

An architectural rendering of a modern residential courtyard. The scene features two-story brick buildings with multiple windows and balconies. In the foreground, there is a landscaped area with green grass, stone retaining walls, and several wooden benches. A path leads through the courtyard, flanked by trees and shrubs. The overall atmosphere is bright and sunny.

Gas Holder Site, Reading

Noise Assessment

April 2019

**Gas Holder Site at
Alexander Turner Close,
Reading**

**Prepared for
Danescroft (Kenavon Drive
Project Management) LLP**

by

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April 2019



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SMA Ref: 5757/NA

Issue Status: 01

DOCUMENT CONTROL			
Project	Gas Holder Site at Alexander Turner Close, Reading		
Job No.	5757		
Document Title	Noise Assessment		
File Location	N:\Admin Project\5700 to 5799\5757 - Gas Holder Site, Reading\Report\Noise\5757 - Noise Report - 01.docx		
Prepared by	Jason Mills	Date	15/03/2019
Reviewed by	Stewart Andrews	Date	25/03/2019
Approved by	Stewart Andrews	Date	04/04/2019
Document Issue	Description / Changes	Revised by	Date
First DRAFT	Internal review and comment	JPM	22/03/2019
Second DRAFT	Issued to Client for comment	JPM	25/03/2019
01	Issued to the Client for Submission	JPM	04/04/2019



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ACRONYMS AND ABBREVIATIONS

'A' weighted	The weighting that is applied to measured sound pressure levels so that the levels correspond more closely to the subjective response of the human ear - expressed as dB(A)
ABC Method	BS 5228 Method for determining the threshold of significance and associated construction impacts
°C	Degrees Celsius
BRE	Building Research Establishment
BS 5228	Code of practice for noise and vibration control on construction and open sites (2014)
BS 8233	Guidance on sound insulation and noise reduction for buildings (2014)
CIRIA	Construction Industry Research and Information Association
CRTN	Calculation of Road Traffic Noise
dB	Decibel – unit of measurement of sound
EHO	Environmental Health Officer
LA10, T	Noise level exceeded for 10% of the time period (T) expressed in decibels with an A weighting
L _{Aeq,T}	A weighted equivalent continuous noise level over a time
L _{Amax}	A weighted maximum noise level
ms ⁻¹	Metres per second
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NPSE	National Policy Statement for England
ProPG	The Professional Practice Guidance on Planning and Noise
RBC	Reading Borough Council
SLM	Sound Level Meter
SMA	Stuart Michael Associates Limited
WHO	The World Health Organisation



1.0 INTRODUCTION

- 1.1 Stuart Michael Associates (SMA), Consulting Engineers, has been appointed by Danescroft (Kenavon Drive Project Management) LLP (the Applicant) to undertake a Noise Assessment for the proposed residential development at the Gas Holder site, Alexander Turner Close, Reading. Refer to **Figure 1.1** for the site location.
- 1.2 Proposals for the site are the “Demolition of existing buildings and Gas Holder and the erection of new buildings ranging between 2 and 9 storeys in height, providing 130 residential units (Class C3) with associated access, car parking, landscaping and open space”. Refer to **Appendix 1** for a copy of the proposed Site Layout.

Site Description

- 1.3 The site occupies a triangular piece of land which is bounded to the south and southeast by the River Kennet, to the west by an existing residential area and to the north by a railway line which crosses over the river adjacent to the site.
- 1.4 Vehicular access to the proposed development will be from Robert Parker Road which is to the west of the site. Wider vehicular access to the site is from Kenavon Drive and the A329 Forbury Road.
- 1.5 Pedestrian access to the site will be from Robert Parker Road (town centre and the train station via existing pedestrian links) and the footbridge over the river (via existing pedestrian links from the south).

Assessment Methodology

- 1.6 For this study a noise impact assessment has been carried out in order to determine the constraints on the development. The constraints are how the existing environment, such as railway noise, will impact on the development.
- 1.7 Constraints on development with regard to noise levels have been assessed using measured sound levels adjacent to the site and modelled sound levels at the development site. A noise level survey was undertaken adjacent to the site. SoundPLAN noise modelling has been used to determine the noise profile throughout the site, the modelling incorporates the topography of the site and surrounding area, and railway traffic and road traffic flows for the surrounding rail and road network.



1.8 The basic outline methodology employed is detailed below:

Utilise recorded sound levels to determine the baseline noise profile of the site;

Determine the impacts from construction activities on local receptors using BS 5228;

Utilise recorded traffic flow data, LiDAR and topographical surveys, and the illustrative masterplan to establish the noise profile of the site using SoundPLAN;

Determine the potential constraints of the existing environment for proposed sensitive receptors;

Compare the constraints against relevant noise standards and objectives; and

Where appropriate recommend mitigation measures.

The Nature, Measurement and Effect of Noise

- 1.9 Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to measure the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.
- 1.10 The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB(A), has been shown to correlate closely to the subjective human response.
- 1.11 When related to changes in noise, a change of ten decibels from, for example, 60 dB(A) to 70 dB(A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB(A) to 60 dB(A) would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible. **Table 1.1** details typical noise levels.



Table 1.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In a car
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain



2.0 POLICY AND LEGISLATION

- 2.1 It is important to consider the relevant legislation, policy and associated guidance in relation to noise effects on the development. Following the revocation of Planning Policy Guidance Note 24 'Planning and Noise' (PPG24), the National Planning Policy Framework (NPPF), British and International Standards and local authority guidance have become the relevant national guidance with regard to noise and new residential developments. The NPPF was revised on 24th July 2018 with minor updates in February 2019. At the heart of the NPPF is a presumption in favour of sustainable development.

National Planning Policy Framework (NPPF)

- 2.2 The NPPF sets out the Government's latest planning policies for England. There are a number of sections within the NPPF which mention noise in a planning context and they have been reproduced below.
- 2.3 The first time noise is mentioned is within Section 15 - "Conserving and enhancing the natural environment". Paragraph 170 states that:

"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;..." (Paragraph 170).

- 2.4 Paragraph 180 states that "Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, 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:



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;
Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and
Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.”

National Planning Practice Guidance (NPPG)

- 2.5 The National Planning Practice Guidance (NPPG), published March 2014, provides advice on how to determine the noise impact on development:

“Local planning authorities’ plan-making and decision taking should take account of the acoustic environment and in doing so consider:

whether or not a significant adverse effect is occurring or likely to occur;
whether or not an adverse effect is occurring or likely to occur; and
whether or not a good standard of amenity can be achieved.

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy.” (Paragraph 004).

- 2.6 The document goes on to provide a definition for the levels of noise exposure at which an effect may occur:

“Significant observed adverse effect level: this is the level of noise exposure above which significant adverse effects on health and quality of life occur.

Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.



No observed effect level: this is the level of noise exposure below which no effect at all on health and quality of life can be detected.” (Paragraph 005).

- 2.7 It is important to understand that as the NPPG does not provide any advice with respect to specific noise levels or limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment.

Noise Policy Statement for England (NPSE)

- 2.8 The Noise Policy Statement for England (NPSE) aims to “through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

avoid significant adverse impacts on health and quality of life;
mitigate and minimise adverse impacts on health and quality of life;
and
where possible, contribute to the improvement of health and quality of life”. (Paragraph 1.8).

ProPG: Planning & Noise

- 2.9 The Professional Practice Guidance on Planning and Noise (ProPG) has been produced by the Institute of Acoustics (IOA), the Association of Noise Consultants (ANC), and the Chartered Institute of Environmental Health (CIEH) to provide practitioners with guidance on the management of noise within the planning system in England.

- 2.10 Amongst other things, ProPG aims to:

“Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
encourages the process of **good acoustic design** in and around new residential developments;
outline what should be taken into account in deciding planning applications for new noise-sensitive developments;
promote appropriate noise exposure standards;
And assist the delivery of sustainable development.” (Paragraph 1.6).



- 2.11 The Guidance provides recommended approaches for new residential developments and offers recommendations to the decision maker. For example, ProPG recommends that maximum internal noise levels should not normally exceed 45 dB $L_{A_{MAX,F}}$ more than 10 times per night.

Calculation of Railway Noise 1995 (CRN)

- 2.12 Within the UK the Department of Transport's publication Calculation of Railway Noise a method is prescribed which needs to be followed when assessing noise from railways.
- 2.13 The Technical Memorandum mainly deals with determining eligibility for insulation of residential properties from railway noise under the conditions specified in the Noise Insulation Regulations 1995.
- 2.14 However, CRN can be used to assess the likely impact of noise from railways, the design and location of new tracks or land use planning near existing or planned railways.
- 2.15 Section III of CRN details the procedures to be followed when measuring railway noise.

Calculation of Road Traffic Noise 1988 (CRTN)

- 2.16 It is common practice in the UK to assess the impacts of road traffic noise in accordance with the method prescribed in The Department for Transport document 'Calculation of Road Traffic Noise 1988 (CRTN)'. Paragraph 1 of the introduction states that:

"These procedures are necessary to enable the entitlement under the Noise Insulation Regulations to be determined but they also provide guidance appropriate to the calculation of traffic noise for more general applications e.g. environmental appraisal of road schemes, highway design and land use planning"

- 2.17 Section II and Section III of CRTN outline the procedures to be followed when calculating the prediction method for future road traffic noise.
- 2.18 All noise levels are expressed in the terms of the index $L_{10,(T)}$ dB(A) where L_{10} is the noise level exceeded for 10% of the time period (T) expressed in decibels with an A weighting, which broadly agree with the range of human hearing.



- 2.19 Chart 7 in CRTN and the associated formulae can be used to adjust the recorded/calculated sound level from road traffic with a change in distance from the source.

BS 8233:2014 and WHO Guidelines

- 2.20 Guidance on absolute limits for noise inside buildings is provided in BS 8233:2014 “Sound insulation and noise reduction for buildings – Code of practice”. Similar guidance can also be found in the current World Health Organisation (WHO) “Environmental Noise Guidelines for the European Region” and the BRE / CIRIA document “Sound control for homes”. A summary of the noise criteria can be seen in **Table 2.1**.

Table 2.1: Summary of Internal Noise Criteria: BS 8233 & WHO

Criterion	Activity	Location	0700 to 2300	2300 to 0700
BS 8233:2014	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 $L_{Aeq,8hr}$
WHO Onset of sleep disturbance		Bedroom		30 dB $L_{Aeq,8hr}$

- 2.21 Guidelines for external noise levels in public and private open space, such as gardens and parks, is available in the WHO guidelines. According to the WHO guidelines, during the daytime ($L_{eq,16hr}$), moderate annoyance may be experienced at noise levels between 50 dB(A) and 55 dB(A) and serious annoyance may be experienced above 55 dB(A).
- 2.22 During the night-time ($L_{eq,8hr}$), an interim target (IT) level of 55 dB(A) is recommended (from WHO Night Noise Guidelines for Europe – 2009). The 55 dB(A) is the lowest observed adverse effect level (LOAEL).
- 2.23 However, it should be noted that the WHO Guidelines for Community Noise – 1999 recommend an external night-time noise level of 45 dB(A) ($L_{eq,8hr}$) in relation to the reduction in noise level through an open window to achieve an internal noise level in bedrooms of 30 dB.



2.24 With regard to the prediction of noise levels from road traffic noise, the $L_{10,18hr}$ can be converted to $L_{Aeq,16hr}$ by subtracting 2 dB from the $L_{A10,18hr}$ (BS 8233 paragraph 6.2.2) $L_{Aeq,16hr} = L_{A10,18hr} - 2 \text{ dB}$.

2.25 The night-time noise level, $L_{Aeq,8hr}$, can be calculated from $L_{A10,18hr}$ using the conversion formula in the TRL document “Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping”.

BS 5228-1:2009

2.26 Within BS 5228 “Code of practice for noise and vibration control on construction and open sites – Part 1: Noise” a method for predicting noise from construction activity is provided. It is the accepted Standard employed for the assessment of noise and vibration from construction sites.

2.27 The Standard also provides a framework for good working practice and guidance on methods of mitigating noise by employing a number of different techniques.

2.28 Annex E of BS 5228 outline three approaches to the assessment of significance of noise effects which are:

- i) Significance based on fixed noise limits. Noise levels should not exceed 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise, or 75 dB(A) in urban areas near main roads in heavy industrial areas;
- ii) Significance based on noise change – method 1. Noise levels should not exceed thresholds determined from existing ambient noise levels using the “ABC Method”:

A - 65 dB (daytime) when ambient noise levels (when rounded to the nearest 5 dB) are less than this value,

B - 70 dB (daytime) when ambient noise levels (when rounded to the nearest 5 dB) are the same as the category A value,

C - 75 dB (daytime) when ambient noise levels (when rounded to the nearest 5 dB) are higher than the category A value.



- iii) Significance based on noise change – method 2. Construction noise levels are deemed to be significant if the total noise (ambient + construction) exceeds the pre-construction ambient noise level by 5 dB or more, subject to the lower cut-off value of 65 dB (daytime).

Local Planning Policy

2.29 A draft new Local Plan for the Borough has been produced which sets out how Reading will develop up to 2036. At the time of writing this noise report, the new Local Plan is in draft version. Therefore, the local policy referred to below has been referenced from the current adopted policy.

2.30 Local policy for Reading Borough Council (RBC) is presented in the RBC Local Development Framework (LDF) which includes the Core Strategy, Reading Central Area Action Plan, and, Sites and Detailed Policies Documents (SDPD).

2.31 Within the Core Strategy, Policy CS34: Pollution and Water Quality deals specifically with pollution and water quality with regard to development and states:

“Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development.

Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.”

2.32 The Reading Central Area Action Plan is one of RBC Development Plan Documents (DPD) and should be read in conjunction with other LDF documents. Policy RC9: Living in the Centre presents criteria which proposed development in the centre of Reading should be assessed against. The policy covers a number of criteria and with regard to air quality states that:

“Proposals for residential development within the central area will be assessed against the following criteria:



ii. Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated.”

2.33 Within the SDPD there are a number of policies which mention noise however the most relevant policy with regard to new residential development is Policy DM4: Safeguarding Amenity which states that:

“Development will not cause a significant detrimental impact to the living environment of existing or new residential properties, in terms of:

- Privacy and overlooking;
- Access to sunlight and daylight;
- Visual dominance and overbearing effects of a development;
- Noise and disturbance;
- Artificial lighting;
- Vibration;
- Dust and fumes;
- Smell; or
- Crime and safety.”



3.0 EXISTING NOISE PROFILE

- 3.1 The existing noise profile of the development site was determined through noise SoundPLAN noise modelling which has been verified through noise measurements. The noise measurements were undertaken adjacent to the site over a 24 hour period.

Noise Level Survey

- 3.2 The environmental noise measurement method detailed in British Standard 7445:2003 was used to record the 'A' weighted ambient ($L_{eq,T}$), maximum ($L_{max,T}$), background ($L_{90,T}$), and single event level (L_{AE}) noise levels.
- 3.3 Measurements of the different types of passenger and freight trains using the railway adjacent to the site were recorded. The SLM was positioned approximately 20 metres from the northern and western site boundary and 4.0 metres above ground level.
- 3.4 The SLM was set up as a logging meter and each log was one second. The SLM was calibrated before and after the measurement periods using an acoustic calibrator. The acoustic calibrator was set to 94 dB at a frequency of 1000 Hertz.
- 3.5 The local weather conditions were recorded at the start of the measurements and at regular interval throughout the measurement period. A description of the weather conditions are presented later on in this chapter.

Equipment Used

- 3.6 The equipment used during the field measurements on site are listed in Table 3.1. The SLM and acoustic calibrator have been calibrated at an UKAS accredited centre (certificates available on request).

Table 3.1: Equipment used during the field measurements

Equipment	Type	Serial Number
Sound Level Meter	Brüel and Kjær Type 2238 Mediator	2381623
Microphone	Brüel and Kjær 4188	2372211
Calibrator	Brüel and Kjær Type 4321	2388830
Anemometer/thermometer	Kestrel 2000	449331
Tripod	4.0 metre	



Results from the Noise Monitoring

Noise Levels

- 3.7 Sound levels for each train pass-by were recorded as L_{AE} (SEL). The measurement was taken whilst the train was audible and passing the measurement position. Freight trains have been split into “moving” and “stationary” to cover trains that approach the site, stop adjacent to the site with the engine idling and then pull away. The numbers of passenger trains during a typical 24 hour period have been taken from the publicly available train time tables. The approximate numbers of freight trains passing the site have been obtained from the “Freightmaster” website.
- 3.8 Train types have been split into 2 & 3 carriage diesel trains and Intercity Type 10 carriage train which are predominantly using the main line to London Paddington and 3 carriage and 8 carriage diesel trains which use the line to Wokingham.
- 3.9 From the measured L_{AE} (SEL), the mean average L_{AE} (SEL) for each train type can be determined, refer to **Table 3.2**. Using the method described in paragraph 32 of CRN, the L_{AE} can be converted to $L_{Aeq,T}$ for the daytime and night time periods.

Table 3.2: Average L_{AE} (SEL) for each train type during the day and night

Average L_{AE} (SEL) for each train type, direction and day or night				
			<i>L_{AE} to L_{Aeq}</i>	
	<i>L_{AE} (SEL) dB</i>	<i>Number of Trains</i>	<i>Day (0600 – 2400)</i>	<i>Night (0000 – 0600)</i>
<i>Passenger Trains</i>				
2 & 3 carriage diesel	72.5	82	43.6	
		6		37.0
3 carriage diesel	79.5	139	52.8	
		10		46.2
8 carriage diesel	75.5	32	42.5	
		0	0	0
Intercity Type (10 carriages)	76.0	124	48.9	
		3		37.5
<i>Freight Trains</i>				
Moving	75.9	18	40.3	
Stationary	86.3	1	38.2	



3.10 Maximum daytime noise levels ($L_{\max}$) recorded during the noise level survey occurred whilst the freight trains were stationary to the north west of the site. The recorded maximum noise level was 84.8 dB.

3.11 Maximum night time noise levels ($L_{\max}$) recorded during the noise level survey was 75.0 dB.

Weather Conditions

3.12 At the start of the noise measurements the wind was 0.8ms^{-1} from the north east and the air temperature was 1.8°C . There were sunny intervals, the ballast was not frozen and the running rails were dry. During the night the wind decreased in speed, the cloud cleared and temperature dropped to -4.0°C .

3.13 In the morning the wind speed increased to 1.0ms^{-1} and was from the east north east. The air temperature increased to 0°C and the sky was hazy at lunchtime. During the afternoon, the wind speed increased to 2.0ms^{-1} and air temperature remained at 0°C . There was scattered cloud during the afternoon.

Noise Modelling

Development Site

3.14 To determine the noise profile of the development site, noise levels across the site have been calculated using SoundPLAN. The proposed site layout, railway and road traffic flows and LiDAR data have been used to predict the noise levels and produce noise contour plots for the development site. The noise levels are adjusted from $L_{A10,18\text{hr}}$ to $L_{Aeq,16\text{hr}}$ and $L_{Aeq,8\text{hr}}$ using the conversion formula detailed in the TRL document "Converting the UK traffic noise index $L_{A10,18\text{hr}}$ to EU noise indices for noise mapping".

3.15 The noise contour plots for the development area are provided in **Figure 3.1** (daytime 0700 – 2300) and **Figure 3.2** (night time 2300 – 0700).

3.16 During the daytime, the western half of the site experiences noise levels below 50 dB $L_{Aeq,16\text{hr}}$ and the majority of the site is below 55 dB $L_{Aeq,16\text{hr}}$. However, the north eastern corner of the site is above 55 dB $L_{Aeq,16\text{hr}}$.

3.17 During the night time the western half of the site experiences noise levels below 45 dB $L_{Aeq,8\text{hr}}$. The eastern half of the site experiences noise levels above 45 dB.



Constraints

- 3.18 Using the results of the monitoring and SoundPLAN noise modelling, the future noise levels across the site are assessed against the WHO and BS 8233 for internal noise levels and local noise policy.



4.0 NOISE ASSESSMENT

- 4.1 From Figures 3.1 and 3.2 it can be seen that the north eastern corner of the site experiences noise levels above 55 dB during the daytime (0700 – 2300) and the eastern half of the site experiences noise levels above 45 dB during the night time (2300 – 0700).
- 4.2 The maximum individual noise level recorded during the night was 75 dB ($L_{MAX,F}$) which is a good indicator that 60 dB will be regularly exceeded throughout the night (i.e. more than 10 times during the night).
- 4.3 As noise levels are predicted to be above 55 dB $L_{Aeq,16hrs}$ during the daytime, and above 45 dB $L_{Aeq,8hrs}$ during the night-time, a commensurate level of mitigation will be required to achieve internal noise levels that comply with local policy, British Standards and WHO guidelines.
- 4.4 Noise can enter a building, whether commercial or residential, through windows, ventilators, walls, roof and doors. In most cases, however, windows provide the main path for noise and it is important they be insulated properly. Section 8.4.7 of BS 8233 (2014) “Windows” Table 10, details the noise reduction of a thermal insulating window (6 – 12 – 6) as of the order of 33 dB(A) for a closed window and 10 dB(A) to 15 dB(A) for a partially open window.
- 4.5 As detailed in Table 2.1 of this report, BS 8233 suggests that internal **daytime** ($L_{eq,16hr}$) noise levels of 40 dB(A) and 35 dB(A) are design targets, respectively for dining rooms, and living rooms and bedrooms. During the **night time**, ($L_{eq,8hr}$) internal noise levels in bedrooms should be 30 dB(A) and noise due to individual events ($L_{max,i}$) should not exceed the 45 dB(A) threshold more than 10 times per night. To achieve an internal noise level of 30 dB(A) with an open window, façade noise levels must be no greater than 45 dB(A) ($45 - 15 = 30$ dB(A)).
- 4.6 Section 5.4.4 of BS 8233 (2014) “Obstructing the sound” gives examples of how sound can be enclosed or obstructed by a solid barrier such as a fence between the noise source and receiver. It should be noted that attenuation levels of around 10 dB are common; however, the benefits from ground absorption may be reduced.



- 4.7 Outside amenity space within the development will be shielded from railway traffic noise by the proposed residential buildings.
- 4.8 BS 8233 states that “Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.”.
- 4.9 The Buildings Research Establishment (BRE) and Construction Industry Research and Information Association (CIRIA) publication ‘Sound Control for Homes’ 1993 presents practical advice on the control within dwellings of noise from outside sources and noise transmitted within and between dwellings. Part B: Scheme Design – Planning to control external noise, gives advice on the potential noise reduction from low-rise dwellings acting as a barrier block between the noise source and noise sensitive areas.
- 4.10 The first paragraph on page 24 of BRE and CIRIA publication Sound Control for Homes states that ‘On an estate of low rise dwellings, those closest to a noise source can give some protection to the remainder of the site’. The order of reduction in noise levels behind these buildings can be in the order of 10 dB for the whole site, where the gaps between the dwellings not exceeding 30% of the site frontage. The construction of the buildings will help shield the amenity area from railway traffic noise and a reduction of up to 10 dB is possible.
- 4.11 Table 13 of the BRE and CIRIA publication Sound Control for Homes gives guidance on the ‘design background noise levels arising from external sources’ and suggests that an internal noise level of <50 dB for less sensitive areas such as the kitchen, bathroom utility room, WC and internal and communal circulation areas is acceptable.



5.0 EFFECTS OF THE PROPOSALS DURING CONSTRUCTION

Effect of Construction Noise on Nearby Sensitive Receptors

5.1 The magnitude of construction noise impacts can be predicted by considering noise emissions data for typical construction equipment based on the expected methods of construction for each phase of work on each worksite. The prediction method follows that recommended in BS 5228 Noise and Vibration Control on Construction and Open Sites, Part 1:2009.

5.2 The guidance contained in BS 5228 does not extend to provide criteria against which to assess construction noise. However, the Department of Environment (DoE) Advisory Leaflet (AL) 72 (1976) "Noise Control on Building Sites" gives advice on the maximum levels of construction site noise at residential locations during daytime hours based on levels associated with speech interference. This publication states that during daytime hours (07:00 to 19:00 hours) the L_{Aeq} noise level at the building façade should not exceed:

75 dB in urban areas, near main roads or in heavy industrial areas:

and

70 dB in rural, suburban and urban areas away from main road traffic and industrial noise.

5.3 During construction the potential impact from activities within the site has been assessed using the "Fixed" limit method described in BS 5228. At this stage, the timetable for construction and landscaping is not known.

5.4 At present, the exact program of works is not known. However, the following scope of works have been assessed:

Site preparation (including demolition);

Groundwork;

Construction and highway works; and

Landscaping.

5.5 An assessment has been undertaken using generic construction machinery and operation at distances from 10 to 100 metres from the noise source. The construction noise assessment is presented in **Appendix 2** and the results are summarised below.



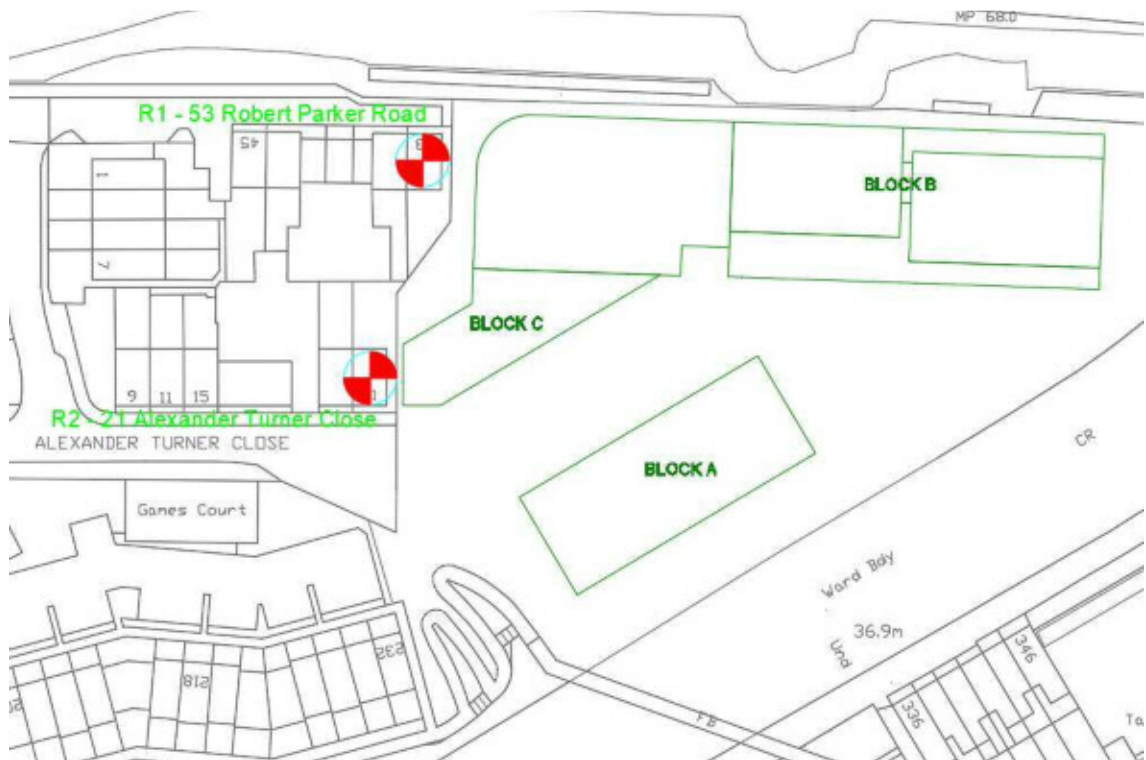
5.6 Two “Sensitive Receptors” near to the site have been assessed:

R1: 53 Robert Parker Road (residential)

R2: 21 Alexander Turner Close (residential)

5.7 Refer to **Figure 5.1** for the receptor locations. According to the BS 5228 ‘Fixed Method’, the daytime ($L_{Aeq,16hr}$) façade threshold of significance at the two receptors is 75 dB(A).

Figure 5.1 Construction Noise Receptor Location Plan



5.8 The results from the “Construction” noise calculations and the BS 5228 threshold of significance at the nearest location (worst-case scenario) for each receptor are summarised in **Table 5.1**.

Table 5.1: Construction noise levels at sensitive receptors

Receptor Location (distance from site in metres)	Existing Ambient dB(A)	Predicted Noise level, dB(A)				BS 5228 Threshold of Significance dB(A)
		Site Prep.	Earthworks	Construction	Landscaping	
R1 (15m)	50	76	70	74	74	75
R2 (10m)	45	NA	74	74	75	75



- 5.9 Noise from some construction activities will be audible at the nearest sensitive receptor locations, however the calculations indicate that construction noise impacts may be of slight significance for a short period of time. If Best Practical Means (BPM) is implemented then noise impacts can be minimised. The noise levels are predicted to be above (76 dB) the 75 dB “Fixed” limit threshold during Site Preparation (which includes Demolition) at the assessed sensitive receptors.
- 5.10 During the Earthworks, Construction and Landscaping phases, construction noise impacts at R1 and R2 are predicted to be at or below the 75 dB “Fixed” limit threshold except at R2 which is at the limit threshold during Landscaping.
- 5.11 A list of common mitigation strategies and how BPM can be implemented is given in Section 7.19. It should be noted that construction impacts are temporary and people are generally more tolerant of higher noise levels if they know they are only going to be of a temporary duration.



6.0 EFFECTS OF THE PROPOSALS POST-CONSTRUCTION

Introduction

- 6.1 The internal noise levels of the proposed residential development have been assessed by using calculated façade noise levels with the mitigation from both a closed window and also an open window in the façade and the results have been assessed against British Standards and WHO guidelines.
- 6.2 External noise levels in the amenity areas have been calculated including the mitigation provided by the proposed residential buildings. The resultant external noise levels have also been assessed against British Standards and WHO guidelines.

Constraints

- 6.3 From Figures 3.1 and 3.2 it can be seen that the north eastern corner of the site experiences noise levels above 55 dB during the daytime (0700 – 2300) and the eastern half of the site experiences noise levels above 45 dB during the night time (2300 – 0700). The noise levels have been calculated at 1.5 metres above ground level.
- 6.4 The constraints of the proposal post-construction on sensitive receptors within the development are examined for the “Do Something” (Future + Proposed Development) scenario. The constraints are assessed at all floor levels and on all façades.
- 6.5 The SoundPLAN model, incorporating future traffic flow data, has been used to predict the daytime and night time noise levels in 2023 for the “Do Something” (Future + Proposed Development) scenario. From the results, noise levels across the site are determined and assessed against current guidelines and British Standards. The noise levels within SoundPLAN are adjusted from an $L_{A10,18hr}$ to $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ using the conversion formula in the TRL document “Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping”.
- 6.6 An “Illustrative Masterplan” has been used to establish the approximate location of the proposed buildings (this is attached as Appendix 1).



- 6.7 The daytime and night time noise profiles of the development area for the “Do Something” scenario (Future + Proposed Development) are provided on **Figure 6.1** and **Figure 6.2** respectively. As with Figure 3.1 and Figure 3.2 the contour plots are displayed as 3 dB coloured bands with a key in the top right hand corner.

Residential development façade Noise Levels - 2023

- 6.8 For this assessment, façade noise levels at the approximate locations of the proposed dwellings have been calculated using the modelling software SoundPLAN which utilises the methods detailed in CRN and CRTN.
- 6.9 The approximate locations of the proposed building and the façade receptors are presented in Figure 6.3.
- 6.10 All façades have been modelled within SoundPLAN and the results from the modelling are presented in **Appendix 3**. Façade noise levels at all floors within the development have been modelled.
- 6.11 Presented in **Table 6.1** are the predicted minimum and maximum façade noise levels at the Apartments in Block A.

Table 6.1: Predicted façade noise levels at Apartments in Block A

Plot Number		Façade Direction	'Future' situation	
			Daytime $L_{eq,16hr}$ dB(A)	Night Time $L_{eq,8hr}$ dB(A)
Block A	Min	SE	41	35
	Max	SE	44	38
	Min	NW	39	33
	Max	NW	52	47
	Min	NE	39	33
	Max	NE	49	44
	Min	SW	38	32
	Max	SW	49	44
KEY: N = North, S = South, E = East, W = West				

- 6.12 With reference to Appendix 3 and Table 6.1 it can be seen that during the daytime, all façades at all floors are predicted to experience noise levels below 50 dB except at the top floor of the northwest façade. During the night time, all façades at all floors are predicted to experience noise levels below 45 dB except at the top floor of the northwest façade.



6.13 Presented in **Table 6.2** are the predicted ground floor and first floor façade noise levels of the proposed Dwellings on the southern side of Block B.

Table 6.2: Predicted façade noise levels at ground floor and first floor Levels in Block B

Plot Number		Façade Direction	'Future' situation	
			Daytime $L_{eq,16hr}$ dB(A)	Night Time $L_{eq,8hr}$ dB(A)
Block B	Min	S	37	32
	Max	S	38	32
	Min	S	38	32
	Max	S	38	33
KEY: N = North, S = South, E = East, W = West				

6.14 From Table 6.2 it can be seen that the façade noise levels are predicted to be well below 50 dB during the daytime and 45 dB during the night time.

6.15 Presented in **Table 6.3** are the predicted minimum and maximum façade noise levels at the Apartments in Block B.

Table 6.3: Predicted façade noise levels at the second floor to the top floor of Apartments in Block B

Plot Number		Façade Direction	'Future' situation	
			Daytime $L_{eq,16hr}$ dB(A)	Night Time $L_{eq,8hr}$ dB(A)
Block B – 2nd to Top Floor	MIN	N	59	53
	MAX	N	60	55
	MIN	E	55	50
	MAX	E	59	53
	MIN	S	38	32
	MAX	S	45	39
	MIN	W	51	45
	MAX	W	59	53
KEY: N = North, S = South, E = East, W = West				

6.16 With reference to Table 6.3 and Appendix 3, it can be seen that at the northern boundary, daytime façade noise levels on the northern, eastern and western façades of Block B are predicted to be between 51 and 60 dB. At night, façade noise levels are predicted to be between 45 and 55 dB.



- 6.17 Daytime façade noise levels on the southern façade of Block B are predicted to be between 38 and 45 dB. At night, façade noise levels are predicted to be between 32 dB and 39 dB.
- 6.18 Presented in **Table 6.4** are the predicted minimum and maximum façade noise levels of the proposed Apartments in Block C.

Table 6.4: Predicted façade noise levels at Apartments in Block C

Plot Number		Façade Direction	'Future' situation	
			Daytime $L_{eq,16hr}$ dB(A)	Night Time $L_{eq,8hr}$ dB(A)
Block C	MIN	NW	44	38
	MAX	NW	52	46
	MIN	S	40	34
	MAX	S	43	37
	MIN	SE	36	31
	MAX	SE	38	33
	MIN	W	44	38
	MAX	W	52	46
KEY: N = North, S = South, E = East, W = West				

- 6.19 With reference to Table 6.4 and Appendix 3, it can be seen that during the daytime all façades are predicted to be below 50 dB. However, the NW and W façades at second floor level are predicted to experience noise levels above 50 dB.
- 6.20 As with the daytime, at night all façades are predicted to be below 45 dB. However, the NW and W façades at second floor level are predicted to experience noise levels above 45 dB.

Free field noise levels in amenity space

- 6.21 Proposals for the development include private and public amenity space which could be impacted upon by railway traffic noise. There is private and public open space at ground level, roof terraces at the apartments at the north boundary of the development (Block B) and balconies on Block A and Block B and the south façade of Block C.
- 6.22 From Figure 3.1 it can be seen that the majority of the development site is predicted to experience noise levels above 55 dB during the daytime with no development.



- 6.23 With the proposed buildings in place, free field noise levels in the private gardens (Block C) and public amenity space (south of Block A and south of Block B) will be reduced thus providing an area below 50 dB during the daytime (Refer to Figure 6.1).
- 6.24 At the roof terraces of Block B, which are approximately 7m above ground level, noise levels are predicted to be 59 to 60 dB on the northern side and 32 to 35 dB on the southern side. With the implementation of a 1m high “safety” screen on the northern terraces all areas are predicted to experience noise levels below 55 dB during the daytime.
- 6.25 Balconies are proposed on the façade with the living rooms at all floors on Block A, Block B (2nd floor to top floor) and the southern façade of Block C.
- 6.26 At Block A and Block C, balcony noise levels are predicted to be below 50 dB during the daytime.
- 6.27 At Block B, balcony noise levels are predicted to be below 50 dB during the daytime on the southern façade. However, on the northern, western and eastern façades, noise levels at the balconies are predicted to be above 55 dB.
- 6.28 Refer to **Figure 6.4** for the locations of the Balconies which are predicted to experience noise levels of above 55 dB during the daytime.
- 6.29 It should be noted that the public amenity space which is accessible to all future residents and within the site is predicted to experience daytime noise levels well below 50 dB. Therefore providing an alternative amenity area for future residents of the apartments in Block B.



7.0 MITIGATION MEASURES

7.1 The section deals with potential constraints on development with regard to internal and external noise levels experienced by future occupants and how this can be overcome with appropriate mitigation.

7.2 External noise levels in the amenity areas have been calculated and have been assessed against British Standards and WHO guidelines.

Constraints on Development

7.3 From Figures 3.1 and 3.2 it can be seen that the north eastern corner of the site experiences noise levels above 55 dB during the daytime (0700 – 2300) and the eastern half of the site experiences noise levels above 45 dB during the night time (2300 – 0700). The noise levels have been calculated at 1.5 metres above ground level.

7.4 With reference to Table 6.1 to Table 6.4, it can be seen that daytime façade noise levels within the site are predicted to be 60 dB or less and night-time façade noise levels are predicted to be less than 55 dB.

7.5 To comply with BS 8233:2014 and WHO guidelines internal noise levels of living rooms and bedrooms should not exceed 35 dB and internal noise levels of dining rooms should not exceed 40 dB during the daytime period. Internal noise levels of bedrooms should not exceed 30 dB during the night-time period.

7.6 Dwellings with façade noise levels greater than 50 dB during the daytime and above 45 dB during the night time will require a commensurate level of mitigation to adhere to daytime and night-time BS 8233:2014 guidelines for living rooms and bedrooms (35 dB $L_{Aeq,16hrs}$ and 30 dB $L_{Aeq,8hrs}$).

7.7 There are many ways for sound to enter a building. The routes are through the roof, the doors and the main route is through the windows. If the roof is built to current Building Regulations and is of sufficient mass it will provide an adequate barrier to the passage of sound. For example, tiles on felt, pitched roof with 100mm mineral wool on plasterboard ceiling have a weighted sound reduction of approximately 43 dB. Doors with adequate mass and minimal gaps between the door and door frame can provide sound reduction of approximately 35 dB when fitted to manufacturers' specification.



7.8 With regard to windows, thermal double glazed units should be fitted in accordance with Building Regulations as a minimum standard. Units are normally of the configuration 6 – 12 – 6 (glass, air gap and glass) with a weighted sound reduction (R_w) of approximately 33 dB. Presented in **Table 7.1** are sound reduction values for window systems utilising various air gap and window thickness.

7.9 If the doors and windows are manufactured to a high standard and installed to the manufacturers' specification, the aforementioned sound reduction and the levels in Table 7.1 should be achieved.

Table 7.1: Example Window Systems

Material	Configuration glass/air gap/glass (mm)	Total Thickness (mm)	Sound Reduction (dB)
Sealed Unit	4/12/4	24	27
Sealed Unit	6/12/6	28	33
Sealed Unit	4/12/12	28	36
Sealed Unit	6/12/10	28	37
Laminated glass	6/12/11	29	40
Laminated glass	10/12/16	38	42
Laminated glass	13/12/13	38	45
Sealed Unit	6/20/12	38	41

7.10 It should be noted that the sound reduction presented in Table 7.1 does not take into account the adjusted factor for road traffic noise (C , C_{tr}). Usually 1 to 2 dB is subtracted for highway road traffic > 80 kmph (C) and between 3 and 6 dB for urban road traffic (C_{tr})* depending on window configuration.

7.11 Presented in the following paragraphs are the highest predicted façade noise levels during the daytime and night time. The required sound reduction index (SRI) of a façade to achieve an internal daytime noise level ($L_{eq,16hr}$) in living rooms and bedrooms and an internal night time ($L_{eq,8hr}$) noise level in bedrooms has been calculated. Also considered is the required SRI of a façade to mitigate maximum noise levels ($L_{max,F}$) from railway traffic during the night time.

7.12 For this purpose the buildings have been split into Block A, Block B, Block B 2nd Floor to Top Floor and Block C.

* BS EN ISO 717-1:1997, Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation, Annex A, Table A.1 – Relevant spectrum adaptation term for different types of noise source



Block A - Apartments

- 7.13 The highest façade noise level at Block A during the night time (2300 - 0700) is predicted to be 47 dB at top floor (F 4) apartments, on the north western façade (refer to Table 6.1 and Appendix 3) which is above the roof level of Block C and faces the railway line. To achieve internal noise level of 30 dB ($L_{Aeq,8hr}$) during the night time a sound reduction index (SRI) of 17 dB would be required ($47 - 30 = 17$). However, a maximum noise level ($L_{max,F}$) of 75 dB was recorded which needs to be taken into account when determining internal noise levels. To achieve an internal noise level of 45 dB ($L_{max,F}$) during the night time an SRI of 30 dB would be required ($75 - 45 = 30$).
- 7.14 During the daytime (0700 - 2300), the highest façade noise levels is predicted to be 52 dB at top floor (F 4) apartments, on the north western façade (refer to Table 6.1 and Appendix 3) which is above the roof level of Block C and faces the railway line. To achieve reasonable resting conditions in bedrooms and living rooms during the daytime an SRI of 17 dB would be required ($52 - 35 = 17$).

Block B – Ground Floor and First Floor Levels

- 7.15 The highest façade noise level at Block B (Ground Floor and First Floor) during the night time (2300 - 0700) is predicted to be 33 dB at first floor (F 1) level, on the southern façade (refer to Table 6.2 and Appendix 3) which overlooks the public open space. To achieve an internal noise level of 30 dB ($L_{Aeq,8hr}$) during the night time a sound reduction index (SRI) of 3 dB would be required ($33 - 30 = 3$).
- 7.16 During the daytime (0700 - 2300), the highest façade noise levels is predicted to be 38 dB at ground floor and first floor (GF and F 1) level, on the southern façade (refer to Table 6.2 and Appendix 3) which overlooks the public open space. To achieve reasonable resting conditions in bedrooms and living rooms during the daytime an SRI of 3 dB would be required ($38 - 35 = 3$).



Block B – 2nd Floor to Top Floor Apartments

- 7.17 The highest façade noise level at Block B (2nd Floor to Top Floor Apartments) during the night time (2300 - 0700) is predicted to be 55 dB at 2nd floor, 3rd floor and 4th floor (F 2, F 3 and F 4) apartments, on the northern façade (refer to Table 6.3 and Appendix 3) which overlooks the railway line. To achieve an internal noise level of 30 dB ($L_{Aeq,8hr}$) during the night time a sound reduction index (SRI) of 30 dB would be required ($60 - 30 = 30$). However, a maximum noise level ($L_{max,F}$) of 75 dB was recorded which needs to be taken into account when determining internal noise levels. To achieve an internal noise level of 45 dB ($L_{max,F}$) during the night time an SRI of 30 dB would be required ($75 - 45 = 30$).
- 7.18 During the daytime (0700 - 2300), the highest façade noise levels is predicted to be 60 dB at 2nd floor, 3rd floor, 4th floor, 5th floor and 6th floor (F 2, F 3, F 4, F 5 and F 6) apartments, on the northern façade (refer to Table 6.3 and Appendix 3) which overlooks the railway line. To achieve reasonable resting conditions in bedrooms and living rooms during the daytime an SRI of 25 dB would be required ($60 - 35 = 25$).

Block C - Apartments

- 7.19 The highest façade noise level at Block C during the night time (2300 - 0700) is predicted to be 46 dB at 2nd floor (F 2) apartments, on the north western façade (refer to Table 6.4 and Appendix 3) which faces the adjacent development and the railway line. To achieve an internal noise level of 30 dB ($L_{Aeq,8hr}$) during the night time a sound reduction index (SRI) of 16 dB would be required ($46 - 30 = 16$). However, a maximum noise level ($L_{max,F}$) of 75 dB was recorded which needs to be taken into account when determining internal noise levels. To achieve an internal noise level of 45 dB ($L_{max,F}$) during the night time an SRI of 30 dB would be required ($75 - 45 = 30$).
- 7.20 During the daytime (0700 - 2300), the highest façade noise levels is predicted to be 52 dB at 2nd floor (F 2) apartments, on the northern façade (refer to Table 6.4 and Appendix 3) which faces the adjacent development and the railway line. To achieve reasonable resting conditions in bedrooms and living rooms during the daytime an SRI of 17 dB would be required ($52 - 35 = 17$).



Mitigation

- 7.21 From the above, it can be seen that with the appropriate combination of a typical wall construction and window specification, internal noise levels will meet BS 8233 and WHO guidelines on all the façade on all the floors of the proposed development with the windows closed.
- 7.22 If any of the windows or doors is open in the façade, the sound reduction for the façade containing the window or door will be reduced to approximately 15 dB. The effect of having the window or door open is a reduction in transmission loss through the façade and results in a higher internal noise level within the room.
- 7.23 Façades with a noise level of greater than 45 dB during the night time and 50 dB during the daytime and a window or door open will not meet the BS 8233 or WHO guidelines for internal noise levels in bedrooms and sitting rooms. Therefore another method of ventilating the rooms will have to be provided without opening the windows or doors.
- 7.24 It is recommended that ventilating the apartments through the use of a mechanical ventilation and heat recovery system (MVHR) which negates the need to open the window to provide background ventilation to the apartment. MVHR systems are available which have multiple settings which can provide different flow rates at the occupant's choice or at pre-set temperatures or humidity levels.
- 7.25 Windows can be opened for purge ventilation or at the occupant's choice.
- 7.26 It is also recommended that at private terraces/balconies the use of purpose built glass/Perspex barriers to provide noise protection and help reduce noise levels to acceptable levels.
- 7.27 With regard to mitigation for noise levels in gardens or outside amenity areas, the construction of the proposed buildings, and boundary treatments such as brick walls or acoustic fences will help reduce noise levels in these areas. For example, in the shadow zone of a building, noise levels could be reduced by up to 10 dB.



- 7.28 It has been demonstrated previously the construction of the proposed buildings will shield the amenity areas from external noise sources to a degree that predicted noise levels are well below the BS8233 and WHO guideline level of 50 dB.

Impacts – Construction

- 7.29 Best practicable means will be used to minimise construction noise through the implementation of the recommendations set out in BS 5228. In particular, the following noise mitigation measures would be implemented:

Proper use of plant with respect to minimising noise emissions and regular maintenance will be required. All vehicles and mechanical plant would be fitted with effective exhaust silencers and will be maintained in good efficient order;

The use of inherently quiet plant where appropriate – all major compressors and generators would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;

Machines in intermittent use would be shut down in the intervening periods between work or throttled down to a minimum;

All ancillary plant such as generators and pumps would be positioned so as to cause minimum noise disturbance, and where necessary, acoustic enclosures will be provided;

Where practicable the use of noisy plant would be limited to core daytime periods;

Channels of communication would be established between the contractor / developer, Local Authority and residents;

A site representative would be appointed responsible for matters relating to noise;

Typical levels of noise would be monitored during critical periods and at sensitive locations;

A 2m high solid site hoarding along the site boundaries would be erected where practical and feasible;

Localised noise barriers can be erected as necessary around items such as generators or heavy duty compressors;



Construction compounds would be laid out so as to minimise noise impacts to neighbouring noise sensitive receptors, by locating noisy operations well away from receptors and using on-site structures and materials to screen noise where practicable and necessary.



8.0 SUMMARY AND CONCLUSIONS

- 8.1 Stuart Michael Associates has been engaged by Danescroft Land Limited to undertake an air quality assessment for a proposed development of 130 units at Robert Parker Road, Reading. This noise assessment has considered the constraints on the proposed development. Also considered are impacts from the development construction.
- 8.2 The constraints on the development have been assessed using the computer model SoundPLAN which incorporates the CRTN and CRN method. Also considered are the potential impacts from construction activities and these have been assessed using the method detailed in BS 5228.
- 8.3 From on-site observations, the dominant noise source in the local area is from the adjacent railway line. To a lesser extent, the local highway network is audible within the site and has been included in the assessment.
- 8.4 A noise level survey was undertaken for the adjacent development site and the results have been used in this assessment to generate the sound levels from railway traffic adjacent to the site.
- 8.5 From the results of the noise level surveys and the computer modelling it is evident that during the daytime and night time, noise levels within development site are above 55 dB and 45 dB respectively and a commensurate level of mitigation will be required.
- 8.6 Within the development site, an assessment has been undertaken of the predicted noise levels at all of the façades and at all floor levels. For assessment, the proposed development has been split into four elements: Block A, Block B, Block B 2nd Floor to Top Floor and Block C.
- 8.7 Maximum noise levels were recorded adjacent to the development site during the daytime and night time periods. The maximum noise level recorded during the night was 75 dB ($L_{MAX,F}$) and this has been taken into account when calculating the appropriate Sound Reduction Index (SRI) for north, east and west facing façades.

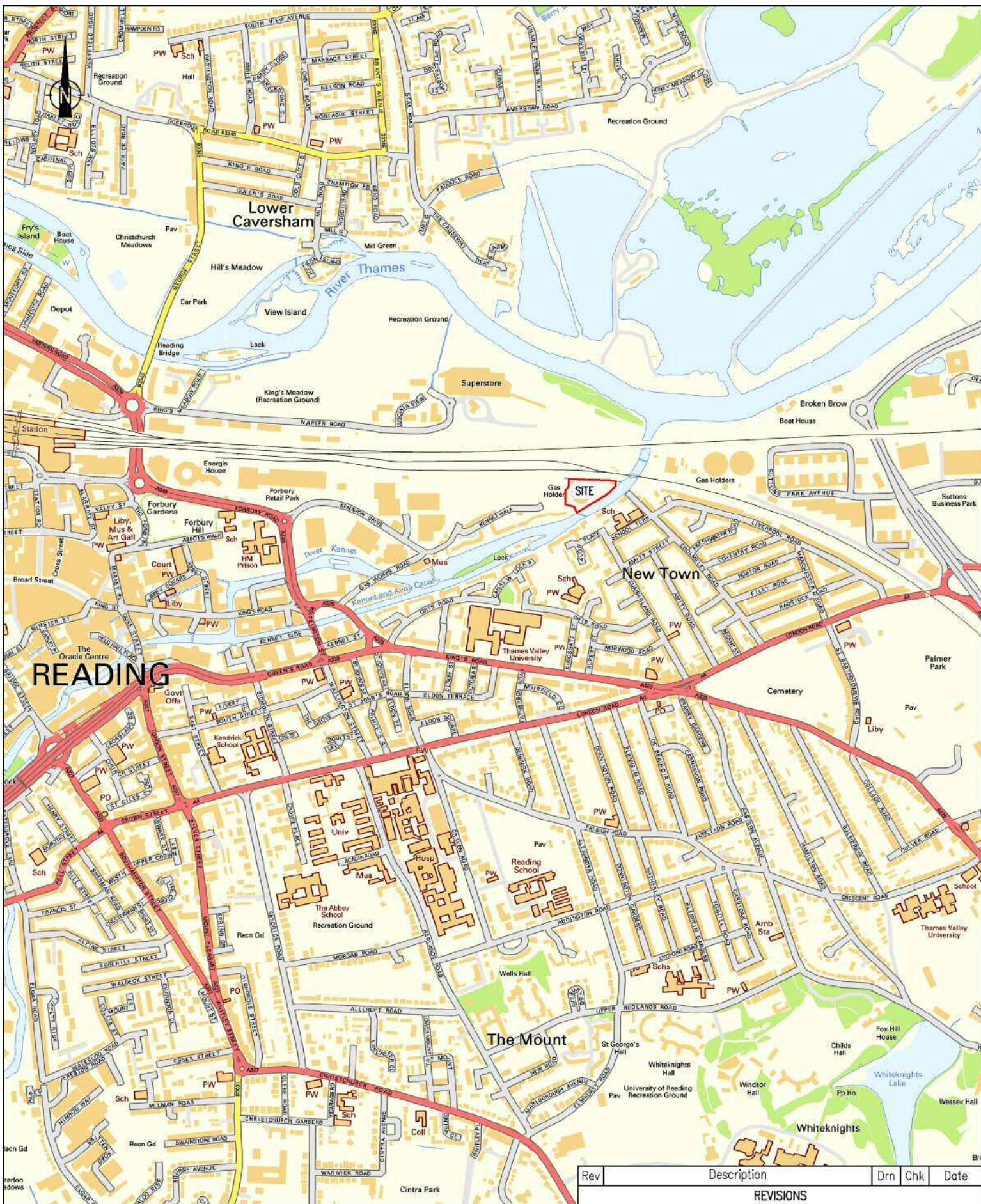


- 8.8 Where façade noise levels are above 50 dB during the daytime and 45 dB during the night time and internal ($L_{MAX,F}$) levels are predicted to be above 45 dB for reasonable number of times during the night, mitigation measures are proposed to ensure internal noise levels meet BS 8233:2014, WHO guidelines and local planning policy.
- 8.9 The use of appropriate glazed windows with an SRI of between 27 dB (4/12/4 sealed unit) and 36 dB (4/12/14 laminated glass) in a wall with an SRI of 55 dB results in appropriate façade sound reduction. Incorporating an appropriate MVHR system will result in internal noise to within BS 8233 and WHO daytime and night internal noise guideline levels.
- 8.10 Within the development site, free field noise levels have been calculated in the private and public amenity areas. The public amenity areas are predicted to experience noise levels of less than 50 dB during the daytime with no noise mitigation other than the proposed buildings themselves. A solid physical barrier at the edge of the roof terraces will ensure that noise levels will be less than 55 dB during the daytime.
- 8.11 Balconies on the north, east and west façade of Block B will be affected by rail traffic noise due to their proximity to the railway line. The construction of a barrier on the balconies, such as glass balustrades or similar, will help shield the private amenity areas from rail traffic noise and a reduction of up to 10 dB to those private amenity areas is possible. The remainder of the Balconies (Block A, south side of Block B and Block C) would not require specific noise mitigation.
- 8.12 It should be noted that there are alternative amenity areas provided within the development site which experience daytime noise levels well below the British Standard and WHO guideline level of 50 dB. Therefore providing an alternative amenity area for future residents of the apartments in Block B.
- 8.13 The results from the BS 5228 assessment indicate that the predicted noise levels at the two sensitive receptors adjacent to the site will be above the threshold limits during the Demolition/Site Preparation phase of construction which is considered significant. Mitigation will be required to minimise the construction noise impacts.



- 8.14 Noise from some construction activities will be audible at the nearest sensitive receptor locations, but if Best Practical Means (BPM) is implemented then noise impacts can be minimised. It should be noted that construction impacts are temporary and people are generally more tolerant of higher noise levels if they know they are only going to be of a temporary duration.
- 8.15 Based on the results of the noise assessment, it has been concluded that with appropriate mitigation, internal and external noise levels meet the national and local standards and are acceptable for future residents of the proposed development.

FIGURES



Rev	Description	Drn	Chk	Date
REVISIONS				

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JOB TITLE
**GASWORKS SITE
ROBERT PARKER ROAD, READING**

DRAWING TITLE
SITE LOCATION PLAN

DATE: **AUGUST 2018** DRAWN: **JPM** CHECKED: **SWA** ISSUE CHECKBOX

DRAWING No. **Figure 1.1** REV. SCALE **1:12,500 @ A4**

Signs and symbols

Railway

Railway axis

Road

Road axis

Emission line

Surface

Main building

Point receiver

Line

Area

Noise level
Leq,16hr
in dB(A)

<= 35

<= 38

<= 41

<= 44

<= 47

<= 50

<= 53

<= 56

<= 59

<= 62

<= 65

<= 68

<= 71

<= 74

<= 77

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Job Title:

Gas Works Site,
Robert Parker Road, Reading

Client:

Danescroft Land Limited

Drawing Title:

Daytime (0700 - 2300)
Noise Profile - 2018

Drawn:

JPM

Scale:

1:500 @ A3

Checked:

SWA

Date:

March 2019

Figure:

3.1

This noise contour map illustrates the predicted noise levels (Leq,16hr in dB(A)) for the daytime period (0700 - 2300) at the Gas Works Site, Robert Parker Road, Reading. The map features a railway line running vertically on the left, with noise contours radiating from it. A road, labeled 'A93 Bypass', runs horizontally across the middle. Several buildings are shown, with their noise levels indicated by numbers: 84, 85, 86, 73, 72, and 63. The map also shows a 'Main building' and a 'Point receiver' marked with an asterisk. The noise contours are color-coded according to the legend, ranging from green (low noise) to red (high noise). The map includes a north arrow and a scale bar.

Signs and symbols

Railway

Railway axis

Road

Road axis

Emission line

Surface

Main building

Point receiver

Line

Area

45 dB(A)

Noise level
Leq,8hr
in dB(A)

<= 35

<= 38

<= 41

<= 44

<= 47

<= 50

<= 53

<= 56

<= 59

<= 62

<= 65

<= 68

<= 71

<= 74

<= 77

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Job Title:

Gas Works Site,
Robert Parker Road, Reading

Client:

Danescroft Land Limited

Drawing Title:

Night time (2300 - 0700)
Noise Profile - 2018

Drawn:

JPM

Scale:

1:500 @ A3

Checked:

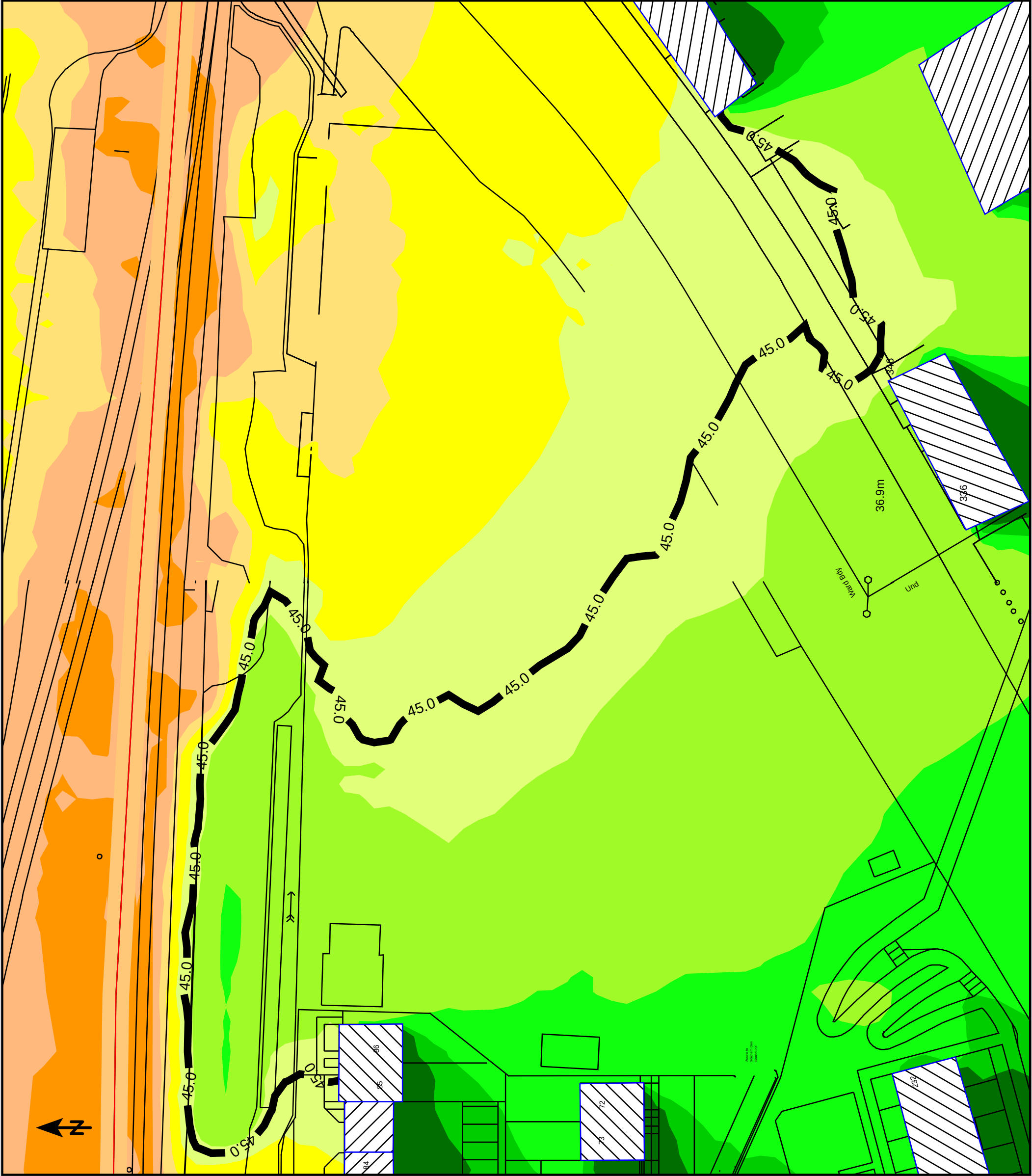
SWA

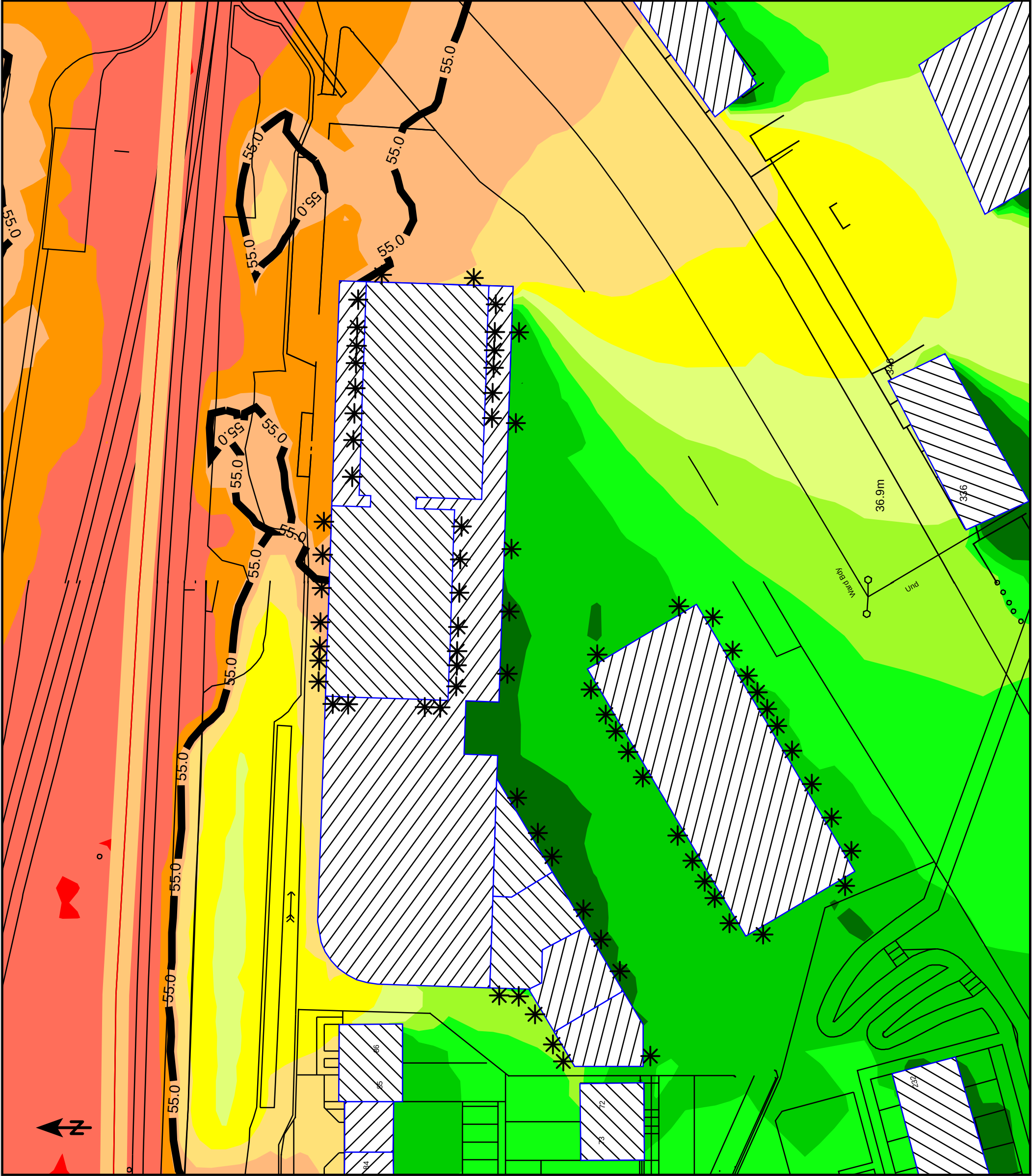
Date:

March 2019

Figure:

3.2

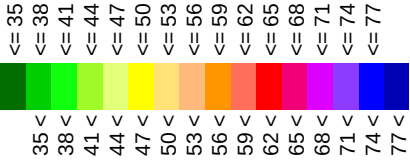




Signs and symbols

- Railway
- Railway axis
- Road
- Road axis
- Emission line
- Surface
- Main building
- Point receiver
- Line
- Area

Noise level
Leq,16hr
in dB(A)



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Job Title:

Gas Works Site,
Robert Parker Road, Reading

Client:

Danescroft Land Limited

Drawing Title:

Daytime (0700 - 2300)
Noise Profile - 2023
with Development

Drawn:

JPM

Scale:

1:500 @ A3

Checked:

SWA

Date:

March 2019

Figure:

6.1

Signs and symbols

Railway

Railway axis

Road

Road axis

Emission line

Surface

Main building

Point receiver

Line

Area

45 dB(A)

Noise level
Leq,8hr
in dB(A)

<= 35

<= 38

<= 41

<= 44

<= 47

<= 50

<= 53

<= 56

<= 59

<= 62

<= 65

<= 68

<= 71

<= 74

<= 77

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Job Title:

Gas Works Site,
Robert Parker Road, Reading

Client:

Danescroft Land Limited

Drawing Title:

Night time (2300 - 0700)
Noise Profile - 2023
with Development

Drawn:

JPM

Scale:

1:500 @ A3

Checked:

SWA

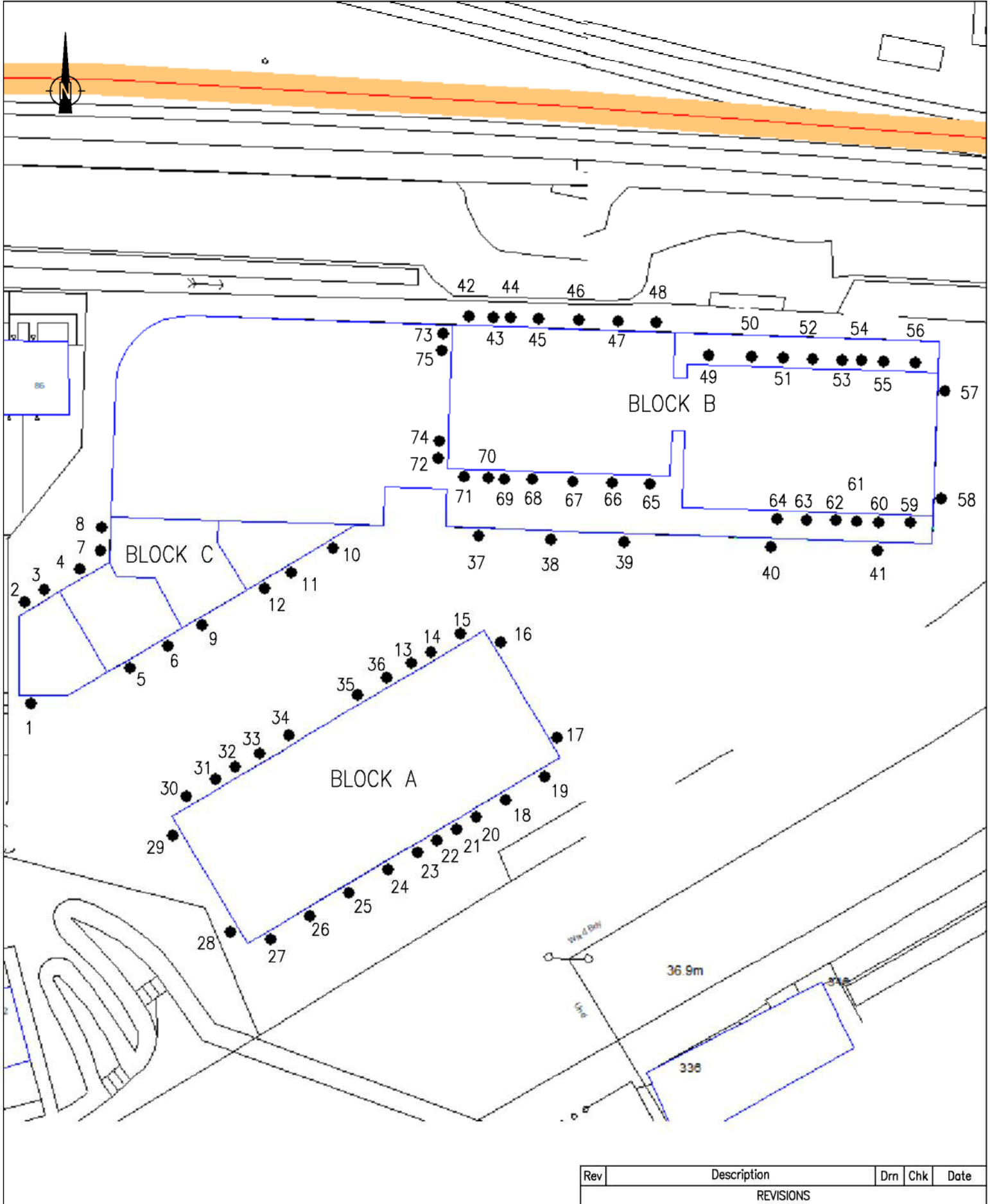
Date:

March 2019

Figure:

6.2

The map displays a noise profile for a development area, with noise contours (45.0 dB(A)) shown in yellow and orange. The development area is outlined in blue and contains several buildings. The noise contours are shown in yellow and orange, indicating noise levels of 45.0 dB(A) and above. The map also shows surrounding roads, railways, and other land use features.



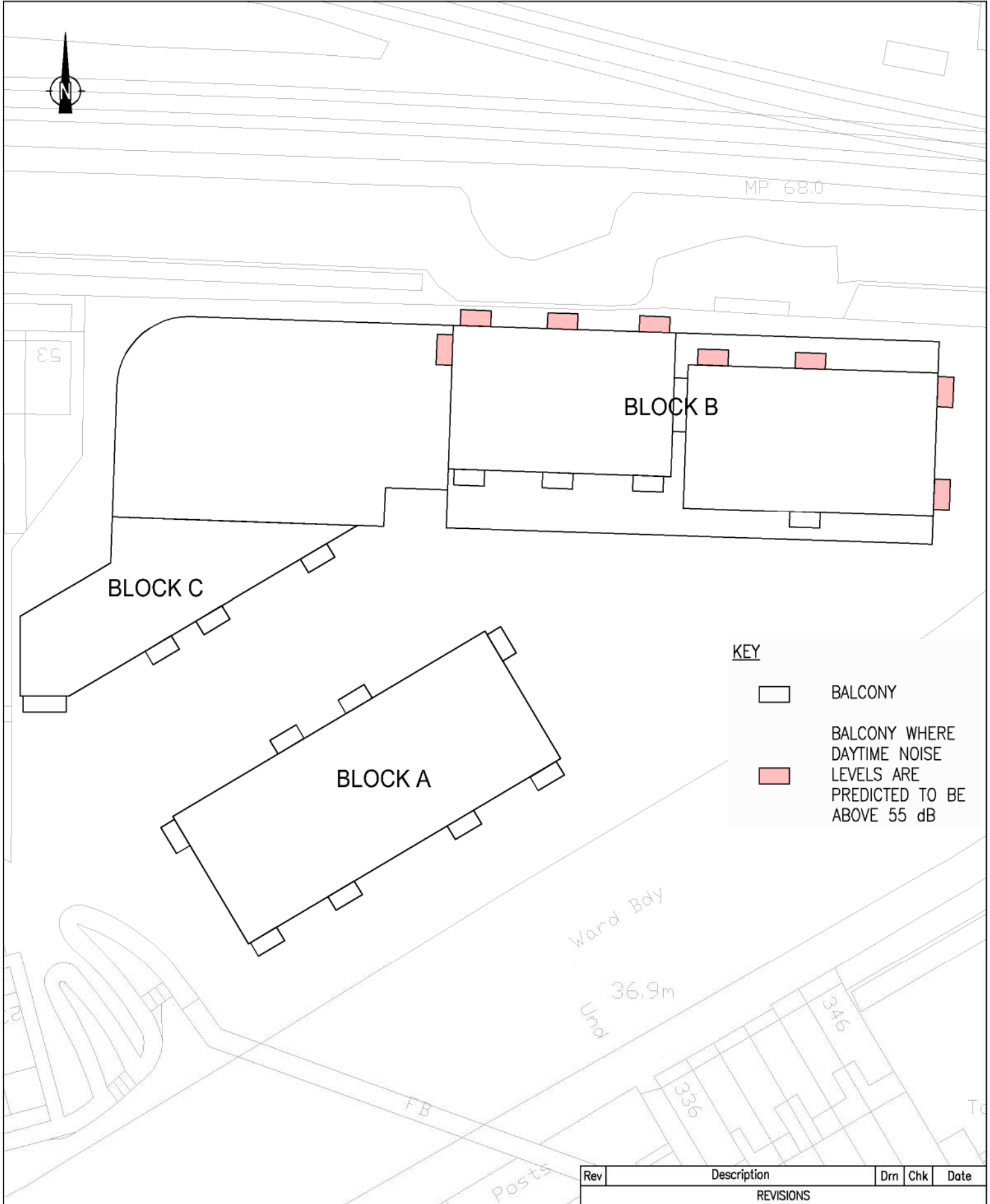
Rev	Description	Drn	Chk	Date
REVISIONS				

JOB TITLE				
GAS HOLDER SITE ALEXANDER TURNER CLOSE				
DRAWING TITLE				
RECEPTOR LOCATION PLAN				
DATE	DRAWN	CHECKED	ISSUE CHECKBOX	
APRIL 2019	JPM	SWA		
DRAWING No.	REV.	SCALE		
Figure 6.3	.	NTS	@ A4	

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KEY

BALCONY

BALCONY WHERE DAYTIME NOISE LEVELS ARE PREDICTED TO BE ABOVE 55 dB

Rev	Description	Drn	Chk	Date
REVISIONS				

JOB TITLE
GAS HOLDER SITE
READING

DRAWING TITLE
INDICATIVE LOCATIONS OF THE PROPOSED
BALCONIES

DATE	DRAWN	CHECKED	ISSUE
APRIL 2019	JPM	SWA	CHECKBOX

DRAWING No. **Figure 6.4** REV. SCALE NTS @ A4

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CONSULTING ENGINEERS

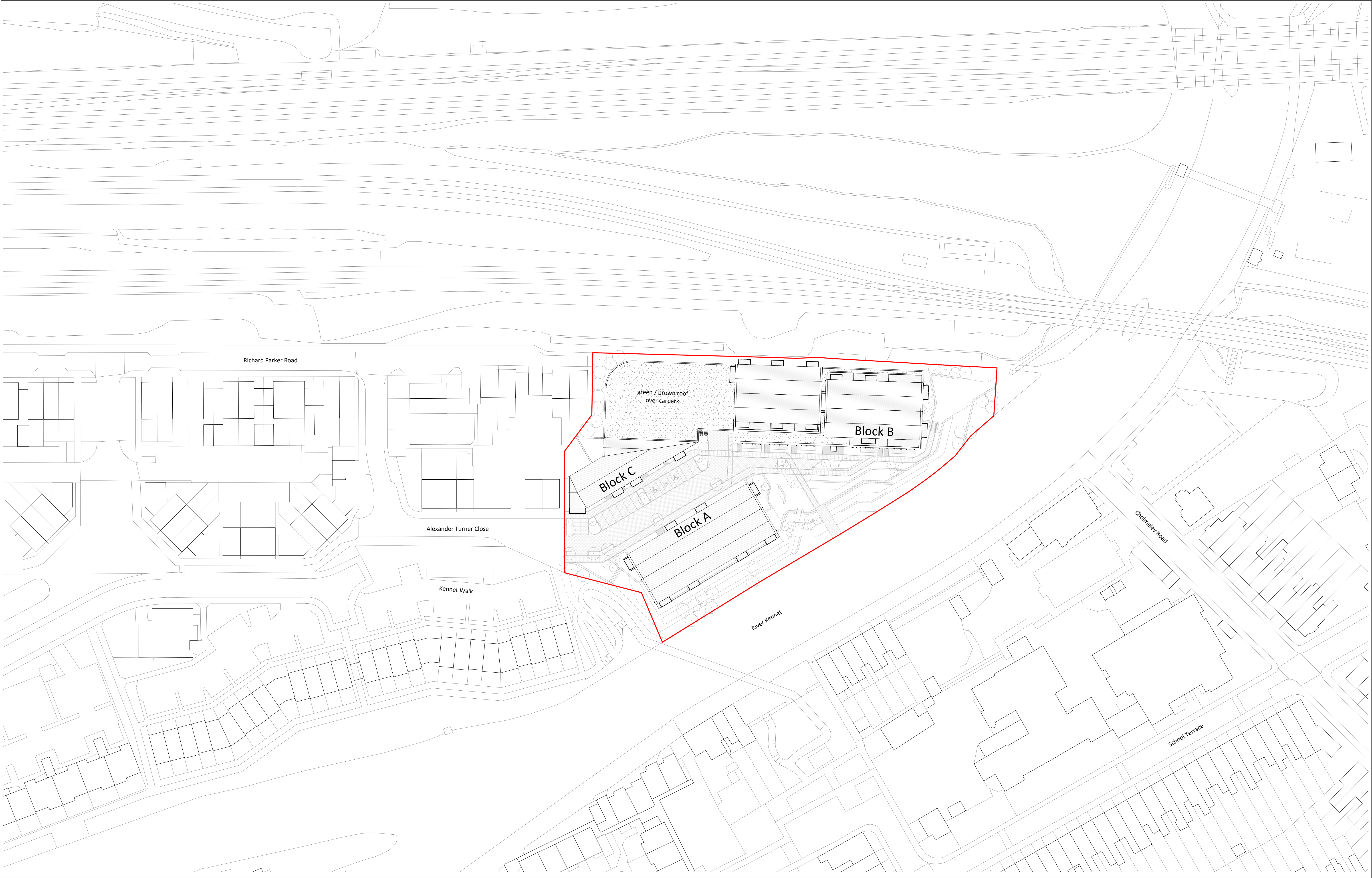
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APPENDICES

Appendix 1 – Collado Collins Architects – Proposed Site Plan – 28/03/2019

APPENDIX 1



NOTES

CONSULTANTS

- Refer to highways consultant's drawings for details
- Refer to landscape consultant's drawings for details
- Landscaping layout is indicative only

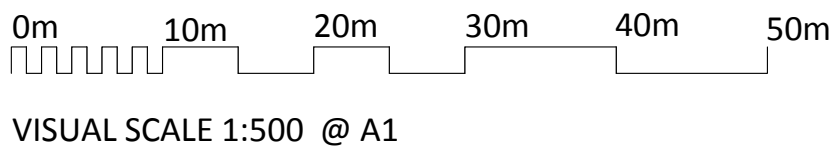
AREAS

- Refer to area schedule

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N

Rev	Notes	Date	By	Auth
P	Planning Application	28/03/19		



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Date: 28/03/19
Drawn By: LK
Checked by: RC
Scale @ A1: 1 : 500
Scale @ A3: 1 : 1000
CAD File No:

Danescroft (KDPM) LLP
Gas Holder, Reading
Proposed Site Plan

PLANNING
16035

P0-010

Revision

Appendix 2 – Construction Noise Assessment

APPENDIX 2

BS 5228 Construction Noise Calculations

No Mitigation

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)	Demolition							
			10	15	35	60	80	100		
53 Robert Parker Road	50	Specific construction noise level	NA	76	69	64	62	60		
21 Alexander Turner Close	45	Total noise level (dB(A))	NA	76	69	64	62	61		
			NA	76	69	64	62	60		

Earthworks

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)							
		10	15	35	60	80	100		
		Specific construction noise level							
		74	70	68	63	61	59		
		74	70	68	63	61	59		
		74	70	68	63	61	59		
		Total noise level (dB(A))							
		74	70	68	63	61	59		
Receptors adjacent to the site									
53 Robert Parker Road	50								
21 Alexander Turner Close	45								

Construction

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)							
		10	15	35	60	80	100		
		Specific construction noise level							
		74	74	70	65	63	61		
		Total noise level (dB(A))							
		74	74	70	65	63	61		
53 Robert Parker Road	50								
21 Alexander Turner Close	45								
		74	74	70	65	63	61		

Landscaping

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)	10	15	35	60	80	100
			75	74	67	62	60	58
53 Robert Parker Road	50	Specific construction noise level	75 <td>74<td>67<td>62<td>60<td>58</td></td></td></td></td>	74 <td>67<td>62<td>60<td>58</td></td></td></td>	67 <td>62<td>60<td>58</td></td></td>	62 <td>60<td>58</td></td>	60 <td>58</td>	58
21 Alexander Turner Close	45	Total noise level (dB(A))	75 <td>74<td>67<td>62<td>60<td>58</td></td></td></td></td>	74 <td>67<td>62<td>60<td>58</td></td></td></td>	67 <td>62<td>60<td>58</td></td></td>	62 <td>60<td>58</td></td>	60 <td>58</td>	58
			75 <td>74<td>67<td>62<td>60<td>58</td></td></td></td></td>	74 <td>67<td>62<td>60<td>58</td></td></td></td>	67 <td>62<td>60<td>58</td></td></td>	62 <td>60<td>58</td></td>	60 <td>58</td>	58

Note

There is no demolition within 10 metres of an existing sensitive receptor

BS 5228 Construction Noise Calculations

With Mitigation

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)	Demolition							
			10	15	35	60	80	100		
53 Robert Parker Road	50	Specific construction noise level	#VALUE!	60	58	53	51	49		
21 Alexander Turner Close	45	Total noise level (dB(A))	#VALUE!	60	58	55	53	52		
			#VALUE!	60	58	53	52	50		

Earthworks

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)	10	15	35	60	80	100
			64	60	58	53	51	49
53 Robert Parker Road	50	Specific construction noise level	64	60	58	55	53	52
21 Alexander Turner Close	45	Total noise level (dB(A))	64	60	58	53	52	50

Construction

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)	10	15	35	60	80	100
			64	64	60	55	53	51
53 Robert Parker Road	50	Specific construction noise level	64	64	60	56	54	53
21 Alexander Turner Close	45	Total noise level (dB(A))	64	64	60	55	53	52

Landscaping

Receptors adjacent to the site	Ambient Noise Level (dB(A)) at receptor	Distance from source to receptor (metres)	10	15	35	60	80	100
			65	64	57	52	50	48
53 Robert Parker Road	50	Specific construction noise level	65	64	57	54	53	52
21 Alexander Turner Close	45	Total noise level (dB(A))	65	64	57	52	51	49

Note

There is no demolition within 10 metres of an existing sensitive receptor

Appendix 3 – Predicted Development Façade Noise Levels

APPENDIX 3

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
1	GF	Block C	S	40	34
	F 1	Block C	S	42	35
	F 2	Block C	S	43	37
2	GF	Block C	NW	44	38
	F 1	Block C	NW	48	42
	F 2	Block C	NW	52	46
3	GF	Block C	NW	44	38
	F 1	Block C	NW	48	42
	F 2	Block C	NW	52	46
4	GF	Block C	NW	44	38
	F 1	Block C	NW	47	42
	F 2	Block C	NW	52	46
5	GF	Block C	SE	36	31
	F 1	Block C	SE	37	31
	F 2	Block C	SE	38	33
6	GF	Block C	SE	36	31
	F 1	Block C	SE	37	31
	F 2	Block C	SE	38	33
7	GF	Block C	W	44	38
	F 1	Block C	W	47	41
	F 2	Block C	W	51	45
8	GF	Block C	W	44	38
	F 1	Block C	W	47	42
	F 2	Block C	W	52	46
9	GF	Block C	SE	36	31
	F 1	Block C	SE	36	31
	F 2	Block C	SE	38	33
10	GF	Block C	SE	37	31
	F 1	Block C	SE	37	31
	F 2	Block C	SE	38	33
11	GF	Block C	SE	37	31
	F 1	Block C	SE	37	31
	F 2	Block C	SE	38	33
12	GF	Block C	SE	37	31
	F 1	Block C	SE	37	31
	F 2	Block C	SE	38	33
13	GF	Block A	NW	39	34
	F 1	Block A	NW	42	36
	F 2	Block A	NW	45	40
	F 3	Block A	NW	49	43
	F 4	Block A	NW	52	47
14	GF	Block A	NW	39	34
	F 1	Block A	NW	42	36
	F 2	Block A	NW	46	40
	F 3	Block A	NW	49	44
	F 4	Block A	NW	52	47

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
15	GF	Block A	NW	40	34
	F 1	Block A	NW	42	36
	F 2	Block A	NW	46	40
	F 3	Block A	NW	49	44
	F 4	Block A	NW	52	46
16	GF	Block A	NE	39	33
	F 1	Block A	NE	41	35
	F 2	Block A	NE	45	39
	F 3	Block A	NE	48	42
	F 4	Block A	NE	49	44
17	GF	Block A	NE	41	35
	F 1	Block A	NE	43	37
	F 2	Block A	NE	44	38
	F 3	Block A	NE	45	40
	F 4	Block A	NE	46	40
18	GF	Block A	SE	42	36
	F 1	Block A	SE	42	37
	F 2	Block A	SE	43	37
	F 3	Block A	SE	43	38
	F 4	Block A	SE	44	38
19	GF	Block A	SE	42	36
	F 1	Block A	SE	43	37
	F 2	Block A	SE	43	37
	F 3	Block A	SE	44	38
	F 4	Block A	SE	44	38
20	GF	Block A	SE	42	36
	F 1	Block A	SE	42	37
	F 2	Block A	SE	43	37
	F 3	Block A	SE	43	37
	F 4	Block A	SE	44	38
21	GF	Block A	SE	41	36
	F 1	Block A	SE	42	37
	F 2	Block A	SE	42	37
	F 3	Block A	SE	43	37
	F 4	Block A	SE	43	38
22	GF	Block A	SE	41	36
	F 1	Block A	SE	42	36
	F 2	Block A	SE	42	37
	F 3	Block A	SE	43	37
	F 4	Block A	SE	43	38
23	GF	Block A	SE	41	36
	F 1	Block A	SE	42	36
	F 2	Block A	SE	42	37
	F 3	Block A	SE	43	37
	F 4	Block A	SE	43	38

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
24	GF	Block A	SE	41	35
	F 1	Block A	SE	41	36
	F 2	Block A	SE	42	36
	F 3	Block A	SE	42	36
	F 4	Block A	SE	43	37
25	GF	Block A	SE	41	35
	F 1	Block A	SE	41	36
	F 2	Block A	SE	42	36
	F 3	Block A	SE	42	36
	F 4	Block A	SE	43	37
26	GF	Block A	SE	41	35
	F 1	Block A	SE	41	36
	F 2	Block A	SE	41	36
	F 3	Block A	SE	42	36
	F 4	Block A	SE	43	37
27	GF	Block A	SE	41	35
	F 1	Block A	SE	41	35
	F 2	Block A	SE	41	36
	F 3	Block A	SE	42	36
	F 4	Block A	SE	42	37
28	GF	Block A	SW	38	32
	F 1	Block A	SW	40	34
	F 2	Block A	SW	42	36
	F 3	Block A	SW	44	38
	F 4	Block A	SW	46	41
29	GF	Block A	SW	39	33
	F 1	Block A	SW	41	35
	F 2	Block A	SW	43	37
	F 3	Block A	SW	46	40
	F 4	Block A	SW	49	44
30	GF	Block A	NW	39	33
	F 1	Block A	NW	41	35
	F 2	Block A	NW	43	37
	F 3	Block A	NW	47	41
	F 4	Block A	NW	51	46
31	GF	Block A	NW	39	33
	F 1	Block A	NW	41	35
	F 2	Block A	NW	43	37
	F 3	Block A	NW	47	41
	F 4	Block A	NW	51	46
32	GF	Block A	NW	39	33
	F 1	Block A	NW	41	35
	F 2	Block A	NW	43	37
	F 3	Block A	NW	47	41
	F 4	Block A	NW	51	46

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
33	GF	Block A	NW	39	33
	F 1	Block A	NW	41	35
	F 2	Block A	NW	43	37
	F 3	Block A	NW	47	41
	F 4	Block A	NW	52	46
34	GF	Block A	NW	39	33
	F 1	Block A	NW	41	35
	F 2	Block A	NW	43	37
	F 3	Block A	NW	47	41
	F 4	Block A	NW	52	46
35	GF	Block A	NW	39	33
	F 1	Block A	NW	41	35
	F 2	Block A	NW	44	38
	F 3	Block A	NW	48	42
	F 4	Block A	NW	52	47
36	GF	Block A	NW	39	33
	F 1	Block A	NW	42	36
	F 2	Block A	NW	45	39
	F 3	Block A	NW	49	43
	F 4	Block A	NW	52	47
37	GF	Block B - Ground and 1st Floor	S	37	32
	F 1	Block B - Ground and 1st Floor	S	38	32
38	GF	Block B - Ground and 1st Floor	S	37	32
	F 1	Block B - Ground and 1st Floor	S	38	32
39	GF	Block B - Ground and 1st Floor	S	38	32
	F 1	Block B - Ground and 1st Floor	S	38	33
40	GF	Block B - Ground and 1st Floor	S	38	32
	F 1	Block B - Ground and 1st Floor	S	38	33
41	GF	Block B - Ground and 1st Floor	S	38	32
	F 1	Block B - Ground and 1st Floor	S	38	33
42	GF	Block B - 2nd to Top Floor	N	59	53
	F 1	Block B - 2nd to Top Floor	N	60	54
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
43	GF	Block B - 2nd to Top Floor	N	59	54
	F 1	Block B - 2nd to Top Floor	N	60	54
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
44	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	55
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
45	GF	Block B - 2nd to Top Floor	N	59	54
	F 1	Block B - 2nd to Top Floor	N	60	54
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	53
	F 5	Block B - 2nd to Top Floor	N	59	53
	F 6	Block B - 2nd to Top Floor	N	59	53
46	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	55
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
47	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	55
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
48	GF	Block B - 2nd to Top Floor	N	60	55
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	55
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
49	GF	Block B - 2nd to Top Floor	N	59	54
	F 1	Block B - 2nd to Top Floor	N	60	54
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	54
	F 5	Block B - 2nd to Top Floor	N	59	53
	F 6	Block B - 2nd to Top Floor	N	59	53

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
50	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	54
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	54
	F 5	Block B - 2nd to Top Floor	N	59	53
	F 6	Block B - 2nd to Top Floor	N	59	53
51	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
52	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
53	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
54	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	59	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
55	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
56	GF	Block B - 2nd to Top Floor	N	60	54
	F 1	Block B - 2nd to Top Floor	N	60	55
	F 2	Block B - 2nd to Top Floor	N	60	54
	F 3	Block B - 2nd to Top Floor	N	60	54
	F 4	Block B - 2nd to Top Floor	N	60	54
	F 5	Block B - 2nd to Top Floor	N	59	54
	F 6	Block B - 2nd to Top Floor	N	59	53
57	GF	Block B - 2nd to Top Floor	E	59	53
	F 1	Block B - 2nd to Top Floor	E	59	53
	F 2	Block B - 2nd to Top Floor	E	59	53
	F 3	Block B - 2nd to Top Floor	E	58	53
	F 4	Block B - 2nd to Top Floor	E	58	53
	F 5	Block B - 2nd to Top Floor	E	58	52
	F 6	Block B - 2nd to Top Floor	E	57	52
58	GF	Block B - 2nd to Top Floor	E	56	50
	F 1	Block B - 2nd to Top Floor	E	56	50
	F 2	Block B - 2nd to Top Floor	E	56	50
	F 3	Block B - 2nd to Top Floor	E	56	50
	F 4	Block B - 2nd to Top Floor	E	56	50
	F 5	Block B - 2nd to Top Floor	E	56	50
	F 6	Block B - 2nd to Top Floor	E	55	50
59	GF	Block B - 2nd to Top Floor	S	43	37
	F 1	Block B - 2nd to Top Floor	S	43	37
	F 2	Block B - 2nd to Top Floor	S	43	38
	F 3	Block B - 2nd to Top Floor	S	43	38
	F 4	Block B - 2nd to Top Floor	S	44	38
	F 5	Block B - 2nd to Top Floor	S	44	38
	F 6	Block B - 2nd to Top Floor	S	44	38
60	GF	Block B - 2nd to Top Floor	S	39	34
	F 1	Block B - 2nd to Top Floor	S	40	34
	F 2	Block B - 2nd to Top Floor	S	40	34
	F 3	Block B - 2nd to Top Floor	S	41	35
	F 4	Block B - 2nd to Top Floor	S	41	35
	F 5	Block B - 2nd to Top Floor	S	41	36
	F 6	Block B - 2nd to Top Floor	S	42	36
61	GF	Block B - 2nd to Top Floor	S	39	33
	F 1	Block B - 2nd to Top Floor	S	39	33
	F 2	Block B - 2nd to Top Floor	S	40	34
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	41	35
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	41	36

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
62	GF	Block B - 2nd to Top Floor	S	39	33
	F 1	Block B - 2nd to Top Floor	S	39	33
	F 2	Block B - 2nd to Top Floor	S	40	34
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	40	35
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	41	35
63	GF	Block B - 2nd to Top Floor	S	39	33
	F 1	Block B - 2nd to Top Floor	S	39	33
	F 2	Block B - 2nd to Top Floor	S	39	34
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	40	35
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	41	35
64	GF	Block B - 2nd to Top Floor	S	39	33
	F 1	Block B - 2nd to Top Floor	S	39	33
	F 2	Block B - 2nd to Top Floor	S	39	33
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	40	34
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	41	35
65	GF	Block B - 2nd to Top Floor	S	38	32
	F 1	Block B - 2nd to Top Floor	S	38	32
	F 2	Block B - 2nd to Top Floor	S	39	33
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	40	34
	F 5	Block B - 2nd to Top Floor	S	40	34
	F 6	Block B - 2nd to Top Floor	S	41	35
66	GF	Block B - 2nd to Top Floor	S	38	32
	F 1	Block B - 2nd to Top Floor	S	38	32
	F 2	Block B - 2nd to Top Floor	S	39	33
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	40	34
	F 5	Block B - 2nd to Top Floor	S	41	34
	F 6	Block B - 2nd to Top Floor	S	41	35
67	GF	Block B - 2nd to Top Floor	S	38	32
	F 1	Block B - 2nd to Top Floor	S	38	32
	F 2	Block B - 2nd to Top Floor	S	39	33
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	41	34
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	41	35

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
68	GF	Block B - 2nd to Top Floor	S	38	32
	F 1	Block B - 2nd to Top Floor	S	38	33
	F 2	Block B - 2nd to Top Floor	S	39	34
	F 3	Block B - 2nd to Top Floor	S	40	34
	F 4	Block B - 2nd to Top Floor	S	41	35
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	41	35
69	GF	Block B - 2nd to Top Floor	S	38	32
	F 1	Block B - 2nd to Top Floor	S	39	33
	F 2	Block B - 2nd to Top Floor	S	40	34
	F 3	Block B - 2nd to Top Floor	S	41	35
	F 4	Block B - 2nd to Top Floor	S	41	35
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	42	35
70	GF	Block B - 2nd to Top Floor	S	38	33
	F 1	Block B - 2nd to Top Floor	S	39	33
	F 2	Block B - 2nd to Top Floor	S	40	35
	F 3	Block B - 2nd to Top Floor	S	41	35
	F 4	Block B - 2nd to Top Floor	S	41	35
	F 5	Block B - 2nd to Top Floor	S	41	35
	F 6	Block B - 2nd to Top Floor	S	42	36
71	GF	Block B - 2nd to Top Floor	S	41	35
	F 1	Block B - 2nd to Top Floor	S	43	37
	F 2	Block B - 2nd to Top Floor	S	44	38
	F 3	Block B - 2nd to Top Floor	S	44	38
	F 4	Block B - 2nd to Top Floor	S	44	38
	F 5	Block B - 2nd to Top Floor	S	44	39
	F 6	Block B - 2nd to Top Floor	S	45	39
72	GF	Block B - 2nd to Top Floor	W	51	45
	F 1	Block B - 2nd to Top Floor	W	54	49
	F 2	Block B - 2nd to Top Floor	W	55	49
	F 3	Block B - 2nd to Top Floor	W	55	50
	F 4	Block B - 2nd to Top Floor	W	55	50
	F 5	Block B - 2nd to Top Floor	W	55	50
	F 6	Block B - 2nd to Top Floor	W	55	50
73	GF	Block B - 2nd to Top Floor	W	58	52
	F 1	Block B - 2nd to Top Floor	W	59	53
	F 2	Block B - 2nd to Top Floor	W	59	53
	F 3	Block B - 2nd to Top Floor	W	59	53
	F 4	Block B - 2nd to Top Floor	W	59	53
	F 5	Block B - 2nd to Top Floor	W	58	53
	F 6	Block B - 2nd to Top Floor	W	58	52

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS

Receptor Number	Floor	Block Name	Façade Direction	Predicted Façade Noise Levels	
				LrD	LrN
				dB(A)	
74	GF	Block B - 2nd to Top Floor	W	51	46
	F 1	Block B - 2nd to Top Floor	W	55	49
	F 2	Block B - 2nd to Top Floor	W	55	50
	F 3	Block B - 2nd to Top Floor	W	55	50
	F 4	Block B - 2nd to Top Floor	W	56	50
	F 5	Block B - 2nd to Top Floor	W	56	50
	F 6	Block B - 2nd to Top Floor	W	55	50
75	GF	Block B - 2nd to Top Floor	W	57	52
	F 1	Block B - 2nd to Top Floor	W	58	52
	F 2	Block B - 2nd to Top Floor	W	58	52
	F 3	Block B - 2nd to Top Floor	W	58	52
	F 4	Block B - 2nd to Top Floor	W	58	52
	F 5	Block B - 2nd to Top Floor	W	57	52
	F 6	Block B - 2nd to Top Floor	W	57	51

APPENDIX 3 - PREDICTED DEVELOPMENT FACADE NOISE LEVELS