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INTRODUCTION

- 8.1 An assessment of noise has been carried out with reference to British Standard and other government guidance. Noise issues relating to the continued extraction operations and import and processing of materials have been considered at the nearest noise-sensitive receptors surrounding the site.
- 8.2 Technical terms or references are occasionally used in this section. To assist the reader, a glossary of terminology, including a table of example noise levels that may be found in general life, are included in Appendix 8/A.

Government Advice, Standards and Good Practice

Consultation with Local Authority

- 8.3 Horsham District Council were consulted to confirm their views and policies on noise-related issues for the local area around the proposed development site and during email correspondence with the Environmental Health Department the following survey and assessment methodologies were agreed;
- Environmental noise surveys would be carried out at the nearest noise sensitive locations to the site to cover the operational hours of the sandpit; namely 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on a Saturday; however due to the construction of a residential development adjacent to the site it was decided that weekday measurements would not be possible due to the influence these operations would have on the prevailing noise climate;
 - In view of the above it was decided that the noise levels would be measured on a Saturday afternoon after the construction operations have ceased;
 - The noise levels generated by the import and processing of materials would be assessed in conjunction with the guidance contained in the technical guidance to the *National Planning Policy Framework (NPPF)*; and
 - All operational noise levels would be predicted using the proprietary software-based noise model, Cadna/A with the calculation algorithms set BS5228-1:2009 being utilised.
- 8.4 Summaries of all the British Standards and other associated guidance mentioned above are shown below.

National Planning Policy Framework – Technical Guidance

- 8.5 The Technical Guidance to the *National Planning Policy Framework (NPPF)* provides the latest advice on planning controls and good practice methods to

keep noise emissions from surface mineral workings to acceptable levels. It also sets out noise limits for long-term surface mineral workings.

- 8.6 The Technical Guidance states that the noise limit, applied to the nearest noise-sensitive receptors should not exceed the background noise level by more than 10dB(A), subject to a maximum limit of 55dB $L_{Aeq,1hr}$ during the daytime (07:00 to 19:00 hours) and 42dB $L_{Aeq,1hr}$ during the evening (19:00 to 22:00 hours) and night-time (22:00 to 07:00 hours) periods.
- 8.7 The Technical Guidance recognises that, in many circumstances, not exceeding the background noise level by more than 10dB(A) would be difficult to achieve without imposing unreasonable burdens on the mineral operator. In such cases, the noise limit should be set as near that level as practicable but not exceeding the noise limits stated above.
- 8.8 During periods of temporary operations the noise limit may be increased up to 70dB $L_{Aeq,1hr}$ for periods of up to eight weeks in any working year at the noise-sensitive receptors. Temporary operations may include soil stripping, the construction of new permanent landforms and aspects of site road construction and maintenance.

British Standard 5228:2009

- 8.9 British Standard 5228:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* sets out a methodology for predicting noise levels arising from a wide variety of construction and related activities. As such, it can be used to predict noise levels arising from the operations of proposed minerals extraction sites. BS5228-1:2009 also sets out tables of sound power levels generated by a wide variety of mobile equipment.
- 8.10 Noise levels generated by the site operations and experienced at local receptors will depend upon a number of variables, the most significant of which are:
- the amount of noise generated by plant and equipment being used at the development site, generally expressed as a sound power level;
 - the periods of operation of the plant at the development site, known as the “on-time”;
 - the distance between the noise source and the receptor, known as the “stand-off”;
 - the attenuation due to ground absorption or barrier screening effects; and
 - reflections of noise due to the presence of hard vertical faces such as walls.

Sources of Information

- 8.11 Information regarding the proposed development, including the fixed and mobile plant associated with the continued extraction operations and the import and processing of material, operational hours and proposed vehicle movements to and from the site, has been provided by the client and/or their sub-consultants.

APPROACH TO THE ASSESSMENT

- 8.12 The assessment considers the likely noise levels that would be generated by the continued extraction operations and the import and processing of materials at the identified nearby noise-sensitive receptors.
- 8.13 An assessment has been made of the baseline situation and the potential impact of the proposals. Environmental impacts have been identified and where appropriate, mitigation measures and/or scheme changes to offset potentially adverse environmental impacts have been identified.

BASELINE CONDITIONS

- 8.14 Environmental noise surveys were undertaken on Saturday 27th July 2013 as part of a previous planning application for the site to capture typical background and ambient noise levels at the closest noise-sensitive receptors to the sandpit.
- 8.15 The noise monitoring equipment used during the surveys is detailed in Appendix 8/B. All noise monitoring equipment was calibrated before and after the measurements and no calibration drifts were found to have occurred. The equipment had been calibrated to a traceable standard by UKAS-accredited laboratories within the 24 months preceding the surveys.
- 8.16 Daytime noise measurements were undertaken at the noise-sensitive locations agreed with Horsham District Council, namely;
- Location 1: The Oaks situated to the north of the site;
 - Location 2: Cardrona situated on Hampers Lane to the east of the site; and
 - Location 3: Chanctonbury Lodge situated on Washington Road to the south of the site.
- 8.17 Noise levels were recorded over a 3.5 hour daytime period at each location and the following noise level indices were recorded:
- $L_{Aeq,T}$ – The A-weighted equivalent continuous noise level over the measurement period.
 - L_{A90} – The A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise.
 - L_{A10} – The A-weighted noise level exceeded for 10% of the measurement period. This parameter is often used to describe road traffic noise.

- L_{Amax} – The maximum A-weighted noise level during the measurement period.
- 8.18 The weather conditions during the survey periods were acceptable for noise monitoring, being dry and clear with no precipitation.
- 8.19 The microphone was placed 1.5m above the ground in free-field conditions, i.e. at least 3.5m from the nearest vertical, reflecting surface.
- 8.20 The noise climate at Locations 1 and 2 consisted of distant road traffic from the A283 and local traffic using Hampers Lane.
- 8.21 At Location 3 road traffic on the A283 Washington Road and aircraft passing overhead contributed to the noise climate.
- 8.22 Natural sounds such as the noise of the breeze in the trees, birdsong and dogs barking were also audible at all of the monitoring locations.
- 8.23 A summary of the noise surveys results are presented in Table 8-1. The full survey results are presented in Appendix 8/C.

Table 8-1
Summary of Measured Noise Levels, free-field, dB

Location	Period	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{Amax}
1 – The Oaks	Daytime	45.9	41.0	45.9	64.9
2 - Cadrona		50.4	42.7	50.3	70.0
3 – Chanctonbury Lodge		66.9	53.9	70.5	82.6

POTENTIAL IMPACT

OPERATIONAL NOISE ASSESSMENT

Operational Plant

- 8.24 The fixed and mobile noise sources which are going to be associated with the import and processing of material at the sandpit have been provided by the applicant and are set out in Table 8-2 below together with adopted sound power levels.
- 8.25 The sound power levels are derived from discussions with the relevant plant manufacturers, monitoring of plant at a similar site, or from tables contained in BS5228-1:2009. All sound power levels derived from measured data take into consideration the operation of any reversing warning systems fitted to the plant, where applicable.

**Table 8-2
Operational Plant**

Plant	Plant L _{WA} dB	Estimated On-Time %
Warrior 1400X Power Screen	106.3	83
JCB JS220 Excavator	103.0	83
CAT D6T Dozer	115.0	83
FX1400-E Wheel Wash	88.1	50
Loading Shovel	108.0	83
HGV	105.0	10 movements per hour

8.26 It must be noted that the plant list shown in the above table reflects a worst-case situation during the initial period when extraction and infilling activities will take place simultaneously.

Noise Criteria

8.27 The Technical Guidance to the NPPF contains the current government advice on noise from mineral extraction sites in England which is directly applicable to the site.

8.28 Table 8-3 shows the noise criteria at each receptor derived in accordance with the advice contained in the Technical Guidance to the NPPF and the results of the background noise survey. The criteria have been rounded to the nearest whole number.

**Table 8-3
Derived Noise Criteria, free-field, dB**

Location	Period	Measured Background Noise Level L _{A90}	Derived Criterion, L _{Aeq,1hr}
1 – The Oaks	Daytime	41.0	51.0
2 - Cadrona		42.7	53.0
3 – Chanctonbury Lodge		53.9	55.0

Proposed Activities

8.29 The operational noise generating activities associated with the continued sand extraction, the import of material and material processing at the site are anticipated to include the following;

- Sand extraction and soil shaping;
- Material screening;
- Import of material via HGV's on the access road; and
- The loading of material into the heavy goods vehicles.

BS5228 Assessment

- 8.30 An assessment has been carried out in accordance with the guidance contained in BS5228-1:2009 to determine whether noise emissions from the fixed and mobile plant at the site would exceed the derived noise criteria at the nearest noise-sensitive properties.
- 8.31 Using the plant noise levels shown in Table 8-2 the noise generated by the operations at the site have been predicted at the nearest noise sensitive locations using the proprietary software-based noise model, Cadna/A, which implements the full range of UK calculation methods, in this instance the algorithm's contained in BS5228-1:2009 have been utilised.
- 8.32 Regarding the locations of the operational plant in relation to each noise sensitive receptor the predictions are based on the operational plant operating in the locations shown in Table 8-4 below.

**Table 8-4
Locations of Operational Plant in Relation to Each Receptor**

Nearest Receptor	Item of Plant	Operational Location on the Site
1 – The Oaks	Excavator	Northern boundary
	Dozer	
	Screen	Southern end of site
	Loading Shovel	Between the northern boundary and the southern end of the site & hardstanding area.
	Wheel Wash	Weighbridge/Hardstanding Area
	HGV's	Access Road
2 – Cardrona	Excavator	Adjacent to bund (closest approach)
	Dozer	
	Screen	Southern end of site
	Loading Shovel	Between the excavator and the southern end of the site & hardstanding area.
	Wheel Wash	Weighbridge/Hardstanding Area
	HGV's	Access Road
3 – Chanctonbury Lodge	Excavator	Southern end of site
	Dozer	
	Screen	Centre of the site
	Loading Shovel	Between the southern end and the centre of the site
	Wheel Wash	Weighbridge/Hardstanding Area
	HGV's	Access Road

- 8.33 The locations of the items of plant listed in the above table are shown on the drawings in Appendix 8/D.

- 8.34 It should also be noted that the predictions take into account the attenuation provided by the earth bund and secure gates located on the western boundary of the hard standing area.
- 8.35 The façade which faces the site has been considered in each case. The results of the predictions are shown in Table 8-5 and are compared to the criteria adopted for this assessment.

**Table 8-5
Operational Assessment, free-field, dB**

Location	Predicted Noise Levels $L_{Aeq,1hr}$	Criterion, $L_{Aeq,T}$	Difference
1 – The Oaks	49.6	51.0	-1.4
2 - Cadrona	54.8*	53.0	+1.8
3 – Chanctonbury Lodge	55.1	55.0	+0.1

- 8.36 *This is the predicted noise level whilst the plant is working closest to Location 1 as due to the local topography the predicted noise level at Location 2 is higher whilst the plant is operational nearest Location 1.
- 8.37 Table 8-5 shows that the predicted noise levels generated by worst-case operations during the initial period when extraction and infilling activities will overlap would meet the criterion derived in accordance with the Technical Guidance to the NPPF at Location 1.
- 8.38 Table 8-5 also shows that the predicted noise levels would exceed the criterion at Locations 2 and 3.
- 8.39 Further to the above mitigation measures are recommended below to reduce the identified noise impacts.

MITIGATION MEASURES

Temporary Acoustic Screens

- 8.40 The erection of temporary acoustic barriers or screens in the area where the excavator and dozer are working would provide some degree of noise attenuation. The screen would need to be positioned so it shields each noise sensitive receptor from the noise generated by the dozer and excavator when they are working at their closest approach to each property.
- 8.41 The approximate locations of the acoustic screens are shown on the drawing in Appendix 8/D.
- 8.42 The barriers/screens would need to be of a solid construction and at least 3.0m high.
- 8.43 Table 8-6 below repeats the assessment for Locations 2 and 3 assuming that the barriers/ screens described above are in-situ.

**Table 8-6
Operational Assessment, Including Acoustic Screens, free-field, dB**

Location	Predicted Noise Levels L _{Aeq,1hr}	Criterion, L _{Aeq,T}	Difference
2 - Cadrona	53.7*	53.0	+0.7
3 – Chanctonbury Lodge	53.3	55.0	-1.7

* Barrier positioned to the south of the dozer and excavator whilst they are operational nearest Location 1

- 8.44 Table 8-6 shows that assuming the temporary acoustic barriers or screens have been correctly erected the predicted noise levels generated by worst-case operations would now meet the criterion derived in accordance with the Technical Guidance to the NPPF at Location 3.
- 8.45 Table 8-6 also shows that the predicted noise levels at Location 2 would still slightly exceed the derived limit; however it should be noted that the noise survey was undertaken on a Saturday afternoon when existing operations at the Washington Sandpit had ceased.
- 8.46 In reality noise from existing operations would contribute to the noise climate during normal operational hours; consequently it is considered that the prevailing noise levels at Location 2 would be higher during a normal working week.
- 8.47 The higher prevailing noise levels would mean that the specified noise criterion at Location 2 would also increase potentially meaning that the predicted noise levels would subsequently be within the noise limits.
- 8.48 It also must be noted that the predicted noise levels at Location 2 are still below the maximum limit of 55dB L_{Aeq,1hr} during the daytime (07:00 to 19:00 hours) specified in the Technical Guidance to the NPPF.
- 8.49 Finally and as previously stated all the noise predictions are based on a worst-case situation during the initial period of the development when extraction and infilling activities will take place simultaneously. Once the extraction activities have ceased the predicted noise levels will almost certainly be lower at all the nearest noise-sensitive receptors.

CONCLUSIONS

- 8.50 The assessment has considered the potential operational proposals to give rise to noise impacts at the closest noise-sensitive receptors.
- 8.51 The NPPF assessment has shown that;
- Predicted noise levels from continued extraction operations and the import and processing of material would meet the derived criteria at Location 1 and exceed the criterion at Locations 2 and 3.

- 8.52 In view of the above mitigation measures in the form of the erection of temporary screens around the area where the dozer and excavator are working are recommended in order to reduce the identified impacts at Locations 2 and 3.
- 8.53 Assuming the screens have been correctly erected the repeated NPPF shows that the predicted noise levels would now be within the derived criteria at Location 3 but would still slightly exceed the criterion at Location 2.
- 8.54 However it is considered that noise should not pose a material constraint to the import and processing of material at the site once the following points have been taken into account;
- The noise surveys were undertaken on a Saturday afternoon when existing operations at the Washington Sandpit had ceased;
 - In reality noise from existing operations would contribute to the noise climate during normal operational hours; consequently it is considered that the prevailing noise levels at Location 2 would be higher during a normal working week;
 - The higher prevailing noise levels would mean that the specified noise criterion at Location 2 would also increase potentially meaning that the predicted noise levels would subsequently be within the noise limits;
 - the predicted noise levels at Location 2 are still below the maximum limit of 55dB $L_{Aeq,1hr}$ during the daytime (07:00 to 19:00 hours) specified in the Technical Guidance to the NPPF; and
 - all the noise predictions are based on a worst-case situation when all the plant is working at its nearest approach to each noise sensitive receptor and during the initial period of the development when extraction and infilling activities will take place simultaneously. Once the extraction activities have ceased the predicted noise levels will almost certainly be lower at all the nearest noise-sensitive receptors.

APPENDIX 8/A – GLOSSARY OF TERMINOLOGY

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

**Table A8-1
Sound Levels Commonly Found in the Environment**

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside a factory
100 to 110dB(A)	Burglar alarm at 1 metre away
110 to 130dB(A)	Jet aircraft on take-off
140dB(A)	Threshold of pain

Acoustic Terminology

- dB (decibel)** The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
- dB(A)** A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
- L_{Aeq}** L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
- L₁₀ & L₉₀** If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L₉₀ is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L₁₀ index to describe traffic noise.

L_{Amax} L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

APPENDIX 8/B - NOISE MONITORING EQUIPMENT

**Table B8-1
Noise Monitoring Equipment**

Location	Description	Serial No.
1 – The Oaks	Cirrus CR:171B Type 1 SLM	G061094
	Cirrus CR:515 Acoustic Calibrator	59336
2 – Cadrona	Cirrus CR:171B Type 1 SLM	G061698
	Cirrus CR:515 Acoustic Calibrator	59336
3 – Chanctonbury Lodge	Norsonic 140 Type 1 SLM	1403010
	Norsonic 1251 Acoustic Calibrator	31875

APPENDIX 8/C – FULL SURVEY RESULTS

Table C8-1
Measured Noise Levels at Location 1 – The Oaks, free-field, dB

Date	Start Time	L _{Aeq,T}	L _{A90}	L _{A10}	L _{Amax}
27/07/13	13:00	38.3	35.5	39.8	52.6
	13:15	38.0	34.5	40.0	52.3
	13:30	40.2	37.2	42.1	52.3
	13:45	42.3	37.3	43.4	59.3
	14:00	45.7	43.0	47.6	56.0
	14:15	47.7	44.3	49.8	58.2
	14:30	52.4	48.5	55.2	62.4
	14:45	48.4	45.9	50.2	64.9
	15:00	45.9	42.9	48.5	64.9
	15:15	47.1	43.3	47.3	64.0
	15:30	43.0	40.9	44.5	54.1
	15:45	43.0	40.0	45.1	56.1
	16:00	43.4	40.9	45.2	55.6
	16:15	42.7	40.4	44.4	57.9

Table C8-2
Measured Noise Levels at Location 2 – Cardrona, free-field, dB

Date	Start Time	L _{Aeq,T}	L _{A90}	L _{A10}	L _{Amax}
27/07/13	13:00	46.7	38.4	45.6	64.5
	13:15	45.8	37.6	45.5	65.1
	13:30	47.1	38.9	46.9	65.6
	13:45	46.6	39.8	47.3	64.5
	14:00	49.7	43.6	51.6	67.3
	14:15	52.9	45.5	56.6	65.3
	14:30	55.0	49.8	57.7	66.9
	14:45	51.6	47.2	53.7	68.5
	15:00	50.8	45.7	52.3	68.6
	15:15	51.1	42.7	51.5	68.0
	15:30	49.9	41.8	48.0	70.0
	15:45	50.2	42.0	49.4	69.1
	16:00	49.7	42.7	49.9	68.8
	16:15	48.5	42.1	48.1	67.2

Table C8-3
Measured Noise Levels at Location 3 – Chanctonbury Lodge, free-field, dB

Date	Start Time	L _{Aeq,T}	L _{A90}	L _{A10}	L _{Amax}
27/07/13	13:00	66.2	52.2	69.9	81.9
	13:15	66.0	51.1	69.9	76.4
	13:30	66.3	53.3	69.8	78.9
	13:45	66.0	51.1	69.6	82.2
	14:00	65.8	50.2	69.8	79.2
	14:15	66.2	52.8	70.1	77.0
	14:30	66.5	55.2	70.1	76.3
	14:45	66.9	53.8	70.4	82.6
	15:00	68.4	58.1	71.9	76.2
	15:15	68.3	57.3	71.9	76.5
	15:30	67.3	54.9	71.2	78.6
	15:45	66.5	54.0	70.4	77.5
	16:00	66.9	55.2	70.8	75.6
	16:15	67.6	55.4	71.3	79.7

**APPENDIX 8/D – NOISE MONITORING AND OPERATIONAL
PLANT LOCATION DRAWINGS**

APPENDIX 8/E – LIMITATIONS TO THIS REPORT

This entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise affecting the site. The objectives of the investigation have been limited to establishing sources of noise material to carrying out an appropriate assessment.

The number and duration of noise measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise emitters. Furthermore, noise sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.