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ACOUSTIC CONSULTANTS

Ref **5345**

For **Earthline Limited**
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Wroxton Quarry, Oxfordshire
Restoration by Means of Imported Inert Material
BS 4142 Noise Assessment for Environment Agency

Date 31 May 2023

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ANC ACOUSTICS & NOISE CONSULTANTS

The Author

Robert Storey BEng PhD MIOA (Senior Consultant) obtained his degree in Mining Engineering from the University of Leeds in 1993 before going on to complete a PhD in "The Acoustic Response of Structures to Blast Induced Ground Vibration" in 1998. He joined WBM in 2007 after working in acoustic consultancy and environmental health since 1999. Robert is involved mainly in environmental noise, working on mineral extraction, waste and industrial projects, including surveys, routine noise monitoring and assessments. He is experienced in noise modelling using SoundPLAN for transportation, industrial and environmental sources.

WBM

WBM (the trading name of Walker Beak Mason Limited) is an established independent acoustic consultancy specialising in architectural & building acoustics, environmental noise, planning issues and expert work. WBM is a member of the Association of Noise Consultants and is also a Corporate Member of the Institute of Environmental Management & Assessment. The consultants are members of the Institute of Acoustics.

Document Control

Revision	Description	Date	Prepared by	Checked by
-	Draft	16/02/2023	R Storey	S Large
	Second Draft	06/04/2023	R Storey	S Large
	Final	31/05/2023	R Storey	S Large

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Contents

Synopsis/Summary

Earthline Limited (Earthline) are applying for an inert landfill permit from the Environment Agency for the infilling of Phases 5a, 5b, 6a and 6b of their quarry at Wroxton in Oxfordshire.

This assessment follows the principles outlined in BS4142: 2014 + A1: 2019 "*Methods for rating and assessing industrial and commercial sound*" to consider the noise impact of the proposals on the nearest noise sensitive receptors.

Baseline survey data of the existing sound environment (with the site not operating) was obtained in October/November 2020 to establish representative background sound levels at the nearest dwellings to Phases 5 and 6.

Calculated site noise levels at the nearest dwellings of the existing and proposed activities on the whole site and within Phases 5 and 6 (based on a worst case scenario of all plant items operating simultaneously at the nearest practical position to each receptor) are presented for comparison with the representative background sound levels at the dwellings.

The assessment demonstrates that the calculated site noise levels (Rating Levels) at the nearest dwellings to Phases 5 and 6 are up to 5dB(A) above the representative background sound levels, i.e. up to or below the level that is considered to be an indication of adverse impact as defined in BS4142 (depending on context) and well below the level indicating a significant adverse impact.

1 Introduction

Earthline have permission for the extraction and processing of mineral from Wroxton Quarry in Oxfordshire under a planning permission dated 21 November 2019 (Ref. MW.0020/19) as granted by Oxfordshire County Council.

The Environment Agency requires a noise impact assessment based on the BS 4142:2014+A1:2019 method for an application for an inert landfill permit associated with the restoration at Wroxton Quarry. The permit applies to infill operations across Phases 5a, 5b, 6a and 6b.

This report sets out the calculated noise levels arising from the importation of inert materials and the infilling of the extraction void using those materials, for use in the BS 4142:2014+A1:2019 assessment method for the nearest dwellings to the infilling areas at Wroxton Quarry.

The calculated site noise levels are compared with representative background sound levels at the nearest existing dwellings. The representative background sound levels have been determined from measurements in October and November 2020 for the assessment of mineral extraction.

This comparison of the calculated noise levels arising from the importation of inert materials and the infilling of the extraction void using those materials (and all other significant noise sources on the site) with the background noise levels established in 2020 with the site dormant forms the basis for the BS 4142:2014+A1:2019 assessment method for the nearest dwellings to the infilling areas at Wroxton Quarry.

To aid comprehension, a glossary of acoustic terms is presented in Appendix A.

A site plan showing the infilling areas and the survey/assessment locations used is presented in Appendix B.

The instrumentation and calibration details for the baseline noise surveys undertaken in October/November 2020 are presented in Appendix C and the full baseline noise survey results are presented in Appendix D.

Details of the noise calculation methods used and sample noise calculation sheets for the two assessment locations are presented in Appendix E.

2 Environment Agency Requirements for the Assessment

The information that must be submitted to the Environment Agency in a noise impact assessment that uses computer modelling or spreadsheet calculations is provided in GOV.UK Guidance "*Noise impact assessments involving calculations or modelling*" and "*Guidance – Noise and vibration management: environmental permits*". The information requested in the document "*Noise impact assessments involving calculations or modelling*" is summarised in Appendix E.

The Environment Agency generally require the overall site noise and BS 4142:2014+A1:2019 Rating Level to be no more than 5dB above the representative background sound level, although this is dependent on context. Additional guidance on the use of BS 4142:2014+A1:2019 when applying for a permit is provided in the Environment Agency "Method implementation document (MID) for BS 4142" dated 27 March 2023.

3 British Standard 4142: 2014+A1:2019

British Standard (BS) 4142:2014+A1:2019 "*Methods for rating and assessing industrial and commercial sound*" describes methods for assessing the likely effects of sound of an industrial and/or commercial nature on residential properties. It includes the assessment of sound from industrial and manufacturing processes, M&E plant and equipment, loading and unloading of goods and materials, and mobile plant/vehicles on the site. It can be used to assess sound from proposed, new, modified or additional industrial / commercial sources, at existing or new premises used for residential purposes.

The standard describes methods to measure and determine ambient, background and residual sound levels, and the rating levels of industrial / commercial sound.

BS 4142:2014+A1:2019 is not intended to be used for the derivation or assessment of internal sound levels, or for the assessment of non-industrial / commercial sources such as recreational activities, motorsport, music and entertainment, shooting grounds, construction and demolition, domestic animals, people, and public address systems for speech.

This standard is not intended to be applied to the rating and assessment of sound from: … "*h) other sources falling within the scopes of other standards or guidance*."

Guidance for noise associated with minerals sites such as quarries is presented in the “Minerals” sections of the UK Governments Planning Practice Guidance (Ministry of Housing, Communities and Local Government, 2014). However it is understood that the Environment Agency requires noise associated with the permit application for the importation of inert material for infilling to be assessed using BS 4142: 2014+A1:2019, despite other guidance being available.

Ambient sound is defined in BS 4142: 2014+A1:2019 as "*totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far*". It comprises the residual sound and the specific sound when present.

Residual sound is defined in BS 4142: 2014+A1:2019 as "*ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound*".

The background sound level is the $L_{A90,\,T}$ of the residual sound level, and is the underlying level of sound. Measurements of background sound level should be undertaken at the assessment location where possible or at a comparable location.

The measurement time interval should be sufficient to obtain a representative value (normally not less than 15 minutes) and the monitoring duration should reflect the range of background sound levels across the assessment period. The background sound level used for the assessment should be representative of the period being assessed.

The specific sound level is the $L_{Aeq,Tr}$ of the sound source being assessed over the reference time interval, T_r. BS 4142:2014+A1:2019 advises that T_r should be 1 hour during the day and 15 minutes at night.

The rating level is the specific sound level plus any adjustment for the characteristics of the sound (tone, impulse, intermittent or other acoustic feature).

The standard describes subjective and objective methods to establish the appropriate adjustment. The adjustments for the different features and assessment methods are summarised in the following table.

Acoustic Feature	Adjustment for Acoustic Feature		
	Subjective Methods	**Objective Methods**	
Tonality	+2 dB if just perceptible +4 dB if clearly perceptible +6 dB if highly perceptible	Third Octave Analysis	Narrow Band Analysis
		+6 dB if tones identified	Sliding scale of 0 to +6 dB depending on audibility of tone
Impulsivity	+3 dB if just perceptible +6 dB if clearly perceptible +9 dB if highly perceptible	Sliding scale of 0 to +9 dB depending on prominence of impulsive sound	
Intermittency	+ 3 dB if intermittency is readily distinctive	n/a	
Other	+ 3 dB if neither tonal nor impulsive, but otherwise readily distinctive	n/a	

Where tonal and impulsive characters are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant, it might be appropriate to apply a single correction. The rating level is equal to the specific sound level if there are no features present.

The level of impact is assessed by comparing the rating level of the specific sound source with the background sound level. Other factors that may require consideration include the absolute level of sound, the character and level of the residual sound compared to the specific sound, and the sensitivity of the receptor and scope for mitigation.

When the rating level is above the background sound level, a difference of around +5 dB is likely to indicate an adverse impact and a difference of around +10 dB or more is likely to indicate a significant adverse impact, depending on the context.

The lower the rating level with respect to the background sound level, the less likely it is that the specific sound source will have an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

4 Site Description

The latest planning permission for the extraction and processing of mineral at Wroxton Quarry was granted by Oxfordshire County Council on 21 November 2019 (Ref. MW.0020/19).

The operator proposes infilling of Phases 5a, 5b, 6a and 6b using imported inert materials.

The site is situated south of the A422 to the south-west of the village of Wroxton and to the east of the village of Balscote.

The nearest dwellings to the proposed infilling areas (Phases 5a, 5b, 6a and 6b) are located to the east in Wroxton village and on the side road to the south.

There is a minimum 200 metre stand-off distance in place between the working areas in Phases 5a, 5b, 6a and 6b and any properties in the villages of Wroxton or Balscote. The nearest edge of Wroxton village is around 280 metres from the nearest part of the current extraction area. The village of Balscote is approximately 1 kilometre from the westernmost boundary of the quarry.

There are other dwellings closer to the phases further from the infilling areas, but due to the significant distance to the infilling areas particularly in comparison to the nearest mineral workings, these have not been included in this assessment.

The plant site is located in Phase 4 on the western side of the site.

Access to the site is off the A422 to the west of the site.

The permitted hours of operation of the site for all mineral extraction, processing plant items and infilling are 07.00 to 18.00 Monday to Friday and 07.00 to 13.00 Saturdays. No operations are carried out on Sundays or recognised Public Holidays.

There is a later start time of 08:00 hours stipulated for the formation and subsequent removal of material from the bunds and soil storage areas.

The location of the quarry and baseline survey/assessment locations used is shown on the plan in Appendix B which also shows the area over which the permit is being applied for.

5 Assessment Locations

The nearest residential properties to the site are in Wroxton Village to the north-east of the infilling areas (Phases 5a, 5b, 6a and 6b). The next nearest residential property is French's Buildings to the south south-east of the infilling areas.

The locations selected for site noise calculations in this assessment are:

Position	Location Description	Grid Reference
1	Wroxton village	E: 440567 N: 241714
2	French's Buildings	E: 441132 N: 240702

These locations were chosen for the purposes of this assessment as they are the closest residential properties to the infilling operations using imported inert material and for which background sound data was available.

Baseline noise surveys for the assessment of mineral extraction were conducted in October and November 2020 at off-site locations in the vicinity of the existing dwellings nearest to the quarry which included measurements at locations that are of relevance to this application.

6 Site Operating Hours

The permitted hours of operation relating to routine operations are set out in Condition 15 of the planning permission dated 21 November 2019 (Ref. MW.0020/19), which states:

"*15.No operations authorised or required by this permission shall be carried out and plant shall not be operated or lorries loaded or despatched, other than during the following hours:*

Between 0700 and 1800 hours, Mondays to Fridays;

0700 and 1300 hours on Saturdays.

No such operations shall take place on Sundays or recognised public holidays or on Saturdays immediately following bank holiday Fridays."

The operating times are within the daytime period. With regard to BS 4142: 2014+A1:2019, the assessment period is therefore 1 hour.

7 Calculated Site Noise Levels

The following assumptions have been made for the calculation of site noise levels for the infilling and associated operations for the restoration at Wroxton Quarry.

The fixed and mobile plant items will all operate for 100% of an hour, to represent a reasonable worst case scenario.

Tipping of the inert material in the excavation void is included in the calculations as taking place 10% of the time.

Mineral extraction is likely to have been completed in Phases 5a and 6a/6b by the time infilling commences.

Once extraction has been completed in Phase 5b the next area to be extracted is considerably further from the residences under consideration and therefore to represent a realistic worst case scenario, it has been assumed for the calculations that mineral extraction is taking place at the nearest point of Phase 5b to each receptor with infilling taking place at the nearest point of Phases 6a/6b to each receptor.

The trommel in the mineral extraction area is assumed to be at roughly the same location as it is at present whilst extraction operations are taking place in that area.

The existing mineral processing plant site and associated operations will continue until mineral extraction is completed on the site.

The imported inert material will be crushed and screened in the existing recycling area that is already permitted under the Environmental permit (Permit No. JB3700LF – SR2010 No12). These recycling operations are also included in the calculations/assessment.

The plant items will achieve the dB L_{WA} values stated. The plant items used in the calculations (see Appendix E) are listed in the table below along with the Sound Power Levels **dB L_{WA}** used in the calculations. As calculations have also been undertaken for the ongoing mineral extraction, recycling and existing processing operations on site (when these processes are expected to take place concurrently with infilling operations) the plant items for those processes are also presented in the table.

The Sound Power Levels of the plant to be used on site are based on a combination of measurements of similar items of plant measured on other sites.

Plant Item	**dB LWA**	**Source height (m)**
Extraction and Processing Operations		
360º Excavator in Mineral Extraction Area	105	2
Dump Trucks in Mineral Extraction Area	105	2
M413 Trommel in Mineral Extraction Area	110	2.5
Loading Shovel for Trommel in Mineral Extraction Area	105	2
CDE AggMax Washing Plant at Plant Site	107	4
Loading Shovel for Washing Plant at Plant Site	105	2

Access Road		
HGVs	104	2
Recycling Operation		
Mobile Crusher and Screen	112	2
Loading Shovel for Crusher and Screen	105	2
Infilling Operations		
Tipping of infill into void	107	0.5
Dump Trucks for movement of infill	105	2
Dozer for grading	108	2

The calculations in this report are based on the methods contained in BS5228-1: 2009 "Code of practice for noise and vibration control on construction and open sites – Part 1: Noise" as amended BS5228-1:2009+A1:2014.

The Environment Agency recommend the use of ISO 9613: "*Acoustics – attenuation of sound during propagation outdoors*", however as ISO 9613 does not allow for some of the required calculation methods for mineral sites (such as haul routes), it was decided that rather than using a hybrid method of calculation, it would be more appropriate to use BS5228 for the calculations in this assessment.

For the elements of the site operations for which both calculation methods can be used, BS5228 tends to calculate the higher noise levels of the two methods and therefore the use of that standard represents a worst case scenario with regard to the presented calculated noise levels.

The nearest extraction/infilling operations will be at least 280 metres from the dwellings in Wroxton village and at least 350 metres from the next nearest dwelling at French's Buildings.

The following details the existing bunding included in the calculations:

- Bunding is already in place to the north-east of Phases 5a, 6a and 6b to a height of 3.5 metres above local ground height;
- The apex of that bunding is 270 metres from nearest dwellings in Wroxton village to a height of 160 metres AOD;

- Bunding is proposed to the south-east of Phase 5b with the apex of the bund 340 metres from the dwelling at French's Buildings to a height of 159-160 metres AOD;

- The bunds will remain in place until infilling in Phases 5a, 5b, 6a and 6b is complete.

The assumed locations of the mobile plant items such as the excavator and dozer are in the closest possible practical position to each receiver location and therefore do not have a single specific OS Grid Reference. Calculation sheets are provided in Appendix E and provide the distances used in the calculations between each source and the receiver.

The dump trucks/HGV movements have been included as being on a haul route approximated as a straight line between the plant site and the working areas and therefore do not have a single specific separate OS Grid Reference. Calculation sheets are provided in Appendix E and provide the perpendicular distances used in the calculations between the haul route and the receiver as well as the angle of view of the haul route for each receiver. This information can be directly input into the formulae given in BS 5228 para F.2.5 "Method for mobile plant using regular well-defined route (e.g. haul roads)".

The trommel in the mineral extraction areas has been included at the approximate location it is in at present (roughly 350 metres from the nearest dwellings in Wroxton and 750 metres from the dwelling at French's Buildings) approximate OS Grid Reference E: 440740, N: 241405. There is a loading shovel associated with this operation included in the calculations in the same approximate location.

The washing plant on the plant site has been included at approximate OS Grid Reference E: 440402., N: 241663 with the crushing and screening operations for the recycling facility located at approximate OS Grid Reference E: 440491, N:241729. There are loading shovels associated with these operations included in the calculations in the same approximate locations.

The sources have been assumed to be omni-directional and no specific directionality has been used in the calculations.

Infilling by means of imported inert materials will take place once each phase has been fully extracted and infilling of the void will be to existing ground levels when the stored indigenous soils are replaced during final restoration.

The site noise levels for the infilling operations using imported materials calculated at the nearest dwellings in Wroxton village and French's Buildings are shown in the following table as well as the calculated overall site noise levels including infilling, mineral extraction, recycling and processing operations when these activities will be taking place at the same time as infilling operations.

The calculated site noise levels are given in terms of dB $L_{Aeq,1\ hour,\ free\ field}$.

Site Noise Calculation Location	Calculated Noise Level (Nearest Infilling*)	Calculated Noise Level (Permitted Operations)**	Calculated Noise Level (Overall Site Noise)***
1. Wroxton village	40	47	47
2. French's Buildings	37	43	44

* Infilling by means of imported material (restoration) + haul road
** Permitted operations + haul road (excluding infilling and temporary operations)
*** Infilling + permitted operations + haul road

For the purposes of the assessment to accompany the application for the Environment Agency permit, the overall calculated noise level for the site operations occurring simultaneously is used. The calculated noise level due to the infilling using imported inert material alone is provided for context.

8 Baseline Noise Surveys and Background Sound Levels (2020)

Baseline noise measurements were undertaken at The Firs as representative of the nearest properties in Wroxton village (set back from the A422) and at French's Buildings on the road heading south from the A422 to the east of the site. Measurements were also taken by the school on Lampitts Green within the village where the average background sound levels were found to be the same as at The Firs. The site was dormant at the time of the surveys and therefore had no impact on the measured background sound levels.

The surveys were comprised of 8 attended sample measurements on two days at the two locations used in the assessment. Four measurements were also taken at Lampitt Green in Wroxton which exhibited the same average background sound levels as at The Firs, but higher ambient sound levels.

Daytime sample measurements were taken between 11:00 and 16:25 on Monday 26 October 2020 and between 11:15 and 16:25 on Wednesday 04 November 2020.

The following table is a summary of the ambient ($L_{Aeq,15\ min}$) and background ($L_{A90,15\ min}$) sound levels at each of the selected sample measurement positions. The values shown are the average sound levels.

Location	**Average Ambient Sound Level** **dB $L_{Aeq,\ 15\ min}$**	**Average Background Sound Level** **dB $L_{A90,\ 15\ min}$**	**Range Background Sound Levels** **dB $L_{A90,\ 15\ min}$**
The Firs, Wroxton	50	42	40 to 44
Lampitts Green, Wroxton(*)	*58*	*42*	*41 to 43*
French's Buildings	64	39	33 to 44

(*) For information purposes only

The attended surveys were carried out with a westerly wind component i.e. from the site to the properties (westerly on Monday 26 October 2020 and north-westerly on Wednesday 04 November 2020) as would be usual based on the prevailing wind direction.

The noise levels in the area in October and November 2020 were generally controlled by distant and local road traffic. During the noise surveys birdsong, wind in the trees, aircraft movement and occasional local activity were also noted.

The representative noise levels chosen to be used for Wroxton village in the assessment are the lower levels measured at The Firs to represent a worst case scenario for the village.

The details of the noise measurement equipment and calibration are presented in Appendix C.

The results of the attended noise surveys are presented in Appendix D.

For the attended sample measurements, the sample duration (T) was 15 minutes.

The following table presents representative ambient ($L_{Aeq,T}$) and background ($L_{A90,T}$) sound levels at the two assessment locations that are used in the assessment:

Position	**Location Description**	**Average Ambient Sound Level** **dB $L_{Aeq,\ T}$**	**Average Background Sound Level** **dB $L_{A90,\ T}$**
1	Wroxton village	50	42
2	French's Buildings	64	39

9 Calculated Site Noise Levels in the Context of the Existing Noise Environment

For this assessment, the two receiver locations representative of the nearest residential properties to the infilling areas on the site where baseline noise measurements were taken in October/November 2020 have been used for the site noise calculations.

The baseline noise measurement/assessment locations closest to the proposed infilling areas are shown or indicated on the plan in Appendix B.

A comparison of the calculated noise levels at the two selected assessment locations closest to the infilling areas with the background and residual sound levels at those locations is as follows.

Receiver Location	**Calculated Site Noise Level dB $L_{Aeq,1\ hour}$**		**Background Sound Level dB $L_{A90,15\ min}$**	**Residual Sound Level dB $L_{Aeq,15\ min}$**
	Infilling*	**Overall**		
1. Wroxton village	40	47	42	50
2. French's Buildings	37	44	39	64

* Infilling using imported materials (restoration) + access road

The overall calculated site noise levels are above the representative background sound levels by 5 dB(A) for the nearest properties in Wroxton village and at the dwelling at French's Buildings.

These differences demonstrate that the infilling operations can be undertaken whilst keeping overall site noise levels to within the +5dB over background sound levels generally required by the Environment Agency (depending on context).

The overall calculated site noise levels are below the residual sound levels by 3 dB(A) at the nearest properties in Wroxton village and by 20 dB(A) at the dwelling at French's Buildings.

For infilling operations alone, the calculated site noise levels are below the representative background sound levels by 2 dB(A) for both the nearest properties in Wroxton village and the dwelling at French's Buildings.

The nearest properties in Wroxton village are located adjacent to the A422. The baseline residual levels at these locations are 45-51 dB $L_{Aeq,T}$ (measured at The Firs - the residual levels at Lampitts Green were considerably higher due to local road traffic).

The noise climate at these dwellings will continue to be controlled by distant and local road traffic on the public highway, birdsong, breeze in the trees and some local activity with the possibility of site noise including infilling being audible on occasion.

The dwelling at French's Buildings is located further from the infilling areas and is approximately 1 kilometre from the A422, but is subject to occasional passing traffic close to the property which controls (and will continue to control) the ambient and residual sound levels at that location.

An assessment has been undertaken in accordance with BS 4142:2014+A1:2019 "*Methods for Rating and assessing industrial and commercial sound*" for the three nearest dwellings to the infill operations examined above.

10 BS 4142: 2014+A1:2019 Assessment

The information to be reported, as specified in Section 12 of BS 4142:2014+A1:2019, is set out below where relevant.

10.1 (a) Statement of Qualifications

See details about The Author on page 2 of this report.

10.2 (b) Source Being Assessed

1) Description of the main sound sources and of the specific sound

The source under investigation is the importation of inert material and the use of inert residues to restore the mineral extraction area of the existing quarry. The plant items are listed in Section 7 and are those within the permit boundary that would give rise to the specific sound levels at the off-site receiver locations.

2) Hours of operation

The permitted hours of operation for routine working are 07:00 to 18:00 hours Monday to Friday, 07:00 to 13:00 hours Saturday and at no other times or on Sundays, Bank and/or Public Holidays.

3) Mode of operation (e.g. continuous, twice a day, only in hot weather)

The dozer for tipped material will be used on most days, but the period of use in a day will depend on the amount of material to be profiled. As a worst case assessment all plant has been assumed to operate for 100% of the hour assessment period, apart from tipping of infill (assumed for 10% of each hour). It is unlikely that all plant and machinery would operate for 100% of each hour for the full duration of each working day and operations tend to be more intermittent depending on the works taking place.

4) Statement of operational rates of the main sound sources (e.g. maximum load setting, 50% max rate, low load setting)

The measurements and assessment have been based on a "*maximum load setting*" i.e. with all components of the material handling and placement operations taking place simultaneously and for 100% of each hour during the daytime periods stated above.

Tipping of the inert material in the excavation void is included in the calculations as taking place for 10% of the time.

The ongoing extraction and processing operations (and the permitted recycling operations) have also been assumed to be taking place for 100% of each hour during the daytime periods stated above.

5) Description of premises in which the main sound sources are situated (if applicable).

The worst case scenario calculated is the infilling operation taking place in Phases 6a and 6b with concurrent mineral extraction and use of the trommel in Phase 5b. Processing of the mineral and the permitted recycling operations will take place on the existing plant site and designated area (Phase 4).

A plan of the quarry showing the application area is provided in Appendix B.

10.3 (c) Subjective Impressions

1) Dominance or audibility of the specific sound

The specific source is not yet in place but it is expected that the specific sound could be just audible at times, but would not normally be clearly audible.

2) Main sources contributing to the residual sound.

The noise climate in the area in October/November 2020 was affected by road traffic noise, birdsong, wind in the trees, aircraft movement and some local activity.

10.4 (d) The Existing Context and Sensitivity of Receptor

The noise climate during the daytime at the two chosen assessment locations is characterised by road traffic noise, birdsong, wind in the trees, aircraft movement and some local activity. With regard to sensitivity, the receptor locations are residential properties and would therefore be considered to be of high sensitivity.

10.5 (e) Measurement Locations and Justification

Measurement locations, their distance from the specific sound source, the topography of the intervening ground and any reflecting surface other than the ground, including a photograph, or a dimensioned sketch with a north marker. A justification for the choice of measurement locations should also be included.

The measurement locations selected for the baseline noise measurements were near to existing residential properties. The locations were used to determine the acoustic environment and to measure residual (ambient) and background sound levels in the vicinity of the dwellings.

The receptor locations selected for this assessment are the two closest dwellings to the working areas of the site.

10.6 (f) Sound Measuring Systems, Including Calibrator / Pistonphone

Precision Sound Level Meter

1) Type 140 (26 October 2020) and NL-52 (04 November 2020).

2) Manufacturer Norsonic (26 October 2020) and RION (04 November 2020).

3) Serial numbers 1404819 (26 October 2020) and 420716 (04 November 2020).

4) Details of the latest verification test including dates

The baseline noise surveys were completed in 2020. The calibration certificate information relevant at the time of the surveys is provided below.

Sound Level Meter	**Norsonic 140 s/n 1404819**	**RION NL-52 s/n 420716**
Associated Calibrator	Norsonic 1251 s/n 33321	RION NC-74 s/n 34425557
For 2020 measurements		
Calibration by	Campbell Associates	ANV
Calibration Date	11/12/2019	11/02/2020
Certificate No.	33590	TCRT 20/1088
Correct level with associated calibrator	113.8	94.0

10.7 (g) Operational Test

1) *Reference level(s) of calibrator, multi-function calibrator or pistonphone;*
113.8 dB(A) for Norsonic 140 s/n 1404819
94.0 dB(A) for RION NL-52 s/n 420716

2) *Meter reading(s) before and after measurements with calibrator, multi-function calibrator or pistonphone applied.*
Norsonic 140 s/n 1404819
Monday 26 October 2020: Before 113.5 dB(A) and after 113.7 dB(A);
RION NL-52 s/n 420715
Wednesday 04 November 2020: Before 93.8 dB(A) and after 93.8 dB(A).

10.8 (h) Weather Conditions

1) Wind speed(s) and direction(s)

Monday 26 October 2020: 1-3 m/s from the W quadrant; and
Wednesday 04 November 2020: 1-2 m/s from the NW quadrant.

2) Presence of conditions likely to lead to temperature inversion (e.g. calm nights with little cloud cover) None.

3) Precipitation None.

4) Fog None.

5) Wet ground None.

6) Frozen ground or snow coverage None.

7) Temperature

Monday 26 October 2020: 10-13°C; and
Wednesday 04 November 2020: 8-12°C.

8) Cloud Cover

3 oktas on Monday 26 October 2020; and

1 oktas on Wednesday 04 November 2020.

10.9 (i) Date(s) and Time(s) of Measurements

Monday 26 October 2020: 11:00 to 16:25;
Wednesday 04 November 2020: 11:15 to 16:25.

10.10 (j) Measurement Time Intervals

15 minutes.

10.11 (k) Reference Time Interval(s)

The reference time interval is 1 hour for a daytime assessment between 07:00 to 23:00 hours. A period of 15 minutes is applicable between 23:00 and 07:00 hours, but is not relevant to this application.

As the site activities occur during daytime hours, a 1 hour assessment period is used.

10.12 (l) Specific Sound Level

1) Measured sound level(s)

The specific sound level could not be measured but has been determined from calculation.

2) Residual sound level(s) and method of determination

The average residual sound levels from the attended sample measurements at the dwellings in Wroxton village and at French's Buildings on Monday 26 October 2020 and Wednesday 04 November 2020 were:

Wroxton village: 50 dB $L_{Aeq,15\ min,\ free\ field}$
French's Buildings: 64 dB $L_{Aeq,15\ min,\ free\ field}$

3) Ambient sound level(s) and method of determination

The average ambient sound levels from the attended sample measurements at dwellings in Wroxton village and French's Buildings on Monday 26 October 2020 and Wednesday 04 November 2020 were:

Wroxton village: 50 dB $L_{Aeq,15\ min,\ free\ field}$
French's Buildings: 64 dB $L_{Aeq,15\ min,\ free\ field}$

For the sample measurements at the two assessment locations the following "Comments" were made:

Wroxton village: Distant and local road traffic, birdsong, aircraft movements, breeze in trees, occasional local activity;

French's Buildings: Distant and local road traffic, birdsong, aircraft movements, breeze in trees, activity at property.

4) Specific sound level(s) and method of determination

The specific sound levels for the two assessment locations have been determined from calculation as:

47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Wroxton village;

42 dB $L_{Aeq,1\ hour,\ free\ field}$ for French's Buildings.

5) Justification of methods

Calculation was used to determine the specific sound level as the infilling operations are not yet taking place at the nearest approach to any of the two assessment locations.

6) Details of any corrections applied

See the Potential Impact of Uncertainty section.

10.13 (m) Background Sound Level(s)

Background sound level(s) and measurement time interval(s) and, in the case of measurements taken at an equivalent location, the reasons for presuming it to be equivalent.

The average daytime background sound levels from the attended sample measurements taken at Wroxton village and French's Buildings on Monday 26 October 2020 and Wednesday 04 November 2020 were:

Wroxton village: 42 dB $L_{A90,15\ min,\ free\ field;}$
French's Buildings: 39 dB $L_{A90,15\ min,\ free\ field.}$

10.14 (n) Rating Level(s)

1) Specific sound level(s)

The specific sound level(s) stated in 8.12 are:

47 dB $L_{Aeq,1\ hour,\ free\ field}$ for Wroxton village; and

44 dB $L_{Aeq,1\ hour,\ free\ field}$ for French's Buildings.

2) Any acoustic features of the specific sound

The potential adjustments for the different features and assessment methods are summarised in the table in Section 3 of this report.

At a separation distance of at least 280 m from the dozer to the nearest receiver location and taking into account the noise attenuation bunding, no requirement for a penalty for tonality, impulsivity or intermittency is expected for the infill operations at the dwellings in Wroxton village or at French's Buildings.

The nature of a dozer grading material could attract the 'Other' correction of + 3 dB "*if neither tonal nor impulsive, but otherwise readily distinctive*" if the dozer tracks are worn. However, at a separation distance of at least 280 m to the two receiver locations, taking into account the noise attenuation bunding and with the use of a modern dozer the 'Other' correction of + 3 dB has not been included. Therefore no acoustic features corrections are applicable.

3) Rating level(s)

The rating levels for daytime are therefore 0 dB above the specific sound levels stated above resulting in the following rating levels determined in accordance with BS 4142:2014+A1:2019:

47 dB $L_{Ar,\ Tr}$ for Wroxton village; and

44 dB $L_{Ar,\ Tr}$ for French's Buildings.

10.15 (o) Excess of the rating level(s) over background sound level(s)

Excess of the rating level(s) over the measured background sound level(s) and the initial estimate of the impacts

The rating levels, the background sound levels and the excess of the rating levels over the background sound levels for the daytime period are presented in the following table:

Receiver Location	**Rating Level dB $L_{Ar,\ Tr}$**	**Average Background Sound Level dB $L_{A90,15\ min}$**	**Excess of Rating Level over Background Sound Level**
Wroxton village	47	42	+5
French's Buildings	44	39	+5

When the rating level is above the background sound level, a difference of around +5 dB is likely to indicate an adverse impact and a difference of around +10 dB or more is likely to indicate a significant adverse impact, depending on the context.

The Rating Levels and differences from representative Background Sound Levels presented above show that the infilling operations can be undertaken whilst keeping overall site noise levels to within the +5dB over background sound levels generally required by the Environment Agency (depending on context).

10.16 (p) Conclusions of the assessment after taking context into account

Wroxton village:

The assessment demonstrates a rating level of 47 dB $L_{Ar,\ Tr}$ at the nearest dwellings in Wroxton village which is 5 dB above the representative background sound level of 42 dB $L_{A90,\ T}$ for Wroxton village. The residual level at Wroxton village is 50 dB $L_{Aeq,T}$.

The calculated site noise levels at this location are controlled by the existing quarry operations with the infilling operations (which are the subject of this permit) in isolation calculated to be below the typical background sound levels. As such the introduction of infilling at the site is not expected to have a significant change on the existing character of the area or on total site noise levels. Furthermore, the residual sound environment is controlled by local road traffic noise, with residual sound levels in the region of 50dB $L_{Aeq,T}$.

Calculated noise from the infilling operations in isolation is 10dB(A) below the existing residual sound level and noise from all site operations is calculated to be below residual sound levels by approximately 3dB(A).

The conclusion is that the assessment indicates that site noise levels (in comparison with existing background sound levels) are below the level indicating an adverse impact (as defined in BS4142: 2014 + A1:2019), with the existing mitigation measures incorporated for the dwellings in Wroxton village and within the Environment Agency requirement of being no more than 5 dB(A) above representative background sound levels.

The soundscape for Wroxton village will continue to be affected by local and distant road traffic noise, aircraft movements, birdsong and breeze in the trees with quarrying activity and infilling operations audible at times.

French's Buildings:

The assessment demonstrates a rating level of 44 dB $L_{Ar,\ Tr}$ at French's Buildings which is 5 dB above the representative background sound level of 39 dB $L_{A90,\ T}$ for French's Buildings. The residual level at French's Buildings is 64 dB $L_{Aeq,T}$.

The conclusion is that the assessment indicates that site noise levels (in comparison with existing background sound levels) are below the level indicating an adverse impact (as defined in BS4142: 2014 + A1:2019), with the existing mitigation measures incorporated for the dwelling at French's Buildings and within the Environment Agency requirement of being no more than 5 dB(A) above representative background sound levels.

The soundscape for French's Buildings will continue to be affected by local and distant road traffic noise, birdsong, breeze in trees, aircraft movements and some local activity with some quarrying/infilling activity just audible at times.

10.17 (q) The potential impact of uncertainty

Section 10 of BS 4142:2014+A1:2019 states: "*Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty*."

The largest level of uncertainty is whether the proposed activity gives rise to the calculated noise level at the two receiver locations and whether the specific noise at those locations attracts acoustic feature corrections.

The measurements and assessment have been based on all components of the material handling and placement (apart from the tipping of material) taking place simultaneously and for 100% of each hour during daytime periods. The site noise calculations also assume that the mineral extraction, recycling and processing operations are taking place 100% of each hour. The site noise calculations do not include any allowance for air absorption but this is unlikely to significantly affect the calculations or the outcome of the assessment.

If a correction of +3 dB were to be required at the two receiver locations for the nearest and uppermost use of the dozer on the infill for restoration, the rating level would be:

Receiver Location	**Rating Level** dB $L_{Ar,\ Tr}$	**Average Background Sound Level** dB $L_{A90,15\ min}$	**Excess of Rating Level over Background Sound Level**
Wroxton village	50	42	+8
French's Buildings	47	39	+8

With the inclusion of a +3 dB correction, the excess of rating level over background sound level would indicate that there could be an indication adverse impact at the dwellings in Wroxton village and at the dwelling at French's Buildings depending on context, but not a significant adverse impact.

The average background sound levels were used in the assessment as the surveys were undertaken with wind directions with a westerly component representative of the prevailing wind and this was considered to be representative of the background sound level that would be normal for the properties in the vicinity of the site.

Should the wind be from the opposite direction, it would be taking site noise away from the properties and therefore the data used would still be appropriate for a positive wind component from the site to the nearest dwellings.

The rating levels used in the assessment are based on the calculated sound levels including the proposed infilling operations as well as the ongoing permitted mineral extraction, recycling and processing operations on site as required by the Environment Agency.

If the infilling operations using imported inert material (the subject of the application for the permit) are considered in isolation, the excess of rating levels over background sound levels for the two assessment locations are as follows:

Receiver Location	**Rating Level (Nearest Infilling)* dB $L_{Ar, Tr}$**	**Average Background Sound Level dB $L_{A90,15\ min}$**	**Excess of Rating Level over Background Sound Level**
Wroxton village	40	42	-2
French's Buildings	37	39	-2

* Infilling by means of imported material (restoration) + haul road

Considering the infilling operations in isolation, the excess of rating level over background sound level indicates no adverse impact at the dwellings in Wroxton village or the dwelling at French's Buildings.

The rating levels used are based on the calculated site noise levels at the two assessment locations when the infilling and mineral extraction operations are occurring simultaneously at the nearest point of each working area to the receptor. As the works move away from that nearest point, the noise levels generated would be expected to reduce.

The operator has included noise attenuation bunds to a height of 3.5 metres above local ground level in the design of the site (which are now in place to the north-east of Phases 5a, 5b, 6a and 6b) to reduce site noise levels at the nearest noise sensitive locations and has made every effort to minimise noise at the nearest noise sensitive locations due to the operations on site. It also noted that the site complies with the existing site noise limits and updated site noise limits if determined from the guidance in Planning Practice Guidance for Minerals, which is the appropriate Government guidance for noise arising from this (quarry / minerals) site.

The operation must be considered in the context of the existing ambient noise levels at the assessment locations, the duration of infilling operations at the nearest point to the dwellings and the noise levels generated by the ongoing permitted mineral extraction, processing and recycling operations at the site.

Examining the infilling operations in isolation, the comparison of rating levels with background sound levels indicates no adverse impact at all the assessment locations throughout the infilling operations.

11 Summary and Conclusions

Earthline have permission for the extraction and processing of mineral from Wroxton Quarry in Oxfordshire under a planning permission dated 21 November 2019 (Ref. MW.0020/19) as granted by Oxfordshire County Council.

The Environment Agency has requested a noise impact assessment based on the BS 4142+A1:2019 method for an application for an inert landfill permit associated with the restoration at Wroxton Quarry.

The calculated site noise levels are compared with the measured background noise levels at the nearest dwellings to the proposed infilling areas (Phases 5a, 5b, 6a and 6b), as measured in October/November 2020 for the assessment of noise from mineral extraction within the previously stipulated stand-off distance from the dwellings in Wroxton village.

This comparison of the calculated noise levels arising from the importation of inert materials and the infilling of the extraction void using those materials with the background sound levels forms the basis for the BS 4142:2014+A1:2019 assessment method for the nearest dwellings to Wroxton Quarry.

The calculated site noise levels presented for comparison also include the ongoing mineral extraction, recycling and processing operations on site, where appropriate (as required by the Environment Agency).

A realistic worst case scenario has been calculated of simultaneous infilling in Phases 6a and 6b with mineral extraction in Phase 5b.

The baseline measurements and assessment demonstrate a worst case rating level of 47 dB $L_{Ar, Tr}$ which is 5 dB above the representative background sound level of 42 dB $L_{A90, T}$ for the nearest dwellings in Wroxton village.

The baseline measurements and assessment demonstrate a worst case rating level of 44 dB $L_{Ar, Tr}$ which is 5 dB above the representative background sound level of 39 dB $L_{A90, T}$ for the dwelling at French's Buildings.

The conclusion is that once contextual factors have been considered, the assessment indicates no adverse impact at both receiver locations (the nearest dwellings in Wroxton village and at French's Buildings) with the existing and previously proposed mitigation measures incorporated.

The rating levels and differences over representative background sound levels demonstrate that the infilling operations can be undertaken whilst keeping overall site noise levels to within the +5dB over background sound levels generally required by the Environment Agency (depending on context).

Examining the infilling operations in isolation, the comparison of rating levels with background sound levels indicates no adverse impact at the two assessment locations throughout the infilling operations, with infilling operations calculated 2dB below the background sound levels.

The soundscape for the two assessment locations considered will continue to be affected by distant and local road traffic noise, aircraft movements, other local activity, birdsong and breeze in the trees, with some quarrying activity and infilling operations audible at times.

Robert Storey
BEng PhD MIOA
Senior Consultant

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Appendix A – Glossary of Acoustic Terms

General Noise and Acoustics

The following section describes some of the parameters that are used to quantify noise.

Decibels dB

Noise levels are measured in decibels. The decibel is the logarithmic ratio of the sound pressure to a reference pressure ($2x10^{-5}$ Pascals). The decibel scale gives a reasonable approximation to the human perception of relative loudness. In terms of human hearing, audible sounds range from the threshold of hearing (0 dB) to the threshold of pain (140 dB).

A-weighted Decibels dB(A)

The 'A'-weighting filter emulates human hearing response for low levels of sound. The filter network is incorporated electronically into sound level meters. Sound pressure levels measured using an 'A'-weighting filter have units of dB(A) which is a single figure value to represent the overall noise level for the entire frequency range.

A change of 3 dB(A) is the smallest change in noise level that is perceptible under normal listening conditions. A change of 10 dB(A) corresponds to a doubling or halving of loudness of the sound. The background noise level in a quiet bedroom may be around 20 –30 dB(A); normal speech conversation around 60 dB(A) at 1 m; noise from a very busy road around 70-80 dB(A) at 10m; the level near a pneumatic drill around 100 dB(A).

Façade Noise Level

Façade noise measurements are those undertaken near to reflective surfaces such as walls, usually at a distance of 1m from the surface. Façade noise levels at 1m from a reflective surface are normally around 3 dB greater than those obtained under freefield conditions.

Freefield Noise Level

Freefield noise measurements are those undertaken away from any reflective surfaces other than the ground

Frequency Hz

The frequency of a noise is the number of pressure variations per second, and relates to the "pitch" of the sound. Hertz (Hz) is the unit of frequency and is the same as cycles per second. Normal, healthy human hearing can detect sounds from around 20 Hz to 20 kHz.

Octave and Third-Octave Bands

Two frequencies are said to be an octave apart if the frequency of one is twice the frequency of the other. The octave bandwidth increases as the centre frequency increases. Each bandwidth is 70% of the band centre frequency.

Two frequencies are said to be a third-octave apart if the frequency of one is 1.26 times the other. The third octave bandwidth is 23% of the band centre frequency.

There are recognised octave band and third octave band centre frequencies. The octave or third-octave band sound pressure level is determined from the energy of the sound which falls within the boundaries of that particular octave of third octave band.

Appendix A (continued)

Equivalent Continuous Sound Pressure Level $L_{Aeq,T}$

The 'A'-weighted equivalent continuous sound pressure level $L_{Aeq,T}$, is a notional steady level which has the same acoustic energy as the actual fluctuating noise over the same time period T. The $L_{Aeq,T}$ unit is dominated by higher noise levels, for example, the $L_{Aeq,T}$ average of two equal time periods at, for example, 70 dB(A) and 50 dB(A) is not 60 dB(A) but 67 dB(A).

The $L_{Aeq,}$ is the chosen unit of BS 7445-1:2003 "Description and Measurement of Environmental noise".

Maximum Sound Pressure Level L_{Amax}

The L_{Amax} value describes the overall maximum 'A'-weighted sound pressure level over the measurement interval. Maximum levels are measured with either a fast or slow time weighted, denoted as $L_{Amax,f}$ or $L_{Amax,s}$ respectively.

Noise Rating NR

The noise rating level is a single figure index obtained from an octave band analysis of a noise. The NR level is obtained by comparing the octave band sound pressure levels to a set of reference curves and the highest NR curve that is intersected by the sound pressure levels gives the NR level.

Sound Exposure Level L_{AE} or SEL

The sound exposure level is a notional level which contains the same acoustic energy in 1 second as a varying 'A'-weighted noise level over a given period of time. It is normally used to quantify short duration noise events such as aircraft flyover or train passes.

Statistical Parameters L_N

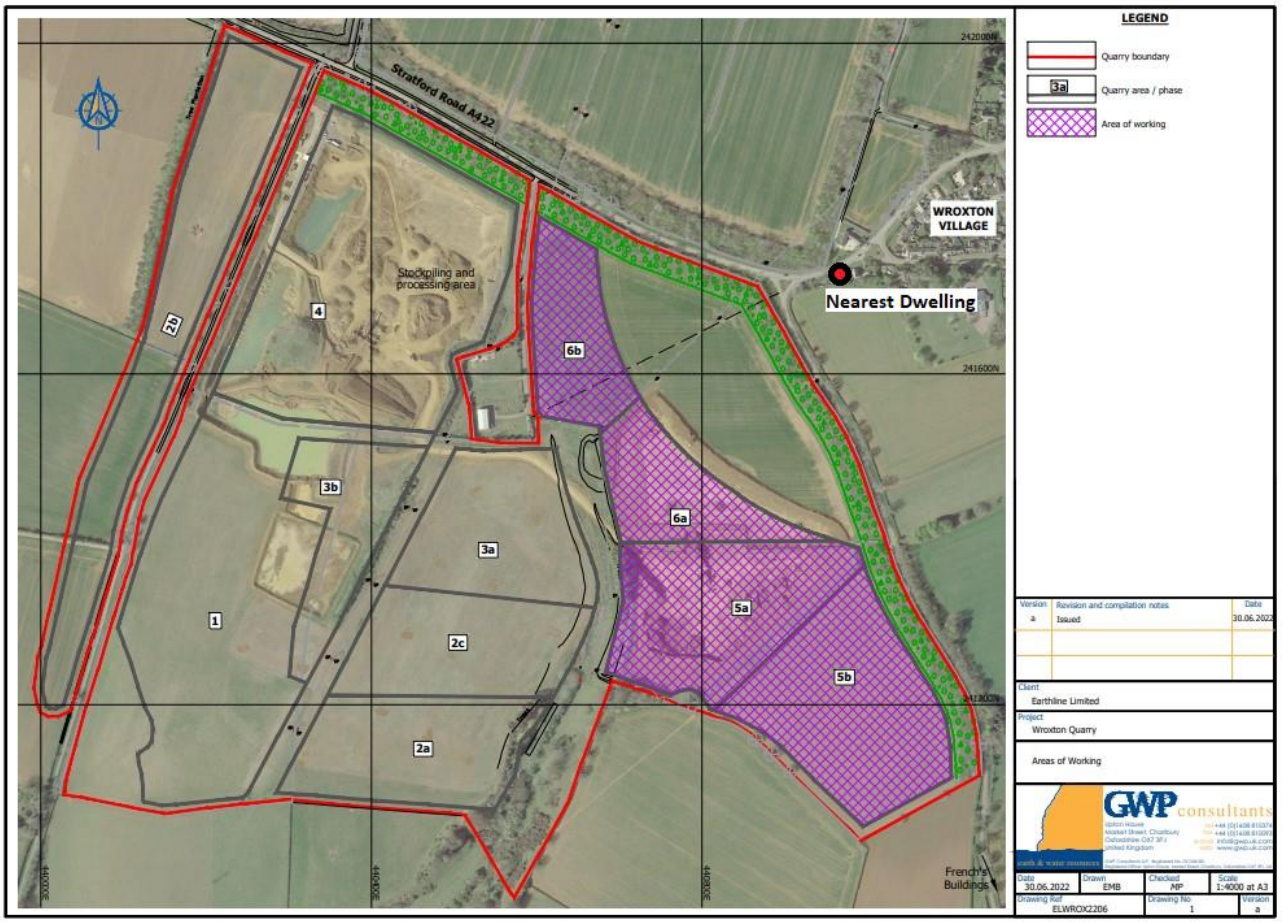
In order to cover the time variability aspects, noise can be analysed into various statistical parameters, i.e. the sound level which is exceeded for N% of the time. The most commonly used are the $L_{A01,T}$, $L_{A10,T}$ and the $L_{A90,T}$.

$L_{A01,T}$ is the 'A'-weighted level exceeded for 1% of the time interval T and is often used to gives an indication of the upper maximum level of a fluctuating noise signal.

$L_{A10,T}$ is the 'A'-weighted level exceeded for 10% of the time interval T and is often used to describe road traffic noise. It gives an indication of the upper level of a fluctuating noise signal. For high volumes of continuous traffic, the $L_{A10,T}$ unit is typically 2–3 dB(A) above the $L_{Aeq,T}$ value over the same period.

$L_{A90,T}$ is the 'A'-weighted level exceeded for 90% of the time interval T, and is often used to describe the underlying background noise level.

Appendix B – Plans Showing Assessment Locations and Permit Area



Approximate position of nearest dwelling in Wroxton village

Survey Locations	Description
The Firs	On cul-de-sac by turning areas
Lampitts Green	In parking area at side of road to north of the school
French's Buildings	On grassed verge to east of property

Appendix C – Instrumentation and Calibration Details

Date and Locations of Survey

First Survey - 11:00 and 16:25 on Monday 26 October 2020

Second Survey - 11:15 and 16:25 on Wednesday 04 November 2020

Survey carried out by

Dr Robert Storey

Weather Conditions

Monday 26 October 2020 – Dry, light cloud, some sun, W wind 1-3 m/s, 10-13°C

Wednesday 04 November 2020 – Dry, mainly clear, some cloud/ sun, NW wind 0-2 m/s, 8-12°C

Instrumentation used (Serial Number)

Monday 26 October 2020:

Norsonic 140 Sound Level Meter (1404819)

Norsonic 1251 Calibrator (33321)

Wednesday 04 November 2020:

Rion NL-52 Sound Level Meter (420716)

Rion NC-74 Calibrator (34425557)

Calibration

The sensitivity of the sample and install meters was verified on site immediately before and after the surveys. The measured calibration levels were as follows:

Survey Date / Meter	Start Calibration	End Calibration
Monday 26 October 2020	113.5 dB(A)	113.7 dB(A)
Wednesday 04 November 2020	93.8 dB(A)	93.8 dB(A)

The meter and calibrator are tested monthly against Norsonic Calibrators, type 1253 (serial number 22906) and type 1256 (serial number 125626100) both with UKAS approved laboratory certificates of calibration. In addition, the meter and calibrator undergo traceable calibration at an external laboratory every two years.

In addition, the meter and calibrator undergo traceable calibration at an external laboratory every two years.

Survey Details

Attended sample measurements of 15-minute duration were taken at the locations listed in Appendix B. The microphone was at a height of between 1.2 and 1.5 metres above local ground level, with a windshield used throughout.

Appendix D – Baseline Noise Survey Results

Results and Observations

Monday 26 October 2020, 11:00 to 16:25

Dry, light cloud, some sun, W wind 1-3 m/s, 10-13°C

Position	Start Time	Results dB (T = 15 minutes)				Comments
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
The Firs	11:00	49	65	52	42	Road traffic (A422), birds, low aircraft, breeze in trees, voices/activity at houses
Lampitts Green	11:20	51	70	51	41	Road traffic (A422 - -partly shielded), birds, breeze in trees, low aircraft, some passing cars, voice of walker
French's Buildings	12:07	64	87	61	39	Distant and some local road traffic, aircraft, birds, voices/playing at property, breeze in trees
The Firs	13:51	51	74	52	44	Road traffic, birds, aircraft, breeze in trees, voice of resident, car leaving close, car parking on close, power tool to east, activity at houses
Lampitts Green	14:09	53	71	53	43	Road traffic, breeze in trees, birds, ambulance turning at school with reversing bleeper, activity at houses, some passing cars, voices of residents, distant dog barking, power tool at house to north-east
French's Buildings	14:28	61	83	61	44	Distant and some local road traffic, birds, breeze in trees, aircraft, voices at property, van turning in field entrance

Appendix D (continued)

Results and Observations

Wednesday 04 November 2020, 11:15 to 16:25

Dry, mainly clear, some cloud/ sun, NW wind 0-2 m/s, 8-12°C

Position	Start Time	Results dB (T = 15 minutes)				Comments
		$L_{Aeq,T}$	$L_{Amax,f}$	$L_{A10,T}$	$L_{A90,T}$	
The Firs	11:18	48	65	52	40	Distant and local road traffic, aircraft, birds, breeze in trees
Lampitts Green	11:39	54	75	54	41	Distant and local road traffic, birds, children at school, dog barking in house, some passing cars, aircraft, occasional breeze in trees
French's Buildings	11:57	65	85	64	39	Distant and occasional passing road traffic, birds, distant impact noises, occasional breeze in trees
The Firs	13:37	50	64	54	40	Low light aircraft, birds, occasional breeze in trees, distant and local road traffic, voices of residents, dog barking, chickens, impact noises by main road, two cars on cul de sac, distant white noise reversing alarm,
Lampitts Green	13:54	63	95	55	41	Distant and local road traffic, birds, children at school, occasional breeze in trees, distant police siren, low light aircraft, dog barking, car alarm beeping, some passing cars, car parking on lane, van turning at school
French's Buildings	14:13	63	84	61	33	Distant and some local road traffic, low light aircraft, occasional breeze in trees, passing horse, voices and dog barking at property, birds

Appendix E – Noise Calculation Methods and Summary Calculation Sheets

Specific noise levels are predicted or measured in terms of the Equivalent Continuous Noise Level, $L_{Aeq,T}$ over a given reference time interval, T. In BS 4142:2014+A1:2019 the reference time interval is 1 hour for daytime and 15 minutes for night-time.

The calculation method for any plant which is relatively fixed in location is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "*Method for activity* L_{Aeq}" described in section F.2.2 or the "*Method for plant sound power level*" described in section F.2.3.

The calculation method for site mobile plant such as lorries and dump trucks is that set out in BS 5228-1: 2009 + A1: 2014, Annex F, and is the "*Method for mobile plant using a regular well defined route (e. g. haul roads)*" described in section F. 2. 5.

Ground Absorption has been calculated using the technique set out in BS 5228-1: 2009 + A1: 2014, Annex F, assuming 70-90% soft ground between the site and the receiver locations depending on the location.

The method of assessing screening is that attributed to Maekawa as used in BS 5228-1: 2009 + A1: 2014, Annex F and various other Government published documents. This method uses the calculated path difference and octave band noise data for each noise source over the frequency range stated in BS 5228-1: 2009 + A1: 2014, Annex F.

The effects of ground absorption are not used in the calculations if screening has been assessed and offers a higher attenuation.

The nearest distances to the respective dwellings, from the various items of plant, have been used in an acoustic model for the site to calculate the reasonable worst case $L_{Aeq,T}$ site noise levels.

Summary site noise calculation sheets for the two assessment locations are included after the explanation of table headings used in the calculation spreadsheet.

Appendix E (continued)

Table at top of page, a summary of the noise sources identified for calculation.

Ref.
Reference number for plant items.

Plant Item
A list of plant items selected as potentially significant noise sources.

Comments on Plant
Typically a reference to where the noise data has been measured or sourced from.

Activity LAeq @ 10 m
The equivalent A-weighted noise level for a nominal period, T, at a distance of 10 metres for this noise source, where appropriate.

Power LWA or LWA / m
The A-weighted sound power level for each plant item. A sound power level can be used to determine an $L_{Aeq,\,T}$ at any distance required, assuming hemispherical propagation.

15 min/1 hour On-time %
The operating time of each plant item given as a percentage of the period, generally taken to be 1 hour.

Capacity Tonnes
Capacity in tonnes of for example a dump truck; when in combination with a daily or hourly amount of material to be moved by dump trucks can be used to determine the number of dump truck movements per day or per hour.

Source Height
The height above the ground at which the actual noise source is located, for example noise sources associated with a medium sized wheeled loader would normally be approximately 2 m above ground level.

2 way flow Q per hour
Used for haul road calculations and specifies the number of vehicles expected on the haul road per hour.

Speed V kph
The expected average speed of the vehicles on the haul road.

Plant Set back(m)
This plant set back, e.g. 10 m, is used when barrier attenuation is being considered to test and ensure that the barrier attenuation is not overstated by placing the noise source too close in behind a bund or barrier.

BS5228 method
The reference number is used in a look up table to indicate which method within BS5228 has been used for assessing this particular noise source.

Appendix E (continued)

Table at bottom of page, dB $L_{Aeq, T}$ noise level contributions from the individual noise sources.

Ref.
Reference number for plant items – to link with table at top of page.

Plant Item
A list of plant items felt to be a potential noise source – to link with table at top of page.

Plan Distance
The distance from the noise source to receptor in metres, when appropriate the worst case scenario is used i.e. the shortest separation distance.

Working Distance
Any further distance correction, in metres, used to alter the distance of the noise source to the receptor, for testing alternative scenarios if required.

Ground Height
The ground height at the location of the noise source, in metres above sea level (Ordnance datum).

Working Height / depth
Any further adjustment to the height of the noise source, for example if noise sources are positioned above or below existing ground level.

Source Height
Indicates the noise source height taking account of the ground height and the height / depth adjustment.

Angle Degrees & Range Metres
Used in the Haul Road Method calculations only and specifies the angle of view and the perpendicular distance to the haul road or extended line of the haul road.

Barrier – Receiver
Distance of any acoustic barrier to the receptor in metres, used to determine path difference.

Barrier Height
The height of the barrier in metres, used to determine path difference.

Path Diff.
The difference in path length from noise source to receptor to which the sound propagation is subjected by introduction of any barrier.

Barrier Atten.
The attenuation in dB(A) caused by the barrier to the resultant dB $L_{Aeq, T}$ for the noise source, based on calculations in octave bands for each noise source.

Appendix E (continued)

Soft Ground %
The percentage of the ground between the noise source and receptor which is taken to be soft, i.e. grass and farmland, rather than hard, i.e. concrete or water.

Ground Atten.
The attenuation in dB(A) caused by any soft ground to the resultant dB $L_{Aeq, T}$ for the noise source, in decibels (not included if barrier attenuation is greater)

Resultant L_{Aeq}
The resulting dB $L_{Aeq, T}$ noise level for the individual noise source at the receptor, including attenuation factors and any mitigation at source.

Appendix E (continued)

EARTHLINE **5245**

Receiver Height : 1.5 m

WROXTON QUARRY INFILLING

Ref	Plant Item	Comments on Plant	Activity LAeq @ 10 m	Power LWA or LWA / m	1 hour On-time %	Capacity Tonnes	Source Height	2 way flow Q per hour	Speed V kph	Plant Set back(m)		BS5228 method	
1	Excavator	Mineral Extraction	77	105	100		2			0	m back	1	Activity
2	Dump Trucks	Mineral Extraction	77	105	100		2	12	15	0	m back	4	Haul Road
3	M413 Trommel Screen	Mineral Extraction	82	110	100		2.5			0	m back	1	Activity
4	Loading Shovel	Mineral Extraction	77	105	100		2			0	m back	1	Activity
5	CDE AggMax Washing Plant	Plant Site	79	107	100		4			0	m back	1	Activity
6	Loading Shovel	Plant Site	77	105	100		2			0	m back	1	Activity
7	HGVs on Access Road/Plant Site	Access Road	76	104	100		2	12	15	0	m back	4	Haul Road
8	Tipping from Dump Trucks	Infilling	79	107	10		0.5			0	m back	1	Activity
9	Dump Trucks	Infilling	77	105	100		2	12	15	0	m back	4	Haul Road
10	Dozer for Grading	Infilling	80	108	100		2			0	m back	1	Activity
11	Crushing/Screening of Imported Material	Recycling Area	84	112	100		2			0	m back	1	Activity
12	Loading Shovel	Recycling Area	77	105	100		2			0	m back	1	Activity

	Location No.	**1**	Wroxton Village											
	Receiver Height	158.5	m AOD											
	Site Noise Level for Items 1 to 12	**47**	**dB LAeq, 1 hour, free field**		**Routine Operations (whole site)**									
	Site Noise Level for Items 1 to 7, 11, 12	**47**	**dB LAeq, 1 hour, free field**		**Routine Operations (existing operations)**									
	Site Noise Level for Items 7 to 10	**40**	**dB LAeq, 1 hour, free field**		**Routine Operations (infilling)**									
Ref	Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
1	Excavator	280	290	156.0	-1.0	157.0	0	0	270	160.0	0.224	11.5	70.0	3.7	36.3
2	Dump Trucks	315	315	156.0	0.0	158.0	100	0	270	160.0	0.048	8.5	70.0	3.8	35.0
3	M413 Trommel Screen	350	350	156.0	-1.0	157.5	0	0	270	160.0	0.042	7.9	70.0	4.0	43.2
4	Loading Shovel	350	350	156.0	-1.0	157.0	0	0	270	160.0	0.057	10.6	70.0	4.0	35.5
5	CDE AggMax Washing Plant	650	650	151.0	0.0	155.0	0	0	270	160.0	0.028	7.8	70.0	4.2	34.9
6	Loading Shovel	650	650	151.0	0.0	153.0	0	0	270	160.0	0.045	9.9	70.0	4.9	30.8
7	HGVs on Access Road/Plant Site	640	640	157.0	0.0	159.0	15	0	270	160.0	0.005	5.7	70.0	4.9	25.5
8	Tipping from Dump Trucks	280	290	156.0	-1.0	155.5	0	0	270	160.0	0.489	16.6	70.0	3.7	23.2
9	Dump Trucks	315	315	156.0	0.0	158.0	100	0	270	160.0	0.048	8.5	70.0	3.8	35.0
10	Dozer for Grading	280	290	156.0	-1.0	157.0	0	0	270	160.0	0.224	13.4	70.0	3.7	37.4
11	Crushing/Screening of Imported Material	650	650	151.0	0.0	153.0	0	0	270	160.0	0.045	8.2	70.0	4.9	39.5
12	Loading Shovel	650	650	151.0	0.0	153.0	0	0	270	160.0	0.045	9.9	70.0	4.9	30.8

Appendix E (continued)

EARTHLINE **5245**

WROXTON QUARRY INFILLING

Receiver Height: 1.5 m

Ref	Plant Item	Comments on Plant	Activity LAeq @ 10 m	Power LWA or LWA / m	1 hour On-time %	Capacity Tonnes	Source Height	2 way flow Q per hour	Speed V kph	Plant Set back(m)		BS5228 method	
1	Excavator	Mineral Extraction	77	105	100		2			0	m back	1	Activity
2	Dump Trucks	Mineral Extraction	77	105	100		2	12	15	0	m back	4	Haul Road
3	M413 Trommel Screen	Mineral Extraction	82	110	100		2.5			0	m back	1	Activity
4	Loading Shovel	Mineral Extraction	77	105	100		2			0	m back	1	Activity
5	CDE AggMax Washing Plant	Plant Site	79	107	100		4			0	m back	1	Activity
6	Loading Shovel	Plant Site	77	105	100		2			0	m back	1	Activity
7	HGVs on Access Road/Plant Site	Access Road	76	104	100		2	12	15	0	m back	4	Haul Road
8	Tipping from Dump Trucks	Infilling	79	107	10		0.5			0	m back	1	Activity
9	Dump Trucks	Infilling	77	105	100		2	12	15	0	m back	4	Haul Road
10	Dozer for Grading	Infilling	80	108	100		2			0	m back	1	Activity
11	Crushing/Screening of Imported Material	Recycling Area	84	112	100		2			0	m back	1	Activity
12	Loading Shovel	Recycling Area	77	105	100		2			0	m back	1	Activity

Location No. **2** French's Buildings

Receiver Height 157.5 m AOD

Site Noise Level for Items 1 to 12 **44** **dB LAeq, 1 hour, free field** **Routine Operations (whole site)**

Site Noise Level for Items 1 to 7, 11, 12 **43** **dB LAeq, 1 hour, free field** **Routine Operations (existing operations)**

Site Noise Level for Items 7 to 10 **37** **dB LAeq, 1 hour, free field** **Routine Operations (infilling)**

Ref	Plant Item	Plan Distance	Working Distance	Ground Height	Working Height/depth	Source Height	Angle Degrees	Range Metres	Barrier -Receiver	Barrier Height	Path Diff.	Barrier Atten.	Soft Ground %	Ground Atten.	Resultant LAeq
1	Excavator	350	360	156.0	-1.0	157.0	0	0	340	159.5	0.161	10.5	90.0	5.2	35.4
2	Dump Trucks	560	560	156.0	0.0	158.0	25	0	340	159.5	0.011	6.1	90.0	6.1	28.9
3	M413 Trommel Screen	750	750	156.0	-1.0	157.5	0	0	340	159.5	0.011	5.9	90.0	6.6	37.9
4	Loading Shovel	750	750	156.0	-1.0	157.0	0	0	0	0.0	-1.000	0.0	90.0	6.6	32.9
5	CDE AggMax Washing Plant	1100	1100	151.0	0.0	155.0	0	0	0	0.0	-1.000	0.0	90.0	6.2	31.9
6	Loading Shovel	1100	1100	151.0	0.0	153.0	0	0	0	0.0	-1.000	0.0	90.0	7.4	28.8
7	HGVs on Access Road/Plant Site	815	815	157.0	0.0	159.0	5	0	0	0.0	-1.000	0.0	90.0	6.8	18.6
8	Tipping from Dump Trucks	715	725	156.0	-1.0	155.5	0	0	340	159.5	0.024	7.5	90.0	6.6	24.3
9	Dump Trucks	560	560	156.0	0.0	158.0	25	0	340	159.5	0.011	6.1	90.0	6.1	28.9
10	Dozer for Grading	715	725	156.0	-1.0	157.0	0	0	340	159.5	0.014	6.8	90.0	6.6	36.0
11	Crushing/Screening of Imported Material	1100	1100	151.0	0.0	153.0	0	0	0	0.0	-1.000	0.0	90.0	7.4	35.8
12	Loading Shovel	1100	1100	151.0	0.0	153.0	0	0	0	0.0	-1.000	0.0	90.0	7.4	28.8

Appendix E (continued)

Information to submit to the Environment Agency in a noise impact assessment that uses spreadsheet calculations.

Information required	Reference
General information	
• the site location and layout	Plan in Appendix B and Section 4 “Site Description”
• your proposed activities and sources of any noise	Description of site activities in Section 7
• local receptors and reasons for selection	Section 5 “Assessment Locations”
• your noise remediation approach	Description of bunding under Section 7
• map showing the site and surrounding area including receptors	Plan in Appendix B
• site plan including the site boundary	Plan in Appendix B
• full noise survey report if you have carried out a BS 4142 assessment	See this main report
• description of the noise mitigation measures you propose using and supporting evidence, such as the manufacturer’s engineering specification for items that mitigate noise emissions, or calculations of the screening effect of barriers	Description of binding under Section 7. Calculation sheets in Appendix E detail distance to bunding and bunding height.
Noise data you must provide	
Fixed and mobile plant	
• grid references	Description of locations provided in Section 7 and OS Grid Reference provided where practicable.
• referenced or derived sound power levels (preferably octave band, for derived provide the measurements and calculations)	Table of sources, sound power levels and source heights provided in Section 7.
• heights	Table of sources, sound power levels and source heights provided in Section 7.
• directivities	No source directivity has been used in the calculations.
• operating times	Section 4 provides site operating hours, description of source on-time provided in Section 10.2(b)
Site traffic	
• grid references for site roads	Description of locations provided in Section 7 and OS Grid Reference provided where practicable.
• vehicle sound power levels	Table of sources, sound power levels and source heights provided in Section 7.
• traffic numbers	Calculation sheets provided in Appendix E confirm traffic numbers.
• traffic speed	Calculation sheets provided in Appendix E confirm traffic speed as 15kph.