DRAGONFLY

CONSULTING

Opus Land (North) Ltd

Interchange 26, Cleckheaton

Noise Impact Assessment

DC3229-R1

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This report has been prepared by Dragonfly Consulting with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client.

Dragonfly Consulting disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Limitations to this Report

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

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

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

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List of Appendices

1.0 INTRODUCTION

Opus Land (North) Ltd has appointed Dragonfly Consulting to carry out a Noise Impact Assessment in support of their proposed commercial development at Interchange 26 near Cleckheaton.

The noise assessment has been conducted with reference to the National Planning Policy Framework and the requirements of the extant planning conditions for the site.

This report therefore describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria. Recommendations are also made with respect to the design of the development.

Measurements of external noise levels have been conducted at the proposed development to allow demonstration by calculation that suitable noise levels will be achieved at the nearest Noise Sensitive Receptors (NSRs).

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Appendix A.

2.0 SITE DESCRIPTION

2.1 Existing Site Conditions

The current site consists of a former wastewater treatment works and open grassland. This former wastewater treatment works can be accessed off of Cliff Hollins Road.

The grounds sit below the road level of the M606. It slopes from east to west away from the M606 and North to South towards the M62 and Cleckheaton beyond.

Residential buildings are situated North and West of the former wastewater treatment works.

2.2 Proposed Site Conditions

The Client proposes to turn the land into two industrial units of class B1(c) and B2. The industrial units are set to be open 24 hours, this means that plant items and equipment could be operating on a 24-hour basis. HGVs may also be arriving and leaving throughout the night time period.

3.0 GUIDANCE

3.1 Consultation with Local Authority

Conditions 28 and 29 of the extant planning permission (planning ref. 2016/60/92298/E) state that:

"The combined noise from all fixed mechanical services and external plant and equipment at any individual unit on the site shall be effectively controlled so that the combined rating level of noise from all such equipment does not exceed 5dB below the background sound level at any time ("rating level" and "background sound level" are as defined in BS4142:2014)…

…Detailed plans and particulars of the reserved matter (layout & landscape) pursuant to condition nos. 1 and 2 above, shall demonstrate how proposals will achieve a level of 5dB attenuation measures through the provision of screening and land features as predicted in Table 21 of the Noise & Vibration Report by AECOM, dated December 2017. Thereafter the development shall be completed in accordance with the approved details, before occupation of any building on site or in agreement with a phasing of the development to which the buildings relate to and thereafter retained."

Summaries of the relevant standards are given below.

3.2 BS7445-1:2003

The assessment of noise impact for this development has been undertaken by measuring external noise levels in accordance with the guidance detailed in BS7445-1:2003 – *Description and Measurement of Environmental Noise – Part 1: Guide to Quantities and Procedures*.

This document defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.

The methods and procedures described in this British Standard are intended to be applicable to sounds from all sources, individually and in combination, which contribute to the total noise at a site. This British Standard does not specify limits for environmental noise.

3.3 British Standard 4142

British Standard 4142:2014 – *Methods for rating and assessing industrial and commercial sound*. This new edition of BS4142 clarifies the application of the standard and introduces the consideration of uncertainty as part of the assessment methodology. The standard provides a method for rating and assessing sound of an industrial or commercial nature, including:

- Sound from industrial and manufacturing process;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises;
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as from FLTs or that from train or ship movements on or around an industrial/commercial site.

The standard is intended for use for both the assessment of complaints and the assessment of the impact of commercial and industrial noise on both new and existing residential developments.

The method described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes at which the sound is incident. The standard specifically excludes itself for the use of determination of nuisance.

The procedure contained in BS4142 for assessing the likelihood of complaint requires the calculation of the noise level from the source to be assessed at a location immediately outside the relevant dwelling; this is described as the 'specific sound level'. Where the specific noise source already exists, its noise level can be derived by measuring the total noise present, or 'ambient noise', and subtracting from it the noise from sources that are not under consideration. Noises not under consideration are called the 'residual noise'.

A 'rating level' is then calculated from the specific sound level. The rating level is then compared with the measured background noise level at that measurement location. If the specific noise source does not yet exist but the details of the intended plant are known, the specific sound level can be derived from first principles using manufacturers' and other data.

The specific, ambient and residual noise levels are measured in terms of $L_{Aeq,T}$ values and the background noise level is measured in terms of an L_{A90} value.

BS4142 considers that certain acoustic features can increase impact of a new noise source over that expected from a simple comparison between the specific noise level and the background noise level. These features can be assessed in one of three ways:

- Objective method - comparing adjoining third octave band noise levels (if available) for the sound source;
- The reference method by analysing measured plant noise levels using the Joint Nordic method;
- Using the prescribed subjective methodology.

These features and the penalties applied to calculate a rating level when assessing subjectively as defined by BS4142 are as follows:

- Tonality – For sound ranging from not tonal to prominently tonal, the Joint Nordic Method gives a correction of between 0 and +6dB for tonality.
    - 2dB for a tone which is just perceptible;
    - 4dB where it is clearly perceptible;
    - 6dB where it is highly perceptible.
- Impulsivity – A correction of up to 9dB can be applied for sound that is highly impulsive, considering both the rapidity of change in sound level and the overall change in sound level.
    - 3dB just perceptible impulsivity;

    - 6dB clearly perceptible impulsivity;
    - 9db highly perceptible impulsivity.

- Intermittency – Where the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time period that contain the greatest amount of 'on' time. This can necessitate measuring the specific sound over a number of shorter periods that are in combination less that the reference time interval in total.
    - If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.
- Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive from the residual acoustic environment, a 3dB penalty can be applied.

In order to assess the significance of the impact, the background noise level is subtracted from the rating level. The standard considers that the greater the difference, the greater the significance.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant 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.

The standard goes on to highlight that these values are not absolute. There are a number of factors that should be taken in to account when assessing the impact and significance of the noise including:

- The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low;
- Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night;
- Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts. The margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse;
- The character and level of the residual sound compared to the character and level of the specific sound;

- The sensitivity of the receptor and if the receptor already includes acoustic design features to mitigate noise.

3.4 IEMA Guidelines for Environmental Noise Impact Assessment

The guidelines state that, for any assessment, the noise level threshold and significance statements should be determined by the assessor, based upon the specific evidence and likely subjective response to the noise.

The impact scale adopted in this assessment is shown in Table 3.1 below:

Table 3.1
Impact Scale for Comparison of Future Noise against Existing Noise

Degree of Effect	Effect Descriptor
None / Not Significant	Less than 2.9dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals
Slight	A 3.0 to 4.9dB L_{Aeq} change in sound level at a receptor of some sensitivity
Moderate	A 3.0 to 4.9dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5dB L_{Aeq} change in sound level at a receptor of some sensitivity
Substantial	Greater than 5.0dB L_{Aeq} change in sound level at a noise sensitive receptor or a 5.0 to 9.9dB L_{Aeq} change in sound level at a receptor of great sensitivity to noise
Very Substantial	Greater than 10.0dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise

The criteria above reflect key benchmarks that relate to human perception of sound. A change of 3dB(A) is generally considered to be the smallest change in noise that is perceptible. A 10dB(A) change in noise represents a doubling or halving of the noise level.

It is considered that the criteria specified in the above table do provide a good indication as to the likely significance of changes in noise levels in this case. Therefore, the above noise threshold levels and significance statements have been used to supplement the criteria provided by the British Standard in order to assess the impact on a listener.

4.0 ENVIRONMENTAL NOISE SURVEY

Daytime and night-time measurements were undertaken from 12th to 13th November 2019. The noise measurements established typical external ambient and background noise levels at the site.

4.1 Survey Methodology

The equipment used during the survey is detailed in Appendix B. The sound level meters were calibrated before and after the measurements and no significant calibration drifts were found to have occurred (>0.2dB). All of the noise monitoring equipment had been calibrated to a traceable standard within the twelve months preceding the survey. Calibration certificates are available on request.

Two measurement locations were surveyed in order to establish the typical ambient and background noise levels at the proposed development site. The measurement locations are hereby referred to in this report as follows:

- 'Location 1' – sound level meter positioned approximately 1.5m from the ground on Bradford road near NSR1;
- 'Location 2' – sound level meter positioned approximately 1.5m from the ground on Cliff Hollins Lane near NSR2.

The measurement locations are shown in Appendix C.

4.2 Survey Results

The weather during the attended survey was suitable for the noise measurements, it being dry with low wind speeds.

Summaries of the measured noise levels are given in Table 4.1 below and these are set out in full in Appendix D.

Table 4.1
Summary of Measured Noise Levels – 12/11/19 to 13/11/19 – free field, dB

Location	Date	Period	Time (h)	$L_{Aeq,T}$	L_{A10}	L_{A90}	L_{AFMax}
1	12/11/19	Daytime	2150-2300	61.6	64.1	57.1	69.6
	12/11/19-13/11/19	Night-Time	2300-0210	57.6	60.6	49.3	73.9
2	12/11/19	Daytime	2200-2300	72.0	72.7	66.5	85.3
	12/11/19-13/11/19	Night-Time	2300-0214	68.9	67.0	59.9	83.2

4.3 Observations and Comments

The noise environment at both locations is characterised as being predominantly noise from road traffic travelling along the M606 and wider road network including the M62.

For both the daytime and night-time assessments, it is considered that the levels measured are representative of the typical acoustic environment at the survey location.

5.0 ASSESSMENT

5.1 Assessment of Noise from Fixed Plant

Condition 28 of the extant planning permission states that:

"The combined noise from all fixed mechanical services and external plant and equipment at any individual unit on the site shall be effectively controlled so that the combined rating level of noise from all such equipment does not exceed 5dB below the background sound level at any time ("rating level" and "background sound level" are as defined in BS4142:2014."

In the absence of detailed information regarding the plant items, the potential impact has been assessed by providing a maximum allowable noise limit at source in accordance with the requirements of BS4142.

The background noise levels for the 1-hour period (daytime) and 15-minute period (night-time) with the lowest measured L_{A90} throughout the survey have been used in the calculations. These periods are as follows:

- For the assessment of plant operating during the daytime period (0700h-2300h):
    - 'Location 1' $L_{A90,1hr}$ – 57.1 dB(A) – 12/11/19 (2155h-2255h)
    - 'Location 2' $L_{A90,1hr}$ – 66.5 dB(A) – 12/11/19 (2200h-2300h)
- For the assessment of plant operating during the night-time period (2300h-0700h):
    - 'Location 1' $L_{A90,15min}$ – 44.1 dB(A) – 13/11/19 (0125h-0140h).
    - 'Location 2' $L_{A90,15min}$ – 47.3 dB(A) – 13/11/19 (0110h-0125h)

It is considered that the use of the lowest measured noise level in any 1-hour period before 2300h and any 15-minute period after 2300h represents a worst-case scenario for this site.

When calculating the rating level, there are four correction types that can be considered. They are:

- Tonality;
- Impulsivity;
- Intermittency;
- Specific noise readily distinctive from the residual environment.

As there is currently insufficient detail available as to the type, size and exact location of the fixed plant, it is not considered possible to accurately apply character corrections to the specific level in order to calculate a rating level at the nearest NSRs.

As such, limits will be provided for the maximum allowable rating levels at the nearest boundaries of the proposed site, based on the measured background levels. When assessing the suitability of future plant installations against these limits, the predicted rating level limit would incorporate any character corrections that may apply to particular plant items.

As it is considered that plant will be operating from two separate sources (Unit 1 and Unit 2), Dragonfly Consulting has provided a 3dB correction to ensure that noise from both sources does not generate a combined level greater than 5dB below the lowest background level. Unit A is the larger of the two units to the west of the site, and Unit B is the smaller of the two units closest to the M606.

The nearest NSRs and their respective distances from the proposed site boundary are shown in Table 5.1. Distance correction has been calculated using standard point-source formulae with no consideration for directivity or order reflections:

Table 5.1
Distance Attenuation from Proposed Sites to NSRs

NSR	Unit	Distance, m	Distance Correction, dB
1	A	120	-49.6
	B	345	-58.8
2	A	200	-54.0
	B	352	-58.9

The noise level limits shown below in Tables 5.2 to 5.9 are based on not exceeding the adopted noise level criterion of 5dB above background noise level, whilst accounting for the 3dB correction for two homogenous noise sources:

Table 5.2
Rating Level Limit at NSR1 in dB(A) – Daytime – Unit A

Lowest Measured $L_{A90,1hr}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR1 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
57.1	-3.0	49.1	-49.6	98.7

Table 5.3
Rating Level Limit at NSR1 in dB(A) – Night Time – Unit A

Lowest Measured $L_{A90,15min}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR1 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
44.1	-3.0	36.1	-49.6	85.7

Table 5.4
Rating Level Limit at NSR1 in dB(A) – Daytime – Unit B

Lowest Measured $L_{A90,1hr}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR1 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
57.1	-3.0	49.1	-58.8	107.9

Table 5.5
Rating Level Limit at NSR1 in dB(A) – Night Time – Unit B

Lowest Measured $L_{A90,15min}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR1 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
44.1	-3.0	36.1	-58.8	94.9

Table 5.6
Rating Level Limit at NSR2 in dB(A) – Daytime – Unit A

Lowest Measured $L_{A90,1hr}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR2 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
66.5	-3.0	58.5	-54.0	112.5

Table 5.7
Rating Level Limit at NSR2 in dB(A) – Night Time – Unit A

Lowest Measured $L_{A90,15min}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR2 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
47.3	-3.0	39.3	-54.0	93.3

Table 5.8
Rating Level at NSR2 Limit in dB(A) – Daytime – Unit B

Lowest Measured $L_{A90,1hr}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR2 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
66.5	-3.0	58.5	-58.9	117.4

Table 5.9
Rating Level at NSR2 Limit in dB(A) – Night Time – Unit B

Lowest Measured $L_{A90,15min}$	Correction for Homogenous Sources	Maximum Permissible Rating Level at NSR2 (dB)	Distance Correction (dB)	Maximum Permissible Rating Level at Source (dB)
47.3	-3.0	39.3	-58.9	98.2

Table 5.2 shows that, using the adopted criteria for any plant items in operation at Unit A during the Daytime period (0700h-2300h), a maximum plant level of 98.7dB(A) would meet the criteria set out by Condition 28.

Table 5.3 shows that, using the adopted criteria for any plant items in operation at Unit A during the Night Time period (2300h-0700h), a maximum plant level of 85.7dB(A) would meet the criteria set out by Condition 28.

Table 5.4 shows that, using the adopted criteria for any plant items in operation at Unit B during the Daytime period (0700h-2300h), a maximum plant level of 107.9dB(A) would meet the criteria set out by Condition 28.

Table 5.5 shows that, using the adopted criteria for any plant items in operation at Unit B during the Night Time period (2300h-0700h), a maximum plant level of 94.9dB(A) would meet the criteria set out by Condition 28.

Table 5.6 shows that, using the adopted criteria for any plant items in operation at Unit A during the Daytime period (0700h-2300h), a maximum plant level of 112.5dB(A) would meet the criteria set out by Condition 28.

Table 5.7 shows that, using the adopted criteria for any plant items in operation at Unit A during the Night Time period (2300h-0700h), a maximum plant level of 93.3dB(A) would meet the criteria set out in Condition 28.

Table 5.8 shows that, using the adopted criteria for any plant items in operation at Unit B during the Daytime period (0700h-2300h), a maximum plant level of 117.4dB(A) would meet the criteria set out by Condition 28.

Table 5.9 shows that, using the adopted criteria for any plant items in operation at Unit B during the Night Time period (2300h-0700h), a maximum plant level of 98.2dB(A) would meet the criteria set out by Condition 28.

5.2 Assessment of Barrier Attenuation

Condition 29 states that:

"Detailed plans and particulars of the reserved matter (layout & landscape) pursuant to condition nos. 1 and 2 above, shall demonstrate how proposals will achieve a level of 5dB attenuation measures through the provision of screening and land features as predicted in Table 21 of the Noise and Vibration report by AECOM, dated December 2017. Thereafter the development shall be completed in accordance with the approved details, before occupation of any building on site or in agreement with a phasing of the development to which the buildings relate to and thereafter retained."

A noise model of the proposed development has been generated using noise mapping software CadnaA by DataKustik.

The assessment incorporates the existing topography, road network and elevation and includes relevant information regarding the proposed development, such as the terrace area and proposed barriers. This information has been taken from information provided by the client.

Further to this, an additional model has been generated with the above parameters but with the topographical data removed i.e. based on a flat site.

The CadnaA plots are shown in Figures 5.1 and 5.2 overleaf:

Figure 5.1
CadnaA Grid of Interchange 26 with no Topography

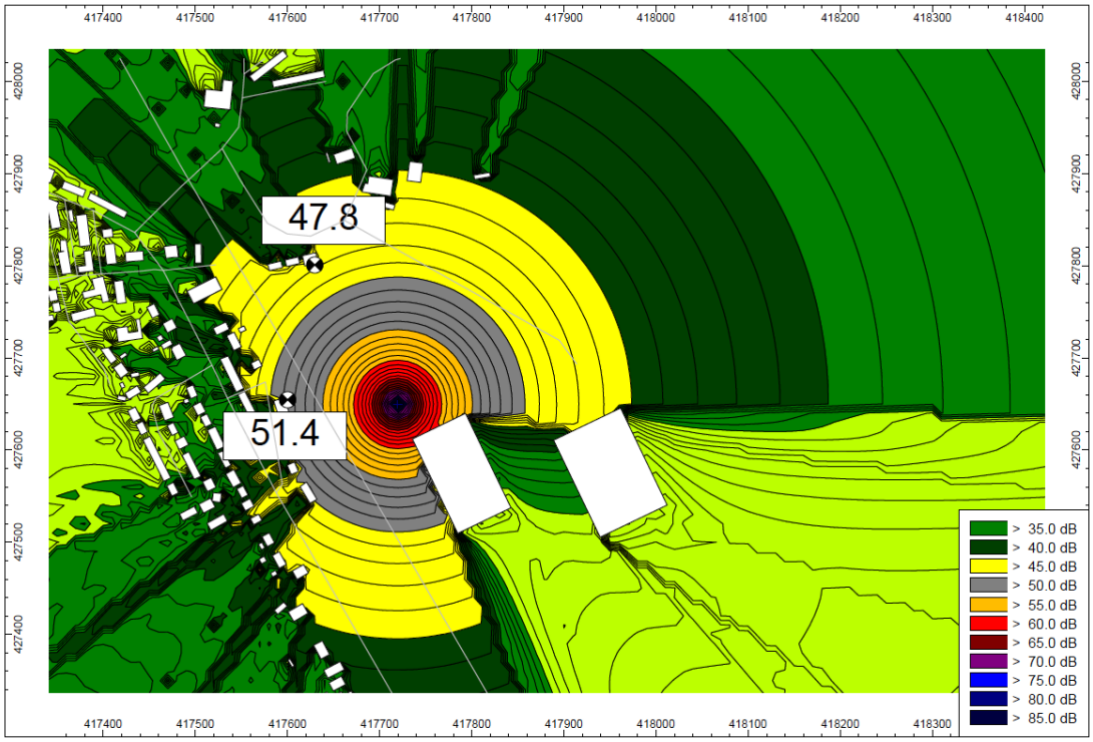

Figure 5.2
CadnaA Grid of Interchange 26 with Topography

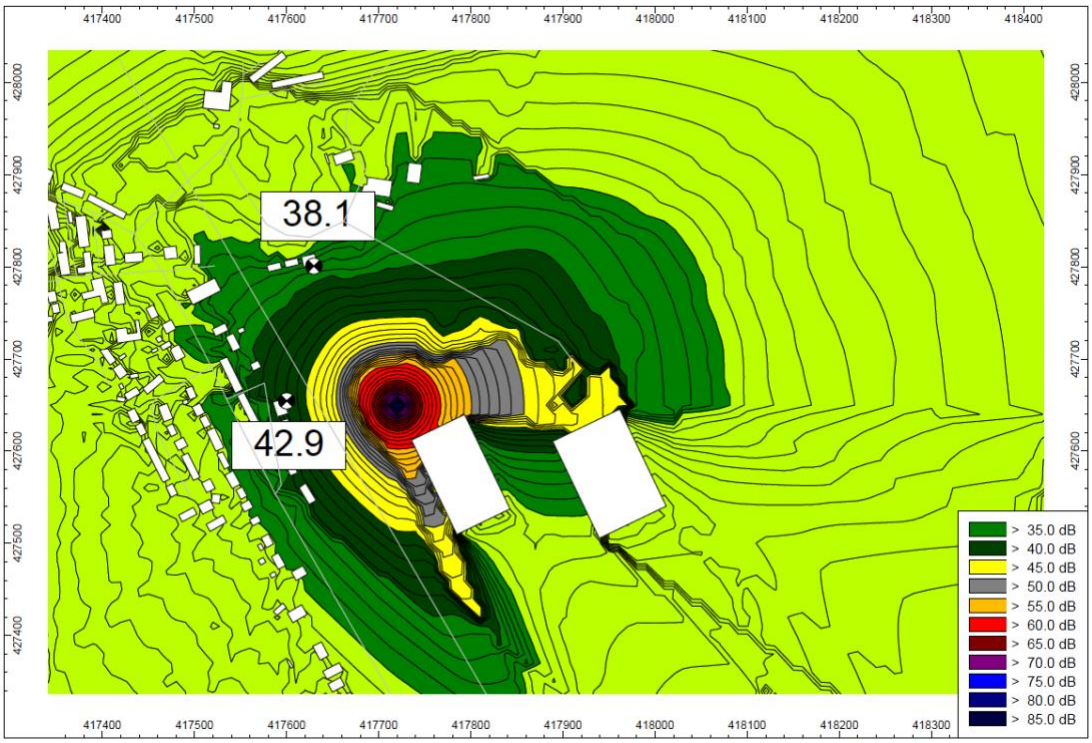

Table 5.10 provides a comparison between the resultant noise levels at each receptor, based on a nominal sound power level of 105dB L_{WA}:

Table 5.10
Effect of Land Features and Topography on Noise Attenuation

NSR	Sound Power Level L_{WA} (dB)	Distance to Receptor (m)	CadnaA predicted sound pressure level at NSRs (dB)		Difference (dB)
			No Topographical Data	With Topographical Data	
1	105	120	51.4	42.6	-8.8
2	105	175	47.8	38.1	-9.7

Table 5.10 shows that the inclusion of topographical data provides an additional 8.8dB attenuation between the proposed site and NSR1 when compared to the flat model.

Table 5.10 also shows that the inclusion of topographical data provides an additional 9.7dB attenuation between the proposed site and NSR2 when compared to the flat model.

It is therefore considered that the topography of the existing site provides a suitable amount of attenuation to satisfy the requirements of Condition 29 without the need for further mitigation measures to be implemented.

5.3 Uncertainty of the Assessment

Following current good practice, an appraisal of the uncertainty within both the on-site noise survey and the prediction calculations has been completed.

The following negative factors have been noted in considering the uncertainty of the on-site noise survey:

- Sound level meter located at head height level for NSRs.

The following positive factors have been noted in considering the uncertainty of the on-site noise survey:

- Low winds and no precipitation.

As such, it is considered that the uncertainty for the on-site noise survey element of the work is ±2dB. Uncertainty for the prediction elements of the work has been considered in line with the normal use of ISO9613 based point source propagation calculations and is predicted at ±3dB.

Utilising the root sum of squares method, this gives a combined uncertainty for this assessment of approximately ±4dB.

5.4 Assertion of Competence

This assessment has been completed by Bailey Hoare, Acoustic Consultant with responsibilities for completing acoustic reports on behalf of Dragonfly Consulting.

I hold a Bachelor of Science in Environmental Science, with Honours, from the University of Exeter.

The assessment has also been undertaken with the oversight of Daniel Vallis, Senior Acoustic Consultant at Dragonfly Consulting.

I hold a Bachelor of Science degree in Music Technology from The University of York and the Institute of Acoustics Diploma in Acoustics and Noise Control. I have over five years of professional experience within the field of acoustics and I am a Corporate Member of the Institute of Acoustics.

I have completed a number of assessments under BS4142:2014 and I assert that I am competent to undertake this assessment under the requirements of BS4142:2014.

6.0 CONCLUSIONS

Opus Land (North) Ltd has appointed Dragonfly Consulting to carry out a Noise Impact Assessment for a proposed commercial development at Interchange 26 near Cleckheaton.

The noise assessment has been conducted in accordance with the National Planning Policy Framework.

This report therefore describes a noise survey of the site and the subsequent analysis to determine the noise environment of the proposed development. It then compares the results with the adopted criteria. Recommendations are also made with respect to the design of the development.

Measurement of external noise levels have been completed for the proposed development to allow demonstration by calculation that suitable noise levels will be achieved at the façade of the most noise exposed dwellings.

6.1 Assessment of Noise from Fixed Plant

The assessment has shown that, using the adopted criteria for any plant items in operation at Units A and B during the Daytime period (0700h-2300h), a maximum plant level of 94.9dB(A) would meet the criteria set out in Condition 28.

The assessment has shown that, using the adopted criteria for any plant items in operation at Units A and B during the Night Time period (2300h-0700h), a maximum plant level of 85.7dB(A) would meet the criteria set out in Condition 28.

It is the opinion of Dragonfly Consulting that the above noise levels would be acceptable within this assessment.

6.2 Assessment of Barrier Attenuation

The assessment shows that the inclusion of topographical data provides an additional 8.8dB attenuation between the proposed site and NSR1 when compared to the flat model.

The assessment also shows that the inclusion of topographical data provides an additional 9.7dB attenuation between the proposed site and NSR2 when compared to the flat model.

It is therefore considered that the topography of the existing site provides a suitable amount of attenuation to satisfy the requirements of Condition 29 without the need for further mitigation measures to be implemented.

Appendix A – Glossary of Terminology

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

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

Table A-1
Sound Levels Commonly Found in the Environment

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

Acoustic Terminology

dB (decibel) The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$Pa).

dB(A) A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq} This is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.

L_{10} & L_{90} If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background level. It is common practice to use the L_{10} index to describe traffic noise.

L_{AMax} This is the maximum A-weighted sound pressure level recorded over the period stated. L_{AMax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment.

Appendix B – Monitoring Equipment

Table B-1
Noise Monitoring Equipment

Equipment	Serial Number
01dB Cube Sound Level Meter	10889
G.R.A.S 40CD Microphone	233511
01dB PRE22N Preamplifier	11071
01dB Fusion Sound Level Meter	11860
G.R.A.S 40CD Microphone	331802
01dB PRE22N Preamplifier	1707207
Castle GA607 Acoustic Calibrator	039063

Appendix C – Measurement Locations

Figure C-1
Measurement Location Plan

Measurement Locations

Noise Sensitive Receptors

Development Site

Appendix D – Full Survey Results

Table D-1
Full Survey Data – Location 1 – 12/11/19 to 13/11/19 – free-field, dB

Start Time (h)	Duration	L_{Aeq}	L_{A10}	L_{A90}	L_{AFMax}
21:50	5 Minutes	61.4	63.6	57.5	65.7
21:55	5 Minutes	61.6	64.1	57.9	67.0
22:00	5 Minutes	62.1	64.6	58.1	68.6
22:05	5 Minutes	61.9	64.1	57.8	67.7
22:10	5 Minutes	63.0	65.1	58.3	67.6
22:15	5 Minutes	62.2	64.6	57.6	69.6
22:20	5 Minutes	61.9	64.4	58.0	65.9
22:25	5 Minutes	61.9	64.2	58.2	67.1
22:30	5 Minutes	60.7	63.6	56.2	65.8
22:35	5 Minutes	60.6	63.3	56.0	66.2
22:40	5 Minutes	61.3	63.9	57.4	67.3
22:45	5 Minutes	60.8	63.8	55.5	66.9
22:50	5 Minutes	61.0	64.0	55.4	67.5
22:55	5 Minutes	60.8	63.7	55.5	68.8
23:00	5 Minutes	60.2	63.2	53.7	68.2
23:05	5 Minutes	59.1	61.6	54.9	66.4
23:10	5 Minutes	60.9	63.6	55.7	67.5
23:15	5 Minutes	60.5	63.4	55.6	66.7
23:20	5 Minutes	60.3	63.3	56.2	66.4
23:25	5 Minutes	59.4	62.5	52.6	67.8
23:30	5 Minutes	58.9	62.4	52.6	67.4
23:35	5 Minutes	58.9	61.2	51.9	67.1
23:40	5 Minutes	58.7	62.1	52.2	65.0
23:45	5 Minutes	57.7	60.6	51.8	64.1
23:50	5 Minutes	58.2	61.6	51.6	65.3
23:55	5 Minutes	59.5	63.2	50.7	67.6
00:00	5 Minutes	59.5	61.9	52.8	73.9
00:05	5 Minutes	57.9	61.1	51.6	65.1
00:10	5 Minutes	58.1	61.8	51.7	67.2
00:15	5 Minutes	57.7	60.6	52.0	69.8
00:20	5 Minutes	57.1	60.6	50.0	65.7
00:25	5 Minutes	58.4	61.9	45.6	67.7
00:30	5 Minutes	57.0	60.5	48.1	67.6
00:35	5 Minutes	57.4	59.6	51.7	67.6
00:40	5 Minutes	57.3	60.2	50.2	67.0
00:45	5 Minutes	56.8	59.3	50.5	69.8
00:50	5 Minutes	56.3	60.3	49.8	63.5
00:55	5 Minutes	55.7	57.9	47.0	68.4
01:00	5 Minutes	54.8	58.2	46.5	65.3
01:05	5 Minutes	55.7	59.6	47.0	65.4
01:10	5 Minutes	55.8	59.6	46.8	67.1
01:15	5 Minutes	57.2	61.0	48.0	67.4
01:20	5 Minutes	55.4	59.0	45.0	65.9
01:25	5 Minutes	54.6	58.9	42.3	66.6
01:30	5 Minutes	54.5	57.9	45.2	68.6

Start Time (h)	Duration	L_{Aeq}	L_{A10}	L_{A90}	L_{AFMax}
01:35	5 Minutes	55.6	59.5	44.2	67.2
01:40	5 Minutes	55.5	59.4	46.3	64.7
01:45	5 Minutes	55.5	59.8	44.4	66.2
01:50	5 Minutes	55.8	59.3	44.5	65.8
01:55	5 Minutes	55.2	58.8	43.9	67.0
02:00	5 Minutes	54.9	58.5	44.7	67.2
02:05	5 Minutes	53.6	57.0	44.6	64.9
02:10	5 Minutes	56.5	60.7	47.1	65.2

Table D-2
Full Survey Data – Location 2 – 12/11/19 to 13/11/19 – free-field, dB

Start Time (h)	Duration	L_{Aeq}	L_{A10}	L_{A90}	L_{AFMax}
21:49	5 Minutes	72.6	75.2	67.8	76.4
21:54	5 Minutes	72.0	75.3	64.0	78.8
21:59	5 Minutes	71.9	75.4	64.1	78.8
22:04	5 Minutes	72.4	75.8	63.2	81.2
22:09	5 Minutes	72.8	76.2	65.4	82.4
22:14	5 Minutes	72.5	76.2	64.3	79.8
22:19	5 Minutes	72.1	75.9	64.5	81.4
22:24	5 Minutes	72.3	76.3	63.0	80.1
22:29	5 Minutes	71.0	74.8	61.2	79.5
22:34	5 Minutes	71.7	75.5	62.0	78.9
22:39	5 Minutes	72.0	75.6	62.8	85.3
22:44	5 Minutes	71.3	74.9	62.9	78.7
22:49	5 Minutes	71.5	75.3	62.7	81.2
22:54	5 Minutes	71.6	75.5	60.0	79.4
22:59	5 Minutes	71.5	75.5	61.0	80.4
23:04	5 Minutes	71.1	75.1	62.2	79.5
23:09	5 Minutes	72.1	75.9	62.9	79.7
23:14	5 Minutes	71.8	75.7	61.2	80.5
23:19	5 Minutes	71.5	75.4	59.3	78.8
23:24	5 Minutes	70.5	74.2	58.8	79.3
23:29	5 Minutes	71.3	75.0	58.7	79.9
23:34	5 Minutes	70.7	75.0	57.5	79.1
23:39	5 Minutes	69.5	73.4	57.0	83.2
23:44	5 Minutes	69.7	73.6	59.5	77.9
23:49	5 Minutes	69.9	74.1	58.5	79.6
23:54	5 Minutes	69.3	73.3	56.1	79.5
23:59	5 Minutes	70.0	74.4	58.1	78.2
00:04	5 Minutes	69.5	73.5	59.4	79.4
00:09	5 Minutes	68.2	72.9	55.5	77.8
00:14	5 Minutes	69.6	73.7	58.5	80.1
00:19	5 Minutes	68.5	73.3	55.4	79.6
00:24	5 Minutes	68.8	73.6	50.1	77.7
00:29	5 Minutes	69.0	72.3	57.4	80.3
00:34	5 Minutes	68.8	72.9	54.4	81.3
00:39	5 Minutes	69.1	74.3	55.5	78.6
00:44	5 Minutes	68.1	73.4	53.0	79.1
00:49	5 Minutes	68.1	73.2	52.5	78.3

Start Time (h)	Duration	L_{Aeq}	L_{A10}	L_{A90}	L_{AFMax}
00:54	5 Minutes	65.1	70.0	50.3	76.5
00:59	5 Minutes	67.1	72.9	51.0	79.0
01:04	5 Minutes	68.6	73.2	54.4	79.4
01:09	5 Minutes	66.3	71.5	50.3	76.7
01:14	5 Minutes	68.6	72.7	54.6	80.6
01:19	5 Minutes	66.1	71.1	50.9	76.6
01:24	5 Minutes	65.2	69.5	46.0	77.3
01:29	5 Minutes	67.9	72.9	50.5	82.3
01:34	5 Minutes	66.3	70.5	48.8	81.5
01:39	5 Minutes	66.4	70.0	47.5	80.0
01:44	5 Minutes	65.1	69.0	50.7	79.3
01:49	5 Minutes	67.1	71.2	52.2	78.5
01:54	5 Minutes	65.4	70.3	44.8	78.9
01:59	5 Minutes	65.7	70.3	49.7	78.4
02:04	5 Minutes	67.0	71.4	48.8	79.3
02:09	5 Minutes	66.2	70.2	49.2	79.6
21:14	5 Minutes	58.5	63.1	48.4	67.2