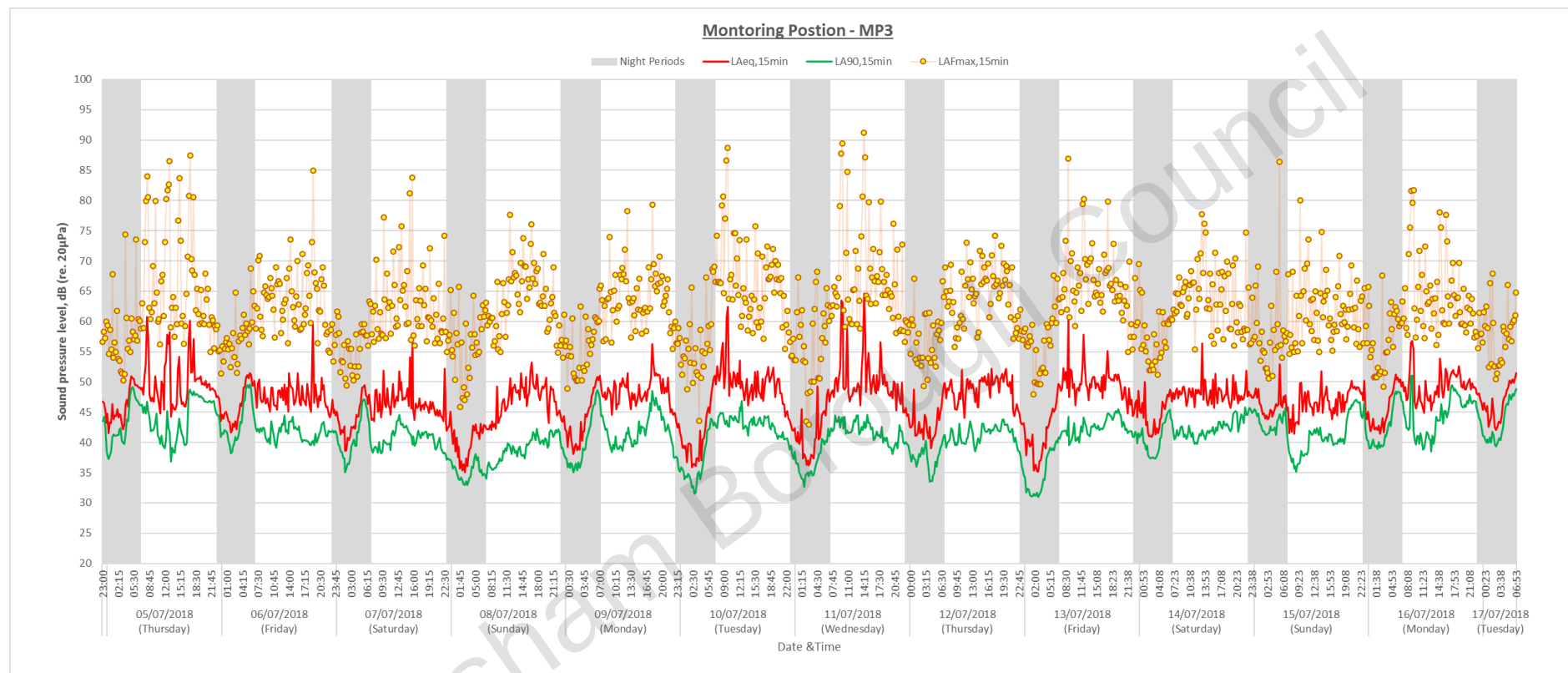


Figure A2.4 MP4 Noise Monitoring Results

