

**SOUND IMPACT ASSESSMENT**

**of**

**LANDFILL AND RESTORATION OF  
MINERAL EXTRACTION AND PROCESSING SITE**

**at**

**HECK AND POLLINGTON LANE,  
POLLINGTON,  
LS25 5LD**

Date of measurements: 18<sup>th</sup> January, 14<sup>th</sup> May, 3<sup>rd</sup> June & 5<sup>th</sup> June 2021  
Date of report: 17<sup>th</sup> February 2023

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Originally established in 1981. Company number 4688174.



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## 1.0 **Introduction**

This report has been commissioned to provide assessment of sound associated with infill and land restoration operations at Pollington Quarry.

The report has been prepared for submission to the Environment Agency and we are informed they have requested that the survey is undertaken to BS 4142, 'Methods for rating and assessing industrial and commercial sound.'

The National Planning Policy Framework also contains guidance that is intended directly for sound emissions from minerals extraction and restoration sites. Assessment using this guidance is also included in this report for completeness.

These documents and central government policies are described in the next subsections.

### 1.1 **Central Government Policies**

The government's planning policies are described in the National Planning Policy Framework (NPPF) which includes consideration of potential adverse impacts of noise caused by new development. The NPPF makes reference to the Noise Policy Statement for England (NPSE) which includes an Explanatory Note describing three incremental categories of noise impact:

- No Observed Effect Level (NOEL) being the situation below which no effect caused by noise can be detected,
- Lowest Observable Adverse Effect Level (LOAEL) being the situation above which adverse effects caused by noise can be detected,
- Significant Observed Adverse Effect Level (SOAEL) being the level above which significant adverse effects caused by noise occur.

Stated objectives of the NPSE are:

1. Avoid significant adverse impacts, usually interpreted as calling for sound levels above SOAEL to be avoided.
2. Mitigate and minimise adverse impacts, usually interpreted as calling for noise mitigation to be used within the bounds of practicality for situations between LOAEL and SOAEL.
3. Where possible contribute to the improvement of health and quality of life, usually interpreted as calling for noise reductions to be made where possible for situations between NOEL and LOAEL.

Although introducing these subjective concepts for the assessment of impact, the NPPF and NPSE documents do not provide quantitative values against which the suitability of a site for development can be assessed in terms of sound levels.

## 1.2 **Noise Assessment Criteria - NPPF**

The Department for Communities and Local Government published the document “Planning Practice Guidance” to the National Planning Policy Framework in March 2014. The section of the document which applies to minerals excavation and surface workings quantifies specific noise standards. These are summarised as:

- During the daytime from 07.00 to 19.00 hours the sound level at noise-sensitive properties should not exceed the background level by more than 10 dBA.
- In some circumstances it may not be possible to meet this requirement without unreasonable burden of the mineral operator in which case the upper limit between 0700 to 1900 hours is 55 dB LA<sub>eq</sub> (1-hour) at noise-sensitive properties.
- During the evening from 19.00 to 22.00 hours the 55 dB LA<sub>eq</sub> (1-hour) limit applies even if the background level is greater than 45 dB LA<sub>90</sub>.
- At night between 22.00 to 07.00 hours the sound level at noise-sensitive properties should not exceed 42 dB LA<sub>eq</sub> (1-hour).
- Where the site noise is tonal in character it may be appropriate to set specific limits for this element of the noise. Peak or impulsive noise, which may include reversing beepers, may need specific limits and should not occur regularly at night.
- It is often necessary to raise the noise limits to allow temporary phases in a development, for example baffle mound construction, soil stripping, and construction of new permanent landforms. A limit of 70 dB LA<sub>eq</sub> (1-hour) is suggested for periods of up to 8 weeks per year.

## 1.3 **Methods of BS 4142: 2014**

The noise rating method of BS 4142 is to measure the outdoor sound levels at noise-sensitive premises during the emission of noise from the industrial or commercial premises under investigation and measure the background sound level typical of that location in the absence of the industrial or

commercial noise. The most common application of this standard is for permanent industrial or commercial development rather than temporary land restoration as in this application, but we are informed that the Environment Agency have requested that this document is used as part of this assessment and the comparative nature of the document is useful.

A correction factor is applied if appropriate to the measured levels for some acoustic features which affect its acceptability, described as tonal, impulsive or other characteristic features which are distinctive against the residual acoustic environment. The corrected measured level, the rating level, is compared with the background.

- If the rating level exceeds the background by around +10 dB or more then this is an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the background, the less likely it is that the industrial / commercial source will have an adverse impact.
- Where the rating level does not exceed the background, this is an indication of the industrial / commercial source having a low impact, depending on the context.

Situations where a noise impact assessment may need to be modified due to the context include those where:

- The residual sound levels in the absence of the industrial / commercial source are particularly high or low.
- The character of the residual sound has acoustic features comparable to those of the industrial / commercial sound.
- The sensitivity of the receptor is significant, and whether residential properties incorporate design measures that secure good internal or outdoor acoustic conditions.

### 1.3 **Conclusions**

The predicted sound levels and BS 4142 conclusions reached later in the report are reproduced in this subsection for ease of reference.

The typical background sound level measured across four different days using attended measurements at three positions is 38 dB LA<sub>90,15mins</sub>.

The distances between the mobile restoration plant and the nearest dwellings will vary depending on the area being filled. For this reason, predictions have been undertaken at each set of dwellings for the closest and furthest restoration operations and also at a typical average distance. This gives a range of values that normal operations will fall within to assist in the overall assessment of site activity.

The specific sound levels from land restoration activity as received at the nearest dwellings are:

**Specific Sound Levels, dB LA<sub>eq,1hour</sub>**

<b>Dwelling</b>	<b>Close Activity</b>	<b>Typical Activity</b>	<b>Far Activity</b>
Farm to North	55.0	49.3	47.5
Dwelling to North East	65.2	49.9	45.5
Pinfold Lane	66.3	54.9	49.7
West End Gardens	64.1	53.2	48.6

Sound from the operation may be interpreted as having intermittent elements or otherwise be of a character that is potentially annoying, so a correction of 3 dB is added when determining the BS 4142 Rating Level.

When workings are at their furthest point from dwellings, the Rating Levels are predicted at 11 – 15 dB above background. This rises to being 20 – 31 dB above background when workings are at their closest point to dwellings, with typical values being 14 – 20 dB above background.

The initial estimate of impacts without taking context into account is that the landfill operations will have significant adverse impact at the nearest dwellings.

Operations such as this are often compared to guidance contained in the NPPF. This sets a limit of sound from operations (expressed as a sound level without BS 4142 Rating Level corrections) being 10 dBA above background, or if this places unreasonable burden on the operator then an overall limit of 55 dBA applies. The predictions contained in the report suggest that the 10 dBA above background requirement is likely to be exceeded, but the overall limit of 55 dBA will be complied with unless workings are close to the dwellings (within approximately 120m).

A higher limit of 70 dBA can apply for short-term working such as soil stripping or activities around a quarry rim, or when restoration activity is very close to dwellings.

Land restoration forms an essential part of quarry operation so that the land can be returned for other use and there is generally little that can be done to reduce sound levels beyond those predicted in this report. It may be worth limiting times of operation when close to dwellings being 08.00 – 17.00 to

provide some concession to residents and attempt to limit noise impact. If commercially practicable, the option remains to further restrict or even remove Saturday workings when close to dwellings to provide additional concession against noise impact.

As part of the consideration of context, it is important to note that the level of noise impact is likely to be very similar to the quarry operation and that the infill process is temporary and essential if the land is to be brought into future use. This type of operation is likely to cause elevated sound levels when required so close to existing dwellings, but it would be prudent of the operator to ensure that all machinery and fitted attenuators are kept in good working order.

## 2.0 **Assessment to BS 4142: 2014 & NPPF**

### (a) **Qualifications and Experience**

S & D Garritt Ltd are members of the Association of Noise Consultants (ANC). All work related to this report was undertaken by David Garritt.

David Garritt has been a member of the Institute of Acoustics since 2005 and holds an honours degree in Electronic and Computer Systems Engineering. David teaches acoustics at post graduate level on a part time basis for the Institute of Acoustics, sits on a committee for the Association of Noise Consultants and has recently authored industry guides and articles. David has extensive experience in the preparation of surveys involving industrial and minerals processing sound sources directly comparable to the subject of this report.

### (b) **Sources Being Assessed**

1. It is proposed to fill and restore land at a quarry site to the south of Heck and Pollington Lane, near Goole, East Riding of Yorkshire. The grid reference of the centre of the site is SE 61212 20076. Previous operations will have been undertaken to extract sand and gravel from the site, this report is concerned with noise impact from land restoration activities only.

The sound sources on site will be an excavator and bulldozer used for restoration, with materials transported onto or around site using HGVs and a dump truck.

A site and receptor location plan is shown overleaf.





2. The proposed hours of operation do not extend beyond 07.00 – 18.00 Monday – Friday and 07.00 – 13.00 on Saturday
3. The operation is assumed to be continuous apart from low speed dump truck manoeuvring at the point of restoration activities, assumed at 30 mins per hour. This does not include movements on the haul / access road, which are assumed as being up to 10 dump truck and 10 HGV movements per hour, moving across the full site.
4. Measurements and predictions have been taken at full load, normal working on similar sites or using data contained in BS 5228.
5. All machinery is outdoors. Access to the site will be from Heck & Pollington Lane using an entrance already formed for previous use. Materials will be transported using 8-wheeled HGVs. The quarry haul road and all operations will remain below ground level where possible. Screening mounds will be created along all of the site boundaries if required as part of the previous quarry operation so acoustic line of sight will be broken between the quarry and all nearby dwellings, either by these screening mounds, natural landforms or the sides of the quarry.

**Source Sound Pressure Levels, 10m**

	<b>dBA</b>	<b>31.5</b>	<b>63</b>	<b>125</b>	<b>250</b>	<b>500</b>	<b>1000</b>	<b>2000</b>	<b>4000</b>	<b>8000</b>
Bulldozer	86		94	95	87	79	78	75	70	67
Excavator, 10m	80	85.4	76.8	80.9	83.1	77.2	73.9	69.5	68.1	61.1
Dump Truck, Manoeuvring	76.4	79.6	75.8	74.6	75.7	71.4	73.1	67.9	64.1	60.9

The calculations of sound from vehicles on the internal roads requires use of sound power levels. These are taken as being SWL = 106 dBA from HGV movements and SWL = 110 dBA from dump truck movements, based on data in BS 5228 and our own on-site experiences.

(c) **Subjective Impressions**

During source measurements the machinery being assessed provided the dominant sound source.

Existing background sound levels were taken at three separate locations using attended measurements, deemed to be a more appropriate and accurate methodology at this particular site instead of leaving equipment on the proposed site for longer duration unattended monitoring, which in any case is insecure and unsuitable for equipment to be left.

The site is close to several existing industrial premises, which contributed to the existing sound climates during our visits, so more accurate background measurements are obtained at the location of nearest dwellings.

(d) **Existing Context**

As noted, the sound climate at the nearest dwellings to the quarry are caused by mixed sources, predominantly road traffic with some contributions from nearby existing industry.

As shown later in this report, sound from the proposed infill restoration activities is likely to be significantly above the existing baseline.

The restoration activity is temporary, will have a similar noise profile to the previous quarry workings and forms an essential part of the overall operation on this piece of land if it is to be reinstated for future use.

As discussed later in this report, there are generally no practicable methods for reducing sound from this type of mobile plant apart from the use of a noise barrier, which already forms part of the proposals. A concession to noise impact is suggested that the times of operation may be delayed to an 08.00 start in the morning, potentially with further consideration of limiting Saturday working when close to dwellings.

(e) **Measurement Locations**

The assessment of sound impact from proposed site activities is undertaken for four sets of the closest dwellings. Other dwellings are at greater distances from the sites and will be subject to lower noise impact than identified in this report. The table showing details of the closest dwellings is shown below.

<b>Dwelling</b>	<b>Min Distance (m)</b>	<b>Max Distance (m)</b>	<b>Grid Reference</b>	<b>Elevation (m)</b>
Farm to North	130	320	SE 61188 20320	12
Dwelling to North East	40	400	SE 61490 20128	13
Pinfold Lane	35	260	SE 61324 19934	7
West End Gardens	45	300	SE 61270 19906	8

The distances between the mobile restoration plant and the nearest dwellings will vary depending on the area being filled, as shown in the table above. For this reason, predictions have been undertaken at each set of dwellings for the closest and furthest restoration operations and also at a typical average distance. This gives a range of values that normal operations will fall within to assist in the overall assessment of site activity.

Measurements of the existing background sound climate were taken outside the dwelling receptors on public land as part of the assessment previously undertaken by us for the main quarry operation.

There are no reflective surfaces other than the ground between source and nearest receptors.

The quarry sides and earth bunds will entirely break line of sight between mobile sources and receptors at all times, apart from the possibility of direct line of sight existing towards the end of the restoration works as ground level rises.

(f) **Instrumentation**

The equipment used during the site visits is shown in the table below, along with details of the calibration certification that was current at the time of the site visits. The same equipment is still in use by us and retains up to date calibration documents.

Equipment Description	Type number	Manufacturer	Date of expiration of Calibration	Calibration Certificate Number
Sound Level Meter	2260 s/n 2409281	Bruel & Kjaer	07.10.2022	147227
Preamplifier	ZC 0026	Bruel & Kjaer	07.10.2022	147227
Sound Level Meter	XL2 TA s/n A2A-10019-EO	NTi Audio	25.08.2022	145408
Microphone	MK 224 s/n 210762A	Cirrus Research	20.08.2022	145404
Microphone	MK:224 s/n 212421D	Cirrus Research Plc	06.10.2022	147221
Calibrator	4231 s/n 2402706	Bruel & Kjaer	26.08.2021	145403

(g) **Operational Tests**

1. The reference level of the calibrator is 94 dB SPL at 1000 Hz.
2. The meter readings with the calibrator before and after measurements were all 94.0 dB SPL as may be expected given that all of the site work was attended, with no long duration unattended measurements when drift may be more expected to occur.

(h) **Weather Conditions**

Weather conditions remained suitable for the outdoor measurement of sound, being dry with wind speeds under  $5 \text{ ms}^{-1}$ , detailed in the table below

<b>Date</b>	<b>Wind Speed</b>	<b>Temperature</b>	<b>Cloud Cover</b>
18 <sup>th</sup> January	2-4m/s	5-8°C	0-50%
14 <sup>th</sup> May	1-2m/s	9-11°C	50-75%
3 <sup>rd</sup> June	0-2m/s	19-22°C	0-25%
5 <sup>th</sup> June	0-2m/s	20-22°C	0-25%

(i) **Date and Time of Measurements**

Sound levels were measured on:

- Monday 18<sup>th</sup> January 2021 from 12.16 to 15.27
- Friday 14<sup>th</sup> May 2021 from 09.45 to 14.29
- Thursday 3<sup>rd</sup> June 2021 from 10.18 to 15.03
- Saturday 5<sup>th</sup> June 2021 from 09.10 to 13.53

(j) **Measurement Time Intervals**

Sound measurements of existing plant items were taken over time periods that allowed the time average sound level to settle.

Background sound levels were measured over continuous 15 minute intervals in accordance with BS 4142: 2014.

(k) **Reference Time Interval**

The reference time interval is 1 hour in accordance with 3.8 of BS 4142. There is no night time operation.

(l) **Specific Sound Levels**

Specific sound levels are determined by calculation since the operation is proposed rather than currently in use, so there are no measurements or calculations of residual sound.

Details of calculations are given in the appendices and have been undertaken using well recognised fundamental principles of acoustics:

- Time averaging is undertaken using the formula

$$\text{Time correction} = 10 * \text{Log} ( T / 60)$$

Where T = on time in minutes

- Distance decay is undertaken using the principle of Rathe

$$\text{Distance Decay} = 20 * \text{Log} (\text{distance ratio})$$

for distances greater than the major dimension of the source / pi.

Since some of the intervening ground between source and receiver is soft, use of this equation that assumes hard ground will be accurate and sometimes conservative

- Barrier attenuation is the 10 dB given in BS 5228 for where line of sight between source and receptor is entirely broken. Cross-sectional plans and spectral data is not available for the frequency dependent method of Maekawa. In this instance, due to the high sides of the quarry, it is likely that the value given in BS 5228 will be conservative for the majority of the time.

The explanation given in section D.3.2.2.1 of BS 5228 states that *'In the absence of spectral data, as a working approximation, if there is a barrier or other topographic feature between the source and the receiving position, assume an approximate attenuation of 5 dB when the top of the plant is just visible to the receiver over the noise barrier, and of 10 dB when the noise screen completely hides the sources from the receiver. High topographical features and specifically designed and positioned noise barriers could provide greater attenuation. Subtract the attenuation from the value of LAeq calculated at the point of interest.'*

There may be some times, especially towards the end of the restoration operation when mobile plant items operate at the rim height of the quarry and become visible at some or all receptors. During these times, the sound levels from the machinery are up to 10 dBA higher than the predictions given in this report. We understand that the intention is to minimise any time when workings are in line of sight to any dwellings through the use of the quarry sides and earth bunds, but it remains possible that some time with exposed working will be required.

The methods of determining the specific sound of the plant items and machinery are in accordance with section F.2.1 of BS 5228-1 which describes methods of quantifying the sound levels of sources on a site. Three alternative means of obtaining the necessary data on source sound levels are described in BS 5228 as:

- (a) Carry out sound measurements on similar plant items operating in the same mode as those proposed at the application site.
- (b) Use data on typical sound levels of various plant items as provided in Annexes C and D of BS 5228-1.
- (c) Use data on the maximum permitted sound levels of plant items under EC Directive 2000/14/EC[11].

Section F.2.1 advises that “The method given in item (a) is likely to provide the most accurate prediction.” Where possible sound measurements have been taken of similar items of equipment in use at other sites. For other items data has been taken from BS 5228.

**Specific Sound Levels, dB LA<sub>eq,1hour</sub>**

<b>Dwelling</b>	<b>Close Activity</b>	<b>Typical Activity</b>	<b>Far Activity</b>
Farm to North	55.0	49.3	47.5
Dwelling to North East	65.2	49.9	45.5
Pinfold Lane	66.3	54.9	49.7
West End Gardens	64.1	53.2	48.6

(m) **Background Sound Level**

Existing background sound levels were taken at three separate locations using attended measurements, deemed to be a more appropriate and accurate methodology at this site instead of leaving equipment on the proposed site for longer duration unattended monitoring. The site is close to several existing industrial premises, which contributed to the existing sound climates during our visits, so more accurate background measurements are obtained at the location of nearest dwellings.

Measurements of the existing sound climate were undertaken as part of our survey work for the full quarry while some restrictions remained in place that were introduced to combat the Coronavirus pandemic. It is possible that this may have some effect on measured background sound levels, though if any is apparent it is most likely that the effect is to reduce existing sound levels, making the assessment more onerous. Roads in the local area appeared subjectively to be carrying similar amounts of traffic to normal during the May and June monitoring periods and it is anticipated that any effect on measured background sound levels is minimal.

Measurements were taken using type 1 sound level meters with current traceable calibration certification. Full details of the equipment used are given in the appendices to this report. Google Earth images of these locations are shown overleaf:

### Heck & Pollington Road



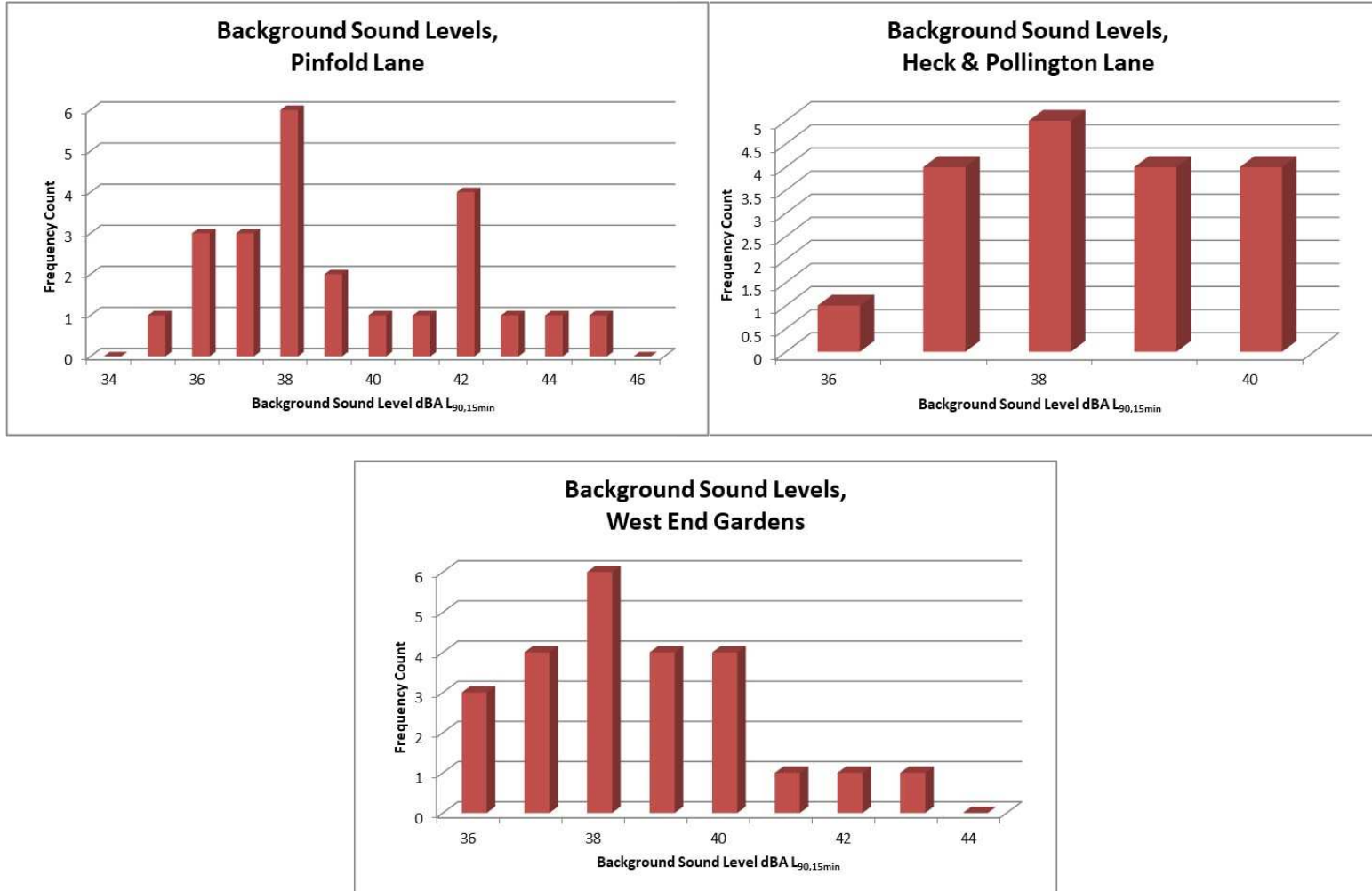
### Pinfold Lane



### West End Gardens



Full measurement data is included in the appendices of this report; a graphical summary of background sound levels is shown below:



Background measurements obtained on Saturday morning were of the same order as during weekdays. The typical background sound level measured across the four monitoring days at each position is concluded as being 38 dB LA90,15mins.

(n) **Rating Levels**

The corrections or penalties for acoustic feature to be applied to the specific level to find the BS 4142 Rating Level should be chosen to reflect the impressions at receptors.

Sound from the operation may be interpreted as having intermittent elements or otherwise be of a character that is potentially annoying, so a correction of 3 dB should be added to get the BS 4142 Rating Level. There



are no tonal or impulsive characteristics by the definition of those terms in BS 4142.

The BS 4142 Rating Levels are shown below, expressed to the nearest whole decibel as required by the standard:

**BS 4142 Rating Levels, dB**

<b>Dwelling</b>	<b>Close Workings</b>	<b>Average / Typical</b>	<b>Far Workings</b>
Farm to North	58	52	51
Dwelling to North East	68	53	49
Pinfold Lane	69	58	53
West End Gardens	67	56	52

(o) **Background Comparisons**

Comparisons between the predicted rating levels and the measured background levels are shown below. A positive number shows where the Rating Level exceeds the typical background sound level, a negative number showing where Rating Levels are below background.

**BS 4142 Rating Levels Comparison to Background, dB**

<b>Dwelling</b>	<b>Close</b>	<b>Average / Typical</b>	<b>Far</b>
Farm to North	+20	+14	+13
Dwelling to North East	+30	+15	+11
Pinfold Lane	+31	+20	+15
West End Gardens	+29	+18	+14

The initial estimate of impacts without taking the context of the operations into account is that sound from the restoration activity is predicted to cause significant adverse impact to the nearest dwellings.

(p) **BS 4142 Conclusions**

It is clear from the above results that sound from the restoration activities is predicted to exceed the typical background by a significant margin and likely to provide one of the dominant sound climate sources depending on position.

When considering the context of the proposals, there are important points to note:

- The proposed activity is temporary, being for the fill and restoration of former quarry land rather than a permanent fixed industrial installation.

- Works are proposed during the daytime only, and there is the possibility of commencing work one hour later in the morning than originally intended (08.00 instead of 07.00). The further possibility exists to discuss later start times on a Saturday when close to dwellings, or even the removal of Saturday working entirely if commercially practicable and required as part of the noise impact mitigation.
- The infill and restoration of former quarry land forms an essential part of the overall project if that land is to be reinstated for future use other than a disused quarry.
- The normal application of the quantitative BS 4142 conclusions is for permanent industrial or commercial development rather than temporary quarry working, though it still provides useful data on potential noise impact. Commentary on the predicted sound levels compared to the normal mineral extraction and processing guidance given in the NPPF is shown below.

### NPPF Assessment

The requirements of the NPPF “Planning Practice Guidance” on sound limits from minerals excavation and surface workings are summarised in section 2.0 of this report. The main requirement is that from 07.00 to 19.00 hours the sound level at noise-sensitive properties should not exceed the background level by more than 10 dBA unless this places unreasonable burden on the operator. In these instances a limit of up to 55 dBA can be applied, but exceedances above the 10 dBA comparison to background should be minimised where practicable.

Activity from the restoration operation is predicted to exceed the 10 dBA above background limit at all receptors for the majority of the time, except at the dwelling to the northeast when workings are at their furthest point.

BS 5228 notes that in some circumstances it may not be possible to meet the requirement to not exceed the background by more than 10 dBA without placing unreasonable burden of the mineral operator. In these cases, the upper limit between 0700 to 1900 hours can be set at up to 55 dB LA<sub>eq</sub> (1-hour) at noise-sensitive properties, but exceedances above the 10 dBA comparison to background should be minimised where practicable.

The predicted sound levels at all dwellings fall within this 55 dBA limit when workings are at their furthest points and average areas, but exceed this limit when restoration workings are close to the dwellings. These predictions are reproduced overleaf for ease of reference.

**Specific Sound Levels, dB LA<sub>eq,1hour</sub>**

Dwelling	Close Activity	Typical Activity	Far Activity
Farm to North	55.0	49.3	47.5
Dwelling to North East	65.2	49.9	45.5
Pinfold Lane	66.3	54.9	49.7
West End Gardens	64.1	53.2	48.6

The minimum distance between each dwelling and the mobile excavation works where compliance with the 55 dBA limit is achieved is:

- All times at the farm to the north,
- Approximately 125m at dwellings to the northeast on Pinfold Lane and West End Gardens

The effect of this is shown on plan below



It is concluded that the restoration and infill of land at Heck & Pollington Lane quarry will:

- Generally be above (ie. not in compliance with) the first requirement to not exceed background by more than 10 dBA

- Comply with the requirement to not exceed 55 dBA unless workings are within 125m of the nearest dwellings
- Comply with the temporary 70 dBA limit permitted for end stage operations when machinery will in view, unless the workings are at their absolute closest point to the dwellings. It is recommended that the time frame when machinery is in view of dwellings is minimised by the use of land forms, bunds etc.

The predictions contained in this report are based on well recognised fundamental principles of acoustics, including the widely used approximation that a barrier breaking line of sight between source and receiver gives an attenuation of approximately 10 dBA.

In practice, it is possible that sound levels at dwellings may be slightly lower due to increased barrier effect, so compliance may be achieved for larger amounts of time, but this cannot be guaranteed. There are limited mitigation measures that can be utilised for the control of outdoor sound beyond the use of noise barriers, selecting the quietest items of suitable machinery available and employing good noise management. This type of operation is likely to cause elevated sound levels when required so close to existing dwellings, but it would be prudent of the operator to ensure that all machinery and fitted attenuators are kept in good working order.

It remains likely that the 10 dBA above background requirement will be exceeded for most of the time and that there will be times when the 55 dBA guidance of the NPPF will be exceeded by the restoration works.

(q) **Uncertainty**

It is a requirement of BS 4142: 2014 that the level of uncertainty in data and calculations should be considered. These uncertainties and how they have been minimised are considered in this section.

The procedures used for the calculation of specific sound levels at the nearest noise-sensitive receptors are based on basic, fundamental principles of acoustics. Sound decay with distance from the sources has been calculated using the principles and methods recommended in BS 5228. The addition and subtraction of sound levels was done logarithmically on an energy basis, which is the correct method for decibel calculations.

It is anticipated that this method would be considered by other suitably qualified acousticians to be relevant, correct and appropriate for this survey and is a method examined by the Institute of Acoustics on their post graduate diploma course. Predicted sound levels have been calculated to reflect the reasonable worst-case scenario with machinery in full operation

and conservative figures used for the barrier effect of existing landforms and structures. Background sound levels were taken when some restrictions were still in place introduced to combat the Covid-19 pandemic and may result in a slightly less favourable (more onerous) assessment.

All sound level measurements were taken with a calibrated type 1 sound level meter, which represents the most accurate type of SLM available. Sound levels were measured to the nearest 0.1 dB, time periods were measured and recorded to the nearest second. No rounding was done in any calculations, the only rounding being done on final results, in compliance with BS 4142 : 2014. The sound level meter was calibrated before and after each survey period and no drift was apparent.

**It is concluded that the uncertainty in this survey has been minimised as far as possible and is believed to be below the level at which it would have an impact on the assessment conclusions contained in this report.**

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## APPENDIX 1

### BACKGROUND SOUND LEVEL MEASUREMENTS

The results of attended background sound level monitoring are:

Position 1, Heck and Pollington Lane

Date	Time	Ambient LA <sub>eq</sub>	Background LA <sub>90</sub>
18/01/2021		<i>No measurements due to roadworks</i>	
14/05/2021	09:45	53.6	38.4
14/05/2021	10:00	55.4	39.3
14/05/2021	10:15	52.9	39.0
14/05/2021	10:30	58.3	40.3
14/05/2021	10:45	57.6	37.8
14/05/2021	11:00	53.7	37.3
03/06/2021	10:18	51.7	40.2
03/06/2021	10:33	49.9	40.4
03/06/2021	10:48	54.4	38.6
03/06/2021	11:03	59.8	39.8
03/06/2021	11:18	52.2	37.4
03/06/2021	11:33	54.6	38.0
05/06/2021	09:10	51.9	38.4
05/06/2021	09:25	52.4	37.3
05/06/2021	09:40	50.3	38.1
05/06/2021	09:55	47.9	36.4
05/06/2021	10:10	48.6	39.0
05/06/2021	10:25	48.8	37.1

Position 2 Pinfold Lane

Date	Time	Ambient LA <sub>eq</sub>	Background LA <sub>90</sub>
18/01/2021	12:16	48.1	43.0
18/01/2021	12:31	47.7	43.6
18/01/2021	12:46	49.4	42.2
18/01/2021	13:01	48.3	42.4
18/01/2021	13:16	46.0	41.7
18/01/2021	13:31	50.5	41.6
14/05/2021	11:23	48.6	38.9
14/05/2021	11:38	49.3	39.5
14/05/2021	11:53	51.0	38.2
14/05/2021	12:08	48.3	37.8
14/05/2021	12:23	48.1	37.4
14/05/2021	12:38	47.7	38.4

03/06/2021	11:55	47.9	41.4
03/06/2021	12:10	54.8	44.6
03/06/2021	12:25	43.4	36.8
03/06/2021	12:40	46.8	38.0
03/06/2021	12:55	53.2	38.6
03/06/2021	13:10	45.9	36.0
05/06/2021	10:47	47.7	36.2
05/06/2021	11:02	49.2	37.6
05/06/2021	11:17	48.6	36.1
05/06/2021	11:32	48.6	37.5
05/06/2021	11:47	51.1	35.1
05/06/2021	12:02	49.0	37.3

Position 3 West End Gardens

Date	Time	Ambient LA <sub>eq</sub>	Background LA <sub>90</sub>
18/01/2021	13:57	48.3	36.7
18/01/2021	14:12	47.3	37.0
18/01/2021	14:27	48.0	37.2
18/01/2021	14:42	46.8	36.9
18/01/2021	14:57	50.2	35.5
18/01/2021	15:12	51.4	38.0
14/05/2021	12:59	49.3	38.3
14/05/2021	13:14	48.7	39.4
14/05/2021	13:29	48.8	39.8
14/05/2021	13:44	53.8	37.9
14/05/2021	13:59	49.9	40.0
14/05/2021	14:14	49.7	40.7
03/06/2021	13:33	48.7	39.0
03/06/2021	13:48	50.3	39.0
03/06/2021	14:03	52.0	42.2
03/06/2021	14:18	41.3	42.6
03/06/2021	14:33	49.3	39.2
03/06/2021	14:48	47.7	39.6
05/06/2021	12:23	48.8	39.9
05/06/2021	12:38	47.3	38.3
05/06/2021	12:53	51.2	38.2
05/06/2021	13:08	50.5	37.6
05/06/2021	13:23	50.0	35.9
05/06/2021	13:38	48.9	36.4

## **APPENDIX 2 – SOUND LEVEL CALCULATIONS**

### **HGVs and Dump Trucks on Road Through Site**

To provide a reasonable worst case assessment of vehicle sound, it has been assumed that there will be ten movements of HGVs and ten movements of dump trucks through the site from the entrance to the extremities of working. These movements have been predicted using the haul road equation given in BS 5228 (below). In addition to this, 30 minutes per hour of slow speed dump truck manoeuvring at the location of the restoration activity have been added to the predictions, based on direct measurements of this activity at a different quarry site.

$$LA_{eq} = L_{WA} - 33 + 10 \log Q - 10 \log V - 10 \log d + 10 \log (a/180) \text{ dB}$$

where V= average speed in km/h

Q = hourly vehicle rate

d = distance from haul road to receiver

a = the angle of view of the haul road from the dwelling.

The other parameters have been determined using online mapping data.

#### **Predictions from HGV Movements**

	Farm to North	Dwelling to North East	Pinfold Lane	West End Gardens
LWA	107	107	107	107
Q (no. movements per hour)	10	10	10	10
V, kmh	16	16	16	16
d (distance)	155	240	100	120
a (angle of view)	45	40	80	80
Shielding	10	10	10	10
LAeq	34.0	31.6	38.4	37.6

#### **Predictions from Dump Truck Movements**

	Farm to North	Dwelling to North East	Pinfold Lane	West End Gardens
LWA	110	110	110	110
Q (no. movements per hour)	10	10	10	10
V, kmh	16	16	16	16
d (distance)	155	240	100	120
a (angle of view)	45	40	80	80
Shielding	10	10	10	10
LAeq	37.0	34.6	41.4	40.6



## Source Levels

### Third Octaves

#### Sound Pressure Levels, dB Linear

Band [Hz]	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
Bulldozer					94			95			87			79			78			75			70			67	
Excavator, 10m	68.8	70.2	85.2	73.5	70.7	71.3	77.7	77.5	69.6	74.2	74.7	81.7	73.4	71.9	71.8	71	68.7	66.5	64.5	64	65.6	64	63.9	61.6	58.1	57.5	49.7
Dump Truck, Manoeuvring	66.8	78.2	73	70.8	71.4	70.8	64.9	66.1	73.4	74	67.4	68.3	68	65.4	66.1	68.5	68.9	67.4	64.2	63.5	61.1	60.2	59.7	57.9	57.3	56.7	53.4

### dBA and Octaves

#### Sound Pressure Levels, Overall dBA and dB Linear Spectra

	dBA	31.5	63	125	250	500	1000	2000	4000	8000
Bulldozer	86		94	95	87	79	78	75	70	67
Excavator, 10m	80	85.4	76.8	80.9	83.1	77.2	73.9	69.5	68.1	61.1
Dump Truck, Manoeuvring	76.4	79.6	75.8	74.6	75.7	71.4	73.1	67.9	64.1	60.9

### Assessment of Tones at Source

The objective method for determination of tones is shown below where third octave data is available.

Excavator, 10m	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
Source Level	85.2	73.5	70.7	71.3	77.7	77.5	69.6	74.2	74.7	81.7	73.4	71.9	71.8	71	68.7	66.5	64.5	64	65.6	64	63.9	61.6	58.1	57.5	49.7	
Diff to band lower		11.7	2.8	0.6	6.4	0.2	7.9	4.6	0.5	7.0	8.3	1.5	0.1	0.8	2.3	2.2	2.0	0.5	1.6	1.6	0.1	2.3	3.5	0.6		
Diff to band higher		2.8	0.6	6.4	0.2	7.9	4.6	0.5	7.0	8.3	1.5	0.1	0.8	2.3	2.2	2.0	0.5	1.6	1.6	0.1	2.3	3.5	0.6	7.8		
Tone?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	

Dump Truck, Manoeuvring	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
Source Level	73	70.8	71.4	70.8	64.9	66.1	73.4	74	67.4	68.3	68	65.4	66.1	68.5	68.9	67.4	64.2	63.5	61.1	60.2	59.7	57.9	57.3	56.7	53.4	
Diff to band lower		2.2	0.6	0.6	5.9	1.2	7.3	0.6	6.6	0.9	0.3	2.6	0.7	2.4	0.4	1.5	3.2	0.7	2.4	0.9	0.5	1.8	0.6	0.6		
Diff to band higher		0.6	0.6	5.9	1.2	7.3	0.6	6.6	0.9	0.3	2.6	0.7	2.4	0.4	1.5	3.2	0.7	2.4	0.9	0.5	1.8	0.6	0.6	3.3		
Tone?		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	

## Calculations at Dwellings

Dwelling	Min Distance (m)	Max Distance (m)	Grid Reference	Elevation (m)
Farm to North	130	320	SE 61188 20320	12
Dwelling to North East	40	400	SE 61490 20128	13
Pinfold Lane	35	260	SE 61324 19934	7
West End Gardens	45	300	SE 61270 19906	8

Calculations are undertaken for specific levels of each item of equipment at each dwelling and then added together on a logarithmic basis.

The predictions at each dwelling are shown in the tables overleaf for when operations are at their closest, furthest point and typical areas from each dwelling.

Time averaging is undertaken using the formula  $\text{Time correction} = 10 * \log ( T / 60 )$  Where T = on time in minutes

Distance decay is undertaken using the principle of Rathe:  $\text{Distance Decay} = 20 * \log (\text{distance ratio})$  for distances greater than the major dimension of the source / pi. Since some of the intervening ground between source and receiver is soft, use of this equation is likely to be conservative

Barrier attenuation is the 10 dB given in BS 5228 for where line of sight between source and receptor is entirely broken. Cross-sectional plans and spectral data is not available for the frequency dependent method of Maekawa. In this instance, due to the high sides of the quarry, it is likely that the value given in BS 5228 will be conservative for the majority of the time.

#### Farm to North Close

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	130	22.28		53.7
Excavator, 10m	80	0		60	0		10		10	130	22.28		47.7
Dump Truck, Manoeuvring	76.4	0		30	3.01		10		10	130	22.28		41.1

#### Dwelling to North East Close

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	40	12.04		64
Excavator, 10m	80	0		60	0		10		10	40	12.04		58
Dump Truck, Manoeuvring	76.4	0		30	3.01		10		10	40	12.04		51.3

#### Pinfold Lane Close

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	35	10.88		65.1
Excavator, 10m	80	0		60	0		10		10	35	10.88		59.1
Dump Truck, Manoeuvring	76.4	0		30	3.01		10		10	35	10.88		52.5

#### West End Gardens Close

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	45	13.06		62.9
Excavator, 10m	80	0		60	0		10		10	45	13.06		56.9
Dump Truck, Manoeuvring	76.4	0		30	3.01		10		10	45	13.06		50.3

#### Farm to North Typical

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	250	27.96		48
Excavator, 10m	80	0		30	3.01		10		10	250	27.96		39
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	250	27.96		38.4

### Dwelling to North East Typical

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	230	27.23		48.8
Excavator, 10m	80	0		30	3.01		10		10	230	27.23		39.8
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	230	27.23		39.2

### Pinfold Lane Typical

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	130	22.28		53.7
Excavator, 10m	80	0		30	3.01		10		10	130	22.28		44.7
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	130	22.28		44.1

### West End Gardens, Typical

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	160	24.08		51.9
Excavator, 10m	80	0		30	3.01		10		10	160	24.08		42.9
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	160	24.08		42.3

### Farm to North Far

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	320	30.10		45.9
Excavator, 10m	80	0		30	3.01		10		10	320	30.10		36.9
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	320	30.10		36.3

### Dwelling to North East Far

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	400	32.04		44
Excavator, 10m	80	0		30	3.01		10		10	400	32.04		34.9
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	400	32.04		34.4

### Pinfold Lane Far

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	260	28.30		47.7
Excavator, 10m	80	0		30	3.01		10		10	260	28.30		38.7
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	260	28.30		38.1

**West End Gardens, Far**

Description	LAeq	LAFmax		Mins used in 1 hr	Time Correction		Barrier Effect		Meas. distance	Receptor distance	Decay		Specific Level at receptor
Bulldozer	86	0		60	0		10		10	300	29.54		46.5
Excavator, 10m	80	0		30	3.01		10		10	300	29.54		37.4
Dump Truck, Manoeuvring	76.4	0		60	0		10		10	300	29.54		36.9

**Specific Sound Levels**

The overall specific sound levels at the nearest receptors from all sources combined at their closest, furthest and typical points are:

Dwelling	Close	Typical	Far
Farm to North	55.0	49.3	47.5
Dwelling to North East	65.2	49.9	45.5
Pinfold Lane	66.3	54.9	49.7
West End Gardens	64.1	53.2	48.6