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BIOTHANE PLANT

Demolition Noise & Vibration Assessment – Revision B

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Demolition Noise & Vibration Assessment

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Revision and Date	Amendment Details	Revision Prepared By	Revision Approved By
Rev A 20/08/24	Minor amendment to the red line boundary, working hours and the addition of the Uncertainty chapter	BD	JDB
Rev B 21/08/24	Planning and Condition reference numbers added, along with more details relating to Community Engagement.	JDB	JDB

1.0 EXECUTIVE SUMMARY

1.1 This report contains the assessment of demolition associated noise and vibration emissions from the removal of the Biothane Plant site in Richmond, TW9 4BD.

1.2 The predicted noise and vibration emissions have been based on the information supplied by the client, empirical data, and previous studies for common associated practices.

1.3 These emissions, and the resulting impact have been assessed and quantified in accordance with the most relevant guidance, as discussed within the body of this report.

1.4 Different mitigative measures have been examined and their subsequent effects have been quantified to provide the client ways to limit this impact. These measures include:

- Attenuation over distance;
- Barrier effects attributed to structure and building facades;
- Localised screening;
- Equipment modifications;
- Phased work timings to minimise exposure times; &
- Open communication with all stakeholders

1.5 The equipment modifications included in the mitigative measures are as follows:

Type of Equipment	Mitigative Measure
Earth Moving	Exhaust, sound reduction equipment/mufflers. Maintain equipment
Breakers / Pneumatics	Screen/Enclose
Cutting Equipment	Screen/Enclose

Table 1.1: Equipment Modifications

1.6 Following the proposed measures of mitigation, there has been some threshold exceedances predicted, using a perceived worst-case scenario (full details of this can be found in the body of this report). Implementation of BPM has been specified to be employed to further mitigate exceedances and all works stages.

1.7 To ensure the project's compliance with the criteria, noise monitoring has been proposed. Threshold limits have been proposed; however these limits and locations of the monitors should be agreed with the LPA/EHO.

2.0 INTRODUCTION

2.1 Create Consulting Engineers Ltd have been commissioned by Clifford Devlin to undertake an assessment of demolition associated noise and vibration emissions from the removal of the Biothane Plant site in Richmond, TW9 4BD in accordance with partial discharging of Condition U007976 (Noise and Vibration Construction Methods) of Planning Permission 18/3310/FUL.

2.2 The proposals are to remove the existing site structures and materials, in preparation for a new development.

Surroundings

2.3 Typically, noise sensitive receptors (NSR's) are residences, schools and healthcare facilities. We have been informed that there are no on-site receptors that require inclusion in this assessment

2.4 The following figure shows the location of the proposed works area, the surrounding NSR locations, and the two acoustic measurement locations (as discussed herein).

Figure 2.1: Aerial View of Demolition Site & NSR (1-3) Locations

2.5 The minimum distance from each NSR to the boundary of the site is ≈ 20mtrs, whereas the distance to the centre of the works area is ≈ 60mtrs, and to the furthest point is ≈ 90mtrs. Each of which have been included and deemed as representative in all calculations.

Work Phasing

2.6 The client informs us that there are no specific work phases or any anticipated changes in work methodologies during the project.

2.7 The stated operational hours for the site are:

- 08:00 – 17:00: Monday – Friday;
- 08:00 – 13:00: Saturday; &
- No working Sundays or Bank Holidays.

Baseline Sound Levels

Preamble

2.8 A noise survey was undertaken by Mr Sam Ward (MIoA) of Create Consulting Engineers Ltd on the 14th August 2024 to determine the sound levels on site, prior to commencement of the works on site (locations as shown in Figure 1.1).

2.9 Whilst on-site, it was determined that there was nowhere secure to leave the equipment unattended overnight, due to some unwanted attention from onlookers during the site walkover.

2.10 As such, two survey locations were selected, with an hour's long measurement at each position. This has been cross-referenced against the results of a Noise Impact Assessment previously conducted by Hoare Lea in 2022, at the Stag Brewery, Mortlake, which was 850mtrs south-east of the site (Document reference: REP-1006369-TH-202200308-Noise Impact Assessment-Rev12).

Survey Specifics

2.11 The sound level meters and acoustic calibrator detailed below were Class 1 standard, in accordance with the British Standards 60942 and 61672. The sound level meters were within the laboratory calibration time-frame of two years during the period of measurement and the laboratory calibration time of 1 year for the calibrator.

2.12 The sound level meters were calibrated to the manufacturer's specific requirements before and after the measurement period and no significant drift in calibration was noted, and there were no periods of inclement weather that warranted exclusion of results from the survey data. Full survey equipment specifics have been included in the appendix.

2.13 Calibration certificates have not been included within this report but are available upon request.

Subjective Impressions

2.14 Noise on site was reported to be wholly dominated by air and road traffic, as the site is directly under the Heathrow flight path.

Objective Results

2.15 The sound levels measured at the two measurement locations are as follows:

Location	Start Time	End Time	dB $L_{Aeq,T}$
1	09:33	10:33	63 dB $L_{Aeq,1hr}$
2	09:42	10:42	65 dB $L_{Aeq,1hr}$

Table 2.1: Survey Results

Hoare Lea Survey Results

2.16 The observations form the noise survey indicated that the soundscape at the Stag Brewery site was also dominated by road noise and aircraft movements. The following table shows the results from Table 7 in the Hoare Lea report, with the most applicable time-periods, highlighted. These levels were largely in line with those measurements taken by Create.

Location	Period	Duration (T)	Average $L_{Aeq,T}$ dB
LT1	Day	12hr	71
	Evening	4hr	69
	Night	8hr	65
LT2	Day	12hr	70
	Evening	4hr	68
	Night	8hr	63
LT3	Day	12hr	61
	Evening	4hr	59
	Night	8hr	55
LT4	Day	12hr	60
	Evening	4hr	58
	Night	8hr	55

Table 2.2: Hoare Lea Results

3.0 ASSESSMENT METHODOLOGY AND CRITERIA

3.1 This section has outlined the assessment methodology and the significance criteria that have been used to assess the significance of risk associated with the proposed development.

Data Sources

3.2 The key data sources reviewed as part of this study have been listed in Table 3.1 below.

Data Source	Reference
British Standards Institute (BSI)	BSI (2009). BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites: Noise & Vibration
	BSI (2014). BS 8233:2014 Guidance on sound insulation and noise reduction for buildings
	BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings
	BS7385-2:1993 Evaluation and Measurement for Vibration in Buildings
	BS6187:2011 – Code of Practice for Full and Partial Demolition

Table 3.1: Key Information Sources

3.3 This assessment has considered the existing ambient noise levels and the likely significant effects on existing and proposed human receptors within the site and surrounding area in terms of:

- existing baseline conditions;
- noise impacts expected during construction; and
- Vibratory impacts expected during construction.

BS5228-1 – Noise

3.4 Guidance relating to the prediction and assessment of the construction phase noise effects has been taken from BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 1: 'Noise'[1] which provides recommendations for basic methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels.

3.5 Amongst other things, the annexes to BS 5228 provide information on the following:

[1] British Standards Institute. (2009). BS 5228:-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. BSI, London.

- relevant legislation (Annex A);
- typical noise sources and advice on mitigating them (Annex B);
- sound level data for use in the prediction methods described in the standard (Annexes C and D);
- assessing the significance of noise effects (Annex E);
- estimating noise levels (Annex F); and
- implementing noise monitoring (Annex G).

BS5228-2 – Vibration

3.6 In a similar vain to the British Standard for noise, this refers to vibration levels and the requirement for consideration of the effect of vibration on persons living and working in the vicinity of construction sites.

3.7 It provides guidance for the protection from vibrational exposure for persons working on site, as well as neighbourhood nuisance from vibration.

3.8 This document also contains many useful annexes at the rear of the Standard, including the following areas:

- Relevant legislation – Annex A;
- Significance of Vibration Effects. This includes guidance on the human response to vibration, as well as threshold values for effects, structural damage and cosmetic damage – Annex B;
- Measured levels for piling – Annex C and D;
- Prediction of Vibration Levels – Annex E;
- Description of Piling – Annex F.

BS6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings

3.9 Structural vibration can often be detected within buildings by the occupants, potentially affecting their quality of life. This document provides guidance on predicting a human's response to vibration in buildings over the frequency range 0.5Hz to 80Hz.

3.10 BS6472 describes how to determine the vibration dose value (VDV) from frequency weighted vibration measurements.

BS7385-2:1993 Evaluation and Measurement for Vibration in Buildings

3.11 This document provides guidance on the assessment of the possibility of vibration-induced damage in buildings due to a variety of sources, including blasting, pilling, machinery and road/rail.

3.12 It provides guidance on the correct measurement of Peak Particle Velocity (PPV) whilst also providing within Table 1, the transient vibration guide values for cosmetic damage.

BS6187:2011 – Code of Practice for Full and Partial Demolition

3.13 This standard has been revised to reflect the advances in technology and equipment used within the demolition industry, and to give recommendations on the following principal areas:

- Project development and management, site assessments, risk assessments, decommissioning procedures, environmental provisions and façade retention.
- Deconstruction techniques, including activities for re-use and recycling.
- Exclusion zones and safe working spaces, including their design and application.

3.14 Recommendations for methods of, and techniques for, demolition and partial demolition, including for structural refurbishment, have been retained, with consideration of specific types of structure, but the text has been significantly updated to reflect current and developing good practices.

4.0 WORKS PROCESSES AND EQUIPMENT

Equipment

4.1 The client has provided a list of noise generating equipment, along with the usage times per shift for this this project. The following table shows the manufacturer stated sound levels (where available) and a reference to the empirical levels in BS5228-1:

Number of Units	Unit	Make / Model	Supplier Sound Level	BS5228-1 reference	BS5228-1 dB(A) SPL at 10mtrs	Usage time per shift (hours)
2	17t Excavator	917E Lui Gong	N/A	C.2-05	76	6.5
2	Brokk 400	Brokk 400	* 100 L_{WA}	C.1-01	92	6.5
1	Crusher	J40	N/A	C.1-15	84	6.5

Table 4.1: Equipment

4.2 The '*' denotes that the due to the range of different materials the machine can work with, the manufacturer stated sound power levels are for the machine source, only. In reality, the material breaking of the Brokk is far louder that the machine source itself, so empirical data for a similarly sized breaker breaking concrete has been used.

5.0 DEMOLITION NOISE & VIBRATION ASSESSMENT

Overview

5.1 Guidance to the prediction and assessment of the demolition and construction phase noise effects has been taken from BS5228-1:2009+A1:2014, which provides recommendations for basic methods of noise control relating to construction and open sites where work activities and operations could potentially generate significant noise levels.

BS5228-1 – Noise

5.2 The annexes to BS5228-1 provide information on the following:

- Relevant legislation – Annex A;
- Typical noise sources and advice on methods for mitigating the noise from these sources – Annex B;
- Sound level data for various phases – Table C.1 has been heavily referenced in this assessment as it relates to plant and equipment used for typical demolition activities;
- Methods of how to assess the significance of these noise effects including the ABC method and the 2-5dB(A) Change methods – Annex E;
- Methods for estimating the noise from these activities on sites, including adjustments for distance, percentage on time etc – Annex F; and
- Suggestions or noise monitoring – Annex G.

5.3 Other specific noise sources and considerations are also included but not relevant in this instance, for example, noise from piling, over pressure from materials falling from heights and blasting works.

BS5228-1:2009+A1:2014: "The ABC Method"

5.4 The 'ABC Method' as outlined in section E.3.2 of BS5228-1:2009+A1:2014 defines threshold values for permissible levels of noise generated by site operations. In essence, the residual ambient noise level ($L_{Aeq\ T}$) is determined and rounded to the nearest 5 dB. This is then compared with the site generated noise and if the noise level exceeds the appropriate category value, then a potential significant effect is indicated.

Assessment and Category Threshold Value Period	Threshold Value in Decibels ($L_{Aeq,T}$) (dB)		
Daytime (07:00 - 19:00)	Category A 65	Category B 70	Category C 75
Evenings and Weekends (19:00 - 23:00 evenings)(07:00 - 23:00 weekends)	Category A 55	Category B 60	Category C 65
Night-time (23:00 - 07:00)	Category A 45	Category B 50	Category C 55

Table 5.1: ABC Method. ***[Excerpt from BS5228-1:2009+A1:2014, Table E.1 p:125]***

5.5 With regards to the measurement results in stated in Tables 2.1 and 2.2 of this report, the representative category threshold is: **Category B: 70 dB $L_{Aeq,10h}$.**

Assessment Criteria and Methodologies

5.6 The cumulative sum of all the noise emissions from the equipment listed in Tables 4.1 have been presented as sound pressure level (L_{PA}) at 10mtrs, and then calculated at the 3 representative distances of 20mtrs, 60mtrs and 90mtrs (as discussed in paragraph 2.5). These calculations have not considered any forms of mitigation (such as screening) and have been compared against the lowest category threshold for all NSRs:

BS 5228-1 Calculation Method	Biothane Plant Removal			Category Threshold (dB): 70			
Equipment Type	dB at 10m	Number of Units	Percent on Time	dB Result at 10m	Closest	Centre	Furthest
					20 mtrs	60 mtrs	90 mtrs
17t Excavator	76	2	80%	78	72	62	59
Brokk 400	92	2	80%	94	88	78	75
Crusher	84	1	80%	83	77	67	64
		Cumulative dB Sum at NSR			88	78	75

Table 5.2: Pre-Mitigation *yellow= exceeded category threshold*

Mitigation and Attenuation

5.7 Table B.1 of BS5228-1:2009+A1:2014 details various measures of mitigation for construction plant equipment and their sound reduction in decibels. The following table shows an excerpt from Table B.1, from which the most relevant pieces of equipment and their reduction amounts have been listed:

Mitigative Measure Identifier	Plant	Noise reduction of Plant			Alternative Plant
		Source of noise	Possible remedies (to be discussed with machine manufacturers)	A-weighted Sound reduction dB	
A	Earth-moving plant: • bulldozer • compactor • crane • dump truck • dumper • excavator • grader • loader • scraper	Engine	Fit more efficient exhaust sound reduction equipment Manufacturers' enclosure panels need to be kept closed	5 to 10	Alternative super silenced plant might be available. Consult manufacturers for details
B1	Compressors and generators	Engine	Fit more efficient sound reduction equipment	Up to 10	Super silenced plant is available. Consult manufacturers for details. Electric-powered compressors are available as opposed to diesel or petrol Sound-reduced compressor or generator can be used to supply several pieces of plant. Use centralized generator system
B2		Compressor or generator body shell	Acoustically dampen metal casing Manufacturers' enclosure panels need to be kept closed		
B3		Total machine	Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured	Up to 10	
B4			Enclose compressor or generator in ventilated acoustic enclosure	Up to 20	
C1	Pneumatic concrete breaker, rock drills and tools	Tool	Fit suitably designed muffler or sound reduction equipment to reduce noise without impairing machine efficiency. Ensure all leaks in air line are sealed	Up to 15	Hydraulic and electric tools are available For large areas of concrete, machine designed to break concrete in bending can be used Thermic Lance
C2		Bit	Use dampened bit to eliminate ringing		
C3		Total machine	Erect acoustic screen between compressor or generator and noisesensitive area. When possible, line of sight between top of machine and reception point needs to be obscured.	Up to 10	
C4			Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation	Up to 20	
C5	Pumps	Engine pulsing	Use machine inside acoustic enclosure with allowance for engine cooling and exhaust	Up to 20	

Table 5.3: Excerpt from Table B.1 BS5228-1:2009+A1:2014

5.8 The following table shows the application of these mitigative measures to the proposed equipment, with the additional reduction of a site hoarding for receptors at ground floor. No reduction for site hoarding has been attributed to receptors above ground floor level:

BS 5228-1 Calculation Method	Biothane Plant Removal						Category Threshold (dB):		70
Equipment Type	dB at 10m	Number of Units	Source Mitigation	dB Reduction	Percent on Time	dB Result at 10m	Closest	Centre	Furthest
							20 mtrs	60 mtrs	90 mtrs
17t Excavator	76	2	A	10	80%	68	62	52	49
Brokk 400	92	2	C4	20	80%	74	68	58	55
Crusher	84	1	N/A	0	80%	83	77	67	64
		Reduction for Site Hoarding (dB)					10	5	4
		Cumulative dB Sum at NSR			Ground Floor		68	63	61
					Above Ground Floor		78	68	65

Table 5.4: Post-Mitigation *yellow= exceeded category threshold*

5.9 As can be seen in the table above, following implementation of all proposed mitigative measures, the impact of the works would be significantly reduced, with only a single exceedance predicted at the closet location.

5.10 Typically, once on site, crushers are generally immobile, and the spoil/waste is transported to them to be processed. It can be seen in the table above that the sound level is significantly reduced at greater distances, so it is recommended that the crusher be located as far away as reasonably practicable.

5.11 Pre-mitigation, the Brokk is the most significant source. It is recommended that the machine be totally enclosed at locations closest to the NSRs. It may be possible to reduce this mitigative measure to include a nearfield acoustic screen only at distances ≥ 60mtrs. This is subject to further investigation.

Figure 5.1: Acoustic enclosure (Left) Nearfield Screening (Right)

Best Practicable Means

5.12 Strict adherence to BPM (Best Practicable Means) would be required to minimise any negative effects as far as reasonably practicable. These would include the noise control measures as stated by the client in Chapter 4, but also:

- 'Noisy Hours' should be agreed upon and strictly adhered to for any noisy or percussive works that are unavoidable.
- Nearby neighbours should be kept informed and apprised of any changes in works processes as the project progresses. This could be via a regular letter drop to the most

affected residents, or via an informal community engagement session, where local residents are encouraged to attend a Q&A session at a suitable local venue;

- Consultations with the most 'at risk' receptors should be conducted to find a mutually beneficial working arrangement;
- Any works that generate high levels of sound or vibration should be carried out using the 'best practicable means' and special consideration should be paid to whether commencement of these works is critical at the location, or can alternative work method be used;
- Site traffic and vehicle access should be kept to a minimum as far as reasonably practical. Switching engines off while vehicles are stationary and adding mufflers to the exhausts of site vehicles/plant will reduce ambient sound levels;
- Additional nearfield screening should be utilised for any works that generate high levels of sound in operation such as the breaking with the Brokk;
- A clear line of communication and complaints procedure should be established with nearby residents in the neighbouring properties to keep them apprised of changes in work processes as the projects progress. Keep working hours within usual business hours and keep noisy works to times agreed upon between the contractor and the LPA; and
- Noise (and vibration) monitoring should be conducted throughout the works period.

Vibration

5.13 The human threshold of perception of vibration varies between the average human. Typically, the threshold of perception would be between 0.14mm.s^{-1} up to 0.3mm.s^{-1}. Generally, the following table provides the guidance on the perception and effects of varying vibrational levels:

Peak Particle Velocity Vibration Level [A), B), C)]	Effect	Magnitude of Impact
0.14 mm.s^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Very Low
0.3 mm.s^{-1}	Vibration might be just perceptible in residential environments.	Low
1.0 mm.s^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Medium
10 mm.s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level ① in most building environments. ①	High

① The magnitude of the values presented apply to a measurement position that is representative of the point of entry into the recipient.

A) A transfer function (which relates an external level to an internal level) needs to be applied of only external measurements are available.

B) Single or infrequent occurrences of these levels do not necessarily correspond of the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are routinely measured or expected then an assessment in accordance with BS6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.

Table 5.7: Guidance on Effects of Vibration Levels

5.14 For residential receptors and other high sensitivity receptors, the low magnitude of impact (LMI) is defined as a PPV of 0.3mm/s, this being the point at which construction related vibration is likely to become perceptible. The medium magnitude of impact (MMI) is defined as a PPV of 1.0mm/s, the level at which construction related vibration can be tolerated with prior warning.

5.15 At receptors above the MMI, further consideration of whether an effect is significant is undertaken using professional judgement, taking into account of the duration, frequency of the effect and the time of day, evening or night the effect would be taking place.

5.16 In addition to human annoyance, building structures may potentially become damaged by high levels of vibration. The levels of vibration that may cause building damage are far in excess of those that may cause annoyance. Consequently, if vibration levels are controlled to those relating to annoyance (i.e. 1.0mm/s), then it is highly unlikely that buildings will be damaged by construction related activities.

5.17 The criteria used in this assessment relate to the potential for cosmetic damage and not structural damage. The principal concern is generally transient vibration from piling or the use of excavators.

5.18 BS7385-2:1993 "Evaluation and Measurement for Vibration In Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration" provides guidance on vibration levels likely to result in cosmetic damage and is referenced in BS5228-2:2009+A1:2014. Guide values for transient vibration, above which cosmetic damage could occur, are given in the table below:

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures – Industrial and heavy commercial buildings	50mm/s at 4Hz and above	
Unreinforced or light framed structures – Residential or light commercial buildings	15mm/s at 4Hz increasing to 20mm/s at 15Hz	20mm/s at 15Hz increasing to 50mm/s at 40Hz and above
Note 1: Values referred to are at the base of the building. Note 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6mm (zero to peak) is not to be exceeded.		

Table 5.8: Transient Vibration Guide Values for Cosmetic Damage

5.19 BS7385-2:1993 defines that minor damage occurs at a vibration level of twice that of cosmetic damage and major damage occurs at a vibration twice that of minor damage. Therefore, the magnitude of impact has been tabulated below:

Magnitude of Impact	Damage Risk	Continuous Vibration Level (PPV mm/s)
High	Major	30
Medium	Minor	15
Low	Cosmetic	6
Very Low	Negligible	<6

Table 5.9: Magnitude of Impact – Construction Vibration Related Damage to Buildings

5.20 Some activities can produce ground-borne vibration, which has the potential to cause concern at nearby sensitive receptors, however given the scope of the works, this is unlikely to cause concern.

5.21 There is no accepted method for accurately predicting the vibration at a sensitive receptor due to the ground-borne vibration from demolition plant. However, BS5228-2 suggests that for the majority of people, vibration levels between 0.14 and 0.3mm.s^{-1} are just perceptible.

Vibration Risk

5.22 The main source of vibration risk associated with the proposals is from breaking and any vibratory compaction. Other sources of vibration would commonly be attributed to vehicle/machinery movements/idling.

5.23 With regards to property damage, there is very little chance of causing cosmetic or structural damage given the proposals, however there is the possibility of vibration associated with the works being perceptible over these distances.

Mitigation

5.24 General principles of mitigation have been discussed throughout the body of this section. Beyond this however, without trial and monitoring data, the main method of mitigation will be open communication with the closest receptor.

5.25 A suitable schedule should be agreed with all stakeholders, to commence the works at the most critical location, which will determine the potential for adverse impact and inform further discussions on how to progress. Managing expectations and maintaining a clear line of communication is especially prevalent when these types of works are conducted at these distances.

Complaint's Procedure

5.26 Following correspondence with surrounding receptors, a complaints procedure should be implemented and used to inform future works processes on the project. This should be provided as a letter drop to the NSRs.

5.27 The Site Manager will inform stakeholders of the complaint's procedure as part of the communication programme. The complaints procedure must satisfy the following requirements:

- Publication of contact details for all relevant contacts, including their telephone and email contact details;
- Implementation and maintenance of a complaints register which records all communications (whether verbal or written) received from the general public or stakeholders;
- Classification of the nature of each communication (above) by category (e.g. complaint, enquiry, complaint);
- If a communication requires the Site Manager will assign the task to an appropriate team member; and
- Ensure completion of the actions and ensure the complaints register is updated with a record of all actions and outcomes.

Noise and Vibration Monitoring

5.28 The locations in the following figure have been recommended for noise and vibration monitoring. Dust monitoring will also likely be required for this, however the location of which

is commonly determined by the prevailing wind and subject to further assessment. This is beyond the scope of this appointment.

Figure 5.2: Suggested Noise and Vibration Monitoring Locations

5.29 The sound level meters should be fixed into position on the site hoarding, with a clear line of sight to both the receptor and source. The limits are proposed to be set in accordance with the BS5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1* 'ABC method'.

5.30 **The Noise Limits have been defined to be Category B - 70 dB $L_{Aeq,T}$ for the daytime.**

5.31 Where possible to do so, the vibration monitor should be fixed directly to the receptor. This is commonly drilled and fixed into the façade at low level. This will provide the most accurate representation of vibration levels at the assessment location.

5.32 **The vibration limits should be set to 0.3mm/s for reference, 1mm/s for an amber alert, and 10mm/s for a red alert.**

5.33 All noise and vibration equipment will be connected to a live cloud-based live system, capable of monitoring in real-time at customisable intervals. Access will be provided to any stakeholder as agreed, with pre-determined levels of administration rights.

5.34 The cloud system should be capable of sending alerts (for amber and red warnings) via email if a set threshold is exceeded. Thresholds will be set to the most appropriate levels for each monitor, at each location. The distribution list is customisable and will be determined as agreed.

Monitoring Instrumentation Compliance

5.35 All noise monitors will be Type 0 or 1 as defined in IEC 60651 and IEC 60804; or Class 1 of IEC 61672-1, and IEC 61260 for octave and fractional octave filters. Results will be presented as an A-weighted figure.

5.36 It is recommended that these are used for the limits at each of the receptor locations.

6.0 UNCERTAINTY

6.1 With all assessments, there is a degree of uncertainty which must be considered.

6.2 Our assessment is based on measurements taken during the daytime hours only, due to there not being a suitably secure location to leave our monitoring devices. We have therefore reviewed the results from these short-term monitoring against the long term noise monitoring undertaken by Hoare Lea at the Stag Brewery, Mortlake. The discrepancy between the two sets of measurements was considered negligible.

6.3 Additionally, the proposed demolition works will only be taking place during daytime hours, so the short term noise measurements taken by Create in 2024 have been considered representative of the local acoustic environment. We do not expect uncertainty associated with the shortened measurement procedure to alter the outcome of the assessment.

6.4 Equipment calibration showed an insignificant calibration drift, and we do not expect uncertainty associated with this to alter the outcome of the assessment.

7.0 CONCLUSIONS

7.1 Create Consulting Engineers have undertaken a noise assessment to assess the potential disturbance at receptor locations from noise and vibration arising from the removal of the Biothane Plant site in Richmond, TW9 4BD.

7.2 The assessment was conducted in-line with manufacturer data, empirical data and national guidance. These levels have been used to determine the potential risk of extraneous noise and vibration levels at the surrounding receptor locations.

7.3 Measures of mitigation and their potential effect have been factored and calculated to aid the developer in mitigating extraneous noise at the receptor locations.

7.4 Due to the site's proximity to the receptor locations around the development area, it has been recommended that strict adherence to BPM (including monitoring) is warranted to reduce resultant sound and vibration levels at the surrounding neighbouring residences.

8.0 DISCLAIMER

8.1 Create Consulting Engineers Ltd disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report.

8.2 The copyright of this report is vested in Create Consulting Engineers Ltd and Clifford Devlin. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or Clifford Devlin.

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APPENDICES

APPENDIX A

Glossary of Acoustic Terminology

dB(A)

The human ear is less sensitive to low (below 125Hz) and high (above 16kHz) frequency sounds. A sound level meter can be used to duplicate the ear's variable sensitivity to sound across a spectrum of frequencies. This is achieved by building a filter into the instrument with a similar frequency response to that of the average ear. This is called an "A-weighting filter". Measurements of sound made with this filter are called A-weighted sound level measurements and the unit is dB(A).

$L_{eq,T}$

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period (T).

$L_{10,T}$

This is the minimum level exceeded for not more than 10% of the time period (T). This parameter is often used as a "not to exceed" criterion for noise.

$L_{90,T}$

This is the minimum level exceeded for not more than 90% of the time period (T). This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{fmax}

This is the maximum sound pressure level that has been measured over a period using a fast time constant.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 10 such octave bands whose centre frequencies are defined in accordance with international standards.

Addition of noise from several sources

Noise from different sound sources combine, on a logarithmic scale, to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than one alone and 3 identical sources produce a 5dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g., stream of cars) drops off by 3dB for each doubling of distance.

Sound Exposure Level (SEL)

This is the level at the reception point which, if maintained constant for a period of 1 second, would cause the same A weighted sound energy to be received as is actually received from a given noise event. The SEL is used to categorise and quantify the noise generated by individual railway vehicles and individual trains. As such, it serves as a "building block" to determine the L_{Aeq} for the total flow of trains over a given time period.

Subjective impression of noise

Sound intensity is not perceived directly at the ear; rather it is transferred by the complex hearing mechanism to the brain where acoustic sensations can be interpreted as loudness. This makes hearing perception highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a reasonable guide to help explain increases or decreases in sound levels for many acoustic scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud
20	About 4 times as loud

Barriers

Outdoor barriers can be used to reduce environmental noises, such as traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and its construction.

Reverberation control

When sound falls on the surfaces of a room, part of its energy is absorbed and part is reflected back into the room. The amount of reflected sound defines the reverberation of a room, a characteristic that is critical for spaces of different uses as it can affect the quality of audio signals such as speech or music. Excess reverberation in a room can be controlled by the effective use of sound-absorbing treatment on the surfaces, such as fibrous ceiling boards, curtains and carpets.

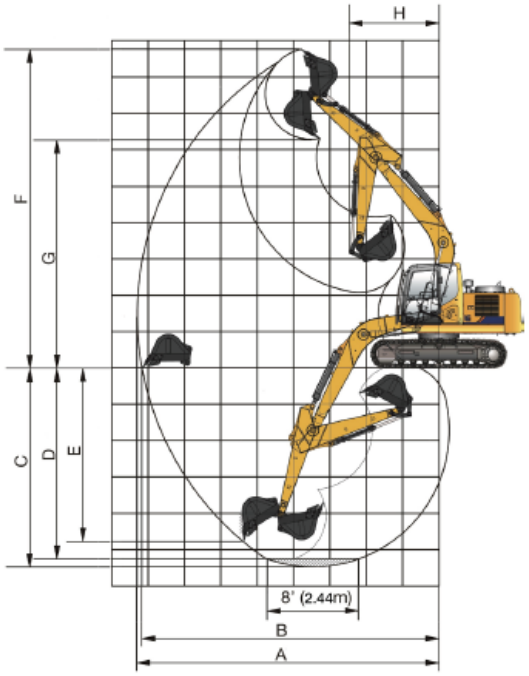
APPENDIX C

Manufacturer Data

917E DM SPECIFICATIONS >>>

ENGINE	
Emission Regulation	Tier 4F / Stage IV
Manufacturer	Cummins
Model	QSB4.5
Rated Power	90 kW (121 hp / 122 ps) @ 2,200 rpm
Net Power	84.3 kW (113 hp / 115 ps) @ 2,200 rpm
Peak Torque	470 N·m (347 lbf·ft) @ 1,500 rpm
Number of Cylinders	4
Displacement	4.5 L (1.2 gal)

UNDERCARRIAGE	
Shoe Width	700 mm (2'3")
Number of Shoes per Side	46
Number of Bottom Rollers per Side	7
Number of Upper Rollers per Side	1



BOOM & ARM	
Boom Length	4,600 mm (15'1")
Arm Length	2,900 mm (9'6")

BUCKET PERFORMANCE	
Std. Bucket Heaped Capacity (Referenced)	0.6 m³ (0.78 yd³)
Min. Heaped Capacity of Bucket Options	0.36 m³ (0.47 yd³)
Max. Heaped Capacity of Bucket Options	0.6 m³ (0.78 yd³)

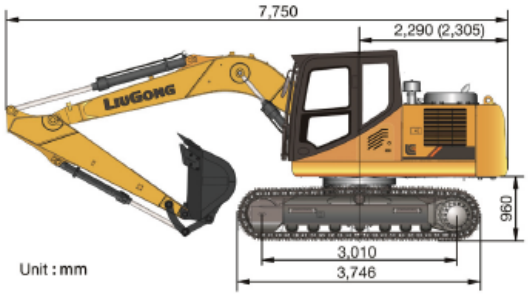
TRACK DRIVE	
Maximum Travel Speed	5.4 km/h (3.4 mph)
Drawbar Pull	124 kN (27,876 lbf)

SERVICE CAPACITIES	
Fuel Tank	245 L (64.7 gal)
Engine Oil	14 L (3.7 gal)
Cooling System	22 L (5.8 gal)
Hydraulic Reservoir	160 L (42.3 gal)
Hydraulic System Total	240 L (63.4 gal)
DEF Tank	17 L (4.5 gal)

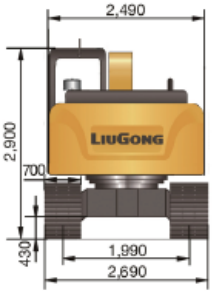
HYDRAULIC SYSTEM	
Main Pumps Total Flow	2×120 L/min (63.4 gal/min)
Relief Pressure, main	34.3 MPa (4,975 psi)
Relief Pressure, boost	37 MPa (5,366 psi)

SWING SYSTEM	
Swing Speed	12.94 rpm

WORKING RANGE	
A. Max. Digging Reach	8,720 mm (28'7")
B. Max. Digging Reach on Ground	8,620 mm (28'3")
C. Max. Digging Depth	5,870 mm (19'3")
D. Max. Digging Depth, 2.44 m (8') level	5,670 mm (18')
E. Max. Vertical Wall Digging Depth	5,160 mm (16'11")
F. Max. Cutting Height	9,040 mm (29'8")
G. Max. Dumping Height	6,590 mm (21'7")
H. Min. Front Swing Radius	2,545 mm (8'4")
Bucket Digging Force (ISO)	96.9 kN (21,784 lbf)
Arm Digging Force (ISO)	70 kN (15,737 lbf)



Unit : mm



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01/2021 Designed by LiuGong

BROKK

Tekniska data

Hydraulhammare i bilder		SB 552
Last- och stabilitetsdiagram kan beställas från Brokk AB		

Prestanda

Svänghastighet		20 sec/360°
Transporthastighet, max.		2,5 km/tim; 0,7 m/s
Stigningsvinkel, max.		30°

Hydraulsystem

Volym hydraulsystem		160 l
Pumptyp		Variabel lastkännande kolvpump
Systemtryck till cylindrar, redskap och motorer, max.		17,0 MPa
Systemtryck, förhöjt till redskap, max.		23,0 MPa
Pumpflöde max*	50Hz	115 l/min
	60Hz	130 l/min

Elmotor

Typ	ABB
Effekt**	30kW
Ström**	65A
Startkopplare	Mjukstart/Direktstart

Styrsystem

Manöverdon	Bärbar manöverlåda
Signalöverföring	Digital
Överföring	Kabel/Radio

Viktuppgifter

Vikt basmaskin utan redskap och extrautrustning	5100 kg
Rekommenderad maxvikt redskap	600 kg

Bullernivå

Ljudtrycksnivå, Lwa, uppmätt enligt direktiv 2000/14/EC	100 dB(A)

*** Max pumpflöde och max systemtryck kan ej tas ut samtidigt, motorn överbelastas**

**** Gäller 400V/50Hz**

Technical Data

Hydraulic breaker in illustrations		SB 552
Load and stability diagram can be ordered from Brokk AB		

Performance

Slewing speed		20 sec/360°
Transport speed, max.		2,5 km/h; 0,7 m/s; 1,6 mph
Incline angle, max.		30°

Hydraulic system

Hydraulic system capacity		160 l; 42,3 US gal
Pump type		Variable load-sensing piston pump
System pressure to cylinders, attatchment and motors, max.		17,0 MPa; 2466 psi
System pressure, increased to attachment, max		23,0 MPa; 3336 psi
Pump flow max*	50Hz	115 l/min; 30,4 US gal/min
	60Hz	130 l/min; 34,3 US gal/min

Electric motor

Type	ABB
Output**	30kW
Current**	65A
Starting device	Soft start/Direct start

Control system

Control type	Portable control box
Signal code	Digital
Transfer	Cable/Radio

Weight

Weight of basic machine excl. attachment & extra equipment	5100 kg; 11 240 lbs
Recommended max attachment weight	600 kg; 1 323 lbs

Noise level

Sound power level Lwa, measured according to directive 2000/14/EC	100 dB(A)

*** Max pump flow and max system pressure cannot be delivered at the same time as the engine will overload ** Valid for 400V/50Hz**

Technische Daten

Hydraulikhammer auf Abbildungen		SB 552
Belastungs- und Stabilitätsdiagramm über Brokk AB erhältlich.		

Leistung

Drehgeschwindigkeit		20 s/360°
Max. Transportgeschwindigkeit		2,5 km/tim; 0,7 m/s
Max. Steigung		30°

Hydrauliksystem

Volumen Hydrauliksystem		160 l
Pumpentyp		Variable lastabtastende Kolbenpumpe
Max. Systemdruck für Zylinder, Anbaugerät und Motoren		17,0 Mpa
Max. erhöhter Systemdruck für Anbaugerät		23,0 Mpa
Max. Pumpenfluß*	50 Hz	115 l/min
	60 Hz	130 l/min

Elektromotor

Typ	ABB
Leistung**	30kW
Strom**	65A
Anlasser	Softstart/Direktstart

Steuersystem

Steuerung	Tragbare Steuereinheit
Signalübertragung	Digital
Übertragung	Kabel/Funk

Gewicht

Gewicht Basismaschine ohne Anbaugerät und Zusatzausrüstung	5100 kg
Empfahlenes/ max. Gewicht anbaugerät	600 kg

Lärmpegel

Schalleistungspegel Lwa, gemessen laut Richtlinie 2000/14/EC	100 dB(A)

*** Max. Pumpenfluß und max. Systemdruck können nicht gleichzeitig erzielt werden. Ansonsten kommt es zu einer Motorüberlastung.**

**** Gültig für 400V/50Hz**

Caractéristiques techniques

Marteau hydraulique représenté dans les illustrations		SB 552
Brokk Ab fournit sur commande des diagrammes de charge et de stabilité		

Performances

Vitesse de rotation		20 s /360°
Vitesse maxi. de transport		2,5 km/tim; 0,7 m/s
Pente maxi.		30°

Système hydraulique

Volume du système hydraulique		160 l
Type de la pompe		Pompe à piston variable sensible à la charge
Pression du système maxi. aux vérins, aux l'outil et aux moteurs		17,0 MPa
Pression du système augmentée vers l'outil maxi.		23,0 MPa
Débit maxi.* de la pompe	50Hz	115 l/min
	60Hz	130 l/min

Moteur électrique

Type	ABB
Puissance**	30kW
Courant**	65A
Dispositif de démarrage	Démarrage doux/Démarrage triangle

Système de commande

Dispositif de commande	Coffret de commande portable
Transmission des signaux	Numérique
Transmission	Câble/Radio

Poids

Poids de l'engin de base sans outil et équipment supplémtaire	5100 kg
Poids recommandé (max) de l'outil	600 kg

Niveau sonore

Niveau d'intensité sonore Lwa, measuré conformément à la directive 2000/14/EC	100 dB(A)

*** Le débit maxi. de la pompe et la pression maxi. du système ne peuvent pas être obtenus simultanément pour ne pas surcharger le moteur**

**** Valable pour 400V/50Hz**

McCloskey INTERNATIONAL

J40

HIGHLY PORTABLE JAW CRUSHER

The J40 Jaw Crusher continues McCloskey's focus on quality, durability, and productivity. With heavy duty cheekplate design, 40" wide jaw and user-friendly control panel with excellent machine diagnostics, the J40 provides contractors with a highly portable option while meeting all production expectations. At 2.5 metres wide, it's ideal for applications that require a high degree of mobility.

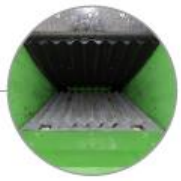
Maximum productivity is delivered through the enhancements to the deeper jaw box, including a faster jaw speed and a larger gap between the crusher discharge and main conveyor feedboot.

The J40 retains the core values expected in a full size McCloskey Jaw Crusher, including high capacity production and heavy duty build, packaged for efficiency and mobility.

CONTROL PANEL
User friendly waterproof and dustproof control panel. Allows monitoring of pressures, fluid levels and fuel consumption. Provides push button control of jaw, track and feeder functions.

MAIN CONVEYOR
36" main conveyor as standard, giving large stockpile capacity. Conveyor lowers and raises hydraulically.

JAW CRUSHER
True 40" x 24" jaw with reversible hydrostatic drive, reversible jaw plates, and fully hydraulic closed side setting (CSS) adjust.



FEEDER
Folding Hardox® hopper mounted over vibrating pan feeder built with steeper angles to reduce material sticking. Feeder rate regulated manually or automatically by load sensing jaw.

OPTIONAL MAGNET
Optional overband magnet enables magnetic material separation from the source material.

IDEAL TRANSPORT SIZE
At only 2.5 m wide, the J40 is easily transported between job sites.

Engine	225 hp (166 kW) Diesel
Transport Height	10' 6" (3.20m)
Transport Length	45' 2.6" (13.78m)
Transport Width	8' 2.5" (2.50m)
Weight-w/ magnet & side conveyor	76,280 lb (34,600kg)
Crushing Chamber	40"(wide) x 24"(pitman opening)
Stockpile Height - Main Conveyor	11' 4.2" (3.47m)
Stockpile Height - Side Conveyor	8' 2" (2.50m)

www.mccloskeyinternational.com

APPENDIX C

Calibration Information

Equipment No.	Equipment	Make/Model	Certification
32	Class 1 Sound Level Meter	Norsonic 140 RTA	Serial Number
			1406932
			Cert No.
			1146505
			Calibration Date
			22/06/2023
	Preamplifier	Norsonic 1209	Serial Number
			1209.21140
			Cert No.
			1146505
			Calibration Date
			23/06/2023
	Microphone	Norsonic 1225	Serial Number
			1225.285513
			Cert No.
			1146505
			Calibration Date
			23/06/2023
	Calibrated Level Before:	**113.9**	**Sens** -26
	Calibrated Level After:	**113.9**	**Sens** -26.1

Equipment No.	Equipment	Make/Model	Certification
33	Class 1 Sound Level Meter	Norsonic 140 RTA	Serial Number
			1406933
			Cert No.
			114506
			Calibration Date
			23/06/2023
	Preamplifier	Norsonic 1209	Serial Number
			1209.21141
			Cert No.
			114506
			Calibration Date
			23/06/2023
	Microphone	Norsonic 1225	Serial Number
			1225.285519
			Cert No.
			114506
			Calibration Date
			23/06/2023
	Calibrated Level Before:	**113.9**	**Sens** -26.2
	Calibrated Level After:	**113.9**	**Sens** -26.2