SHARPS REDMORE

ACOUSTIC CONSULTANTS · Established 1990

Report 1

Weybeards Farm,

Harefield, Uxbridge

Sound Level Assessment

Prepared by
Sam Moran BEng(Hons) MIOA

Senior Consultant

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North England
Sharps Redmore
The Plex, 15 Margaret Street,
Wakefield, WF1 2DQ
T 01924 586468
E northengland@sharpsredmore.co.uk
W sharpsredmore.co.uk

Regional Locations
North England,
South England (Head Office),
Wales, Scotland

Sharps Redmore Partnership Limited
Registered in England No. 2593855
Directors
RD Sullivan BA(Hons). PhD. CEng. MIOA. MAAS. MASA;
KJ Metcalfe BSc(Hons). MIOA;
N Durup BSc(Hons). MSc. PhD. CEng. FIOA. MInstP. MASA. MAES;
GJ King MIOA. MCIEH
Company Consultant
TL Redmore BEng. MSc. PhD. MIOA

Institute of Acoustics sponsoring organisation

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This report has been prepared with all reasonable skill, care and diligence commensurate with an acoustic consultancy practice under the terms and brief agreed with our client at that time. Sharps Redmore provides no duty or responsibility whatsoever to any third party who relies upon its content, recommendations or conclusions.

1.0 Introduction

1.1 Sharps Redmore have been appointed by Integrated Skills Limited on behalf of FJ Heppelthwaite Solutions to undertake a sound level assessment in relation to a waste management facility at Weybeards Farm, Harefield, Uxbridge. The proposals are to change the currently permitted activities at the site associated with the receipt, storage and treatment of waste cooking oil to allow for the receipt, storage and treatment of waste collected from the operators' skip collection service.

1.2 The proposed operating hours of the facility are as follows:

The site is open to receive waste between the hours of:

- 07:00-18:00 Monday to Friday
- 07:00-13:00 on Saturdays
- With no operations on Sunday or Public Holidays

Waste processing hours of operation:

- 09:00 – 17:00 Monday to Friday only

1.3 This sound level assessment considers the impact at the nearest residential properties and has been undertaken in accordance with the guidance provided within BS 4142:2014+A1:2019[1]. A Noise Management Plan has been provided by Integrated Skills separately.

1.4 A guide to the acoustic terminology used within this report is included in Appendix A.

[1] BS 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound

2.0 Assessment Methodology and Criteria

2.1 The assessment has been undertaken in accordance with the guidance provided within BS 4142. In brief, the BS4142 assessment method is to obtain an initial potential impact finding by comparing the difference in level between the site-attributable sound (called the rating level) and the background sound. The latter is the underlying value in the absence of the site sound. A rating level acoustic feature correction is to be applied if the source sound has tonal, impulsive, intermittent, or other characteristics which attract attention. The initial impact finding is then to be considered in context and that can modify the outcome.

2.2 In terms of the 'difference' comparison, a difference of around +10dB or more is considered likely to be an indication of a significant adverse impact, depending on the context. A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context. When the difference is zero or negative in magnitude, the indication is of a low impact, again depending on the context.

2.3 Context is key and pertinent factors to consider include the absolute level of the source; the character of the neighbourhood sounds (with and without the site contribution); the sensitivity of the receptor and the presence or otherwise of sound mitigation measures. (Clause 11 of BS4142).

2.4 It is therefore entirely possible that whilst the numerical outcome of a BS 4142 assessment is indicative of adverse or significant adverse impact, when the proposal is considered in *context* the significance of the impact is reduced to an acceptable level.

3.0 Description of Neighbourhood and Sound Level Survey

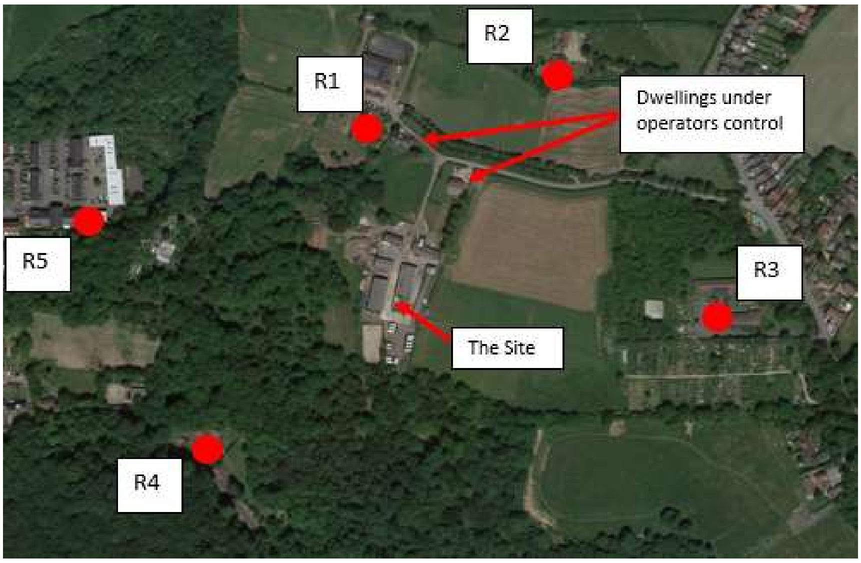
3.1 The site is located approximately 325m to the west of Hill End Road and is surrounded by fields and woodland. The outskirts of Harefield is located approximately 700m to the south east of the site whilst the M25, traversing in a north / south direction, is located approximately 2.5km to the west of the site. The closest residential premises to the north of the site are under the control of the operator and occupied by family members.

3.2 The closest residential premise which is not under the control of the operator is located approximately 110m to the north west of the permit boundary. To the east, the closest receptor is a Care Home which is located approximately 250m from the permit boundary. The main processing building is located further into the site. To the south and west, residential receptors are located over 200m from the permit boundary and there are significant differences in topography with these premises being at a much lower ground level than the site with the landform providing a natural barrier.

3.3 The Old Park Wood SSSI is located to the south and east of the site which is designated for being a woodland. The SSSI comprises a large area to the south and west of the site and covers a large area. Given the designation and the previous commercial / industrial noise present at the site this is not considered to be a sensitive receptor.

3.4 The location of the site and closest residential premises are also shown in Figure 3.1.

Figure 3.1 Site and Sensitive Receptor Location Plan



Baseline Noise Survey

3.5 An environmental sound level survey has been undertaken by Sam Moran, Senior Consultant, Sharps Redmore on 27th and 28th March 2023.

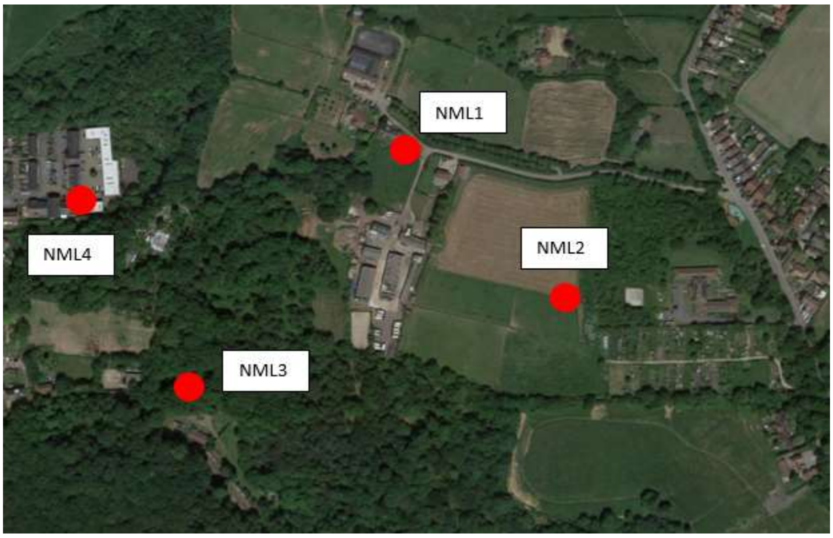
3.6 Continuous baseline measurements were collected over the course of the survey at two locations (NML1 and NML2) which were representative of the closest residential receptors to the north and east of the site. The equipment was left to log unattended during the evening and night-time period. Sample measurements were also obtained at two further locations to the south west and west of the site. The site was attended during the daytime period on 27th and 28th March. During the survey, specific noise generating activities associated with the operation at the site were replicated to enable source sound level measurements to be undertaken. Data collected during these periods has not been used when establishing existing baseline conditions as part of this assessment.

3.7 A description of the sound monitoring locations is as follows:

- NML1 – Along a boundary of the residential premise (under the control of the operator) to the east of the dwelling. This location was screened from the 'processing' building by intervening buildings within the site;
- NML2 – In the field to the east of the site between the site and Parkwood House Care Home. The monitoring location was partially screened from the 'processing' building by intervening buildings. The top edge of the open eastern elevation of the building was partially visible.
- NML3 – within the woodland area to the north of the residential dwelling (R3) on Bellevue Terrace.
- NML4 – On the pavement to the north of the Copper Mill Car Centre on Canal Way.

3.8 A plan showing the sound level monitoring locations is presented in Figure 3.2.

Figure 3.2 Sound Level Monitoring Location



3.9 The sound level measurements were carried out in free-field conditions except at location NML4 where measurements were obtained on the pavement approximately 2m from the façade of the adjacent care home building. The microphones were mounted at a height of approximately 1.5m above local ground level at all locations except NML2 where measurements were collected at a height of approximately 2m above local ground level (above the height of a metal rail fence).

3.10 Details of the type 1/class 1 sound level meters and calibrators used for the survey are presented in Appendix B. The sound level meters were calibrated before and after the survey with no significant drift recorded (≤0.5 dB) with the calibration drift recorded for each sound level meter presented in Appendix B.

3.11 A summary of the measured sound levels is presented in Table 3.1. Time history graphs for NML1 and NML2 are presented in Appendix C. The raw data for NML1 to NML4 is also tabulated in Appendix C. The relevance of presenting the daytime and evening periods in Table 3.1 separately for NML1 and NML2 is subsequently explained.

TABLE 3.1: Summary of Measured Noise Levels

Location	Date and Time	Ambient / average sound level dB $L_{Aeq,T}$	Underlying / background sound level dB $L_{A90,T}$
NML 1	27/03/23: 17:00 – 19:00	45	32 – 34
	27/03/23: 20:00 – 23:00	44	38
NML 2	27/03/23: 17:00 – 19:00	43	32
	27/03/23: 20:00 – 23:00	43	37
NML 3	27/03/23: 17:20 – 17:50	46	34
NML 4	28/03/23: 07:11 – 07:15	40	49

3.12 Observations of weather conditions at the site and in the surrounding area were made during the afternoon and evening of 27th March and the morning of 28th March. Weather conditions on the 27th March were categorised by dry conditions with generally no wind other than a very light occasional northerly breeze. The sky was 50% overcast with temperature approximately 11°C. Observations made during the late evening of the 27th March indicated comparable conditions although a southerly breeze was just perceptible (measured using a handheld anemometer at around 2m/s).

3.13 On the 28th March, wind speeds were greater and rain was present. At around 06:30, there were occasional drops of rain observed and, at NML4 at 07:10, there was a low southerly breeze present although the location was in a relatively sheltered position due to the surrounding topography and buildings. The temperature was around 8°C with the sky 100% overcast.

3.14 Rain showers started to occur from around 07:30 over the course of the remainder of the site visit with periods of heavier rain also present. Wind speeds, measured using a hand held anemometer, were generally measured to be between 3m/s – 5m/s although intermittent gusts of greater than 5m/s were also measured. A southerly wind direction was present. Due to weather conditions, data collected on the 28th March has not been used for analysis.

3.15 During the attended site visit on 27th March, the baseline sound climate was observed to be primarily influenced by bird song and overhead aircraft noise (helicopters, small light aircraft and larger passenger planes). The level of aircraft movement was observed to vary from periods where there was occasional aircraft events to periods aircraft noise was far more prominent. The low drone of distant road traffic noise was also audible.

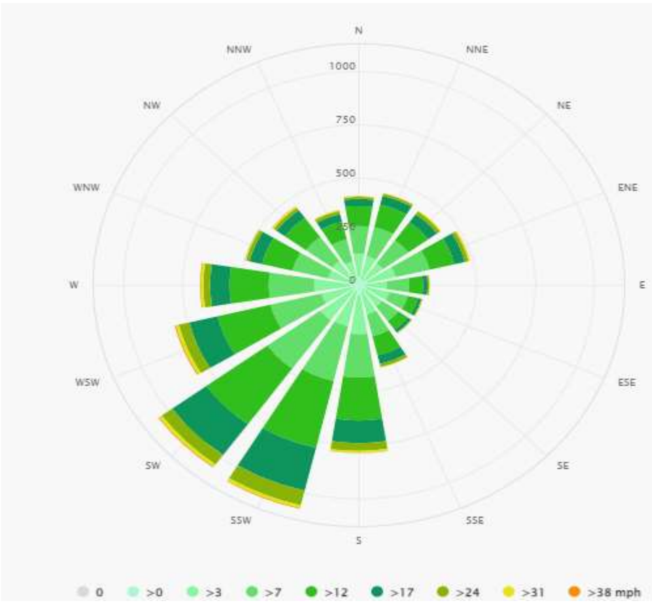
3.16 Construction works were being undertaken at the closest receptor to the north west of the site (Primrose Cottage) with the sound climate at this location and measurements collected at NML1 up to approximately 16:30 predominantly governed by noise from a small excavator operating close to the eastern boundary of this receptor.

3.17 On 28th March the sound levels at the site and surrounding area were dominated by road traffic noise emanating from the south / south west. At NML4, distant road traffic noise was the dominant source. Infrequent vehicle movement within the housing estate and along the access road adjacent to the monitoring location to commercial premises was also observed. The measurement at this location was stopped after 13 minutes due to activities at the commercial premises including a van idling becoming more prevalent along with rain starting to become more prominent. However, as established further on in this report, the predicted absolute levels at the residential premises represented by location NML4 are very low (< 30 dB $L_{Aeq,T}$) and sound level measurements at this location do not have a bearing on this assessment.

3.18 As noted above, a summary of measured sound levels at NML1 and NML2 have been presented separately. This is on the basis that sound level measurements at NML2 and, after the period when construction works ceased, NML1 during the afternoon were very low. During this period there was generally no wind other than a very light occasional northerly breeze. However, given the presence of the strategic road network including the M25 in the wider area to the west and south of the site, it would not be expected that such low background sound levels would be typically present during the daytime period.

3.19 During the evening, typical background sound levels were measured to be higher at around 37 dB $L_{A90,15mins}$ at NML1 and 38 dB $L_{A90,15mins}$ at NML2 with background sound levels remaining generally above 35 dB $L_{Aeq,15mins}$ for the remainder of the survey. Figure 3.3 also presents a wind rose from Heathrow Airport which is located approximately 14km to the south of the site. This shows the prevailing wind direction within proximity to the site is broadly from the south west. This presents an indication that baseline sounds levels would be typically influenced to a greater degree by road traffic noise from the M25 and strategic highway network with the most sensitive receptors also downwind from the site during such periods. These conditions are considered to be represented by sound level measurements obtained during the evening period.

Figure 3.3 Heathrow Airport Windrose Data[2]



3.20 As such to present a robust approach, the data collected during the afternoon of 27th March has been used as a basis of the assessment. However, it is considered reasonable to also consider the data collected during the evening of the 27th March for context as it is

[2] Sourced by Integrated Skills Limited and replicated from the Noise Management Plan https://www.metoffice.gov.uk/services/transport/aviation/regulated/airfield-climate-stats#Heathrow

expected that sound level obtained during this period would be representative of typical conditions.

3.21 Noise data collected on the 28th March from around 04:00 has not been considered for the numerical example due to the unsuitable weather conditions for the measurement of sound which may have started a short period after this time.

Specific Sound Level Survey

3.22 In addition to the baseline sound level measurements, specific measurements were obtained during the attended daytime periods on site where operational noise sources were replicated. This included a period on 27th March (approximately 15:00 – 16:00) when the processing of construction and demolition waste using the trommel loaded by a 360 material handler with grab was replicated for the purposes of this assessment

3.23 Sound level measurements were collected within proximity to the processing activities at a position of sufficient distance from the equipment to be considered to be far field conditions (> than 25m from the trommel). Distances from equipment were established using an infra-red rangefinder sight and tape measure.

3.24 Observations were made at locations further away from the building, however, the sound climate further from the site was influenced by sound sources in the wider area including overhead aircraft and extraneous noise sources attributable to the presence of construction works within the curtilage of the property to the west of NML1.

3.25 The processing of waste was also replicated on the morning of 28th March, however, road traffic noise from the M25 was dominant along with unsuitable weather conditions. It was possible to obtain a specific measurement of the baler compacting carboard on 28th March which was not influenced by weather conditions as the operation and measurements were undertaken within a building.

3.26 Further details of the specific survey and associated assessment are presented in Section 4.

4.0 Key Findings

Development Description and Site-Attributable Sound Levels

4.1 A description of the proposed operations is provided in the Environmental Permit application prepared by Integrated Skills Ltd[3]. In summary, the operation will be small scale waste sorting and separation. The process will use manual and mechanical sorting to separate waste from the mixed pile. The remaining waste will be loaded into a trommel screen which is a small machine, suited for the small scale operations. For dry recyclables, a small manually fed baling machine will be used within one enclosed building.

4.2 In the future, the operator may undertake small scale shredding or crushing. It is understood that this would be undertaken infrequently over a very short timeframe on a weekday with such operations occurring for around a hour a week once processing within the building had ceased but not after 17:00. The operation would occur in the area to the north of the 'processing, building which is predominantly surrounded on-site buildings to minimise the noise impact. Given the very infrequent operation, no further assessment operation has been undertaken.

4.3 A proposed site plan is presented in Appendix D.

4.4 Plant on site to include the following:

- Baughans Middi trommel screen
- Kobelco SK75SR-3E 360^o material handler with grab attachment
- Manitou MLT 634-120 PS Elite Telehandler
- Orwak 8020 baler
- Skip lorries delivering waste to the reception area (infrequent due to being family run business, with no third party deliveries accepted)
- 8 wheel tipper lorry removing sorted waste.

4.5 In the specific context of sound emissions, sound from the processing of waste using the trommel which was positioned in the south western part of the building will be the principle noise generating operational activity with other activities being of an insignificant magnitude in comparison.

4.6 The measured sound level of the baler operation was very low (63 dB $L_{Aeq,T}$ at 6m inside the building) with a comparable sound level measured when carboard was being placed manually into the baler and compacting as well as compacting in isolation. With regard to the removal of waste by tipper wagon, this activity would be infrequent and of short duration. It is understood that this event would occur two to three times per week with the loading activity occurring for around 5 to 7 minutes.

4.7 As such the following assessment is based on the processing of construction and demolition waste using a trommel which represents a reasonable worst-case scenario.

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[3] Integrated Skills Limited, Application to Vary Environmental Permit:HEP-VAR-01, Version 2, 13.3.2023

4.8 The waste is received via skip lorries which will reverse into the building from the open northern elevation and unload waste into the receiving area in the central part of the building. The tipped material will be sorted in the central part of the building to separate the major heavy fractions of waste. The waste is loaded into the trommel by the 360 grab with the material being sorted along the processing line. Sound levels close to the building and at further distances from the process were observed to be governed by the tumbling of material in the trommel.

4.9 Sound level measurements were obtained of this operation at two positions to the east and north of the trommel building. The measurements locations were approximately; T1 –28m from the trommel and 15m from the building: and T2 – 40m from the trommel and 13m from the building. The building which houses the process is open sided on the western and northern elevation up to a height of approximately 5m. The openings provide access to the building. The southern and western elevations are constructed using a concrete panel wall (approximately 2.3m in height) with timber panels enclosing the elevations up to the lower edge of the roof structure. The timber panels are constructed of approximately 20mm thick softwood Yorkshire boarding with the construction being double boarded with panels overlapping gaps. The location of the T1 and T2 monitoring positions as well as that of the baler (B1) inside the building are shown in Figure 4.1. The baler is currently stored in the north eastern most building within the permit boundary. However, it is understood that the baler would be housed within the building immediately to the north of the processing building as shown on the proposed site layout plan.

Figure 4.1 Trommel and Baler Sound Level Monitoring Locations

4.10 There was a direct line of sight from the T1 and T2 measurement positions to the trommel. A sound level of 73 dB $L_{Aeq,T}$ was measured at both locations. The measured sound levels at T1 and T2 have been used as a basis of noise modelling to predict the level of noise at identified receptors. The measured sound levels at T1 and T2 are presented in Table 4.1 below.

Table 4.1: Measured Source Sound Levels - Trommel (27th March)

Location	Time	Duration (Mins)	Octave band centre frequency Hz – dB L_{eq}								dB $L_{Aeq,T}$
			63	125	250	500	1k	2k	4k	8k	
T1	15:12	15	71	66	65	66	67	68	64	56	73
T2	15:29	5	69	67	68	66	68	68	65	59	73

Noise modelling

4.11 Acoustic computer modelling has been undertaken using SoundPLAN 8.2 to calculate the sound propagation from the site based on measured specific source sound levels which are representative of proposed operations. The model uses the calculation methodology described by ISO 9613-2[4] with the model input parameters presented in Appendix E.

4.12 The trommel is located within a building with two open sides and thus is considered to be positioned within a semi reverberant environment. Initial calculations, were undertaken to estimate an apparent sound power level of the plant based on the measurements obtained at T1 which was closest to the trommel. An apparent sound power level of 107 dB $L_{WA'}$ was calculated[5] which is comparable to specific levels attributable to similar plant and activity measured by Sharps Redmore at other similar waste sites. Using this source sound level as a basis of the noise modelling, a comparison with the measured sound levels has been undertaken.

4.13 A comparison of the modelled and measured sound levels is presented in Table 4.2.

Table 4.2: Noise Model Verification ($L_{Aeq,T}$)

Location	Measured Specific Level (dB $L_{Aeq,T}$)	Modelled Level (dB $L_{Aeq,T}$)	Difference (dB)
T1	73	72	-1
T2	73	74	1
NML1*	Between 37 and 42[6]	40	Between -2 and 3

*during measurements obtained at NML1 when the trommel was operating, the measured sound level ranged between 44 dB $L_{Aeq,15mins}$ to 49 dB $L_{Aeq,15mins}$. During the periods when sound levels were highest, it was observed that there was considerable influence from overhead aircraft. At 15:15 a sound level of 44 dB $L_{Aeq,T}$ was measured when the trommel was operating under full load. During periods after the trommel ceased operating up to

[4] ISO 9613-2:1996, Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation

[5] 107 dB LWA = 73 dBA + 20*log(28)+5.

[6] $L_s = 10lg(10^{L_a/10} - 10^{L_r/10})$ where L_s = Specific Sound Level, L_a = ambient sound level, L_r = residual sound level (L_r has been calculated using 37 and 42 dB $L_{Aeq,T}$)

18:30, the residual sound level ranged between 40 dB $L_{Aeq,15mins}$ and 43 dB $L_{Aeq,15mins}$. Predominantly, the residual level (in the absence of noise from the operation) was measured to be 43 dB $L_{Aeq,T}$ which suggests that the noise model is predicting a slightly higher level than the calculated specific level. This is considered to reduce uncertainty in the modelling.

4.14 It is not possible to provide a similar comparison at NML1, due to the influence of the adjacent construction works.

4.15 The modelled specific levels attributable to the trommel are within 3 dBA of the measured / calculated specific levels. Therefore, it is considered that the model is suitably verified.

Assessment

4.16 Table 4.3 presents a comparison of the background noise level with the predicted rating level at identified receptors. The reference existing background sound levels are based on a review of the baseline survey data and represents a reasonable worst-case scenario. As noted previously, it is considered that the reference background sound levels presented in Table 4.3 are untypically low. A further comparison of baseline sound levels measured during the evening period is presented in Table 4.3 with further rationale presented in Paragraph 4.20.

4.17 For the care home receptors, as it is assumed that there would be residents at first floor level, receptors have been assessed at both ground and first floor. At R3, the southernmost block of the care home is single storey. A noise contour plot is presented in Appendix F.

4.18 Noise from the processing operation was observed to be neither tonal nor impulsive. A +3 dB character correction has been applied for the distinctiveness of noise emissions. Based on Sharps Redmore's experience of similar type activities, this character correction is considered appropriate to establish the rating level.

Table 4.3: Comparison between background sound levels and rating levels

Location	Reference Existing Background Sound Level (dB $L_{A90,T}$)	Predicted Specific Level (dB $L_{Aeq,1hour}$)	Predicted Rating Level (dB $L_{A,Tr}$)	Difference (dB)	Initial impact finding, depending on context
R1	32	43	43	11	Significant
R2	32	35	38	6	Adverse
R3(Ground Fl)	32	35	38	6	Adverse
R3a (1st Fl)	32	37	40	8	Adverse
R4	34	32	35	1	Low
R5 (1st Fl)[7]	34	20	23	-11	Low

4.19 At receptors to the east, west and south, the initial impact outcome is predicted to be low to adverse. At R1 to the north west, the initial outcome is predicted to be an indication of a significant impact. However, there are various contextual considerations which are

[7] Based on the reference background sound level obtained at NML3 as a conservative approach rather than sound level data collected at NML4 on 28th March. Given the very low absolute levels this does not have a bearing on the assessment.

considered pertinent to reduce the impact 'level' to a lower band. These are outlined below.

4.20 As identified previously, the background sound levels measured during the daytime period were considered to be very low with measured sound levels higher during the evening period. This is considered to be attributable to road traffic noise from the M25 with the change in wind direction at that time being comparable to that of the prevailing wind direction. Therefore, a further comparison has been undertaken based on the reference existing background sound level measured during the evening period. Reference has been given to a background sound level of 37 dB L_{A90} which is considered to present a conservative approach in terms of typical background sound levels measured at NML1 and NML2 during this period. The assessment is presented in Table 4.4.

Table 4.4: Comparison between background sound levels and rating levels (Southerly wind direction – representative of the prevailing wind direction)

Location	Reference Existing Background Sound Level (dB $L_{A90,T}$)	Predicted Specific Level (dB $L_{Aeq,1hour}$)	Predicted Rating Level (dB $L_{A,Tr}$)	Difference (dB)	Initial impact finding, depending on context
R1	37	43	43	6	Adverse
R2	37	35	38	1	Low
R3(Ground Fl)	37	35	38	1	Low
R3 (1st Fl)	37	37	40	3	Low
R4	37	32	35	-2	Low
R5 (1st Fl)	37	20	23	-14	Low

4.21 Based on the sound levels measured during the evening, the initial impact outcome would low at the majority of receptors. At R1, the initial impact outcome is predicted to be an indication of an adverse impact.

4.22 Further points of context which are pertinent and where assessment uncertainty has been minimised are as follows:

- Based on measurements obtained at NML1 and NML2 during the daytime and evening periods the predicted specific levels are below existing ambient sound levels.
- Predicted rating levels are considered to be low in absolute terms (< 45 dB $L_{Aeq,1hour}$).
- Measured sound levels were considered to be very low on the afternoon of 27th March. To present a worst-case scenario, an assessment has been undertaken based on the reference background sound level measured during this period. Using this data to represent baseline conditions, this is considered to over-emphasise the initial impact outcome. Consideration has also been given to a period when meteorological conditions were representative of the prevailing wind direction and background sound levels were higher due to distant road traffic noise as presented in Table 4.4.
- It should be also noted that the site and surrounding land has always been in operational use. The site was an operational farm with cattle and pigs. In 2006, the site diversified and started to collect, store and treat waste cooking oil. Therefore, previous commercial / industrial operations have been undertaken at the site. Plant and machinery have always been associated with this land. Noise associated with previous

commercial / industrial use is not incorporated or reflected within the measured baseline sound levels.

- Assumptions have been made to minimise uncertainty in the noise model as far as practicable. Specific sound level measurements of the installed processing plant have been undertaken at the site. The measured specific source levels have been used to form the basis of noise modelling to predict specific levels at receptors located in the area around the site. These are based on measurements close to the processing activities as well as, where feasible, at further distance away.

- The processing of construction and demolition waste was measured and used as a basis of the assessment. This represents a reasonable worst-case scenario associated noise generating activities associated with the process. Such activities would occur on occasion during the day and not all day.

4.23 Further to the points of context, the principle measure to minimise the noise impact at the site is the restriction of hours when processing operations when the trommel would be in operation would be no earlier than 09:00 and no later than 17:00 on a weekday (not on bank holidays). Therefore, the noisiest operations would be managed and would occur on occasion during the less sensitive time daytime weekday period.

Final Impact

4.24 On the basis of the above including the restriction of processing hours, Sharps Redmore consider the impact would be low to adverse at the closest sensitive receptor locations with measures outlined to minimise impacts. Impacts which are significant are not predicted.

5.0 Conclusions

5.1 Sharps Redmore have undertaken an environmental sound assessment to consider the sound impact associated with the variation of an environmental permit to allow for a small scale waste management facility at Weybeards Farm, Harefield.

5.2 A baseline sound survey has been undertaken and background sound levels representative of the closest residential receptors have been established. Specific source sound levels have been modelled and rating levels predicted at the closest residential receptors. A reasonable worst case scenario associated with the processing of construction and demolition waste using a trommel has been considered. It should be noted that such activities would occur on occasion during the day and not all day.

5.3 This assessment has objectively demonstrated in the context of BS 4142 that sound levels from proposed operations would not be expected to give rise to a significant adverse impact at nearby residential receptors. In general, a low impact is predicted at the majority of receptors with an adverse impact predicted at one residential property located to the north west of the site. Processing operations will be managed to minimise impacts with such operations occurring during the least sensitive weekday daytime period. A Noise Management Plan has been submitted separately as part of the Permit application.

APPENDIX A

ACOUSTIC TERMINOLOGY

Acoustic Terminology

A1 Noise, which is sometimes defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. 50 dB + 50 dB = 53 dB. Increases in continuous sound are perceived in the following manner:

1 dB increase - barely perceptible.

3 dB increase - just noticeable.

10 dB increase - perceived as twice as loud.

A2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.

A3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).

A4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p. Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p.

A5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.

A6 The main noise indices in use in the UK are:

L_{A90}: The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.

L_{Aeq}: The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.

L_{A10}: The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

L_{AMAX}: The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

A7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB.}$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

A8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \text{ Log } {}^{160}/_{10} = 60 - 24 = 36 \text{ dB.}$$

APPENDIX B

EQUIPMENT DETAILS

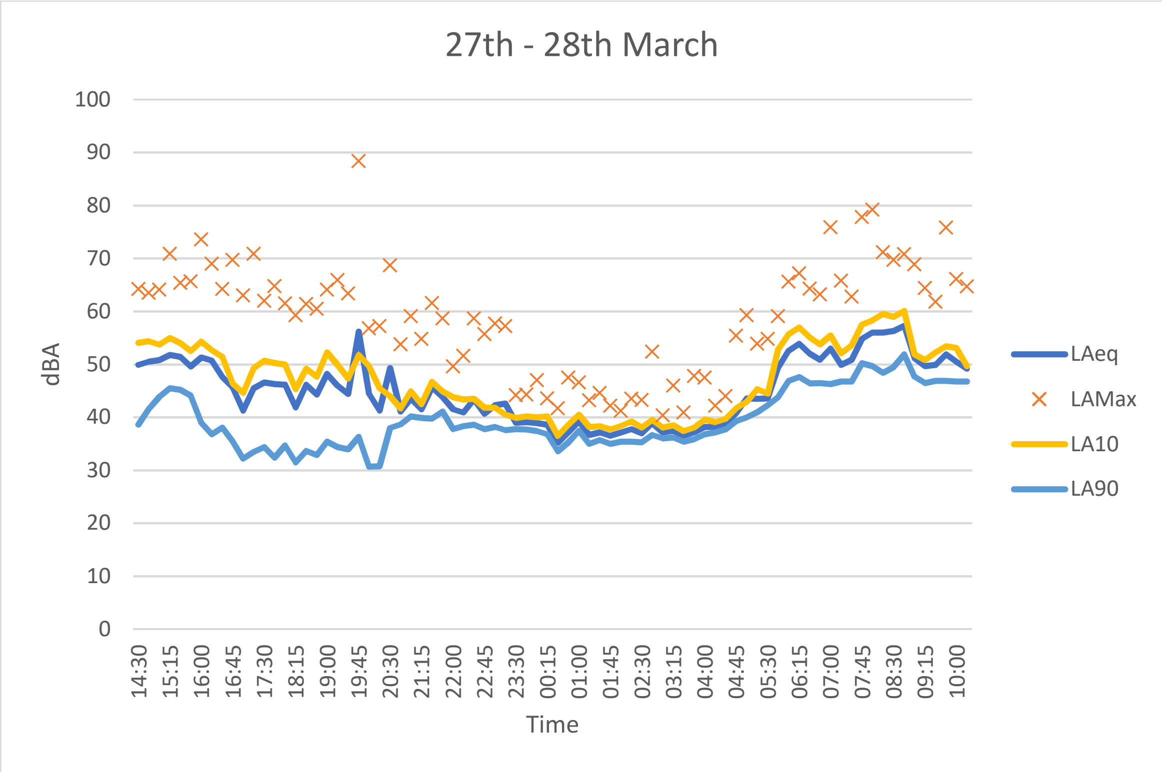
Equipment	Location	Serial Number	Date Last Calibrated	Calibration Drift
Cirrus Optimus CR:171B SLM	NML1	G079788	27.10.22	+0.5 dB
Cirrus CR:515 Calibrator		60698	28.10.22	-
Norsonic 118 SLM	NML2	30600	13.03.23	-0.3 dB
Norsonic 1251 Calibrator		30795	13.03.23	-
Norsonic 140 SLM (Attended measurements)	NML3, NML4 & Source measurements	1404434	05.04.22	-0.2 dB (27th March) +0.1 dB (28th March)
Norsonic 1251 Calibrator		33001	05.04.22	-

*SLM: Sound Level Meter

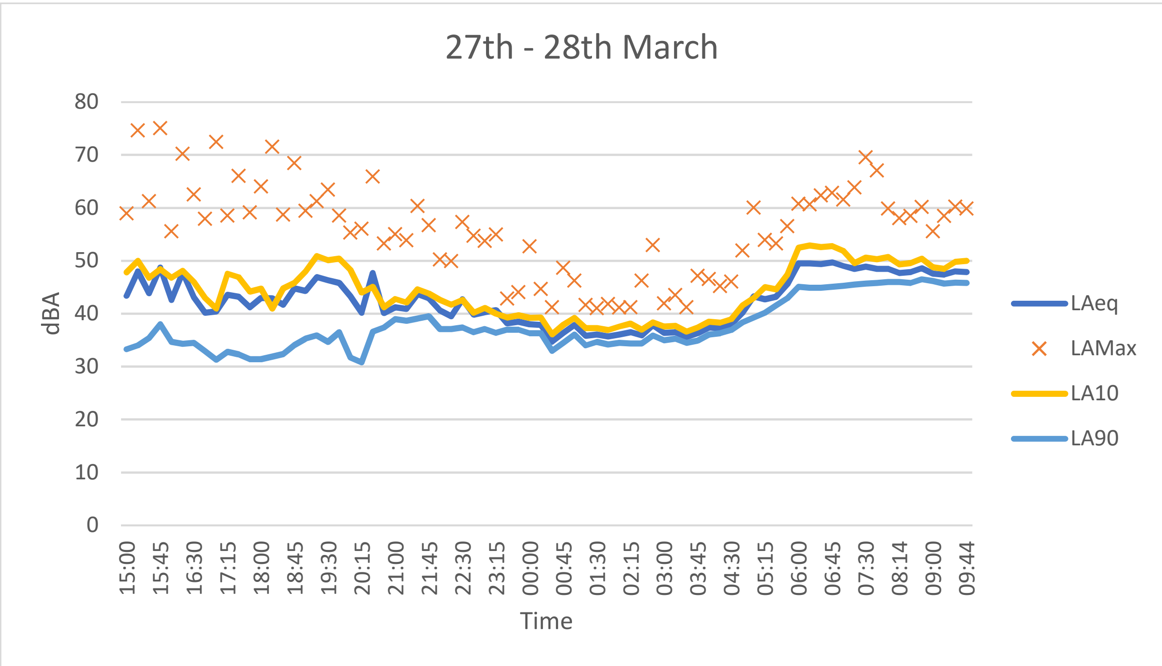
APPENDIX C

SOUND SURVEY DATA (NML1 – NML4)

NML1


27th - 28th March
dBA
Time
LAeq
LAMax
LA10
LA90

NML2


27th - 28th March
dBA
Time
LAeq
LAMax
LA10
LA90

NML 1

Time / Date		$L_{Aeq,T}$	L_{Amax}	$L_{A10,T}$	$L_{A90,T}$
27/03/2023	14:30	49.9	64.2	54.1	38.6
27/03/2023	14:45	50.5	63.5	54.4	41.6
27/03/2023	15:00	50.8	64.1	53.7	43.9
27/03/2023	15:15	51.8	70.9	55.0	45.5
27/03/2023	15:30	51.4	65.4	54.0	45.2
27/03/2023	15:45	49.6	65.7	52.5	44.1
27/03/2023	16:00	51.3	73.6	54.3	39.0
27/03/2023	16:15	50.7	69.0	52.7	36.8
27/03/2023	16:30	47.6	64.2	51.4	38.1
27/03/2023	16:45	45.7	69.7	46.4	35.5
27/03/2023	17:00	41.3	63.0	44.6	32.2
27/03/2023	17:15	45.5	70.9	49.3	33.5
27/03/2023	17:30	46.6	62.0	50.7	34.4
27/03/2023	17:45	46.3	64.8	50.3	32.4
27/03/2023	18:00	46.2	61.5	50.0	34.7
27/03/2023	18:15	41.9	59.3	45.3	31.5
27/03/2023	18:30	46.2	61.4	49.2	33.7
27/03/2023	18:45	44.3	60.5	47.7	32.9
27/03/2023	19:00	48.2	64.1	52.3	35.4
27/03/2023	19:15	46.0	65.9	49.9	34.4
27/03/2023	19:30	44.4	63.4	47.3	34.0
27/03/2023	19:45	56.2	88.4	51.8	36.3
27/03/2023	20:00	44.5	56.8	49.7	30.7
27/03/2023	20:15	41.3	57.2	45.5	30.8
27/03/2023	20:30	49.3	68.7	44.0	38.0
27/03/2023	20:45	41.1	53.8	41.7	38.7
27/03/2023	21:00	43.5	59.1	44.9	40.2
27/03/2023	21:15	41.5	54.8	42.5	39.9
27/03/2023	21:30	45.7	61.6	46.7	39.8
27/03/2023	21:45	43.8	58.7	44.9	41.1
27/03/2023	22:00	41.5	49.6	43.8	37.8
27/03/2023	22:15	40.9	51.6	43.4	38.3
27/03/2023	22:30	43.4	58.7	43.5	38.6
27/03/2023	22:45	40.7	55.7	41.8	37.8
27/03/2023	23:00	42.3	57.7	41.8	38.2
27/03/2023	23:15	42.6	57.2	40.5	37.6
27/03/2023	23:30	39.0	44.2	39.9	37.8
27/03/2023	23:45	39.1	44.3	40.2	37.7

Time / Date		$L_{Aeq,T}$	L_{Amax}	$L_{A10,T}$	$L_{A90,T}$
28/03/2023	00:00	38.9	47.0	40.0	37.4
28/03/2023	00:15	38.6	43.6	40.2	36.8
28/03/2023	00:30	35.2	41.7	36.5	33.6
28/03/2023	00:45	37.2	47.5	38.6	35.3
28/03/2023	01:00	39.2	46.6	40.5	37.5
28/03/2023	01:15	36.7	43.2	38.2	35.0
28/03/2023	01:30	37.2	44.6	38.3	35.7
28/03/2023	01:45	36.5	42.2	37.7	35.0
28/03/2023	02:00	37.1	41.2	38.4	35.4
28/03/2023	02:15	37.8	43.5	39.2	35.4
28/03/2023	02:30	37.0	43.3	38.1	35.3
28/03/2023	02:45	38.9	52.4	39.5	36.7
28/03/2023	03:00	37.2	40.4	38.1	36.0
28/03/2023	03:15	37.5	46.0	38.5	36.2
28/03/2023	03:30	36.5	40.9	37.4	35.4
28/03/2023	03:45	37.2	47.8	38.1	35.9
28/03/2023	04:00	38.2	47.5	39.6	36.8
28/03/2023	04:15	38.2	42.2	39.1	37.2
28/03/2023	04:30	38.8	44.0	39.7	37.7
28/03/2023	04:45	40.8	55.4	41.7	39.3
28/03/2023	05:00	43.6	59.3	42.9	40.0
28/03/2023	05:15	43.5	53.9	45.3	41.0
28/03/2023	05:30	43.6	54.8	44.5	42.3
28/03/2023	05:45	49.3	59.1	52.8	43.8
28/03/2023	06:00	52.6	65.6	55.7	46.9
28/03/2023	06:15	53.9	67.2	57.0	47.6
28/03/2023	06:30	52.0	64.3	55.1	46.4
28/03/2023	06:45	50.9	63.2	53.8	46.5
28/03/2023	07:00	53.0	75.9	55.5	46.3
28/03/2023	07:15	49.9	65.8	52.1	46.8
28/03/2023	07:30	50.9	62.8	53.6	46.8
28/03/2023	07:45	54.8	77.8	57.5	50.2
28/03/2023	08:00	56.0	79.2	58.3	49.7
28/03/2023	08:15	56.0	71.2	59.5	48.4
28/03/2023	08:30	56.3	69.7	59.0	49.5
28/03/2023	08:45	57.3	70.8	60.1	51.9
28/03/2023	09:00	51.2	68.9	51.9	47.7
28/03/2023	09:15	49.7	64.4	50.8	46.5
28/03/2023	09:30	49.9	61.8	52.3	46.9
28/03/2023	09:45	51.9	75.8	53.4	46.9
28/03/2023	10:00	50.5	66.1	53.1	46.8
28/03/2023	10:15	49.2	64.7	49.7	46.8

NML2

Time / Date	$L_{Aeq,T}$	L_{Amax}	$L_{A10,T}$	$L_{A90,T}$
(2023/03/27 15:00:00.00)	43.4	59.0	47.8	33.3
(2023/03/27 15:15:00.00)	48.0	74.7	50.0	34.0
(2023/03/27 15:29:59.00)	43.9	61.3	46.8	35.4
(2023/03/27 15:45:00.00)	48.7	75.1	48.4	38.0
(2023/03/27 16:00:00.00)	42.6	55.6	46.8	34.7
(2023/03/27 16:15:00.00)	47.8	70.3	48.1	34.3
(2023/03/27 16:30:00.00)	43.1	62.6	46.0	34.5
(2023/03/27 16:45:00.00)	40.2	58.0	43.0	32.9
(2023/03/27 17:00:00.00)	40.4	72.5	41.0	31.3
(2023/03/27 17:15:00.00)	43.6	58.6	47.6	32.8
(2023/03/27 17:30:00.00)	43.2	66.1	46.9	32.3
(2023/03/27 17:45:00.00)	41.2	59.2	44.2	31.4
(2023/03/27 18:00:00.00)	43.0	64.1	44.7	31.4
(2023/03/27 18:15:00.00)	42.9	71.6	41.0	31.9
(2023/03/27 18:30:00.00)	41.7	58.8	44.8	32.4
(2023/03/27 18:45:00.00)	44.8	68.5	45.8	34.1
(2023/03/27 19:00:00.00)	44.3	59.5	48.0	35.3
(2023/03/27 19:15:00.00)	46.9	61.3	50.9	35.9
(2023/03/27 19:30:00.00)	46.3	63.5	50.1	34.7
(2023/03/27 19:45:00.00)	45.8	58.6	50.4	36.5
(2023/03/27 20:00:00.00)	43.3	55.4	48.3	31.7
(2023/03/27 20:15:00.00)	40.2	56.1	44.0	30.8
(2023/03/27 20:30:00.00)	47.7	66.0	45.1	36.6
(2023/03/27 20:45:00.00)	40.1	53.3	41.2	37.4
(2023/03/27 21:00:00.00)	41.2	55.1	42.8	39.0
(2023/03/27 21:15:00.00)	40.9	53.9	42.1	38.7
(2023/03/27 21:30:00.00)	43.7	60.4	44.6	39.1
(2023/03/27 21:45:00.00)	42.9	56.8	43.8	39.5
(2023/03/27 22:00:00.00)	40.6	50.3	42.6	37.1
(2023/03/27 22:15:00.00)	39.5	50.0	41.7	37.1
(2023/03/27 22:30:00.00)	42.7	57.4	42.6	37.4
(2023/03/27 22:44:59.00)	39.8	54.8	40.2	36.5
(2023/03/27 23:00:00.00)	40.3	53.8	41.1	37.1
(2023/03/27 23:15:00.00)	40.7	55.0	40.0	36.4
(2023/03/27 23:30:00.00)	38.2	42.9	39.3	37.0
(2023/03/27 23:45:00.00)	38.5	44.1	39.7	37.0

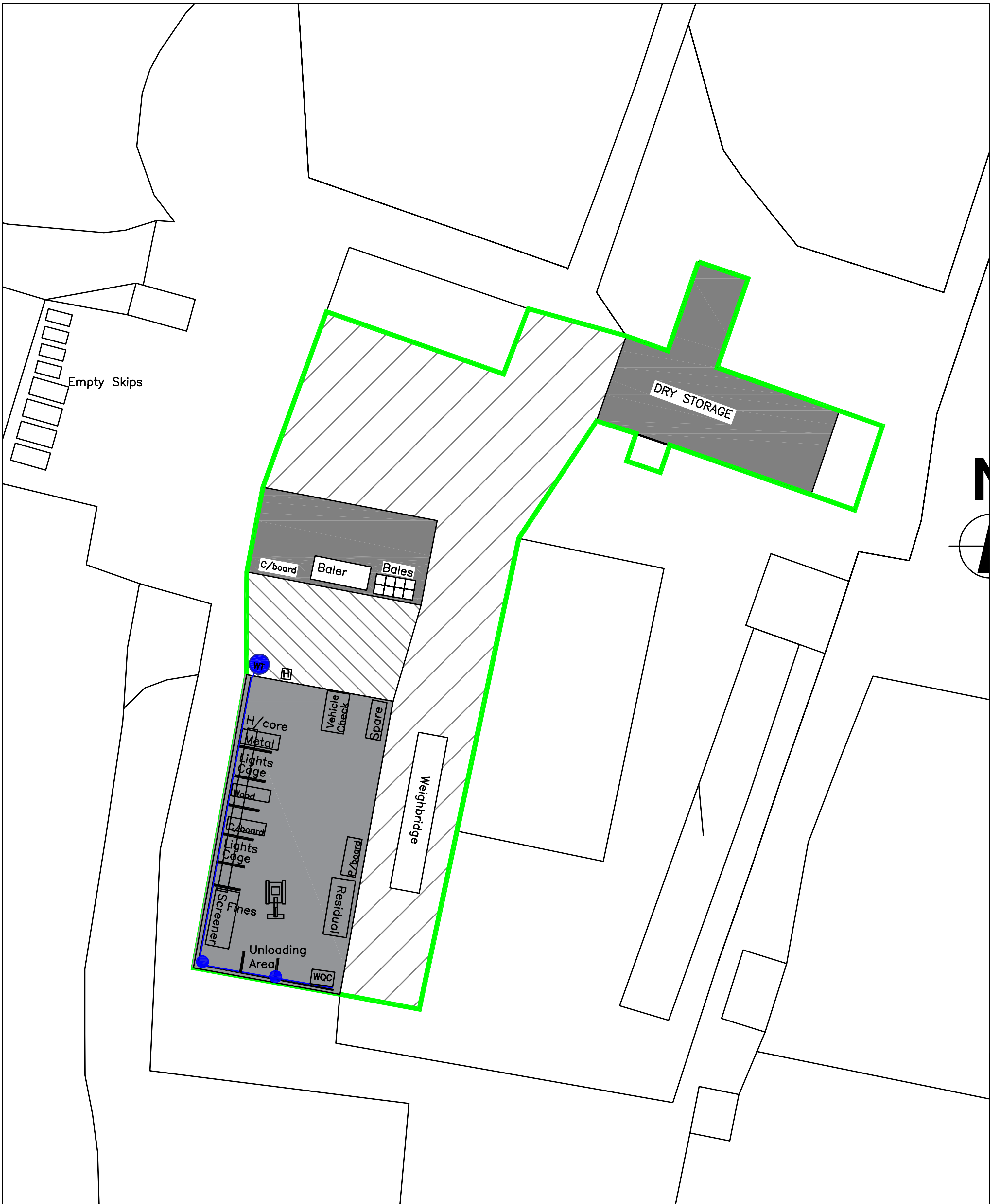
Time / Date	$L_{Aeq,T}$	L_{Amax}	$L_{A10,T}$	$L_{A90,T}$
(2023/03/28 00:00:00.00)	38.0	52.8	39.2	36.3
(2023/03/28 00:15:00.00)	37.9	44.7	39.3	36.3
(2023/03/28 00:30:00.00)	34.7	41.3	36.1	33.0
(2023/03/28 00:45:00.00)	36.4	48.7	37.9	34.5
(2023/03/28 01:00:00.00)	37.9	46.3	39.2	36.1
(2023/03/28 01:14:59.00)	35.8	41.7	37.3	34.0
(2023/03/28 01:30:00.00)	36.1	41.1	37.3	34.7
(2023/03/28 01:45:00.00)	35.7	41.9	36.9	34.2
(2023/03/28 02:00:00.00)	36.1	41.2	37.6	34.5
(2023/03/28 02:15:00.00)	36.5	41.3	38.1	34.4
(2023/03/28 02:30:00.00)	35.9	46.3	37.0	34.4
(2023/03/28 02:45:00.00)	37.8	53.0	38.4	35.9
(2023/03/28 03:00:00.00)	36.4	42.0	37.6	35.0
(2023/03/28 03:15:00.00)	36.5	43.6	37.7	35.3
(2023/03/28 03:29:59.00)	35.6	41.3	36.6	34.5
(2023/03/28 03:45:00.00)	36.3	47.2	37.4	34.9
(2023/03/28 04:00:00.00)	37.4	46.6	38.5	36.1
(2023/03/28 04:15:00.00)	37.3	45.3	38.3	36.3
(2023/03/28 04:30:00.00)	38.0	46.1	39.0	36.9
(2023/03/28 04:45:00.00)	40.2	52.0	41.6	38.4
(2023/03/28 05:00:00.00)	43.3	60.1	43.0	39.3
(2023/03/28 05:15:00.00)	42.7	54.0	45.0	40.2
(2023/03/28 05:29:59.00)	43.2	53.3	44.6	41.6
(2023/03/28 05:45:00.00)	45.6	56.6	47.4	42.9
(2023/03/28 06:00:00.00)	49.5	60.8	52.5	45.1
(2023/03/28 06:15:00.00)	49.5	60.7	52.9	44.9
(2023/03/28 06:30:00.00)	49.4	62.4	52.6	44.9
(2023/03/28 06:45:00.00)	49.7	62.9	52.8	45.1
(2023/03/28 07:00:00.00)	49.0	61.6	51.9	45.3
(2023/03/28 07:15:00.00)	48.5	63.9	49.6	45.5
(2023/03/28 07:30:00.00)	48.9	69.6	50.6	45.7
(2023/03/28 07:45:00.00)	48.5	67.1	50.3	45.8
(2023/03/28 08:00:00.00)	48.5	59.9	50.7	46.0
(2023/03/28 08:14:59.00)	47.7	58.1	49.3	46.0
(2023/03/28 08:29:59.00)	47.9	58.5	49.6	45.8
(2023/03/28 08:45:00.00)	48.6	60.2	50.4	46.5
(2023/03/28 09:00:00.00)	47.6	55.6	48.8	46.2
(2023/03/28 09:15:00.00)	47.4	58.5	48.5	45.7
(2023/03/28 09:30:00.00)	48.0	60.3	49.8	45.9
(2023/03/28 09:44:59.00)	47.9	59.9	50.0	45.8

Location	Date / Start Time	Duration (Mins)	dB $L_{Aeq,T}$	dB L_{Amax}	dB $L_{A10,T}$	dB $L_{A90,T}$
NML3	(2023/03/27 17:20:57.00)	15	47.8	62.2	52.1	35.0
NML3	(2023/03/27 17:36:15.00)	15	44.2	61.1	47.9	34.1
NML4*	(2023/03/28 07:11:35.00)	13	49.1	68.0	51.8	40.1

*Description relating to shortened measurement period presented in Paragraph 3.17

APPENDIX D

PROPOSED SITE PLAN



▮	Concrete Surface within a Building
▨	Concrete Surface External
▧	Hardstanding (Compacted Hardcore)

Client: FJ Hepplethwaite Solutions

Project: Proposed Layout

Weybeards Farm
Harefield
Uxbridge
UB9 6LH

Date: March 2023 | Scale: 1:500@A4

Drn: ARC | Drg No: HEP/WEY/LAY/01 Rev B

APPENDIX E

NOISE MODEL INPUT DETAILS

Table E.1: SoundPlan Model Sources and Parameters

Parameter	Source	Details
Base Plan	OS	OS Vector Map
Ground Levels	Defra	2m Lidar (DTM)
Building Heights	SR Observations	On site buildings based on SR observations; 7 metres for off-site buildings (2.5 – 3.5m for single storey buildings)
Barriers	SoundPlan	No barriers included in the model
Receptor Positions	SoundPlan	1.5m height. Receptors: in gardens or 1m from façade (freefield of the façade)
Absorbent Ground	SoundPlan	G=0 (hard ground) around the site ; G=1 (soft ground) in other areas
Reflections	SoundPlan	3rd order reflections
Site Layout	Integrated Skills	Site setting: HEP-WEY-LAY-01 Rev B

As detailed in Paragraphs 4.11 to 4.15, the modelled specific sound power level for the trommel has been calculated from the measured sound level at T1. The measured sound level and modelled source sound power level are presented in Tables E.2 and E.3.

Table E.2: Measured Source Sound Level - Trommel

Location	Octave band centre frequency Hz – dB L_{eq}								dB $L_{Aeq,T}$
	63	125	250	500	1k	2k	4k	8k	
T1	71	66	65	66	67	68	64	56	73

Table E.3: Modelled Source Sound Power Level

Plant	Octave band centre frequency Hz – dB L_{eq}								Apparent Sound Power Level (dB $L_{WA',1hour}$)
	63	125	250	500	1k	2k	4k	8k	
Trommel	105	100	99	100	101	102	98	89	107

Using the SoundPlan 'Indoor Noise' Module, it is possible to calculate the sound level within a building from a sound power level associated with a source assigned at a particular position within the building. SoundPlan calculates an sound level within the space taking into account the properties of the building including transmission and absorption spectra of the building construction. Uncertainty in the modelling assumptions have been minimised on the basis that the building has been assigned as being open on the main northern and eastern elevations thus representing the semi-reverberant conditions present at the site.

A point source has been assigned in an approximate central position of the trommel within the building (based on distance measurements taken within the building) at a height of 2.5m. Assumptions have been made with regard to the building construction in terms of the sound insultation performance and absorption coefficient of the observed building materials which are presented in Tables E.4 and E.5 below.

Table E.4: Estimated Sound Reduction Index of the Building Elements

Building Element	Description	Source	Octave Band Sound Reduction Index Hz - dB							
			63	125	250	500	1k	2k	4k	8k*
Lower Wall**	100mm concrete	Marshall Long[1]	32	37	36	45	52	59	62	70
Upper Wall**	Wood panelling (softwood)	Insul[2]	15	19	23	27	25	26	34	34
East and north main elevations	Open		0	0	0	0	0	0	0	0
North and south roof gable end	1mm steel	SoundPlan		14	16	20	25	29	23	
Roof	Cementitious corrugated board	Insul	6	10	16	21	26	31	34	37
	Rooflights	SR Database	11	12	15	20	25	30	35	35
	Composite Roof SRI	Calculation	10	11	15	20	25	30	35	35

Table E.5: Estimated Absorption Coefficient of the Building Elements

Building Element	Description	Source	Octave Band Absorption Coefficient – Sabine m^2							
			63	125	250	500	1k	2k	4k	8k*
Lower Wall	100mm concrete	Woods[3]	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.05
Upper Wall	Wood panelling	Marshall Long	0.15	0.19	0.14	0.09	0.06	0.06	0.05	0.03
East and north main elevations	Open		1	1	1	1	1	1	1	1
North and south roof gable	1mm steel (Untreated walls and ceiling surfaces)	SoundPlan	0.050	0.060	0.070	0.080	0.080	0.090	0.100	0.110
Roof	Cementitious corrugated board	Woods	0.05	0.05	0.10	0.15	0.25	0.30	0.30	0.30

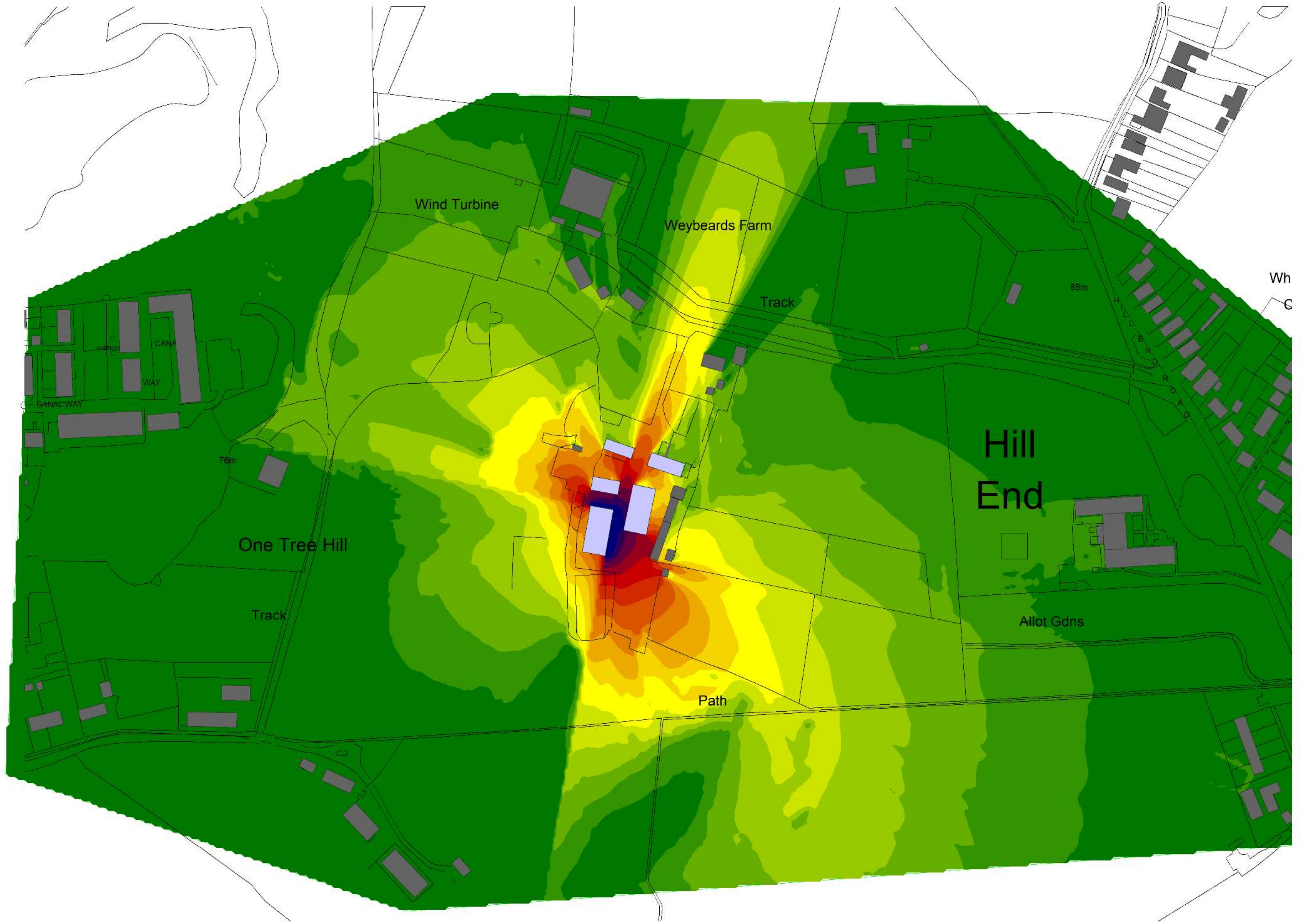
*8k estimated

**Lower and Upper Walls – western and southern elevations

Source References : 1 - Marshall Long, Architectural Acoustics (2014) ; 2 – Woods Practical Guide to Noise Control (2005); 3 - Marshall Day Insul Software

APPENDIX F

SKETCHES



Noise level
LAeq(T)
(dB)

		<=	37
37	<	<=	40
40	<	<=	43
43	<	<=	46
46	<	<=	49
49	<	<=	52
52	<	<=	55
55	<	<=	58
58	<	<=	61
61	<	<=	64
64	<	<=	67
67	<	<=	70
70	<	<=	73
73	<	<=	76
76	<	<=	79
79	<		

SK01 Predicted Specific Noise Level Contour Plot

(LAeq,1hour)

Contour Grid at 1.5m height

(Noise contour plot provided for indicative purposes only)

Scale 1:3500

0 15 30 60 90 120 m