



NOISE IMPACT ASSESSMENT

NMGH- WASTE COMPOUND

Manchester University NHS Foundation Trust
2062435-RSKA-RP-001-(02)





General notes

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Acoustics Ltd.



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1 Introduction

1.1 Overview

RSK Acoustics (RSKA) has been instructed by Manchester University NHS Foundation Trust to undertake a noise impact assessment to evaluate the operational noise impact resultant of the relocation of a waste compound at North Manchester General Hospital.

The assessment benefits from a baseline noise survey and an attended noise monitoring exercise. The baseline noise assessment was undertaken at two positions representative of nearest noise sensitive receptors (NSRs), to determine typical background noise levels during both daytime and night-time periods. Attended noise monitoring was undertaken at the existing waste compound in order to obtain representative noise data for the expected site activities.

This report describes the assessment methodology and the baseline conditions currently prevailing across the immediate area to evaluate the suitability of the new waste compound location, considering the noise impact of both site activity and plant items.

1.2 Objectives

The aim of this noise impact assessment is to:

- Quantify and report the prevailing noise climate at nearest noise sensitive receptors (NSRs) to the proposed waste compound location;
- Present relevant impact assessment thresholds from national guideline BS 4142 and the impact categorised;
- Predict the operational noise impact from the new waste compound location at the nearest NSRs;
- Assess predicted noise levels against the relevant noise impact thresholds; and
- Specify noise mitigation measures where necessary.

1.3 Exclusions

It is anticipated that site activities and the function of the heat pump will not result in significant vibration. Therefore, operational vibration has been scoped out of the assessment.



2 Relevant Policy and Guidance

2.1 British Standard (BS) 7445-1:2003

The three-part standard BS 7445 'Description and measurement of environmental noise. Guide to quantities and procedures' provides the framework within which environmental noise should be quantified. Part 1 provides a guide to quantities and procedures and Part 2 provides a guide to the acquisition of data pertinent to land use. Part 3 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 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 metres above the ground);
- No strong temperature inversions near the ground; and
- No heavy precipitation

2.2 British Standard (BS) 4142:2014+A1:2019

BS4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' describes the methods for rating and assessing noise of an industrial or commercial nature. The standard is applicable for the purpose of assessing sound from multiple sources at existing dwellings, including the following:

- Sound for industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from the premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

Where certain acoustic features are present at the assessment location, a character correction should be applied to the specific sound level to give the rating level to be used in the assessment. The difference between the background noise level and the noise rating (including any penalties) is then calculated.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of adverse impact depending on the context.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.



As indicated above, the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. BS4142 states that:

“An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context”.

Where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be taken into account, including:

- The absolute level;
- The character and level of the residual sound; and
- The sensitivity of the receptor and whether dwellings will already (or likely) to incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
 - façade insulation treatments;
 - ventilation and/or cooling; and
 - acoustic screening.

2.3 World Health Organization Guidelines for Community Noise, 1999

The 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 levels which are relevant to this assessment are set out in Table 1 below:

Environment	Critical health effect(s)	L_{eq} dB(A)	Time base (hours)	$L_{max,F}$ dB(A)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45 ^[1]
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60
Notes ^[1] Should not exceed 45 dB L_{AFmax} more than 10-15 times per night				

Table 1 WHO Guidelines for Community Noise



3 Development

3.1 Site Location and Description

The development site is currently a car park off Crescent Road, to the east of North Manchester General Hospital (NMGH). An agricultural area is situated immediately to the east of the development site, with a heavy goods vehicle (HGV) rental yard located beyond. To the north-west, the site is largely surrounded by further hospital buildings. Further afield lies a series of residential estates and occasional parkland, serviced by a local road network.

3.2 Development

It is understood that the development plans involve the conversion of an existing car park area into a waste compound similar to that which is currently situated to the north of the hospital site. Plans involve the construction of a waste compound and staff welfare unit including a heat pump, the relocation of two waste compactors and relocation of bin stores and associated activities. It is anticipated the area will be operational during daytime hours (07:00-23:00), with the exception of the changeover of clinical bins between the hours of 04:00-06:00.

3.3 Existing Receptors

The following NSRs have been identified as being the closest and/or most exposed to the development site. for assessment purposes:

Ref.	NSR Name	NSR Type	Distance from closest development boundary (m; direction)
NSR1	Closest Hospital facade	Hospital	14; W
NSR2	12 Longshaw Close	Residential	101; SE

Table 2 NSR Locations



4 Noise Survey Method

4.1 Survey Details

A baseline noise survey was undertaken from 11 April 2024 to 14 April 2024 to obtain data for both midweek and weekend periods. Unattended noise monitoring was undertaken at two locations, one adjacent from the closest hospital façade in the staff carpark situated off Crescent Drive and one further location situated in the lower staff carpark (access adjacent to Lilac Centre Gynaecology Department).

The measurement locations were selected with consideration to the site constraints, security of the monitoring equipment and accessibility of positions with the intention of quantifying noise from surrounding sources such as the contribution from road traffic, overall hospital activity and the third-party HGV yards situated further to the east. It was not possible to install the sound level meter within the curtilage of the NSRs and, therefore, proxy locations were chosen based on proximity to the identified NSRs. Observations made during installation and collection determined that the noise environment at the monitoring location was consistent with that witnessed at the NSRs.

In addition, attended noise monitoring was undertaken in the early hours of 16 April 2024 in order to quantify the noise impact of early morning site activities. Currently, all waste disposal activities are undertaken at an existing waste compound in the north of the site, including the early morning movement and disposal of 770L Stericycle clinical waste bins between the hours of 04:00-06:00.

A summary of the measurement locations is provided in Table 3 and are shown graphically in Appendix A. With specific reference to the attended measurements, distances from the measurement location to site activities are detailed in Section 4.3.

Measurement Location	Location Coordinates
Unattended Monitoring Locations	
MP1	53.515383, -2.227630
MP2	53.515300, -2.226750
Attended Monitoring Location	
MP3	53.518879, -2.225816

Table 3 **Measurement Location Details**





Figure 1 Attended and Unattended Monitoring Positions



4.2 Baseline Noise Survey

4.2.1 Survey Observations

The acoustic environment was observed by the consultant to comprise the following during the equipment installation:

- MP1:
 - Consistent birdsong.
 - Road traffic noise audible in instances of passing traffic on Crescent Drive.
 - Construction noise from adjacent hospital works site consisting of plant beacons, plant engine noise/plant movement and intermittent banging.
- MP2:
 - Consistent birdsong largely dominant in absence of other noise sources.
 - Wider road network audible and consistent.
 - Intermittent low-level construction noise audible from adjacent hospital site consisting of plant beacons and intermittent banging.

4.2.2 Survey Equipment

Noise monitoring was undertaken using the following equipment, detailed in Table 4:

Equipment	Type	Serial Number	Calibration Due Date
Class 1 sound level meter	Svantek 307	119105	02 February 2025
Class 1 sound level meter	Rion NL-52	453835	29 August 2025
Acoustic calibrator	Rion NC-75	34524164	14 August 2025

Table 4 Noise Monitoring Equipment – Unattended Survey

All measurements were undertaken with the microphone positioned away from reflecting surfaces and at a height of 1.5 m above the ground, considered to be under free-field measurement, to the requirements of BS 7445. The calibration of each sound level meter was checked before and after the measurements, using the acoustic calibrator at 94 dB at 1 kHz; no significant calibration drift was noted (+/- 0.3 dB). The sound level meters used conform to the Class 1 requirements of BS EN 61672-1: 2013 'Electroacoustics. Sound level meter, Specifications'. The calibrator used conforms to the requirements of BS EN 60942: 2018 'Electroacoustics, Sound calibrators.' The equipment used has a calibration history that is traceable to a certified calibration institution.

4.2.3 Weather Conditions

Weather conditions during the unattended measurement period were obtained from Wunderground (www.wunderground.com), using the weather station closest to the measuring location (with available historical data). This was judged to be Tariff Street (IMANCH162); the weather data is summarised in Table 5 overleaf.



Date	Temperature High (°C)	Temperature Low (°C)	Wind Speed High (m/s)	Accum. Precipitation Throughout Day (mm)
11.04.24	14	5	5.3	1.4
12.04.24	17	11	5.3	0
13.04.24	17	9	3.6	3.9
14.04.24	14	7	4.2	0

Table 5 Summarised Weather Data During Monitoring Period

When considering the weather conditions throughout the monitoring period, it was noted that rainfall had occurred on occasion during periods of interest. However, further scrutiny of the measurement data concluded that these periods have not materially affected the baseline conditions or the subsequent statistical analyses for the measurement data. As such, conditions were conducive for noise monitoring.

4.3 Attended Noise Survey

4.3.1 Survey Observations

In order to inform computer noise modelling, attended noise monitoring of Stericycle bin collection activities was undertaken to obtain representative noise data of site activities and also inform perceptive observations of the noise impact of site activities. Discussions with Stericycle staff allowed for the activities to be split into separate monitoring periods, so that representative data of each activity could be obtained.

4.3.2 Survey Equipment

Attended noise monitoring was undertaken using the following equipment, detailed in Table 6:

Equipment	Type	Serial Number	Calibration Due Date
Class 1 sound level meter	Svantek 971A	121062	24 April 2024
Acoustic calibrator	Rion NC-75	34524164	14 August 2025

Table 6 Noise Monitoring Equipment – Attended Survey

4.3.3 Weather Conditions

Weather conditions during the attended measurement period were considered by the consultant in attendance to be conducive to source noise level monitoring (clear/dry/low wind speeds). This was confirmed via a handheld anemometer operated by the RSKA staff member in attendance.



5 Noise Survey Results

5.1 Baseline Noise Survey Results

To display a summarised dataset within this section, the following methods have been used:

- Ambient levels, dB $L_{Aeq,T}$, are calculated via logarithmic average of contiguous 15-minute records across the assessment periods;
- Statistical values, dB $L_{A10,T}$ and $L_{A90,T}$, are calculated via arithmetic average of contiguous 15-minute records across the assessment periods;
- Maximum levels, dB L_{AFmax} , are summarised as the highest individual $L_{AFmax,15min}$ recorded across each assessment period; and
- All values have been rounded to the nearest decibel.

5.1.1 Noise Monitoring Position MP1

A summary of the measured noise levels at position MP1 are presented in Table 7 below:

Date	Time period (hh:mm)	Measured Noise Levels, dB(A)			
		Average $L_{Aeq,T}$	Highest $L_{AFmax,T}$	Average $L_{A90,T}$	Average $L_{A10,T}$
11.04.24	14:30 – 23:00	59	83	46	62
11.04.24-12.04.24	23:00 – 07:00	52	81	41	52
12.04.24	07:00 – 23:00	58	84	45	62
12.04.24-13.04.24	23:00 – 07:00	54	93	39	52
13.04.24	07:00 – 23:00	61	95	46	62
13.04.24-14.04.24	23:00 – 07:00	51	75	40	51
14.04.24	07:00 – 10:00	53	75	40	52

Table 7 Summary of Noise Measurements – MP1

A summary of the measured noise levels at position MP2 are presented in Table 8 below:

Date	Time period (hh:mm)	Measured Noise Levels, dB(A)			
		Average $L_{Aeq,T}$	Average $L_{Aeq,T}$	Average $L_{Aeq,T}$	Average $L_{Aeq,T}$
11.04.24	15:00 – 23:00	48	82	45	49
11.04.24-12.04.24	23:00 – 07:00	47	76	41	49
12.04.24	07:00 – 23:00	49	79	44	50
12.04.24-13.04.24	23:00 – 07:00	47	74	39	47
13.04.24	07:00 – 23:00	51	80	45	52
13.04.24-14.04.24	23:00 – 03:45	43	59	39	45

Table 8 Summary of Noise Measurements – MP2



5.1.2 Derivation of Background Noise Levels

Representative background noise levels are provided for daytime and night-time periods. The methodology detailed in BS 4142: 2014+A1: 2019 provides an example of statistical analysis to determine the representative background noise level during the daytime ($L_{A90, 1h}$) and night-time ($L_{A90, 15min}$).

The analysis adopts the methodologies applied within the standard to the NSRs with the representative measurement location background levels. Graphs of the statistical analyses of the background noise levels are shown in Appendix C.

NSR	Representative Measurement Location	Representative Background Sound Level, dB $L_{A90,T}$	
		Daytime, $L_{A90, 1h}$ (07:00-23:00)	Night-time, $L_{A90, 15min}$ (23:00-07:00)
NSR1	MP1	42	37
NSR2	MP2	45	37

Table 9 Receptor Background Levels

5.2 Attended Noise Survey Results

Details of the attended measurements are provided in Table 10 below:

Site Activity	Distance from Activity (m)	Measurement Length	Measured noise level dB (L_{Aeq})
Loading empty bins off HGV and into compound	1	1m 54s	73
Loading full bins onto HGV from compound	1	2m 38s	71
Full load on load off cycle	1	3m 37s	70
Movement of bins around compound	2-5	0m 45s	73
HGV leaving compound	6.5*	0m 58s	64
Note: All dB values are rounded to the nearest whole number *Initial distance from monitoring position to HGV before leaving compound			

Table 10 Attended Measurement Details



6 Noise Prediction Model

6.1 Methodology

The predicted noise levels likely to be generated from the site have been calculated using a noise prediction model. These predictions realise the noise propagation of any plant noise in isolation at the nearest sensitive receptors to the site taking terrain and local topographical features into consideration.

The noise predictions (specific sound levels at noise sensitive receptors) are based on International Standard ISO 9613-2:1996 'Attenuation of sound during propagation outdoors – general method of calculation'. ISO 9613 provides a method for the prediction of noise levels in the community from sources of known sound emission.

The ISO 9613-2 method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation, or equivalently, propagation under a moderate ground-based temperature inversion as commonly occurs at night.

A computer noise model of the site has been produced using SoundPLAN v9.0 based on site layout information passed on by the client, with consideration of the positioning/orientation of all buildings and structures.

Input data in the form of noise emission levels has been assigned to the proposed plant, adjusted to the geometry and nature of the site operations for the site, with the noise data obtained from previous solar panel planning applications.

The noise prediction method described in ISO 9613 is suitable for a wide range of engineering applications where the noise level outdoors 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, barriers and buildings.

6.2 Modelling Parameters

An overview of the modelling parameters is given in Table 11 overleaf:



Item	Setting
Algorithms	International Standard: ISO 9613-2
Façade Corrections	Predictions are at 1 m from a given façade
Ground Absorption	Ground Absorption had been set to reflect the terrain of the area. 0=Soft Ground, 1=Hard Ground
Meteorological Conditions	10 degrees Celsius; 70% humidity; and Wind from source to receiver.
Façade Corrections	Calculations are free-field. No façade corrections have been applied
Source Modelling	See Section 6.3.
Terrain	Terrain has been derived from NextMap Britain 2m_Contours and with consideration of the conditions observed by RSKA staff members in attendance.
Site Layout	Digitised based on site layout as per Appendix A.

Table 11 Detailed Modelling Parameters

6.3 Operational Source Noise Data (Unmitigated)

6.3.1 Plant Item Noise Data

At present, the specific heat pump to be installed at the waste compound site is yet to be confirmed. At the request of the client, the Mitsubishi Electric Ecodan R32- PUZ-HWM140VHA(-BS) has been considered for the purpose of noise modelling. In order to account for a worst-case scenario, this version of the Ecodan R32 is the loudest in terms of noise emissions of the 3 possible model variations. Table 12 (below) details the noise specification data employed for the purpose of noise modelling:

Heat Source Pump model	Noise Level at 1m (dB L _{PA})	Sound Power Level (dB L _{WA})
Mitsubishi Electric Ecodan R32- PUZ-HWM140VHA(-BS)	53	67

Table 12 Heat Pump – Noise Specification

It has been confirmed that the existing Pakawaste Portakrush 2000 portable compactors will be situated within the waste compound.

At the time of completing this assessment, it was not possible to obtain noise levels in proximity to the existing units whilst in operation. Plant specifications for the units do not detail noise emission data and it has not been possible to obtain adequate noise emission data from the manufacturer.

As a result, representative data has been obtained from a similar model. In order to employ conservatism, the representative model selected (CP30 Hopper Waste Compactor) exceeds the Pakawaste Portakrush 2000 in terms of motor rating and compaction force. Table 13 (overleaf) displays a comparison of the respective compactor specification data and the noise level used for the purpose of assessment:



Specification Parameter	Pakawaste Portakrush 2000	CP30 Hopper Waste Compactor
Overall length (mm)	6452	6811
Overall width (mm)	2523	2360
Overall height (mm)	2850	2523
Normal operating compaction force (tonnes)	25	28
Dry cycle time (Seconds) ^(a)	45	41
Motor rating (Kw)	5.5	7.5
Noise level at 3m (dB)	-	67
^(a) Pakawaste Portakrush 2000 dry cycle time exceeds CP30 Hopper Waste Compactor, therefore Pakawaste Portakrush 2000 dry cycle time used for the purpose of assessment		

Table 13 *Compactor Specification Comparison*

With consideration to the above information in Table 13, it is therefore considered that the CP30 Hopper Waste Compactor Plant specification is a reasonable assumption in the context of the assessment.

6.3.2 Waste Compound Operations Noise Data

In order to inform the assessment, attended noise monitoring of the collection of 770L bins by Stericycle was undertaken to allow for physical site activities to be considered. These were split into individual activities and were included in the calculation model as separate noise sources to appropriately identify their contribution to the specific sound level at the NSRs.

With respect to activities in which the sound source was moving, the measured data was first calculated as a Single Event Level (dB L_{AE}) to present a source level reflective of the wider operation as opposed to an average value. This includes the movement of bins around the compound and of the HGV movement.

With respect to the loading and unloading operations, these were implemented into the calculation model as point sources to reflect the spatial position of the sound source.

6.4 Operational Assumptions

Computer noise modelling has considered the heat pump and compactors to be a consistent noise source throughout any given 1-hour or 15-minute reference period for this assessment.

Site operatives have confirmed that compactors are in use most of the day from 09:30-18:30; however, there are no instances where both compactors would be operational during any one time. To present a robust assessment, the calculation model therefore assumes that the compactors are in constant use in any given 1-hour reference period during the daytime, but with only one running at a time. It has been verified that the waste compactors are not used during the night-time period and therefore have been excluded from the hours of 23:00-07:00.

For the waste compound operations, moving point sources were time-corrected with the assumption of a single event taking place across a specified path in a given 1-hour or 15-minute period and are representative of the anticipated speed of the noise source: 20km/h for the HGV in transit along the public highway, 10km/h whilst in the site and 5 km/h for pedestrian movements of the bins.

Similarly, point sources have been time-corrected against the timeframe in which the attended measurements took place; from discussions with the Stericycle operator on site, it is understood that these periods reflect the time taken to complete each task.



6.5 Predicted Noise Levels at Site NSRs

The following noise levels are predicted at the NSRs as a result of the site activities described above.

NSR	Specific Sound Level, dB L _{AS,T}	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)
NSR1	55	60
NSR2	41	39

Table 14 Predicted Noise Levels at site NSRs – Daytime and Night-time



7 Operational Noise Impact

7.1 Operational Noise Impact

The Rating Level from site activity has been predicted as the contribution (energetic sum) of the site activities and the installed heat source pump within the proposed development. This scenario provides a conservative interpretation of the resulting noise levels at each receptor.

7.1.1 Acoustic Correction

According to BS 4142:2014+A1: 2019, where certain features of the specific noise level can increase the significance of impact of a sound level, a character correction is applied to provide a rated noise level. The characteristics of a sound that are likely to cause an increase in the significance of impact are tonality, impulsivity, intermittency or other characteristic features such as an identifiable 'hiss'.

Taking the above acoustic features into consideration, the application of rating penalties is as follows:

Tonality

- From observations of on-site activities and prior RSKA experience of heat pumps, it is considered that these elements of the development do not present characteristics deemed 'tonal' in the context of BS 4142 and, therefore, a character correction is not required.
- However, some concern is raised with regards to the potential tonality issues resultant of the operation of the waste compactors. This is expected to be of greater concern at NSR1 than NSR2 due to distance causing the specific level to be quieter in comparison to residual background levels at the NSR and the specific characteristic deemed less prominent as a result. Therefore, a conservative character correction of +4dB at NSR1 and +2dB at NSR2 has been applied. As it has been confirmed that the compactors will only be operational during the daytime period, no correction has been applied during the night-time period with regards to tonality.

Impulsivity

- The character of the sound from on site activities is expected to be somewhat impulsive, with concerns as to movement of bins, and the impulsive nature of the operation of the waste compactors. This is expected to be of greater concern at NSR1 than NSR2, where the reduced distance is more likely to result in any impulsive characteristics being more distinctive against the prevailing residual environment. Therefore, a conservative character correction of +6dB at NSR1 and +3dB at NSR2 has been applied for the daytime period.
- As the waste compactors will only be in use during the daytime period, a reduced night-time character correction of +3dB has been applied at both NSRs to reflect any perceived impulsive nature of the bin activities only, as perceived by the RSKA staff member in attendance during the attended monitoring exercise.

Intermittency

- As multiple on/off conditions within a given 1-hour (daytime) or 15-minute (night-time) reference periods are not considered to be identifiable amongst the residual environment, intermittency character corrections have not been applied.

Table 15 (overleaf) displays the applied character corrections for both the daytime and night-time periods:



NSR	Tonality Correction (dB)	Impulsivity Correction (dB)	Intermittency Correction (dB)	Total Character Correction (dB)
Daytime				
NSR1	+4	+6	0	+10
NSR2	+2	+3	0	+5
Night-time				
NSR1	0	+3	0	+3
NSR2	0	+3	0	+3

Table 15 Applied Character Corrections

7.1.2 Comparison between Rating Level and Background Sound Level

The derived Rating Levels at each NSR and excess over background noise levels for the daytime and night-time periods, are as follows:

NSR	Specific Sound Level, dB $L_{AS,T}$	Background Sound Level, dB $L_{A90,1h}$	Character Corrections, dB	Rating Level, dB $L_{Ar,Tr}$	Excess Over Background, dB
NSR1	55	42	10	65	+23
NSR2	41	45	5	46	+1

Table 16 Comparison between Rating Level and Background Sound Level – Daytime

NSR	Specific Sound Level, dB $L_{AS,T}$	Background Sound Level, dB $L_{A90,15min}$	Character Corrections, dB	Rating Level, dB $L_{Ar,Tr}$	Excess Over Background, dB
NSR1	60	37	3	63	+26
NSR2	39	37	3	42	+5

Table 17 Comparison between Rating Level and Background Sound Level – Night-time

The Rating Level (inclusive of penalty corrections) from site activity has been predicted as the contribution (energetic sum) of all active sources within the proposed development. This scenario provides a conservative interpretation of the resulting noise levels at receptor.

BS 4142 states:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of adverse impact depending on the context.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Rating levels are above the representative background noise level for both the daytime (+23dB) and night-time (+26dB) at NSR1.

Rating levels are above the representative background noise level for the daytime period (+1dB) and night-time (+5dB) at NSR2.



8 Context Evaluation of Significance Criteria

Table 18 below lists the significance of noise impact for each NSR based on the above assessment, pending contextual factors for the site and surrounding area.

NSR	Scenario	Difference between Rating and Background Levels, dB(A)	Expected Impact
NSR1	Daytime	+21	Significant Adverse
	Night-time	+26	Significant Adverse
NSR2	Daytime	+1	N/A
	Night-time	+3	Adverse

Table 18 *Appraisal of BS 4142 Assessment*

In isolation, i.e., without taking contextual factors into account, the initial assessment suggests that noise levels would be of a significant impact at NSR1 during both the daytime and night-time period.

However, BS 4142 states that:

“An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context”.

The following should be noted when determining the noise impact of the proposed development:

- It should be noted that the noise level specification considered for the waste compactors is that of a more powerful model with regards to motor rating and compaction force. It is therefore expected that the Pakawaste Portakrush 2000 will be marginally quieter in practice than the model considered.
- It is understood that the compactors would not both be operational concurrently. The assessment assumes both units in operation to account for potential short-term crossover but it should be noted that this is unlikely to be the case for a prolonged period of time.
- Dependent on the hospital ventilation strategy, it can be expected the absolute noise within the hospital building due to the proposed development may be equally, or more, important when considering the degree of change. Consideration can also be given to the attenuation allowed by the hospital façade to limit the absolute noise level within the hospital building.
- With respect to the night-time impacts, it should be noted that the representative background sound level accounts for typical levels observed throughout the full 8-hour period (23:00-07:00). However, it has been confirmed that the on-site operations would be unlikely to take place outside of the hours of 04:00-06:00. Consideration should be given to the fact that the representative background sound level adopted for this assessment may be overly pessimistic when accounting for the likely real-world scenario.



9 Mitigation

The following provides an indicative overview of potential mitigation options for a development site such as this:

9.1 Mitigation Options

When choosing attenuation measures or implementing an effective noise reduction program, there are two possible approaches for treatment:

- At source – modify the source to reduce noise levels; and
- In the path – deflect or block the acoustic path of noise.

9.1.1 Mitigation at Source

When considering the noise impact of the waste compound, it is evident that the biggest area of concern is the waste compactors. Attention to the equipment and its operation can have a major effect on controlling noise emissions at the site:

- Equipment changes – the installation of quieter waste compactors at the site could significantly reduce noise impact. The potential to install a single, larger compactor that is used less may also reduce the overall noise impact. However, this may also increase the inherent noise emissions per unit.
- Management planning – the instigation of a management plan where the waste compactors are used more efficiently and therefore over a reduced period could also reduce noise impact. Management planning could also be employed with regard to site activities: for example, limiting the times of bin collections or employing best practice when filling the bins to reduce the noise generated could reduce the overall noise impact.
- Location – Positioning the compactors further away from NSR1 could reduce noise impact. However, due to the size constraints of the development site, care would have to be given as to ensure this does not inherently cause a detrimental impact at NSR2.

9.1.2 Mitigation Through Transmission

The construction of an acoustic barrier may aid with the reduction of noise emissions. Barriers should be constructed of a suitably dense material of no less than 10 kg/m² and preferably more than 20 kg/m², with no holes or gaps around or underneath, and should be designed to appropriately screen the enclosed unit so there is no direct line of sight from all plant to NSR1 (the hospital façade), taking into consideration the presence of 1st floor windows.

Consideration of the external façade mitigation afforded by the hospital may also be a factor when determining the significance of impact and the efficacy of any mitigation strategies. By adopting alternate measures at the hospital with respect to ventilation schemes (i.e., via means other than opening windows), the reduced requirements for opening windows and therefore reduce the noise impact of the compound within the hospital rooms.

9.2 Planned Mitigation Methods

It is understood that a number of mitigation methods are in the planning stages with the intention of reducing the operational noise impact of the site. At present, the client has confirmed the following measures are expected to be implemented:

- Operational Plan Amendments – Changes to the operational times of the site are expected, reducing the noise impact in the early morning periods. It can therefore be expected that the noise impact of the site during the calculated night-time period (23:00-07:00) will be reduced.



- Equipment Changes – The waste team are investigating the possibility of updating equipment, selecting quieter models.
- Acoustic Screening – screening of the compactors is being considered. It is recommended that the barriers are at a minimum of equal height to the compactors and positioned as close as operationally possible in order to maximise their efficiency regarding noise attenuation.
- Acoustic fencing – It is expected that acoustic fencing around the site's perimeter is to also be installed. Again, it is recommended that the line of sight is broken from the noise sources associated with the compound activities to the hospital façade, and that the recommendations discussed in Section 9.1.2 are met.

At present, all mitigation measures are at the planning stage. Prior to installation, the methods of mitigation are to be assessed in terms of their effectiveness via computer noise modelling and assessment, with recommendations to be given as to the expected effectiveness. It is anticipated that once implemented, the mitigation methods put in place will significantly reduce the noise impact of the proposed waste compound.



10 Uncertainty

It is accepted that uncertainty may arise from all levels of measurement and assessment and reasonably practicable steps have been made at all stages with the aim of reducing uncertainty.

The following measures have been taken into consideration when determining the uncertainty of this assessment:

- Background sound level measurements have been obtained at representative assessment locations over a duration of four days to appropriately characterise the existing residual environment during the intended operational hours of the proposed development;
- Representative background levels obtained during the daytime and night-time have been utilised to inform the assessment;
- Use of monitoring equipment in accordance with section 5 of BS 4142: 2014+A1: 2019, using Class 1 instrumentation;
- Measurement procedures followed in accordance with section 6 of BS 4142: 2014+A1: 2019 with all precautions taken to minimise interference; and
- Specific sound levels have been calculated to the requirements of ISO 9613-2: 1996 which is the widely accepted procedure for the calculation of sound propagation (including favourable wind conditions from source to receiver). The assessment is informed by comparison of the predicted Rating Levels against the representative background sound levels at each receptor in accordance with section 7 of BS 4142: 2014+A1: 2019.

Given the measures outlined above and the magnitude of predicted operational levels in the context of the existing local noise environment, it is considered that the uncertainty does not have any significance on the outcome of the assessment. Because the approach taken is likely to be an over-prediction of worst-case noise levels, while there are many uncertainties present in the assessment, it is considered that the broader outcome is unlikely to change.



11 Conclusions

11.1 Summary

A noise impact assessment has been undertaken to consider the noise impact of a proposed waste compound at North Manchester Greater Hospital. The assessment focuses on the operational impact of the development at the nearest hospital façade and residential receptors to the requirements of BS 4142: 2014+A1: 2019.

A baseline noise survey has been utilised to determine representative background noise levels at those closest existing receptors to the site, through statistical analysis.

A computer noise model has been developed which incorporates the expected site activities, waste compactors and a heat source pump. Predictions account for the operation of the waste compound during daytime and night-time assessment periods.

Rating levels are above the representative background noise level for both the daytime (+23dB) and night-time (+26dB) at NSR1.

Rating levels are above the representative background noise level for the daytime period (+1dB) and night-time (+5dB) at NSR2.

Following consideration of context, it is considered that a significant adverse impact is expected for NSR1 during both daytime and night-time periods, with an adverse impact predicted at NSR2 during the night-time only.

It is recommended that additional mitigation be sought when addressing the impact of the proposals, particularly upon the hospital occupants. This may include:

- Consideration of fixed plant with a lower noise emission;
- Implementation of a noise management plan;
- Screening of noise sources using acoustic barriers or enclosures; and
- Investigation of the extant building façade and its inherent noise mitigation within hospital rooms.

In addition to the above, it is recognised that mitigation measures have been planned. It is anticipated that implementation of these measures described in Section 9.1.3 would considerably lower the noise impact from the site activities at the specified NSRs, although further assessment may be required to confirm this.



References

- British Standard 4142: 2014+A1:2019, '*Methods of rating industrial and commercial sound*'. British Standards Institution.
- British Standard 7445-1: 2003, '*Description and measurement of environmental noise – Part 1: Guide to quantities and procedures*'. British Standards Institution.
- ISO 9613-2:1996 '*Attenuation of sound during propagation outdoors – general method of calculation*'. International Organization for Standardization.
- National Planning Policy Framework – Department for Communities and Local Government. March 2012 (as amended February 2019)
- Noise Policy Statement for England (NPSE). DEFRA, 2010.
- World Health Organization (WHO), '*Guidelines for Community Noise – 1999*'.

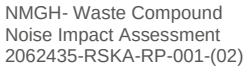


Glossary of Acoustic Terminology

Term	Definition
Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. 2×10^{-5} Pascal.
dB(A)	A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include: 140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
NR	Noise rating. A set of curves based on the sensitivity of the human ear. They are used to give a single-figure rating for a range of frequencies.
Rating level	Specific sound level of a source plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Sound absorption	Process whereby sound energy is converted in to heat. Sound absorption properties is expressed as the sound absorption coefficient α or the sound absorption class (A-E).
Sound insulation	The reduction or attenuation of airborne sound by a solid element between source and receiver.
Specific sound	Sound pressure level produced by the source being assessed at the assessment location.



Figure 2 *Site Layout Plan*



Appendix B: Monitoring Location Photographs

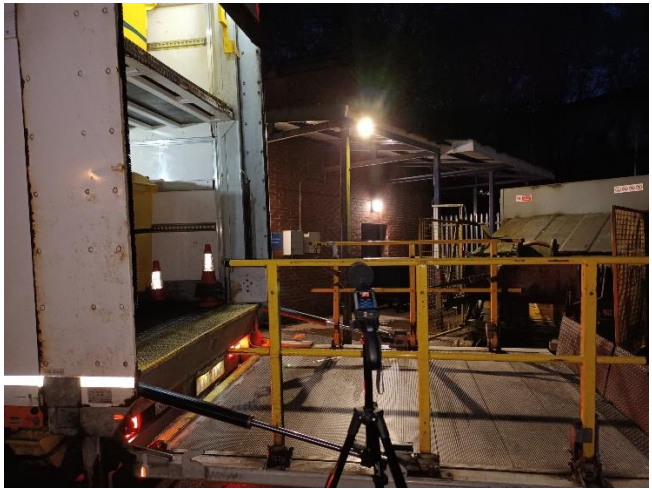
Measurement Location	Location Coordinates	Photographs
MP1	53.515383, -2.2276306	
MP2	53.515300, -2.2267500	
MP3	53.518879, -2.225816	

Table A.1 Measurement Location Coordinates and Photographs





Appendix C: Measured Noise Levels and Background Noise Level Graphs

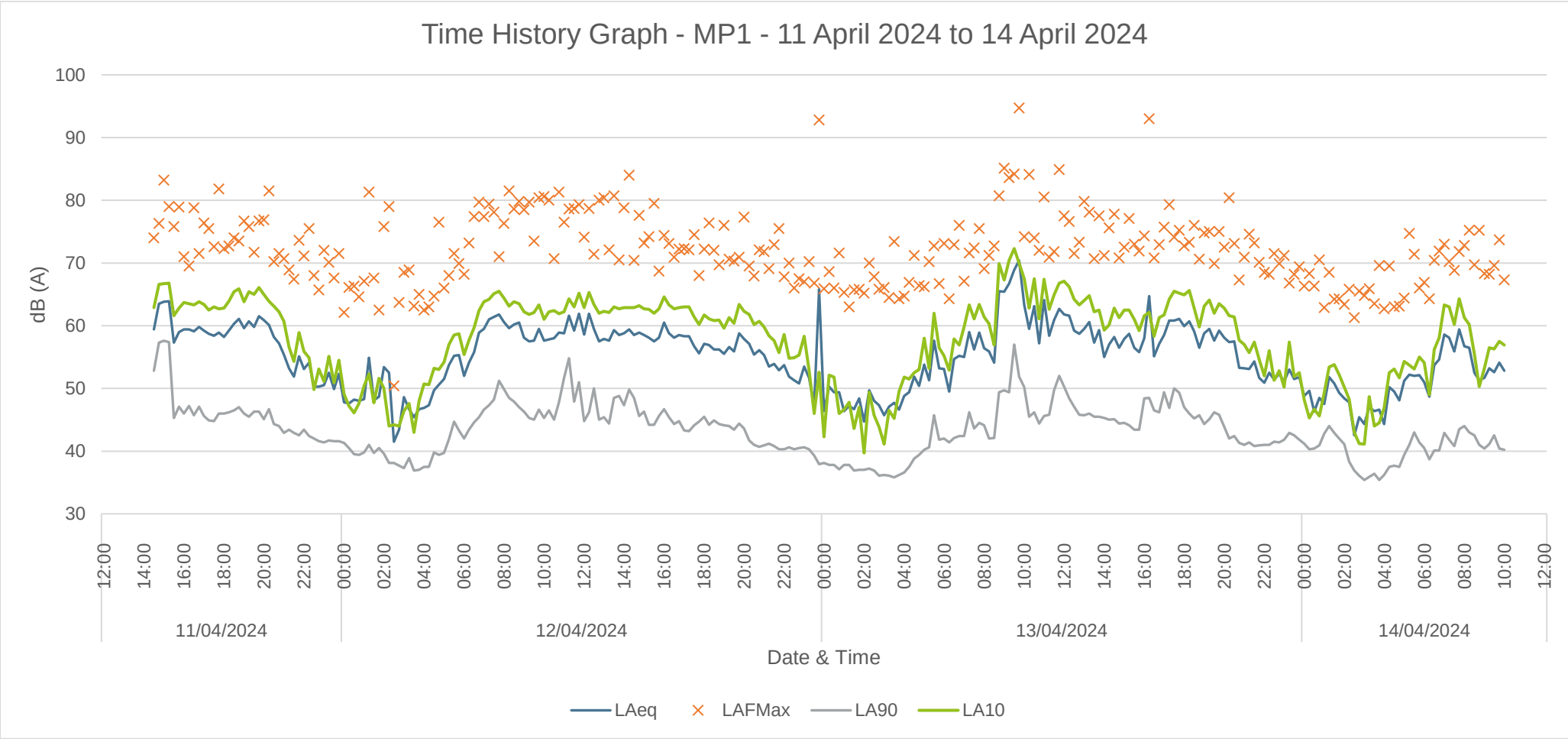


Table B.1 Time History - MP1 – 11/04/24 to 14/04/24



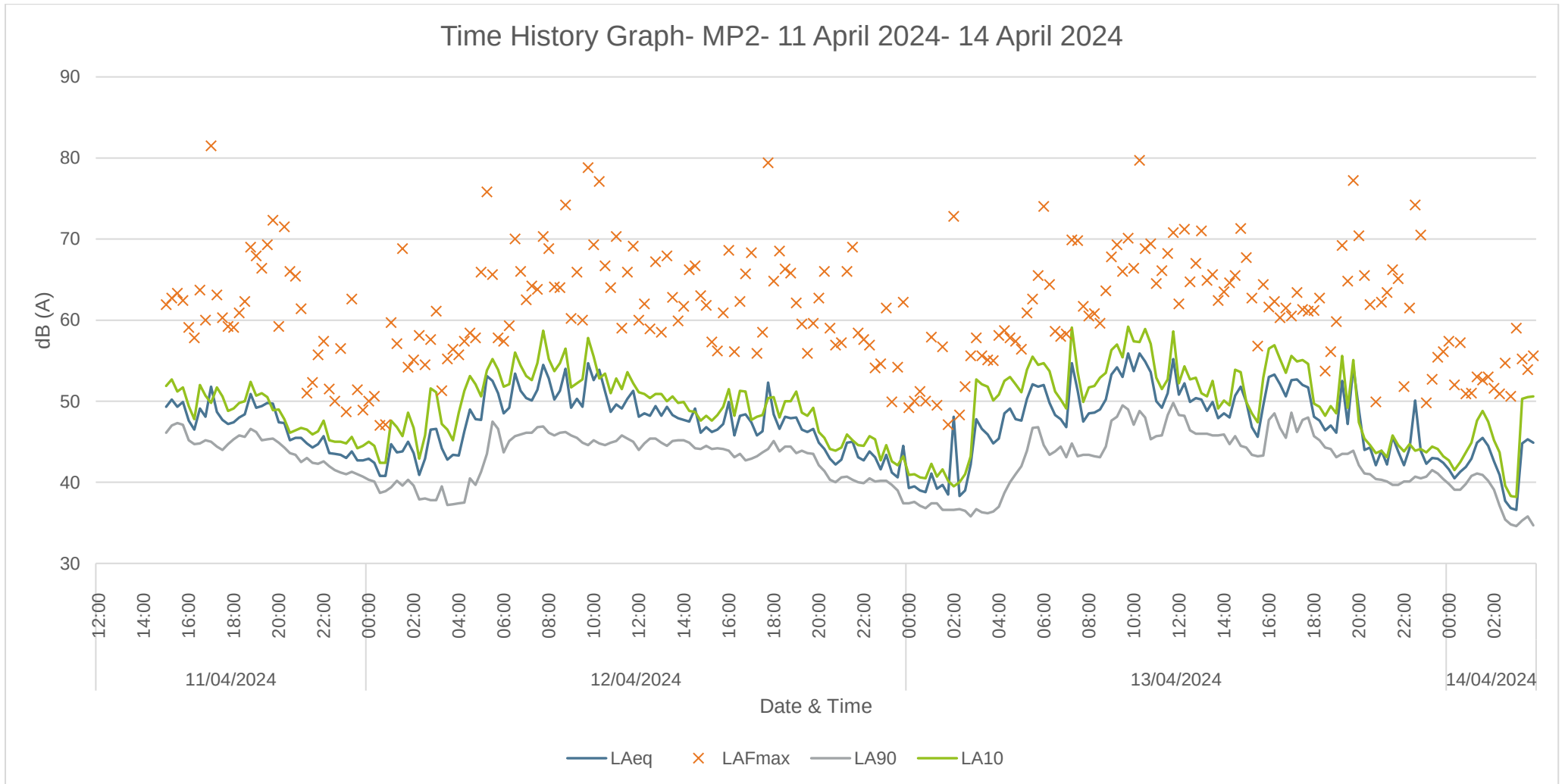


Table B.2 Time History - MP2 – 11/04/24-14/04/24



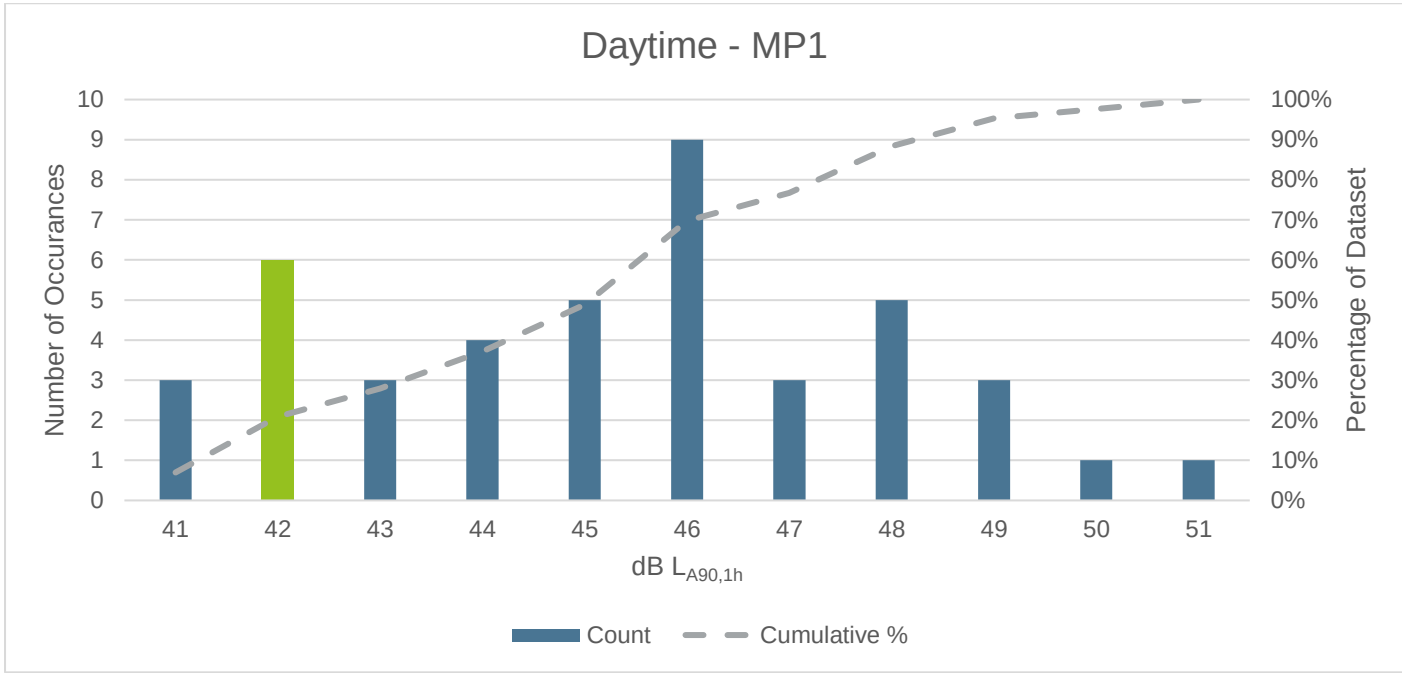


Table B.3 Background Analysis - MP1 Daytime

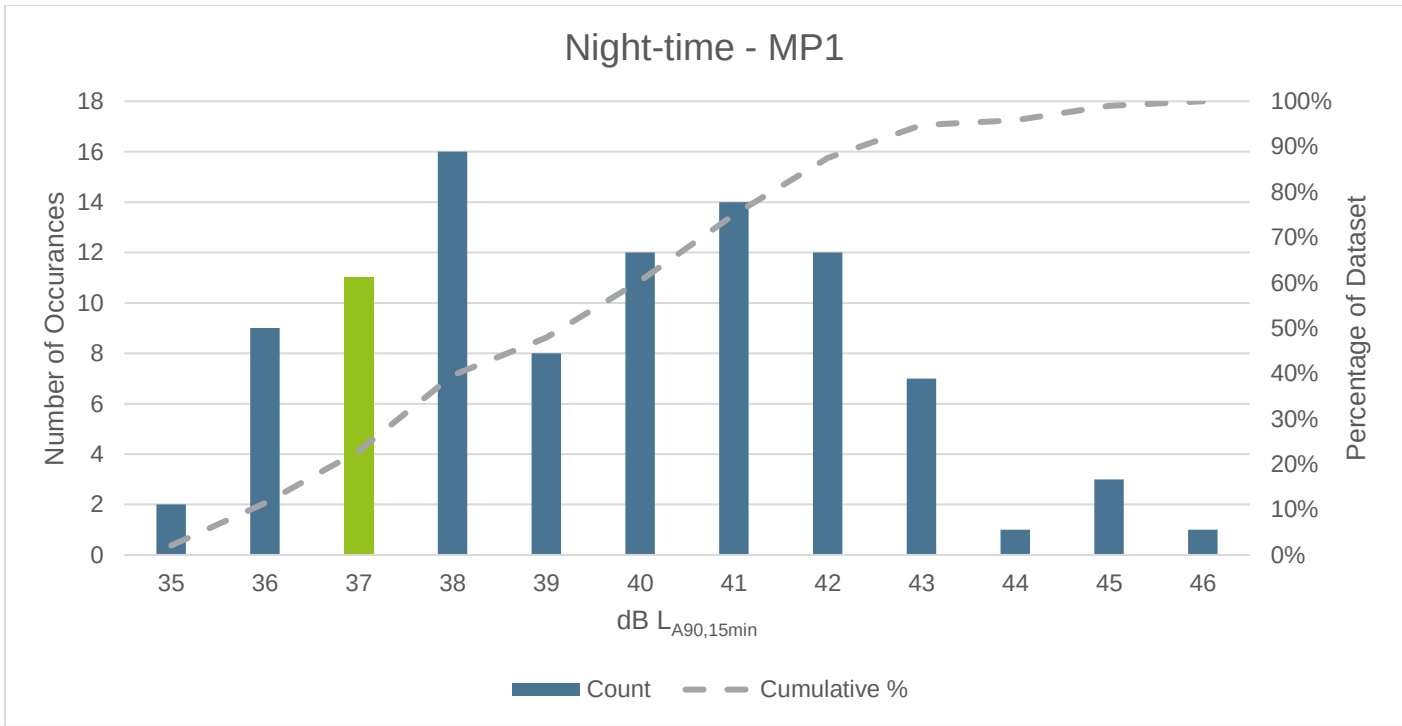


Table B.4 Background Analysis - MP1 Night-time



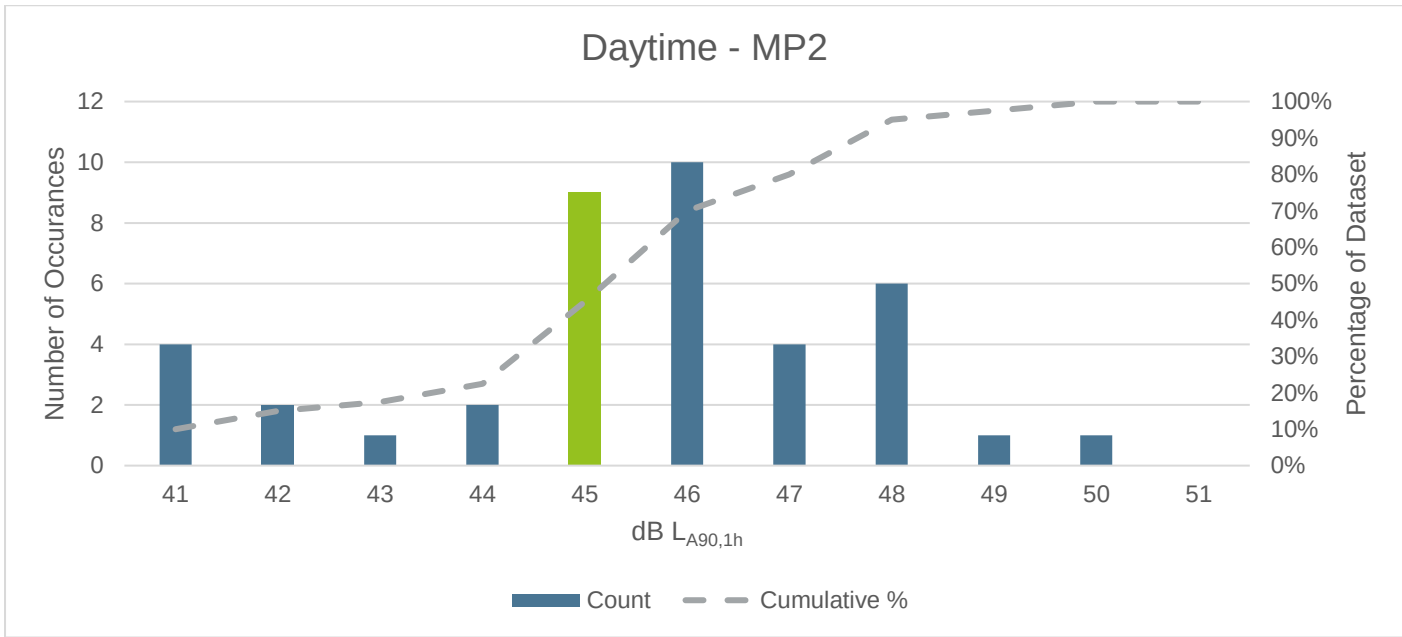


Table B.5 Background Analysis - MP2 Daytime

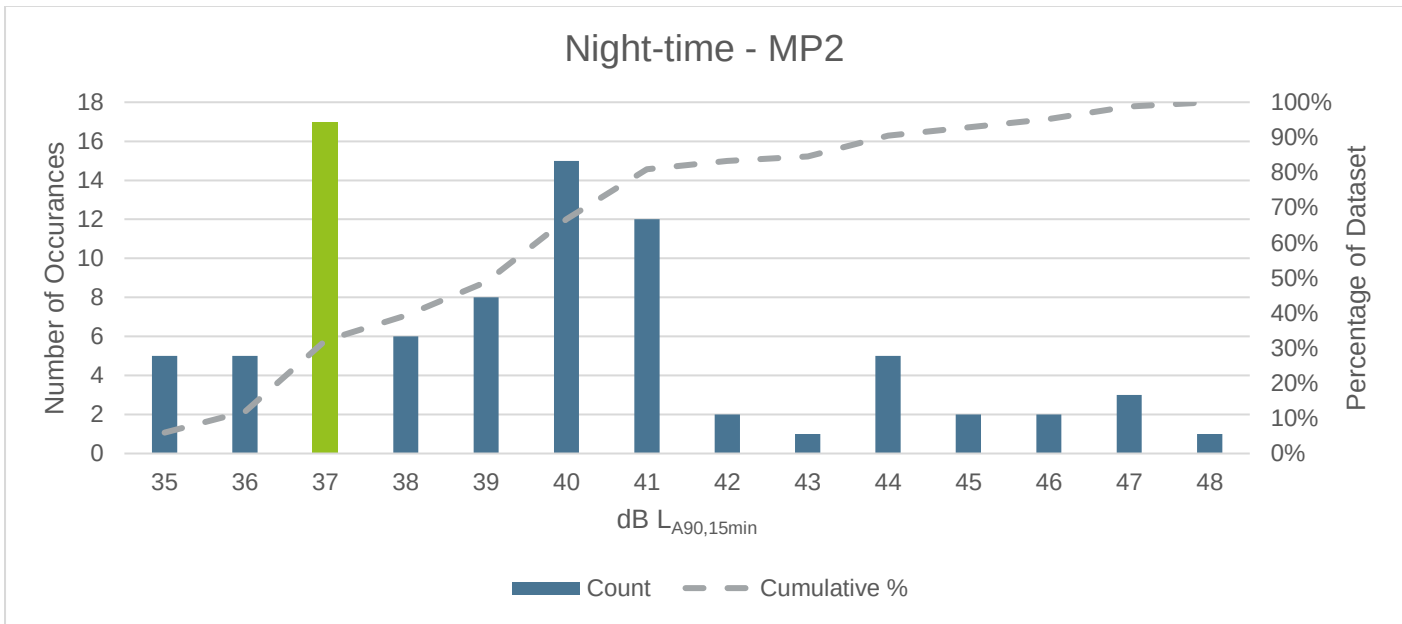


Table B.6 Background Analysis - MP2 Night-time



Appendix D: Operational Façade Noise Maps

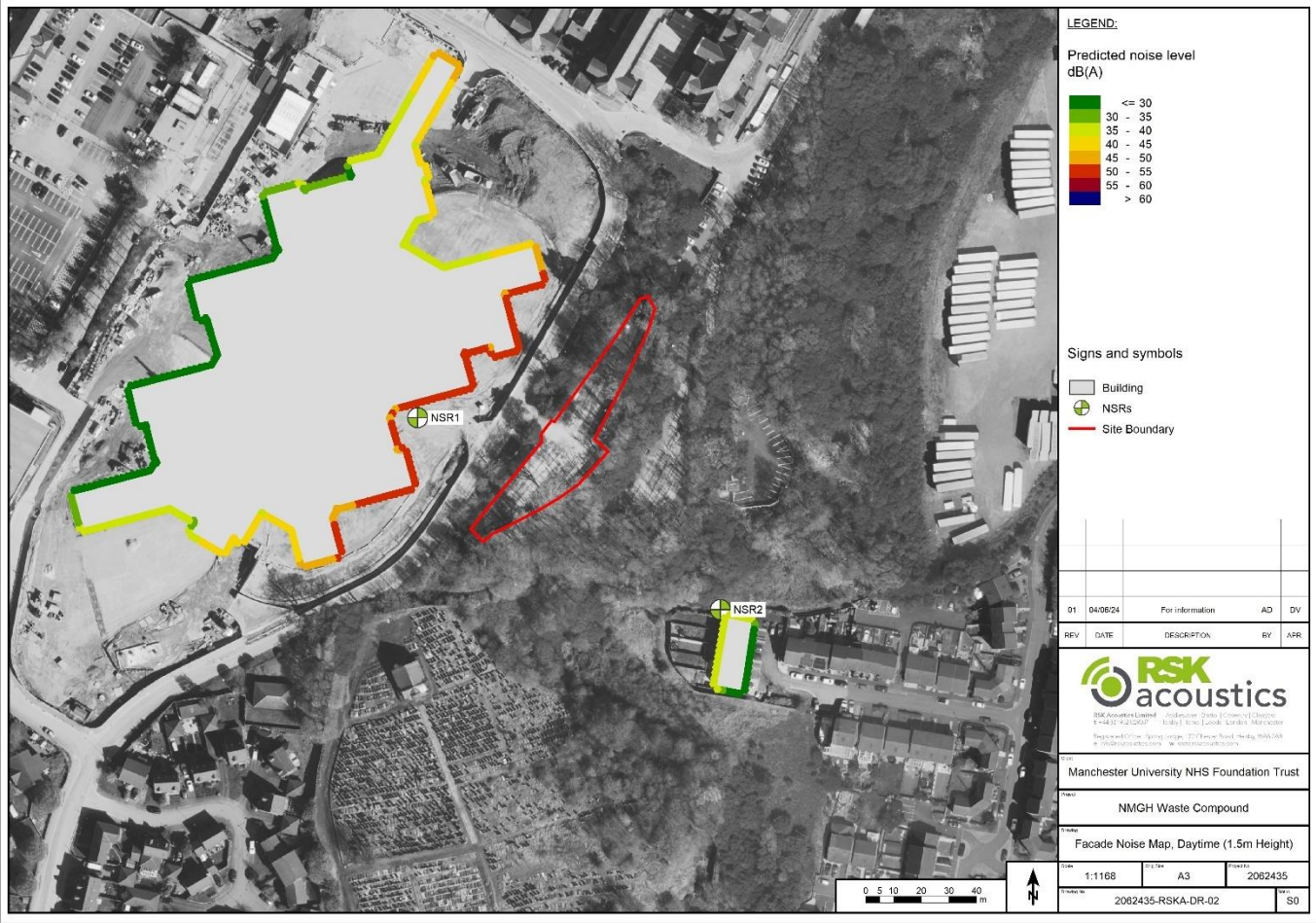


Figure D.1 Façade Noise map 1.5m Daytime





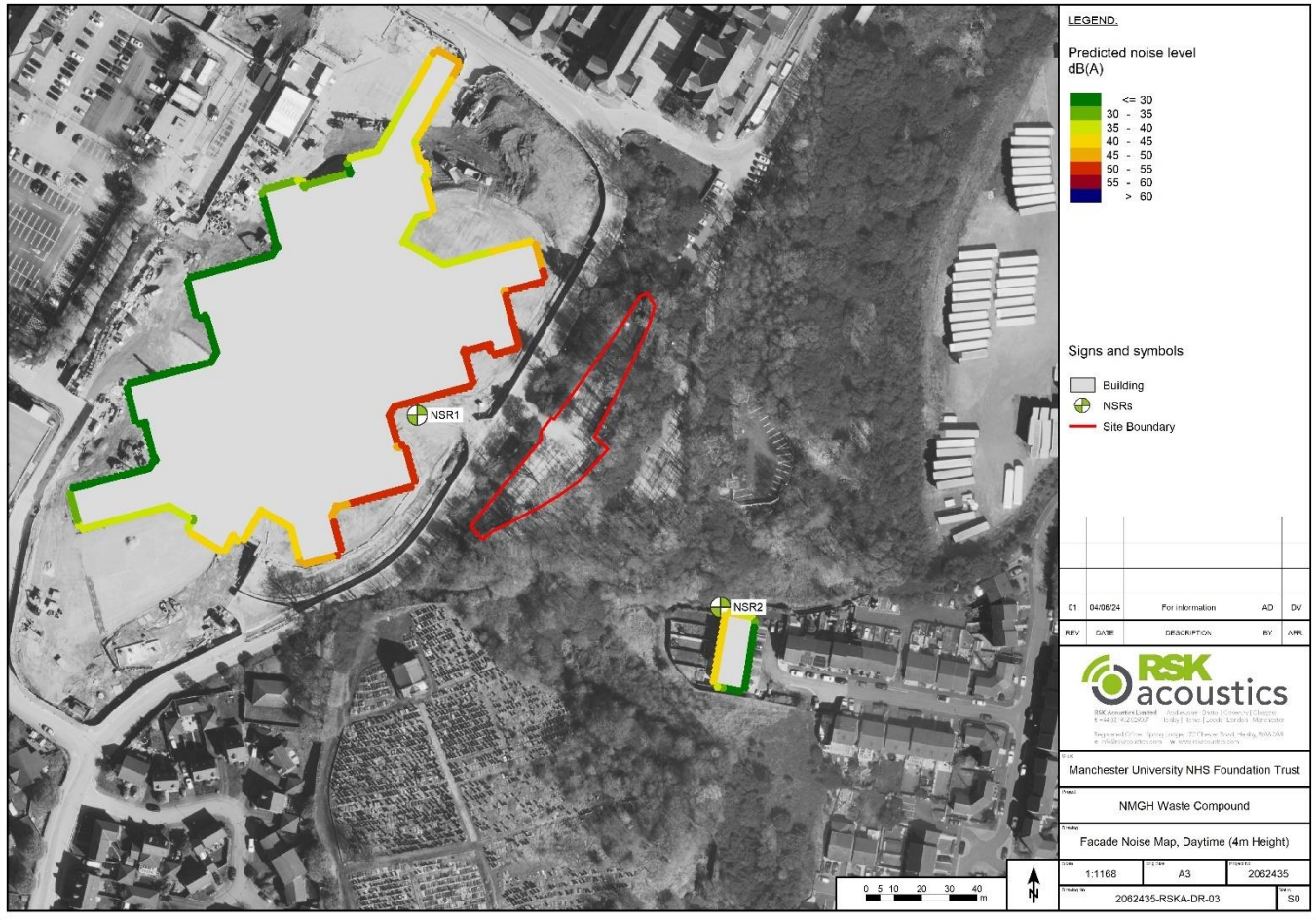


Figure D.3 Façade Noise map 4m Daytime



