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Project:

Chalcot Yard

Title:

Car Lift Noise Assessment

quietly moving forward

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CONTENTS:

1 INTRODUCTION

1.01 Environmental Equipment Corporation Limited has been commissioned by Planning Potential Ltd to undertake a noise assessment of a proposed Car Lift at Chalcot Yard, NW1 8TZ.

1.02 This report is presented to satisfy the requirements of Condition 7 of the London Borough of Camden's Final Decision Notice dated 9th May 2014, with reference to the original planning permission for the site reference 2009/0084/P.

1.03 This report predicts noise levels based on the provided manufacturers noise data at the closest noise sensitive property to the proposed Car Lift.

1.04 The report includes the following;

- Details of measured background noise levels at the site measured in 2010;
- Setting of plant noise limits based on the requirements of Condition 7 of the Decision Notice and the results of the noise survey undertaken at the site in accordance with the requirements of BS4142; and
- Predictions of external noise levels based on the proposed operation of the Car Lift using the supplied manufacturers noise levels and onsite constructions.

1.05 This report is prepared solely for Planning Potential Ltd. Environmental Equipment Corporation Ltd accepts no responsibility for its use by any third party.

1.06 Whilst every effort has been made to ensure that this report is easy to understand, it is necessarily technical in nature. To assist the reader, an explanation of the terminology used in this report is contained in Appendix A.

2 SITE DESCRIPTION AND PROPOSALS

2.01 Chalcot Yard is a former plasterworks site located between 6 and 10 Fitzroy Road. The site is surrounded on all aspects by neighbouring residential properties and is therefore sheltered from the majority of external road traffic noise sources.

2.02 As part of proposals at the site a Car Lift is to be located towards the rear, to facilitate underground parking for two cars.

2.03 Access to the Car Lift will provided off Fitzroy Road, whereby the vehicle will drive west underneath the existing residential dwelling fronting Fitzroy Road to approach the Car Lift.

2.04 The Car Lift is designed to be 'hidden' when not in use, with the lift platform and all major components of the lift being under the ground until activated. Once the car is positioned close to the lift, the lift motor, which is located at basement level will be activated and the platform will start to rise. When rising, the platform will 'collect' the top canopy of the Car Lift, at lower ground level, raising it above the level of the car at ground level. The car will then drive onto the platform, under the canopy, whereby the driver will then exit the car and activate the retraction of the lift underground.

2.05 After the lift has stopped at the bottom and the occupant has walked to the underground area where the car lift stops, the roller access door can be opened so that the driver can re-enter the car and remove the car from the lift.

2.06 The following structural/architectural elements of the lift design are important to this assessment;

- The top of the lift canopy is to be infilled with solid materials which has a significant superficial mass of 150kg/m^2;
- Typically a gap of approximately 10mm surrounds the canopy when it is in its down position. However, it has been stated by the manufacturer that there will be no gap and the surround will be suitably acoustically sealed;
- The lift shaft is constructed of a minimum of 300mm dense concrete with a minimum superficial mass of 700kg/m^2;
- The lift motor is to be located behind the shaft wall, i.e. not in the lift shaft itself and will be vibration isolated from the lift shaft structure;
- The lift motor only operates during the upward motion of the Car Lift. With a travel distance of approximately 5m, the duration that the motor will be operating per movement will be approximately 58 seconds;
- As the platform of the lift raises it collects the canopy that rises above ground level. At the point of contact there is a slight impulsive noise. The loudness of this noise has not been quantified by the manufacturer, but it has been stated that this is the only other operational noise associated with the Car Lift apart from the motor. Resilient pads are used to mitigate the coupling noise. In light of the above, noise associated with the coupling of the platform with the canopy has been accounted for by the inclusion of a +5dB penalty for the impulsive noise, in accordance with BS4142.
- The Car Lift motor does not operate during the downward movement of the lift. However, there is a noise that is generated by the viscous movement of oil within the hydraulics.

- The underground entrance / exit to the Car Lift will be controlled via an acoustic electrically powered rolling door, with a minimum stated acoustic performance of 27dB R_W;
- The lift has the potential to operate during both the daytime and night-time.

2.07 The nearest noise sensitive properties are the neighbouring residential properties to the east above the vehicular entrance to the property. These residential properties nearest windows are approximately 15m from the proposed Car Lift, and are shown in the photograph below.

Figure 1: Photograph showing nearest residential windows above vehicular access

3 GUIDANCE AND NOISE CRITERIA

3.01 The Final Decision Notice for the planning applications stated the following in Condition 7;

> *"Prior to commencement on the relevant part of the development details of the car lift, including an acoustic report which demonstrates that the equipment will comply with the requirements of condition 7 of the original permission (2009/0084/P) shall be submitted to and approved in writing by the local planning authority."*

3.02 The original permission states;

> *"Noise levels at 1 metre external to sensitive facades shall be at least 5dB(A) less than existing background measurement (L_{A90}), or 10dB(A) less if the source contains distinct impulses (bangs, clicks, clatters, thumps)"*

3.03 As stated above, a 5dB penalty has been applied to the noise limit to account for the potential impulsive noise generated by the coupling noise of the platform with the canopy of the Car Lift.

3.04 A summary of BS4142 is provided in Appendix C of this report.

4 MEASUREMENTS

4.01 Background noise levels have been measured over an extended period at a suitable location, representative of the immediate noise environment, as shown on the site plan in Appendix B.

4.02 The equipment was set up to integrate sound levels over 5 minute intervals between 1050hrs, Thursday 16th and 0230hrs, Friday 17th December 2010.

4.03 Weather conditions were generally clear throughout, with some light precipitation at the beginning of the survey, however this was not considered to adversely affect the noise measurements

4.04 The measurements are considered to be representative of the current noise environment as there have not been any significant changes to the area and therefore the expected noise levels in recent years.

5 EQUIPMENT

5.01 The equipment used for the survey was as follows:-

- Brüel & Kjær type 2260 Integrating Sound Level Meter conforming to type 1 BS EN 60804 & BS EN 60651: 1994.
- Brüel & Kjær Condenser Microphone and Connecting Leads.
- Brüel & Kjær Outdoor Microphone Kit, type UA1404.
- Tripod.

5.02 The equipment holds current UKAS or equivalent accreditation and serial numbers as follows:

Sound Level Meter B&K2260	Serial No.	2248275
	Calibration Date	13 October 2009
	Cal Certificate No.	C0908531
½" Condenser Mic. B&K4189	Serial No.	2502922
	Calibration Date	13 October 2009
	Cal Certificate No.	C0908531
Calibrator B&K4231	Serial No.	2389051
	Calibration Date	13 October 2009
	Cal. Certificate No.	C0908496

N.B. Copies of calibration certificates are available upon request.

5.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

6 RESULTS

6.01 A list of the levels measured is included in Appendix C and represented graphically in Appendix D.

6.02 A summary of the time averaged ambient level and lowest measured background levels are shown in Table 6.1, below.

Period	Average $L_{Aeq,T}$ – dB	Lowest L_{A90} – dB
Day time (1100-1900 hrs)	53.8	40.4
Evening (1900-2300 hrs)	45.1	35.3
Night-time (2300-0230 hrs)	38.7	31.0

Table 6.1: Measured Ambient and Lowest Background Noise Levels

7 ASSESSMENT

7.01 There are two main mechanisms for noise generation associated with the Car Lift; the operation of the motor and the viscous noise of oil moving through the hydraulics.

7.02 The following data has been provided by the manufacturer, measured at a distance of 1m from the motor of the Car Lift;

- Ascent (Motor noise and Hydraulic Noise)– 71dBA for the 58 second duration; and
- Descent (Hydraulic noise only) – 64dBA for the 58 second duration.

7.03 Noise measured during the accent includes the contribution of both the hydraulics noise and noise of the operation of the motor running. Noise measured during the decent is only from the hydraulics.

Noise Associated with the Car Lift ascent

7.04 The motor for the lift is located behind the lift shaft wall within a louvred plant area. Therefore noise generated by the lift motor has to travel through the louvred doors of the plant area around the lift shaft to the roller door, through the roller door, 5m up the shaft and through the platform structure. Alternatively the noise could travel directly through the lift shaft wall. However, as the shaft wall is of significant construction, the direct noise transfer through this route is not considered to be significant and therefore does not need consideration.

7.05 The hydraulic pistons are located below the platform, therefore noise from this source travels from the piston, through the platform to combine with the motor noise.

7.06 Additional to the above, there are then the following two conditions that act for effectively 50% of the travel of the lift that affect the noise pathway:

- Condition 1 : For the first 30 seconds, whilst the lift is not coupled to the canopy, noise will travel through the canopy and exit the lift shaft before travelling a further 15m to the closest receptor window;
- Condition 2: For the remaining 30 seconds, after the platform has coupled to the canopy, the canopy rises from the ground, opening the top of the lift shaft. Therefore the noise does not then pass through canopy construction. However, the noise is screened by the canopy and the 'lip' of the lift shaft as it exits before travelling for 15m to the closest receptor window.

Noise Associated with the Car Lift decent

7.07 Noise associated with the decent is generated from the hydraulics only, therefore as above the noise travels from the pistons through the platform and then follows the two pathways described in Condition 1 and Condition 2. Additional to the screening of the canopy and the 'lip' there is also the additional screening provided by the car itself.

BS4142 Assessment

7.08 An assessment in accordance with BS4142 is required to satisfy the planning requirements of the Local Authority of noise from any proposed new items of static plant. The London Borough of Camden require that all plant be designed to be 5dB below the lowest background noise level, unless it contains a tonal or impulsive noise component, whereby plant items should meet 10dB below, which is assumed to be the case in this instance.

7.09 It should be borne in mind that noise relating to the movement of the underground doors, or the vehicles themselves are not assessed, as neither are considered to be anonymous sources to the site nor are they likely to fall under the assessment methodology of BS4142 as none are static items of plant associated with the Car Lift.

7.10 Prediction of impacts in accordance with BS4142 is considered applicable to the assessment of noise generated from the motor, the coupling of the canopy and hydraulic platform elements only.

7.11 Based on the standard requirements of LBC and the lowest measured background noise level in each time period, Table 7.1 sets out the recommended noise limits that the proposed Car Lift should meet at the closest noise sensitive receptor.

Position	Period	Measured Existing $L_{A90,T}$	Proposed Noise Limit L_{Ar}
Closest Noise Sensitive Receptor	Day	40	30
	Evening	35	25
	Night	31	21

Table 7.1: Suggested Plant Noise Emission Limits Based on Lowest Measured L_{A90}, Free-field dB

7.12 Note that the limits suggested above are rating levels and as such any design should take into account the acoustic characteristics of the plant.

7.13 It should be noted that the criteria presented below are considered extremely low in terms of the guidance in BS4142, and are outside the applicability of the standard. In most instances it would be considered pragmatic to relax the criteria by 5dB, however a relaxation of the criteria has not been sought with the LA.

7.14 Predictions have been based on the following assumptions;

- Noise data provided by the manufacturer, i.e. 71dBA from the motor (up) and 64dBA from the hydraulics (down);
- The Car Lift takes approximately 58 seconds in ascension and 58 seconds to descend, as stated by the manufacturer;
- The closest windows to the top of the Car Lift is approximately 15m;
- There is a maximum of 1.No upward and 1.No downward movement that take place during a worst-case night-time 5 minute period and a maximum of 4.No upward and 4. No downward movements during a worst-case daytime one hour period. Note that there are only two parking spaces served by the lift;
- The operation of the Car Lift attracts the 5dB penalty for tonality noise and the possible coupling noise as required in BS4142;
- The reverberation time within the underground area parking and plant areas average 1.5 seconds, whilst the reverberation time within the lift shaft averages 1 second;
- the access/exit roller door is closed during the operation of Car Lift and provides a sound reduction performance of 27dB R_W;
- The construction of the platform is steel with a minimum superficial mass of 8kg/m^2 and a sound reduction performance of 23dB R_W;
- The construction of the canopy is in-filled with a material with a minimum superficial mass of 150kg/m^2 providing a sound reduction of 40dB R_W;
- the internal walls of the lift shaft are 300mm dense concrete (with a minimum density of 700kg/m^2) providing a sound reduction performance of 60dB R_W; and
- The louvred door to the area where the Car Lift motor is installed provides a minimum of 8dB R_W noise reduction.

7.15 It should be noted that the predicted noise levels, given below, are based on single figure data provided by the manufacturer, which gives no indication of how the energy is spread across the sound frequency spectrum.

7.16 Based on the above assumptions, noise levels from the Car Lift in various modes of operation have been calculated. Tables 7.2 to 7.7 present the predicted noise levels at the closest receptor based on the various noise transfer paths.

Noise Location	Calculated Noise Level, dBA	Notes
Motor Noise SPL	71	Stated by manufacturer
Motor Noise SWL	82	based on point source
Motor SPL in Plant Space	83	including corrections for volume and reverberation time of plant space
Motor SPL in Parking area	71	including corrections for SRI of louvre, area of louvre, volume of parking area and reverberation time of parking area
Motor SPL in bottom Car Lift	45	including corrections for SRI of roller door, area of roller door, volume of lower part of the lift shaft and reverberation time of lower part of the lift shaft
Motor SPL in top of Carlift	26	including corrections for SRI of platform floor, area of platform floor, volume of upper part of the lift shaft and reverberation time of upper part of the lift shaft
Motor SPL at Window	**0**	including corrections for SRI of canopy top, area of canopy top, internal reverberant to external free field correction and Rathes method distance correction.

Table 7.2: Upward Motion Predicted Motor Noise Level During the First 29 Seconds

Noise Location	Calculated Noise Level, dBA	Notes
Hydraulic Noise SPL	64	Stated by manufacturer
Hydraulic Noise SWL	75	based on point source
Hydraulic SPL in bottom car lift	73	including corrections for volume and reverberation time of lower lift shaft
Hydraulic SPL in top of car lift	54.2	including corrections for SRI of platform floor, area of platform floor, volume of upper part of the lift shaft and reverberation time of upper part of the lift shaft
Hydraulic SPL at Window	**0**	including corrections for SRI of canopy top, area of canopy top, internal reverberant to external free field correction and Rathes method distance correction, and -5dB Screening

Table 7.3: Upward Motion Predicted Hydraulic Noise Level During the First 29 Seconds

Noise Location	Calculated Noise Level, dBA	Notes
Motor Noise SPL	71	Stated by manufacturer
Motor Noise SWL	82	based on point source
Motor SPL in Plant Space	83	including corrections for volume and reverberation time of plant space
Motor SPL in Parking area	71	including corrections for SRI of louvre, area of louvre, volume of parking area and reverberation time of parking area
Motor SPL in bottom Car Lift	45	including corrections for SRI of roller door, area of roller door, volume of lower part of the lift shaft and reverberation time of lower part of the lift shaft
Motor SPL at Window	**2**	including corrections for SRI of platform floor, area of opening, internal reverberant to free field and Rathes distance correction and -5dB screening

Table 7.4: Upward Motion Predicted Motor Noise Level During the Last 29 Seconds

Noise Location	Calculated Noise Level, dBA	Notes
Hydraulic Noise SPL	64	Stated by manufacturer
Hydraulic Noise SWL	75	based on point source
Hydraulic SPL in bottom car lift	73	including corrections for internal reverberant, volume and reverberation time of lower lift shaft
Hydraulic SPL at residential window	**29**	including corrections for SRI of platform floor, area of opening, internal reverberant to free field and Rathes distance correction and -5dB screening

Table 7.5: Upward Motion Predicted Hydraulic Noise Level During the Last 29 Second

Noise Location	Calculated Noise Level, dBA	Notes
Hydraulic Noise SPL	64	Stated by manufacturer
Hydraulic Noise SWL	75	based on point source
Hydraulic SPL in bottom car lift	73	including corrections for internal reverberant, volume and reverberation time of lower lift shaft
Hydraulic SPL at window	**24**	including corrections for SRI of platform floor, area of opening, internal reverberant to free field and Rathes distance correction and -10dB screening

Table 7.6: Downward Motion Predicted Hydraulic Noise Level During the First 29 Seconds

Noise Location	Calculated Noise Level, dBA	Notes
Hydraulic Noise SPL	64	Stated by manufacturer
Hydraulic Noise SWL	75	based on point source
Hydraulic SPL in bottom car lift	73	including corrections for volume and reverberation time of lower lift shaft
Hydraulic SPL in top of car lift	54.2	including corrections for SRI of platform floor, area of platform floor, volume of upper part of the lift shaft and reverberation time of upper part of the lift shaft
Hydraulic SPL at Window	**0**	including corrections for SRI of canopy top, area of canopy top, internal reverberant to external free field correction and Rathes method distance correction and -10dB Screening

Table 7.7: Downward Motion Predicted Hydraulic Noise Level During the Last 29 Seconds

7.17 It can be seen from Tables 7.2 through to 7.7 that predicted noise levels from the hydraulics during the last 29 seconds of the upward motion and the first 29 seconds of the downward motion are required to be considered. Noise from the motor does not contribute to the noise level at the closest window.

7.18 Noise levels predicted during all other states of the Car Lift's motion are considered to be negligible and therefore do not require any further consideration.

7.19 Based on the above, the following summary of calculated noise levels demonstrate that predicted noise levels meet the requirements of Condition 7 at the site.

Calculation	Car Lift Motion		Notes
	Up Last 29 Seconds	Down First 29 Seconds	
A - Predicted Noise Level	29	24	Based on the results of Table 7.5 and 7.6
B - Time Correction	-21	-21	10xlog(29/3600) - based on 29 second duration over a daytime 1 hour period
C - Number of Movements Correction	6	6	10xlog(4) - based on four movements in an hour
D - Daytime Noise Levels	14	9	A+B+C
Cumulative Daytime Noise Level	**15**		**Sum of up and down movements**
Daytime Noise Limit	25		based on lowest background noise level - 10dB
Exceedance of Noise Limit	**-10**		Comparison of predictions with background noise level

Table 7.8: Daytime Period Assessment (4 upward, 4 downward in 1 hour)

Calculation	Car Lift Motion		Notes
	Up Last 29 Seconds	Down First 29 Seconds	
A - Predicted Noise Level	29	24	Based on the results of Table 7.5 and 7.6
B - Time Correction	-10	-10	10xlog(29/300) - based on 29 second duration over a daytime 5 minute period
D - Daytime Noise Levels	19	14	A+B
Cumulative Daytime Noise Level	**20**		**Sum of up and down movements**
Night-time Noise Limit	21		based on lowest background noise level - 10dB
Exceedance of Noise Limit	**-1**		Comparison of predictions with background noise level

Table 7.9:Night-time Period Assessment (1 upward, 1 downward in 5 minutes)

7.20 It can be seen from Tables 7.8 and 7.9 that the operation of the proposed Car Lift meets the requirements of Condition 7 of the Final Decision Notice.

8 CONCLUSION

8.01 Environmental Equipment Corporation Limited has been commissioned by Planning Potential Ltd to undertake a noise assessment for a proposed Car Lift as part of the proposed development at Chalcot Yard.

8.02 Condition 7 of the Final Decision Notice requires a noise impact assessment of the operation of the Car Lift in accordance with the requirements of BS4142.

8.03 Details of the noise emission levels of the proposed Car Lift have been used along with details of the proposed construction and the results of a noise survey at the site have been used to predict noise impacts at the closest noise sensitive receptor to the Car Lift.

8.04 Based on the above, calculated external noise levels are predicted to be more than 10dB below the lowest measured background noise levels during both the daytime and night-time periods.

8.05 With regard to BS4142 this would be described as being below the level at which “complaints are unlikely”.

8.06 In light of the above, noise impacts as a result of the operation of the Car Lift are considered to meet the requirements of Condition 7 of the Final Decision Notice.

APPENDIX A

GLOSSARY OF TECHNICAL TERMS

TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (SWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level a 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

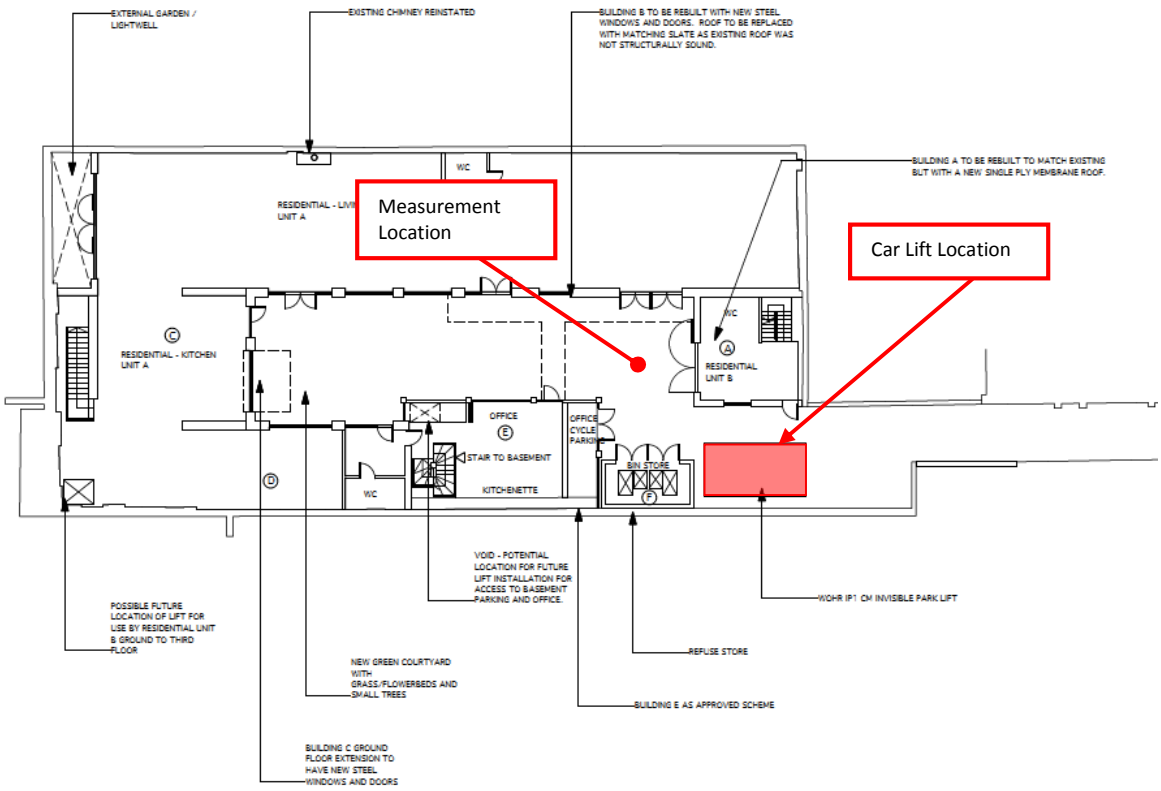
L_{90} This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.

L_{10} This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

L_{eq} The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L_{eq} level tends to be dominated by the higher noise levels measured.

APPENDIX B

SITE PLAN
&
MEASUREMENT LOCATION



British Standard 4142

British Standard (BS) 4142: 1997 *Method for rating industrial noise affecting mixed residential and industrial areas* is intended to be used to assess whether noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises is likely to give rise to complaints from people residing in nearby dwellings.

The procedure contained in BS4142 for assessing the likelihood of complaints is to compare the "*specific noise level*", which is the measured or predicted noise level from the source in question immediately outside the dwelling, with the background noise level. Where the noise contains a "*distinguishable discrete continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks, clatters or thumps), or if the noise is irregular enough to attract attention*" then a correction of +5dB is added to the specific noise level to obtain the "*rating level*" or L_{Ar}.

The likelihood of noise provoking complaints is assessed by subtracting the background noise level from the rating noise level. BS4142 states:

> *"A difference of around 10dB or higher indicates that complaints are likely. A difference of around 5dB is of marginal significance. A difference of -10dB is a positive indication that complaints are unlikely."*

The standard also notes that:

> *"The greater this difference the greater the likelihood of complaints."*

In the context of the NPPF, it is considered that a situation where BS4142 suggests complaints are unlikely would equate to the No Observed Effect Level (NOEL). The situation where BS4142 suggests complaints are likely would equate to the Significant Observed Adverse Effect Level (SOAEL).

The Lowest Observed Adverse Effect Level (LOAEL) has been equated to the situation that BS4142 describes as "marginal" as this is the only intermediate threshold identified in BS4142.

Setting plant noise limits in accordance with the requirements of WCC will result in noise levels either below the NOEL or between the LOAEL and the NOEL depending on the measured ambient noise level.

This assessment is carried out over a one hour period for the daytime and a five minute period for the night-time. Day or night are not defined in the standard but it states that night should cover the times when the general adult population are preparing for sleep or are actually sleeping. For the purposes of this assessment, it is assumed that daytime and night-time are 07:00 to 23:00 hours and 23:00 to 07:00 hours respectively.

BS4142 has been referenced in setting noise limits for any fixed plant proposed as part of the proposed development.

APPENDIX D

SURVEY RESULTS
(TABULAR)

Noise data

Time	$L_A$eq	L_A10	L_A90
10:50	62	59	47
10:55	49	50	46
11:00	49	51	46
11:05	50	52	47
11:10	51	53	47
11:15	51	54	47
11:20	51	53	46
11:25	51	53	46
11:30	51	53	47
11:35	52	55	47
11:40	51	53	46
11:45	52	53	47
11:50	50	52	45
11:55	51	53	46
12:00	50	52	45
12:05	50	53	45
12:10	53	55	45
12:15	52	53	44
12:20	51	52	45
12:25	47	49	43
12:30	51	53	45
12:35	49	51	44
12:40	48	50	44
12:45	47	48	44
12:50	47	48	44
12:55	47	48	43
13:00	50	52	45
13:05	51	53	46
13:10	52	54	46
13:15	55	58	50
13:20	60	64	54
13:25	56	59	50
13:30	55	58	50
13:35	61	64	55
13:40	61	65	53
13:45	57	60	49
13:50	54	56	46
13:55	52	54	45
14:00	50	52	45
14:05	50	52	44
14:10	50	53	44
14:15	48	50	42
14:20	48	51	42
14:25	48	50	42
14:30	48	50	42
14:35	49	51	43
14:40	47	50	41
14:45	47	49	41

Time	$L_A$eq	L_A10	L_A90
14:50	48	51	40
14:55	47	49	41
15:00	48	50	42
15:05	50	52	45
15:10	51	53	44
15:15	51	53	43
15:20	51	53	44
15:25	51	52	43
15:30	51	53	43
15:35	54	58	43
15:40	49	51	43
15:45	48	49	41
15:50	50	53	42
15:55	49	51	43
16:00	50	51	45
16:05	51	53	45
16:10	53	54	46
16:15	53	55	46
16:20	52	54	44
16:25	51	53	45
16:30	54	56	48
16:35	58	60	51
16:40	59	63	51
16:45	59	62	51
16:50	60	63	53
16:55	61	65	54
17:00	60	64	53
17:05	58	61	50
17:10	56	58	49
17:15	55	57	48
17:20	56	59	49
17:25	54	56	47
17:30	54	56	48
17:35	53	55	46
17:40	53	55	46
17:45	53	55	46
17:50	52	54	46
17:55	51	53	45
18:00	51	53	45
18:05	52	55	47
18:10	51	54	45
18:15	51	53	44
18:20	50	52	44
18:25	50	52	44
18:30	50	52	43
18:35	50	52	43
18:40	49	51	43
18:45	49	52	44

Noise data

Time	$L_A$eq	L_A10	L_A90
18:50	49	52	43
18:55	50	52	43
19:00	49	51	43
19:05	51	52	44
19:10	48	50	41
19:15	49	51	41
19:20	47	50	40
19:25	47	48	40
19:30	47	49	40
19:35	47	50	41
19:40	46	48	40
19:45	48	51	42
19:50	46	48	40
19:55	44	47	40
20:00	45	46	40
20:05	47	50	41
20:10	45	46	40
20:15	44	47	40
20:20	44	47	40
20:25	46	47	40
20:30	45	47	40
20:35	46	49	40
20:40	44	46	40
20:45	45	46	40
20:50	44	46	40
20:55	44	46	40
21:00	44	47	41
21:05	43	44	40
21:10	45	47	41
21:15	47	50	42
21:20	44	47	41
21:25	42	44	40
21:30	44	47	41
21:35	44	47	41
21:40	43	45	40
21:45	47	51	40
21:50	41	43	39
21:55	41	43	40
22:00	43	45	38
22:05	43	46	39
22:10	42	45	39
22:15	43	46	39
22:20	40	42	36
22:25	39	40	38
22:30	40	43	36
22:35	37	39	35
22:40	40	43	37
22:45	40	42	37

Time	$L_A$eq	L_A10	L_A90
22:50	40	42	36
22:55	37	39	35
23:00	38	40	36
23:05	41	43	36
23:10	38	40	36
23:15	38	40	35
23:20	37	38	35
23:25	47	41	35
23:30	38	41	35
23:35	38	40	35
23:40	37	40	34
23:45	41	44	35
23:50	43	42	36
23:55	44	42	35
00:00	39	40	36
00:05	37	39	35
00:10	37	38	34
00:15	38	41	35
00:20	37	39	35
00:25	45	47	35
00:30	37	39	35
00:35	37	39	35
00:40	36	37	35
00:45	37	39	34
00:50	36	36	34
00:55	35	37	34
01:00	36	38	34
01:05	37	38	35
01:10	37	40	34
01:15	34	35	33
01:20	34	35	32
01:25	35	35	32
01:30	35	36	32
01:35	34	35	32
01:40	34	36	32
01:45	34	35	32
01:50	34	35	32
01:55	34	36	32
02:00	35	37	33
02:05	35	36	33
02:10	34	35	33
02:15	34	35	32
02:20	34	36	31

APPENDIX E

SURVEY RESULTS
(GRAPHICAL)

Noise Level Time History at Chalcot Yard, Camden