

Extra Care Centre - Brunswick

External Plant Noise Assessment

Vistry Partnerships

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Quality information

Prepared by

Tom Lucas
Principal Acoustic
Consultant

Checked by

Alex Young
Principal Acoustic
Consultant

Verified by

Jon Casey
Principal Acoustic
Engineer

Approved by

Jon Casey
Principal Acoustic
Engineer

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Prepared for:

Vistry Partnerships

Prepared by:

Tom Lucas
Principal Acoustic Consultant
T: 0115 827 8135
M: 07824 303156
E: tom.lucas@aecom.com

AECOM Limited
12 Regan Way
Chetwynd Business Park
Nottingham NG9 6RZ
United Kingdom

T: +44 (115) 907 7000
aecom.com

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1. Introduction

AECOM has been instructed to assess noise emissions from 3 no. external condensers which service a new Extra Care Facility in Brunswick, Manchester.

The building comprises four storeys and is located on Brunswick Street, Manchester, adjacent to the Brunswick Parish Church. The area immediately surrounding the site consists of existing residential properties and areas of proposed future residential development. This includes the existing Artillery Court apartment block located to the north-east of the site.

As this report contains technical terminology, an acoustics glossary is given in Appendix A.

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2. Relevant Guidance and Criteria

2.1 Manchester City Council

Condition 19 of the planning permission for the development states the following:

'Before first occupation of each particular premises hereby approved, any necessary externally mounted ancillary equipment for that building shall be acoustically insulated in accordance with a scheme submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the equipment.'

In 2015 Manchester City Council published a guidance document on planning and noise¹. This document states that noise from plant and equipment should be assessed following the methodology in BS4142² and includes the following assessment criterion:

'Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location.'

2.2 BS 4142

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The method compares the *rating level* of the sound source under consideration with the *background sound level* near residential locations. The relevant parameters are as follows:

- *Residual sound level, L_r , $L_{Aeq,T}$ dB* – residual sound is defined in the standard as the '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'.
- *Specific sound level, L_s , L_{Aeq,T_r} dB* – the specific sound source is defined in the standard as the 'sound source being assessed', with the specific sound level being specified at the assessment location over a given reference time interval, T_r .
- *Background sound level, $L_{A90,T}$ dB* – defined in the standard as the 'A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T , measured using time weighting F and quoted to the nearest whole number of decibels'.
- *Rating level, L_{Ar,T_r} dB* – the 'specific sound level plus any adjustment made for the characteristic features of the sound'.

BS 4142 attempts to account for perceivable acoustic characteristics at the receptor locations that are 'likely to attract attention' such as a tonal element, impulsivity or intermittency. BS 4142 requires that this is accounted for by adding a penalty to the *specific sound level* in order to obtain the *rating level* at the sensitive receptors. The following penalties could apply:

- Tonality: up to +6 dB penalty
- Impulsivity: up to +9 dB penalty (this can be summed with tonality penalty)
- Other sound characteristics (neither tonal or impulsive but still distinctive): +3 dB penalty
- Intermittency: +3 dB

¹ Manchester City Council, Planning & Noise: Technical Guidance, December 2015, available from:

https://secure.manchester.gov.uk/downloads/download/5199/environmental_and_public_protection_information_for_developers

² British Standard 4142:2014 + A1:2019 'Methods for rating and assessing industrial and commercial sound'

3. Methodology

3.1 Nearest noise sensitive receptors

The nearest noise sensitive receptors to the site predominately comprise residential properties, in addition to the Brunswick Parish Church.

The locations of these receptors and the measurement location used in the baseline survey (discussed below) are shown in Figure 1.

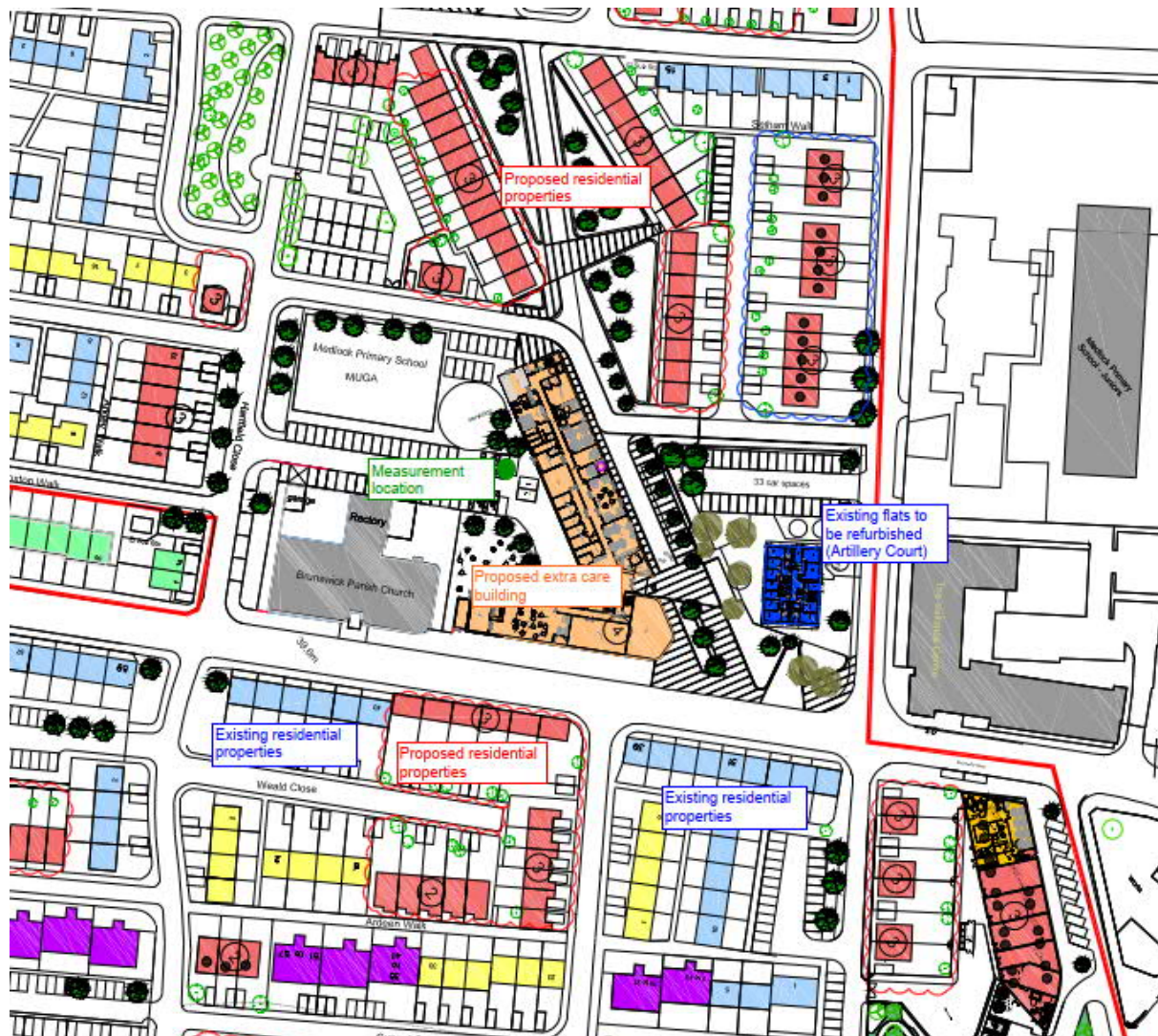


Figure 1: Noise sensitive receptor and survey locations

3.2 Baseline sound survey

A baseline sound survey was carried out on Monday 23rd and Tuesday 24th July 2018 at the rear of Brunswick Parish Church, as indicated in Figure 1.

The measurements were carried out using a Norsonic Nor118 Class 1 sound level meter, mounted in free-field conditions on a tripod at an approximate height of 1.5 m and set to log sound levels at 15-minute intervals. The calibration level of the equipment was checked prior to and after monitoring with no significant drift (> 0.2 dB) noted. Calibration certificates can be provided on request.

Weather conditions during the survey were dry with relatively light winds (< 5 m/s).

The full survey results are provided in Appendix B.

The condensers could potentially operate during the daytime or night-time. Following an analysis of the most relevant and sensitive time periods, 41 dB $L_{A90,15min}$ has been taken as the representative *background sound level* for use within the assessment.

3.3 Operational sound predictions

The external condensers are to be located at roof level, as indicated in Figure 2.

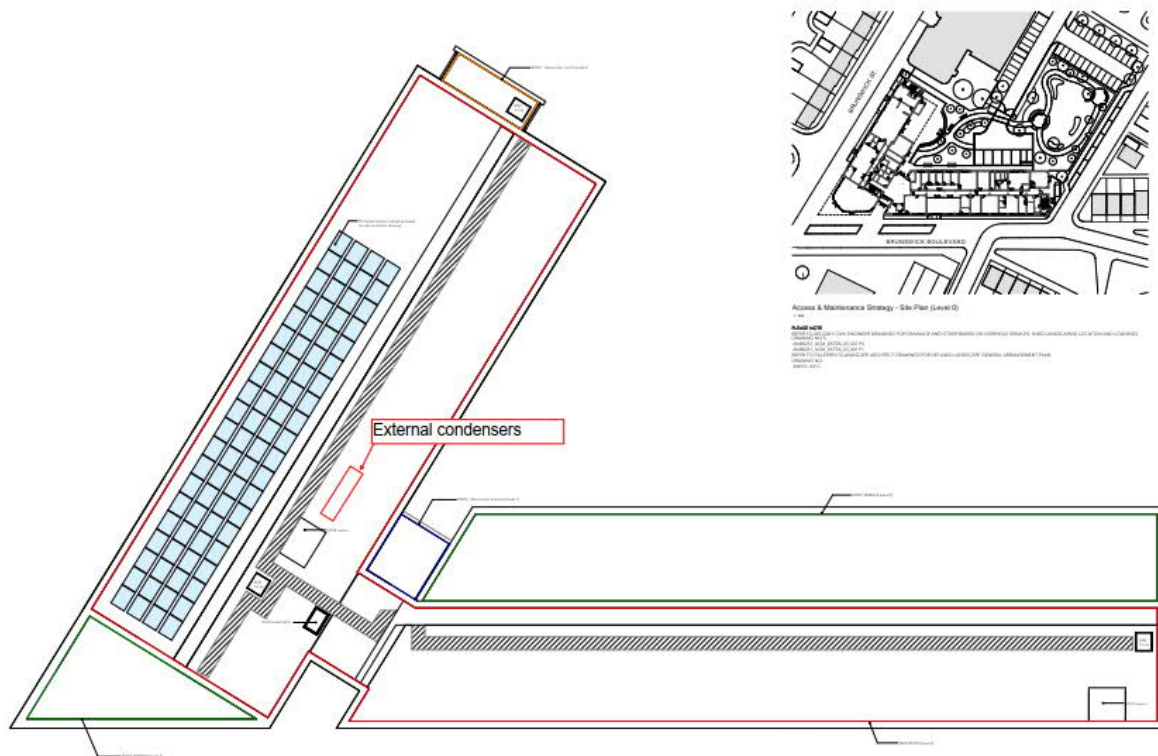


Figure 2: Proposed condenser location

Details of the condensers, as provided by Vistry Partnerships, are provided below:

- 2 no. Toshiba RAV-GP801AT-E
- 1 no. Toshiba MMY-MAP1406FT8P-UK

To calculate sound emissions from the plant items at the receptor locations, a 3D noise model of the site and surrounding area has been constructed using CadnaA noise modelling software. The settings used in the modelling software are given in Appendix C.

In-situ measurements of the larger MMY-MAP1406FT8P-UK unit were undertaken on Friday 22nd January 2021. Measurements were taken on all four sides and above the unit. It is understood that the unit was operating at maximum duty during the measurements.

The measurements were carried out using a Norsonic Nor140 Class 1 sound level meter. The calibration level of the equipment was checked prior to and after monitoring with no significant drift (> 0.2 dB) noted. Calibration certificates can be provided on request. Weather conditions during the survey were dry with relatively light winds (< 5 m/s).

The results of the measurements are summarised in Table 1.

Table 1: In-situ measurements of MMY-MAP1406FT8P-UK condenser

	Distance from unit (m)	Measured sound pressure level, $L_{Aeq,T}$ (dB)
Side of condenser	1.5	62.8 ¹
Above condenser	1.5	69.3

¹ Average of the measurements around the sides of the condenser

The results in Table 1 have been used to establish the sound power level of the sides and top of the condenser for use within the 3D model.

In the case of the two smaller RAV-GP801AT-E units, the manufacturer's quoted sound power level of 65 dB L_{WA} has been used for the assessment.

4. BS 4142 Assessment

4.1 Background sound level and rating level limit

Based on the results of the baseline survey, the representative *background sound level* used for this assessment is 41 dB $L_{A90,T}$.

Based on the Manchester City Council criterion for the *rating level* to be at least 5 dB below the *background sound level*, this results in a limit for the *rating level* from the new plant items of 36 dB L_{Ar,T_r} .

4.2 Rating penalty

The BS 4142 methodology states that penalties should be applied to sounds that contain distinctive characteristics (e.g. tonality, impulsivity, intermittency etc.). No data regarding these features is available from the manufacturer, however, based on experience of undertaking measurements of similar plant items, it is considered unlikely that the sound from the condensers would exhibit any such audible features at the receptor locations. Furthermore, these characteristics were not noticeable during the in-situ measurements. No penalty has therefore been added and the calculated *rating level* is equivalent to the *specific sound level*.

4.3 Calculated rating level

The predicted *rating level* from the 3 no. condensers at the receptor locations is shown in Figure 3 in Appendix D. The values shown in Figure 3 are for the worst-case floor level of each receptor building.

The highest calculated *rating level* at the noise sensitive receptor locations is $L_{Ar,T_r} = 36$ dB, which is at the upper floors of Artillery Court. Based on the requirements of the planning condition, as outlined in the preceding sections, the worst-case *rating level* complies with these requirements.

4.4 Uncertainty

Any predictions of sound levels have an associated degree of uncertainty. Modelling and measurement processes have been carried out in such a way to reduce such uncertainty; however, it is unavoidable that some remains. Potential sources of uncertainty associated with the modelling are discussed below:

- Predictions of sound pressure levels according to ISO 9613 assume moderate downwind propagation, and hence could be considered as a worst-case calculation. However, the standard also indicates an estimated accuracy of ± 3 dB in predicted levels.

In addition, any measurement of existing ambient or background sound levels will be subject to a degree of uncertainty. Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient or background sound levels. However, given the location of the site on the outskirts of Manchester city centre, relatively close to primary transport routes, it is considered unlikely that the background sound levels would fall significantly below those measured.

5. Summary

AECOM has been instructed to undertake an assessment of the noise emissions from 3 no. external condensers which are to service a new Extra Care Facility in Brunswick, Manchester.

The assessment has been carried out in accordance with BS 4142 in order to determine compliance with condition 19 of the planning permission for the development.

The calculated *rating level* at the worst-affected receptor, the upper floors of Artillery Court, has been found to satisfy the requirements of the planning condition.

Appendix A Acoustic Glossary

Term	Definition
Decibel (dB)	The range of audible sound pressures is approximately 2×10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0dB to 140dB. Mathematically Sound Pressure level = $20 \log \{p(t)/p_0\}$ Where $P_0 = 2 \times 10^{-5}$ Pa.
“A” Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. “A” weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of risk of damage of hearing due to noise.
Frequency (Hz)	The number of cycles per second, for sound this is subjectively perceived as pitch.
Frequency Spectrum	Analysis of the relative contributions of different frequencies that make up a noise.
Ambient Sound	Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far (<i>The ambient sound comprises the residual sound and the specific sound when present</i>).
Ambient Sound Level $L_a = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Equivalent Continuous A-weighted Sound Pressure Level $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation: $L_{Aeq,T} = 10 \lg_{10} \left\{ \left(\frac{1}{T} \right) \int_{t_1}^{t_2} \left[p_A \frac{(t)^2}{p_0^2} \right] dt \right\}$ Where p_0 is the reference sound pressure (20μPa); and $P_A(t)$ is the instantaneous A-weighted sound pressure level at time t
Measurement Time Interval T_m	Total time over which measurements are taken (<i>This may consist of the sum of a number of non-contiguous, short-term measurement time intervals</i>)
Rating level $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound
Reference Time Interval, T_r	Specified interval over which the specific sound level is determined (<i>This is 1 h during the day from 07:00 h to 23:00 h and a shorter period of 15 min at night from 23:00 h to 07:00 h</i>)
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
Residual sound level $L_r = L_{Aeq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound in a given situation at the assessment location over a given time interval, T.
Specific sound level $L_s = L_{Aeq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T.
Specific Sound Source	Sound source being assessed
L_{AFmax}	The maximum RMS A-weighted sound pressure level occurring within a specified time period. Fast time weighting indicates sound pressure level measurements undertaken using a 125-millisecond moving average time weighting period
Sound Power Level, L_w	Sound Power is the total sound energy radiated by a source, in all directions and measured in watts. Sound Power is the product of the sound pressure and the sound particle velocity
Weighted sound reduction index R_w	A single-figure value of sound reduction index, derived according to procedures given in BS5821, used for rating and comparing partitions and based on the values of sound reduction index at different frequencies.

Appendix B Baseline Survey Data

Start Time	$L_{Aeq,15min}$ dB	$L_{AF90,15min}$ dB
12:20	53.3	46.2
12:35	51.4	45.5
12:50	57.5	47.0
13:05	62.9	47.0
13:20	52.0	47.3
13:35	55.8	49.2
13:50	51.8	47.0
14:05	49.4	45.0
14:20	51.8	46.6
14:35	49.9	44.9
14:50	53.1	46.8
15:05	53.0	47.6
15:20	53.4	48.1
15:35	54.8	47.7
15:50	52.6	49.2
16:05	53.3	48.9
16:20	51.5	48.3
16:35	50.9	48.1
16:50	50.9	48.0
17:05	55.2	48.1
17:20	51.2	48.4
17:35	54.4	46.5
17:50	50.2	46.4
18:05	49.5	47.1
18:20	49.2	46.0
18:35	48.6	45.2
18:50	48.3	44.4
19:05	47.4	43.8
19:20	47.0	44.1
19:35	46.7	43.6
19:50	47.7	43.4
20:05	46.4	43.1
20:20	46.3	43.1
20:35	47.2	43.6
20:50	48.4	45.3
21:05	49.8	47.3
21:20	49.1	46.8
21:35	48.6	44.8
21:50	47.4	43.8
22:05	48.7	42.9
22:20	45.8	42.2
22:35	47.3	41.7
22:50	46.1	42.4

Start Time	$L_{Aeq,15min}$ dB	$L_{AF90,15min}$ dB
23:05	46.4	43.1
23:20	44.8	42.2
23:35	44.8	42.0
23:50	45.7	41.3
00:05	45.2	42.1
00:20	44.8	40.6
00:35	43.7	41.1
00:50	43.9	40.7
01:05	42.3	38.9
01:20	42.2	38.8
01:35	41.9	38.6
01:50	44.7	40.2
02:05	44.0	40.0
02:20	41.9	38.2
02:35	40.9	37.8
02:50	39.7	37.2
03:05	40.0	36.7
03:20	39.9	36.7
03:35	41.0	37.2
03:50	38.2	36.2
04:05	40.2	36.4
04:20	42.2	36.2
04:35	39.6	36.7
04:50	40.0	37.5
05:05	41.5	37.5
05:20	44.0	38.3
05:35	43.0	39.7
05:50	45.0	40.7
06:05	46.1	41.2
06:20	48.3	41.7
06:35	47.9	43.2
06:50	49.1	43.5
07:05	48.8	44.1
07:20	50.5	44.7
07:35	49.7	45.0
07:50	55.1	49.0
08:05	55.7	48.1
08:20	57.9	51.5
08:35	56.5	50.0
08:50	54.8	48.7
09:05	54.5	48.0
09:20	56.0	51.0

Appendix C Noise Modelling Details

Modelling Software:	CADNA/A 2020 MR1
Modelled Scenarios:	Predicted noise emissions from the operation of proposed condensers
Calculation Algorithms:	ISO 9613-1:1993 Acoustics-Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere ISO 9613-2:1996 Acoustics-Attenuation of sound during propagation outdoors – Part 2: General method of calculation
Model inputs	Base map and details of the wider area: M4976-169-C-XX Extra Care Landscape.dwg M005_2.1.1.8_Rev_F_masterplan.pdf Building layout plans, elevations and sections as provided by Buttress Architects Sketches and photos identifying condenser location provided by Vistry Partnerships
Assumptions/Settings:	Ground absorption: 0.0 for all areas to constitute a worst-case. Facade receiver height: 1.5 m for ground floor, and at every 2.5 m for floors above ground floor. Numbers of reflections: 3 Building heights: Extra Care building heights are determined using the above model input data. The heights of other nearby buildings have been estimated using the floor number information given in the masterplan drawing above and a review of aerial photography: - 2 storey buildings have been assigned a height of 6.5 m - 3 storey buildings have been assigned a height of 9 m - Artillery Court has been assigned a height of 40 m - Brunswick Parish Church has been assigned a height of 6.5 m All existing buildings are set to have a 1 dB reflections loss (structured façade).

Appendix D Operational Sound Level Predictions



AECOM

PROJECT
Extra Care Centre - Brunswick
External Plant
Noise Assessment

CLIENT
Vistry Partnerships

CONSULTANT
AECOM Limited
12 Regan Way
Chetwynd Business Park
Chilwell
Nottingham, NG9 6RZ
www.aecom.com

LEGEND
■ External Condensers

Operational Sound Level at
Facade (dB L_{Aeq}) (free-field)

- ≤ 28
- >28 and ≤ 30
- >30 and ≤ 32
- >32 and ≤ 34
- >34 and ≤ 36
- >36 and ≤ 38
- >38 and ≤ 40
- >40

NOTES

ISSUE PURPOSE

FINAL

PROJECT NUMBER

60648042

SHEET TITLE

Operational Sound Level
Daytime (free-field)
Unmitigated

SHEET NUMBER

Figure 3



1:1,000 @ A4

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