Appendix 2: Noise Assessment

Rowan

Baseline Environmental Noise Survey Report 2021

Hinch Site, Saggart, Co. Dublin

Coffey Constructions Ltd

Client Ref:6613/COF0001-6

This page is intentionally left blank.

Table of Contents

Executive Summary

Writer's Instructions

Rowan Engineering Consultants were contracted by Coffey Construction Ltd to carry out a daytime baseline noise assessment at the Hinch Site in Saggart, Co. Dublin and to determine the expected noise levels arising during the proposed infill activities. During the noise survey, noise levels were recorded at 4 No. Noise Sensitive Location (NSL's).

Conclusion

This conclusion is my professional opinion based on the baseline noise survey carried out at The Hinch Site, Saggart, Co. Dublin on the 18th of May 2021.

Day noise measurements were recorded at 4 No. NSL's at the Hinch site. The daytime LAeq recorded at NSL's ranged between 41.0dB and 67.6.9dB. The LA90 readings ranged between 37.4dB and 50.6dB. Table 13, demonstrates that the noise levels from the proposed Project will be compliant with the relevant daytime noise limits for the site of 55dBLeq,T between 07:00 and 19:00hrs at all NSL's. It is also proposed that the Dump trucks are only permitted to tip the soil and stone in the centre of the site to further reduce noise at the NSL's.

Section 1 Introduction

1.1 Introduction

Rowan Engineering Consultants Ltd were contracted by Coffey Construction Ltd to undertake a daytime baseline noise survey at Hinch site in Saggart, Co. Dublin and to determine the expected noise levels arising during the proposed infill activities. During the noise survey, noise levels were recorded 4 No. NSL's. This report will accompany a planning application for permission for the spreading of soil and stone materials for the benefit of improving the agricultural lands. The volume of material to be placed on the site is c.38,000m^3 over a c.11.7ha site, with an average fill level of c.3m above existing.

This report considers the impacts associated with the importation and insertion of soil and stone into the site and the associated day to day operating activities on the site such as material inspection and operation of wheel wash.

Section 2 Methodology

2.1 Monitoring Locations and Period

In order to assess the surrounding environmental noise levels, a daytime noise survey was conducted on the 18th of May 2021. Following a review of the nearby sensitive receptors, it was considered sufficient to monitor 4 No. Noise Sensitive Locations.

Ian Douglas of Rowan Engineering Consultants undertook all the noise monitoring on the 18th of May 2021. The measurements were taken for 2No. 30 minutes periods at each of the 4No. NSL's. Grid references were taken at each monitoring location and the noise monitoring locations are illustrated on the map in Appendix A.

In order to assess the baseline noise environment at the proposed site, the following criteria was used:

Table 1: Noise monitoring locations, period and duration of monitoring

Noise Monitoring Locations, Period and Duration of Monitoring	
Period	**Survey Duration**
Noise Sensitive Locations	
Daytime (07:00-19:00)	**2 No. consecutive 30-minute sample periods**

2.2 Noise Monitoring Equipment and Calibration

The equipment used during this noise survey was a SVAN 971 Class 1 IEC 61672-1:2013 Sound Level Meter (Serial No. 77617).

The sound level meter was calibrated before the measurements, and its calibration checked after, using a SVANTEK SV33A Class 1 Acoustic Calibrator (Serial No. 79912). No calibration drifts were found to have occurred during surveys.

All noise equipment had been calibrated to a traceable standard by UKAS (United Kingdom Accreditation Service) accredited laboratories within 12 months preceding the surveys.

2.3 Noise Monitoring Standard and Methodology

All measurements were carried out in general accordance with ISO 1996: '*Acoustics- Description and measurement of environmental noise*'. Consultation was also given to the Agency's 2016, *'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'* prior to the noise survey been conducted. The 'Objective method for assessing the audibility of tones in noise' as detailed in Appendix E of ISO 1996-2:2007 was used to assess the 1/3 octave frequency analysis.

In addition to the EPA Guidance Note for Noise, the following methodology has been adopted:

- Review of appropriate guidance in order to identify appropriate noise criteria for the proposed Project;
- Carry out noise monitoring at a number of critical locations (e.g. in the vicinity of the nearest NSL's); and
- Assess the predicted noise levels against the appropriate criteria and existing noise levels and outline required mitigation measures (if any).

Appendix E presents a glossary of the acoustic terminology used in this section.

Appendix F presents an overview of the basic fundamentals of acoustics to assist in the understanding of this report.

Measurements were made placing the microphone at a height of 1.2m above ground level and were free field, measured >3.5m from reflecting surfaces. The measurement results were noted onto survey record sheets immediately following each measurement and also stored in the instrument's internal memory for subsequent analysis, notes were taken in relation to the primary contributors to noise build-up at each location. A 1/3 octave frequency analysis was also carried out.

2.4 Metrological Conditions

Weather conditions during the surveys were in line with the conditions described within ISO 1996, Acoustics 'Description and Measurements of Environmental Noise'. During the daytime survey, the weather was dry and sunny and a light south easterly breeze (1.2 - 3.1m/s), the air temperature was recorded at 12°C.

2.5 Noise Parameters

Environmental noise parameters which were measured are defined below:

Table 2: Environmental Noise Parameters

Noise Parameter	Description
L_{Aeq}	*Is the A-weighted equivalent continuous steady sound level during the measurement period and effectively represents an average ambient noise value.*
L_{A10}	*Is the A-weighted sound level that is exceeded for 10% of the measurement period and is used to quantify road traffic noise.*
L_{A90}	*Is the A-weighted sound level that is exceeded for 90% of the measurement period and is used to quantify background noise level.*
A-weighting	*Is the process by which noise levels are corrected to account for the non-linearity of human hearing. All noise levels quoted are relative to a sound pressure of 2x10-5 Pa.*
Tonal Analysis	*One-third octave band tonal analysis involves the calculation of an averaged noise level to represent the frequencies within each third of an octave. These noise levels are then compared with the noise levels calculated for the adjacent one-third octave bands. The appropriate level differences vary with frequency. They should be greater than or equal to the following values in both adjacent one-third-octave bands to be considered tonal:* • *15dB in low-frequency one-third-octave bands (25Hz to 125Hz);* • *8dB in middle-frequency bands (160Hz to 400Hz) and;* • *5dB in high-frequency bands (500Hz to 10,000Hz).*

Section 3 Legislative Framework

3.1 National/ Regional Legislation or Guidance

Currently, there is no national or regional legislation which specifically addresses the backfilling / infilling of agricultural land voids using imported inert soil and stone. However, there are a number of guidance documents that are relevant in the context of noise action planning.

3.2 Planning Guidelines

The South Dublin County Development Plan 2016-2022 sets out the planned direction for growth and future development in the county. In this document, the flowing noise pollution objectives are identified:

- **IE7 Objective 1:** *To implement the provisions of EU and National legislation on air, light and noise control and other relevant legislative requirements, as appropriate, in conjunction with all relevant stakeholders*;

The above objective relates to the policy of the Council to have regard to European Union, National and Regional policy relating to air quality, light pollution and noise pollution and to seek to take appropriate steps to reduce the effects of air, noise and light pollution on environmental quality and residential amenity. This report aims to demonstrate the potential impacts if any from the proposed project.

3.3 Guidance Note for Noise: Licence Applications, Surveys, and Assessments in Relation to Scheduled Activities (NG4)

The EPA's 2012 '*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*' sets out scope, content, and methodology for scheduled / licensed industrial and waste activities in Ireland.

In accordance with the NG4 guidance, it is necessary to designate the noise environment at each sensitive receptor location as a 'Quiet Area', a 'Low Background Noise Area' or 'Not an Area of Low Background Noise'.

To be categorised as a 'Quiet Area' the following criteria must be met:

- At least 3km from urban areas with a population > 1,000 people;
- At least 10km from any urban areas with a population >5,000 people;
- At least 15km from any urban areas with a population >10,000 people;
- At least 3km from any local industry;
- At least 10km from any major industry centre;
- At least 5km from any National Primary Route; and
- At least 7.5km from any motorway or dual carriageway.

If any of the above criteria are not met, then it is necessary to undertake a baseline noise survey of the existing daytime noise environments in order to establish whether the receptor is located in a 'Low Background Noise Area' or 'Not an Area of Low Background Noise'.

The noise criteria for these designations are shown in Table 3 below. For an area to be designated as an area of low background noise (LAF_{90}), the daytime, evening, and night-time noise limits must all be met.

Table 3: Noise Criteria for Area Designation

Designation	Day $L_{AF\ 90}$ dB	Evening $L_{AF\ 90}$ dB	Night $L_{AF\ 90}$ dB
Low Background Noise Area	≤40	≤35	≤30
Not an Area of Low Background Noise	≥41	≥35	≥31

The procedure outlined in the NG4 Guidance document then sets out a methodology to determine an acceptable noise limit at a receptor location. This noise limit is termed the noise rating level (or $L_{Ar,T}$) and includes, if necessary, a plus 5dB tonal penalty, or a plus 5dB impulsive penalty. If a noise source is both tonal and impulsive however, only one adjustment should be made.

In order to determine whether or not a 5dB tonal penalty should be applied, it is necessary to obtain third octave frequency data of the noise source in question.

The NG4 guidance states that:

'... the time average sound pressure level in the one-third-octave band of interest should exceed the time-average sound pressure levels of both adjacent one third- octave bands by some constant level difference'. 'The appropriate level differences vary with frequency. They should be greater than or equal to the following values in both adjacent one-third-octave bands:

- 15dB in low-frequency one-third-octave bands (25Hz to 125Hz);
- 8dB in middle-frequency bands (160Hz to 400Hz); and
- 5dB in high-frequency bands (500Hz to 10,000Hz).'

In order to determine whether or not a 5dB impulsive penalty should be applied to a noise source, it is necessary to establish whether or not the noise in question may be 'described as something with a thumping, banging or impact noise that is clearly audible above everything else.'

The permitted rating noise level in each designated area is shown in Table 6.2.

Table 4: Permitted Rating Noise Levels

Designation	Daytime Noise Criterion, dB $L_{Ar,T}$ (07:00 to 19:00hrs)	Evening Noise Criterion, dB $L_{Ar,T}$ (19:00 to 23:00hrs)	Night-Time Noise Criterion, dB $L_{Ar,T}$ (23:00 to 07:00hrs)
Quiet Area	Noise from the licensed site to be at least 10dB below the average daytime background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10dB below the average evening background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey.
Areas of Low Background Noise	45.0	40.0	35.0
All other Areas	55.0	50.0	45.0

3.4 British Standard 5228: 2009+A1:2014

British Standard 5228-1:2009+A:2014 Noise and vibration control on construction and open sites, Part 1: Noise (BS5228) sets out a methodology for predicting noise levels arising from a wide variety of construction and related activities. It can be used to predict noise levels arising from the operations of proposed minerals extraction sites. BS5228 also sets out tables of sound power levels generated by a wide variety of mobile equipment.

Noise levels generated by site operations and experienced at local receptors will depend upon a number of variables, the most significant of which are:

- The amount of noise generated by plant and equipment being used at the development site, generally expressed as a sound power level;
- The periods of operation of the plant at the development site, known as the "on-time";
- The distance between the noise source and the receptor, known as the "stand-off";
- The attenuation due to ground absorption or barrier screening effects; and,
- Any reflections of noise due to the presence of hard vertical faces such as walls.

3.5 Guidelines for Noise Impact Assessment (IEMA)

The Guidelines for Noise Impact Assessment produced by the Institute of Environmental Management and Assessment (IEMA) are generally recognised as established good practice standards for scope, content, and methodology of noise impact assessment.

These guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur. These guidelines state that for any assessment, the noise level threshold and significance should be determined by the assessor, based upon the specific evidence and likely subjective response to noise. An example impact scale offered by the IEMA guidelines is shown in Table 6.3

Table 5: Example Impact Scale from the Change in Sound Levels (IEMA)

Long Term Impact Classification	Short Term Impact Classification	Sound Level Change dB LpAeqT (+ive or –ive) T = either 16hr day or 8hr nigh
Negligible	Negligible	≥ 0 dB and < 1 dB
	Minor	≥1 dB and < 3 dB
Minor	Moderate	≥3.0 dB and < 5 dB
Moderate	Major	≥5.0 dB and < 10 dB
Major		≥10.0

The criteria above reflect the key benchmarks that relate to human perception of sound. A change of 3dB is generally considered to be the smallest change in environmental noise that is perceptible to the human ear under most normal conditions. A 10dB change in noise represents a doubling or halving of the noise level. The difference between the minimum perceptible change and the doubling or halving of the noise level is split to provide greater definition to the assessment of changes in noise level.

To determine the overall noise impact, the magnitude and sensitivity Noise Effects Descriptors are presented in Table 6.

Table 6: Noise Effects Descriptors (IEMA)

Very Substantial	Greater than 10 dB LAeq change in sound level perceived at a receptor of great sensitivity to noise.
Substantial	Greater than 5 dB LAeq change in sound level at a noise sensitive receptor, or a 5 to 9.9 dB LAeq change in sound level at a receptor of great sensitivity to noise.
Moderate	A 3 to 4.9 dB LAeq change in a sound level at a sensitive or highly sensitive noise receptor, or a greater than 5 dB LAeq change in sound level at a receptor of some sensitivity.
Slight	A 3 to 2.9 dB LAeq change in a sound level at a receptor of some sensitivity.
None/Not Significant	Less than 2.9 dB LAeq change in sound level and/or all receptors of negligible sensitivity to noise or marginal to the zone of the influence of the proposed development.

As recognised in the IEMA guidance, there are however many factors which affect people's perception and responses to noise. Magnitude of the impact and significance of the effects are presented in Appendix F.

Section 4 Noise Monitoring Results

4.1 Baseline Conditions at Noise Sensitive Locations

The application site comprises of a small agricultural landbank which is to be infilled in low lying areas. The site is located in the townland of Slade, Co. Dublin, on the outskirts of the town of Saggart. The site encompasses approximately 2.2 hectares and is accessed by through agricultural land directly north of the proposed site. This will limit the need for traffic to use the Castle Road and prevent traffic congestion. The site is undulating and has an elevation of approximately 137m Above Ordnance Datum (AOD).

As part of the noise survey, 4 No. noise sensitive location (NSL's) was selected. The location of the NSL's are illustrated on the map in Appendix A and the locations of the proposed fill areas are displayed in Appendix B. The NSL's monitoring were undertaken for 2No. consecutive 30-minute sample periods during the day. The results from the NSL's are provided in Table 4 below and the 1/3 Octave Band Analysis Results can be reviewed in Appendix D.

4.2.1 NSL1 Monitoring Results

The survey results for NSL 1 are summarised in Table 7 below.

Table 7: NSL1 Monitoring Results 18th May 2021

Monitoring Location	Monitoring Period	Tonal/ Impulsive	$L(A)_{eq}$	$L(A)_{10}$	$L(A)_{90}$	$L(A)_{max}$
NSL 1 E303305, N226109	10:34- 11:04	No	48.3	51.5	41.7	66.8
	11:04- 11:34	No	51.4	53.8	42.3	77.8
	Arithmetic Average of L_{Aeq} (dB)				**49.9**	

The L_{Aeq} results were used at NSL 1. During the daytime survey periods, the main sources of noise noted in the area were cars entering and exiting the nursing home and construction traffic in the distance. Daytime noise levels were in the range of 48.3 – 51.4dB L_{Aeq}.

4.2.2 NSL2 Monitoring Results

The survey results for NSL 2 are summarised in Table 8 below.

Table 8: NSL2 Monitoring Results 18th May 2021

Monitoring Location	Monitoring Period	Tonal/ Impulsive	L(A)eq	L(A)10	L(A)90	$L(A)_{max}$
NSL 2 E303359, N225992	11:42-12:12	No	41.0	42.8	37.4	70.4
	12:12-12:42	No	46.4	44.3	37.9	79.6
	Arithmetic Average of L_{Aeq} (dB)				**43.7**	

The L_{Aeq} results were used at NSL 2. During the daytime survey periods, the main sources of noise noted in the area was construction and agricultural traffic and nearby cattle and birds. Daytime noise levels were in the range of 41.0 – 46.4dB L_{Aeq}.

4.2.3 NSL4 Monitoring Results

The survey results for NSL 4 are summarised in Table 9 below.

Table 3: NSL9 Monitoring Results 18th May 2021

Monitoring Location	Monitoring Period	Tonal/ Impulsive	$L(A)_{eq}$	$L(A)_{10}$	$L(A)_{90}$	$L(A)_{Max}$
NSL 4 E303456, N226000	12:49-13:19	No	52.9	54.9	50.6	73.5
	13:19-13:49	No	56.1	57.2	46.1	67.3
	Arithmetic Average of L_{Aeq} (dB)				**54.5**	

The L_{Aeq} results were used at NSL 4. During the daytime survey periods, the main sources of noise noted was construction traffic in the distance. Daytime noise levels were in the range of 52.9 – 56.1dB L_{Aeq}.

4.2.4 NSL5 Monitoring Results

The survey results for NSL 5 are summarised in Table 10 below.

Table 10: NSL5 Monitoring Results 18th May 2021

Monitoring Location	Monitoring Period	Tonal/ Impulsive	$L(A)_{eq}$	$L(A)_{10}$	$L(A)_{90}$	$L(A)_{Max}$
NSL 5 E303423, N226197	14:53-15:23	No	66.4	69.2	46.1	84.0
	15:23-15:53	No	67.6	69.4	47.0	96.2
	Arithmetic Average of L_{A90} (dB)				**46.6**	

The L_{A90} results were used at NSL 5 as they measure the A-weighted sound level that is exceeded for 90% of the measurement period and is used to quantify background noise level. During the daytime survey periods, the main sources of noise noted was construction traffic in the distance. Daytime noise levels were in the range of 66.4 – 67.6dB L_{Aeq}

4.2.5 1/3 Octave

Upon reviewing the 1/3 Octave data gathered at the NSL's 1-5, data demonstrated that there were no tones detected.

Please revert to Appendix D which provides a visual overview of the 1/3 Octave Analysis at the four noise sensitive locations.

4.2.6 Results Discussion

Noise results at NSL1, NSL4 and NSL5 (after been rounded up or down to the nearest whole number) were equal to or above the 41dB LAF90 dB noise criteria for area designation as set out in Table 4 (Noise Criteria for Area Designation).

Therefore, on the basis of the data presented in Tables 7 to 10 above, it is concluded that all locations may be designated as "Not an Area of Low Background Noise" in accordance with standards set out in the EPA's NG4 Guidance and therefore the limits of 55dB during the day as set out in Table 4 shall be deemed applicable for this site.

Section 5 Predicted Impacts

Given the nature of the proposed works at the site, the construction and operational phases have been considered as the one phase/process.

Potential effects that could occur as a result of works from the proposed Project include:

- Noise from increased traffic levels on the public roads;
- Noise from the transport of materials to and from the site;
- Noise as a result of the tipping of material from lorries, and,
- Noise from the levelling of incoming material using a bulldozer.

Noise generation at the site will be intermittent and limited to the hours of operation and the lifetime of the facility.

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. In this instance, in order to assess the potential noise impact from any changes in road traffic, the Design Manual for Roads and Bridges, 2011, was referred to and Table 11 below, offers guidance as to the likely impact associated with a particular change in traffic noise levels.

Table 11: Likely Impacts Associated with Change in Traffic Noise Level

Change in Sound Level (dB LA10)	Subjective Reaction	Magnitude of Impact
<3	Typically, inaudible	Imperceptible
3-5	Perceptible	Slight
6-10	Up to a doubling of loudness	Moderate
11-15	Over a doubling of loudness	Significant
>15		Profound

It is expected that approximately 40 No. vehicles per day will enter the site from the reservoir north of the site and drop fill material.

Prediction calculations for the daily site operations have been conducted generally in accordance with the British Standard 5228-1:2009+A1:2014. Tables 12 & 13 below outlines the proposed plant that will be used on site for the restoration works and illustrates the predicted noise impact from the site activities.

The predictions have been made based on LAeq1hour value with the Dozer and Tracked Excavator listed operating for a continual period of 1 hour and the Articulated Dump Truck operating for a continual period of 5 hours. This may be considered a worst-case scenario, as it assumes all plant and machinery will be running for 100% of the time, while in reality it is unlikely that all plant and machinery would be running simultaneously for any extended period at the site and therefore the noise levels would be expected to be lower.

Table 12: Predicted Total Daily Noise Exposure

Phase	Plant Item (BS 5228 Ref.)	L_{Aeq}	Duration of activity per day	Daily Exposure	Total Daily Exposure
Restoration works & delivery of material	Dozer, 142kW, 20t	81dB	1 hour	72dB	76dB
	Articulated Dump Truck Tipping Fill	74dB	5 hours	72dB	
	Tracked Excavator	79dB	1 hour	70dB	

Table 13 below, calculates the predicted operational total daily noise levels at each of the 4No. NSL's. It should also be noted that the worst-case scenario has been used and distances to the NSL's have been calculated from the closest boundary locations of the site. In reality, the majority of the activities shall be taking place in a more central location and therefore the noise emissions would be expected to be much lower.

Table 13: Worst Case Scenario Predicted Operational Noise Levels at Noise Sensitive Locations

Phase	Plant Item (BS 5228 Ref.)	L_{Aeq}	NSL1 234m Total LAeq	NSL2 190m Total LAeq	NSL4 110m Total LAeq	NSL5 122m Total LAeq
Restoration works & delivery of material	Daily Exposure Combined Noise	76	49	50	55	49

Table 13 above, demonstrates that the noise levels from the proposed Project will be compliant with the relevant daytime noise limits for the site of 55dBLeq,T between 07:00 and 19:00hrs at all NSL's. It is also proposed that the Dump trucks are only permitted to tip the soil and stone in the centre of the site to further reduce noise at the NSL's.

To further mitigate to reduce the potential for noise impact at nearby dwellings it is proposed to only permit dump truck to tip loads at the centre of the site to reduce noise impacts along the site boundary. This will allow loads of soil and stone to build up at the central location and a bulldozer can periodically push the soil and stone at the correct levels across the site. When this mitigation measures has been implemented it will further ensure that noise levels do not exceed the daytime limit of 55dBLeq,T between 07:00 and 19:00hrs.

When these predicted noise levels are compared to the existing noise levels at the NSL's, the likely impact can be deemed Imperceptible to Slight.

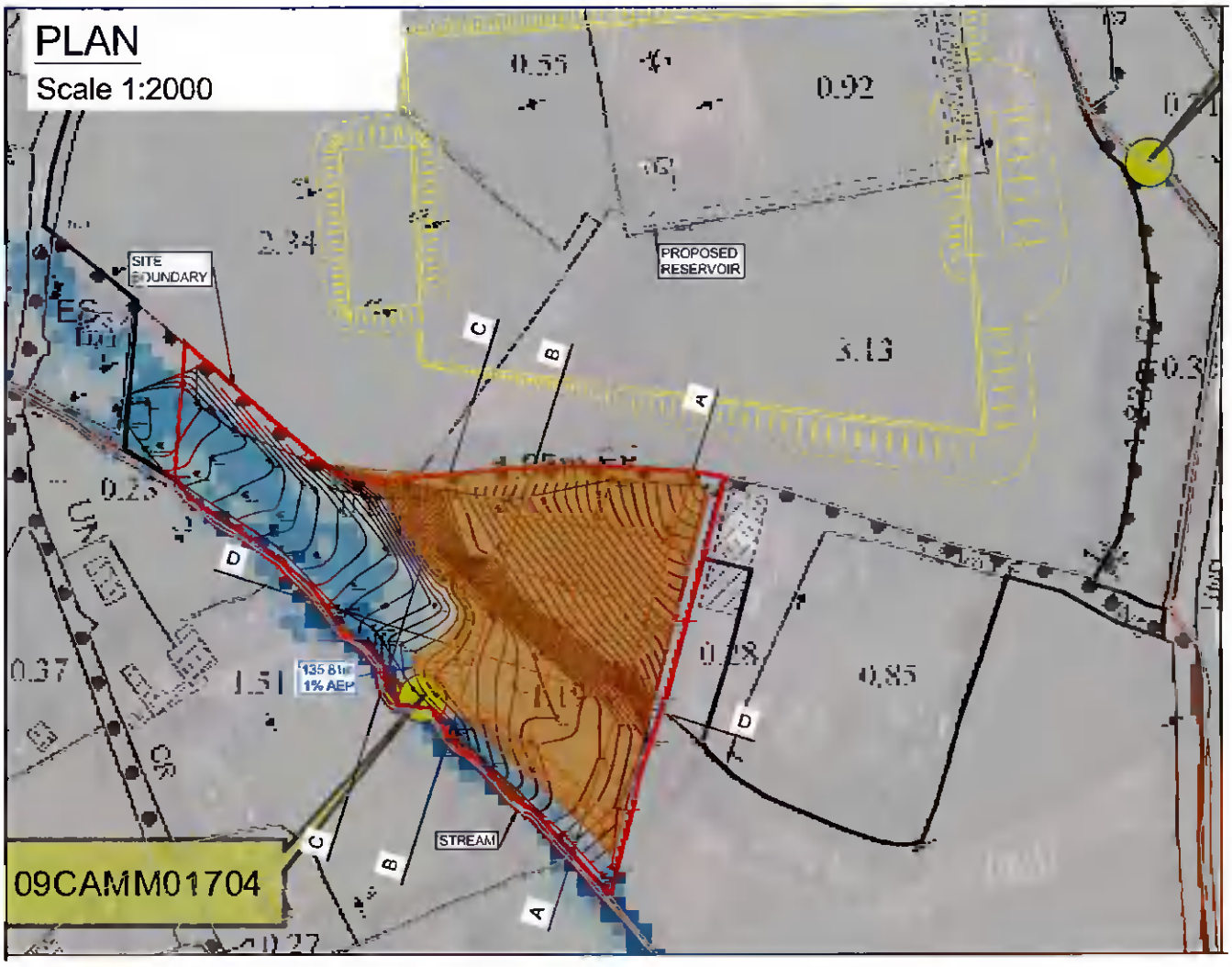
Section 6 Conclusion

This conclusion is my professional opinion based on the baseline noise survey carried out at The Hinch Site, Saggart, Co. Dublin on the 18th of May 2021.

Day noise measurements were recorded at 4 No. NSL's at the Hinch site. The daytime LAeq recorded at NSL's ranged between 41.0dB and 67.6.9dB. The LA_{90} readings ranged between 37.4dB and 50.6dB. Table 13, demonstrates that the noise levels from the proposed Project will be compliant with the relevant daytime noise limits for the site of 55dBLeq,T between 07:00 and 19:00hrs at all NSL's. It is also proposed that the Dump trucks are only permitted to tip the soil and stone in the centre of the site to further reduce noise at the NSL's.

Appendix A: Noise Monitoring Locations

Appendix B: Proposed Fill Locations



Appendix C: Calibration Certificates

SONITUS SYSTEMS

Certificate of Calibration

Issued to:	Certificate Number
Rowan Engineering Consultants Unit 14 Scurlockstown Bus. Park Co. Meath	AC200099

Test Date: 03/02/2020

Equipment Information

Item Calibrated:	Acoustic Calibrator	**Model:**	SV33A
Make:	Svantek	**Serial Number:**	79912

Calibration Procedure

The above calibrator was verified in line with the requirements of BS EN 60942:2003. The calibrator was allowed to stablize for a suitable period, as described in the manufacturer's instruction manual, in laboratory conditions. The sound pressure level in the cavity (half-inch). The operating frequency and signal distortion were also measured.

Calibration Standards

Description	Serial Number
National Instruments PXI-4461	19C91D2
GRAS 42AA Pistonphone	227947
GRAS 46A0 Pressure Field Microphone	228216

The standards used in this calibration are traceable to NIST and/or other National Measurement Institutes (NMI's) that are signatories of the International Committee of Weights and Measures (CIPM) mutual recognition agreement (MRA).

Signed on behalf of Sonitus Systems:

SONITUS SYSTEMS

Calibration Report

Equipment Information

Model: SV33A
Serial Number: 79912

Ambient Conditions

Measurement conditions were within the tolerances defined in BS EN 60942.

Barometric Pressure: 1040 hPa
Temperature: 19.6 °C
Relative Humidity: 42 %

Results

Calibrator Setting	Measured Parameter	Measured Value	Tolerance +/-	Uncertainty +/-
114 dB, 1KHz	Sound pressure level (dB)	114.37	0.75	0.14 dB
	Frequency (Hz)	1000.00	20 Hz	0.25 Hz
	Distortion (%)	0.09	4.0	0.3

RESULT: PASS

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in Annex B of IEC 60942:2003 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organization responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003.

The manufacturer's guidelines concerning free-field correction should be observed when using the calibrator.

Notes
1. All measurements were made with the half-inch configuration of the calibrator in place.
2. The measurement uncertainty is reported as a standard uncertainty multiplied by a coverage factor k=2 which, for a normal probability distribution, corresponds to a coverage probability of approximately 95%.
3. The given uncertainty corresponds to measured values only and does not relate to the long term stability of the device under test.

Unit 2, Goldenbridge Industrial Estate, Inchicore, Dublin, D08 YY38
www.sonitussystems.com Email: info@sonitussystems.com

SONITUS SYSTEMS

Statement of Calibration

issued to:
Rowan Engineering Consultants
Unit 14
Scurlockstown Business Park
Co. Meath

Calibration Reference
SLM210123

Test Date: 08/01/2021
Procedure: TP-SLM-1

Equipment

Item Calibrated:	Sound Level Meter	**Model**	971
Make:	Svantek	**Serial Number:**	77617

Calibration Procedure

The sound level meter was allowed to stabilize for a suitable period, as described in the manufacturer's instruction manual, in laboratory conditions. The sound level meter was calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), Periodic tests, specification of sound level meters. Tolerances for verification procedures are specified in IEC 61672-1 (2003).

Calibration Standards

Description	Serial Number
National Instruments PXI-4461	19C91D2
Stanford Research DS360	123803

The standards used in this calibration are traceable to NIST and/or other National Measurement Institutes (NMI's) that are signatories of the International Committee of Weights and Measures (CIPM) mutual recognition agreement (MRA).

Signed on behalf of Sonitus Systems:

Appendix D: 1/3 Octave Band Analysis Results

Date: 18/05/2021	NSL1 Day	NSL1 Day	NSL2 Day	NSL2 Day	NSL4 Day	NSL 4 Day	NSL5 Day	NSL5 Day
Time:	10:34- 11:04	11:04- 11:34	11:42-12:12	12:12-12:42	13:51-13:21	13:21-13:51	12:49-13:19	13:19-13:49
Frequency [Hz]	LAeq [dB]	LAeq [dB]	LAeq [dB]	LAeq [dB]	LAeq [dB]	LAeq [dB]	LAeq [dB]	LAeq [dB]
25	8.8	9.5	14.6	5.6	11.5	12.6	9.7	11.7
31.5	13.5	13.9	19.3	13.6	17.4	17.9	17.3	18.9
40	19.0	17.6	23.6	20.1	20.9	19.8	21.6	21.5
50	22.6	21.7	29.1	26.3	28.1	25.9	29.2	29.6
63	30.6	27.8	32.7	31.6	36.4	34.1	36.5	34.9
80	33.2	28.7	34.5	32.7	36.2	35.6	36.2	33.1
100	32.1	26.7	33.2	31.7	32.6	31.1	38.0	33.8
125	29.4	27.2	34.1	32.7	31.8	31.6	43.6	42.7
160	28.4	27.1	33.9	34.2	33.4	33.1	41.4	41.4
200	28.6	28.1	32.1	32.4	32.2	31.6	44.2	45.0
250	28.8	29.1	32.1	31.5	34.4	32.0	43.7	45.3
315	27.8	29.8	34.4	32.6	33.4	34.2	44.4	47.6
400	28.5	32.1	37.9	34.5	37.7	37.6	47.0	51.8
500	31.1	34.3	39.8	36.6	39.2	40.9	50.9	55.3
630	33.5	36.8	40.8	39.6	40.7	43.6	54.3	58.8
800	35.2	37.7	42.6	42.5	42.1	45.7	58.2	61.9
1,000	36.2	35.8	43.8	43.8	42.2	45.7	59.6	60.4
1,250	33.5	35.1	42.2	42.7	40.2	43.5	58.2	61.0
1,600	33.3	35.1	40.9	42.0	40.0	42.5	57.7	60.7
2,000	37.0	37.0	39.4	43.3	44.8	45.4	56.7	57.9
2,500	36.5	35.4	36.8	43.1	45.7	46.4	53.4	53.6
3,150	31.9	31.0	38.2	37.2	42.9	46.5	51.8	52.1
4,000	35.0	31.2	39.3	32.9	37.4	39.1	50.1	47.5
5,000	35.0	32.0	36.0	30.7	35.6	37.8	48.4	46.6
6,300	34.3	30.4	36.0	27.8	32.8	35.4	46.3	43.6
8,000	27.6	26.7	30.3	22.4	24.9	30.5	43.4	43.7
10,000	12.0	16.6	15.5	16.2	12.9	25.9	39.5	45.4

Appendix E: Glossary of Terms

Ambient Noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far.
Background Noise	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T $_{(LAF90,T)}$.
A-Weighting	A frequency weighting applied to measured or predicted sound levels in order to compensate for the non-linearity of human hearing.
Broadband	Sounds that contain energy distributed across a wide range of frequencies.
dB (Decibel)	The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
Hertz (Hz)	The unit of sound frequency in cycles per second.
Impulsive Noise	A noise that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.
L_{10}	The noise level exceeded for just 10% of a sample period. $L_{10(1hour)}$ is therefore the noise level exceeded for 10% of the time over a period of one hour. $L_{10(18hour)}$ is the arithmetic average of the eighteen $L_{10(1hour)}$ values between 06:00 and 24:00hrs.
L_{90}	The noise level exceeded for 90% of a sample period; typically used as a descriptor for background noise level.
L_{max}	The instantaneous maximum sound level measured during a sample period.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AFmax}	Is the instantaneous slow time weighted maximum sound level measured during the sample period (usually referred to in relation to construction noise levels).
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
Noise	Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.
NSL	Noise Sensitive Location - Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
Octave Band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
PPV	Peak Particle Velocity (PPV) expressed in millimetres per second (mm/s) is a vibration indicator used for the purposes of assessing potential annoyance to humans or damage to buildings.

Tonal Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.

1/3 Octave Analysis Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each.

The "A" suffix denotes that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.

An "F" suffix would denote that the parameter has been measured with 'Fast' time-weighting applied.

A "T" suffix would denote within a specified time interval.

Appendix F: Fundamentals of Acoustics

This appendix is intended to provide a brief overview of the fundamentals of acoustics and to offer a broad understanding of some of the technical discussion in this noise assessment. This section is not intended to give a complete description of all of the quantities used in acoustics and noise control.

Sound pressure is the small variation above and below atmospheric pressure created by the passage of a sound wave; this is what most people think of as noise. The human ear is a very sensitive anatomical organ and can detect a wide range of fluctuations in pressure levels, from the quietest whisper to a jet engine take off. In order to represent this range of detectable pressure changes in a more efficient manner, sound is typically measured in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The sound pressure as measured by a microphone varies in time and can also be described in terms of the frequency of the sound. The ear has different sensitivities to sounds of different frequencies, and a frequency weighting is often applied to the signal to make it more representative of the sound perceived by a listener.

The frequency of sound is the rate at which a sound wave oscillates, and is expressed in Hertz (Hz). Human hearing is less sensitive at very low and very high frequencies, that is to say it is not uniform across the sound spectrum. In order to account for this weighting, filters are commonly applied when measuring and/or assessing sound. The most common frequency weighting in current use is 'A-weighting', which is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies. SPL's measured using 'A-weighting' are expressed as LpA (dB). The 'A' subscript denotes that the sound levels have been A-weighted.

In terms of sound pressure levels, audible sound ranges from 0dB (i.e. the threshold of hearing) to the threshold of pain at 120dB. A doubling/halving of pressure equates to a 3dB increase/decrease in decibel level. Typically, under normal circumstances, a 3dB change in environmental noise level is the smallest noticeable to the human ear. A 10dB increase/decrease in sound level normally equates to a subjective doubling/halving of noise.

An indication of the level of some common sounds on the LpA (dB) scale is presented in Figure A5.2.1 below.

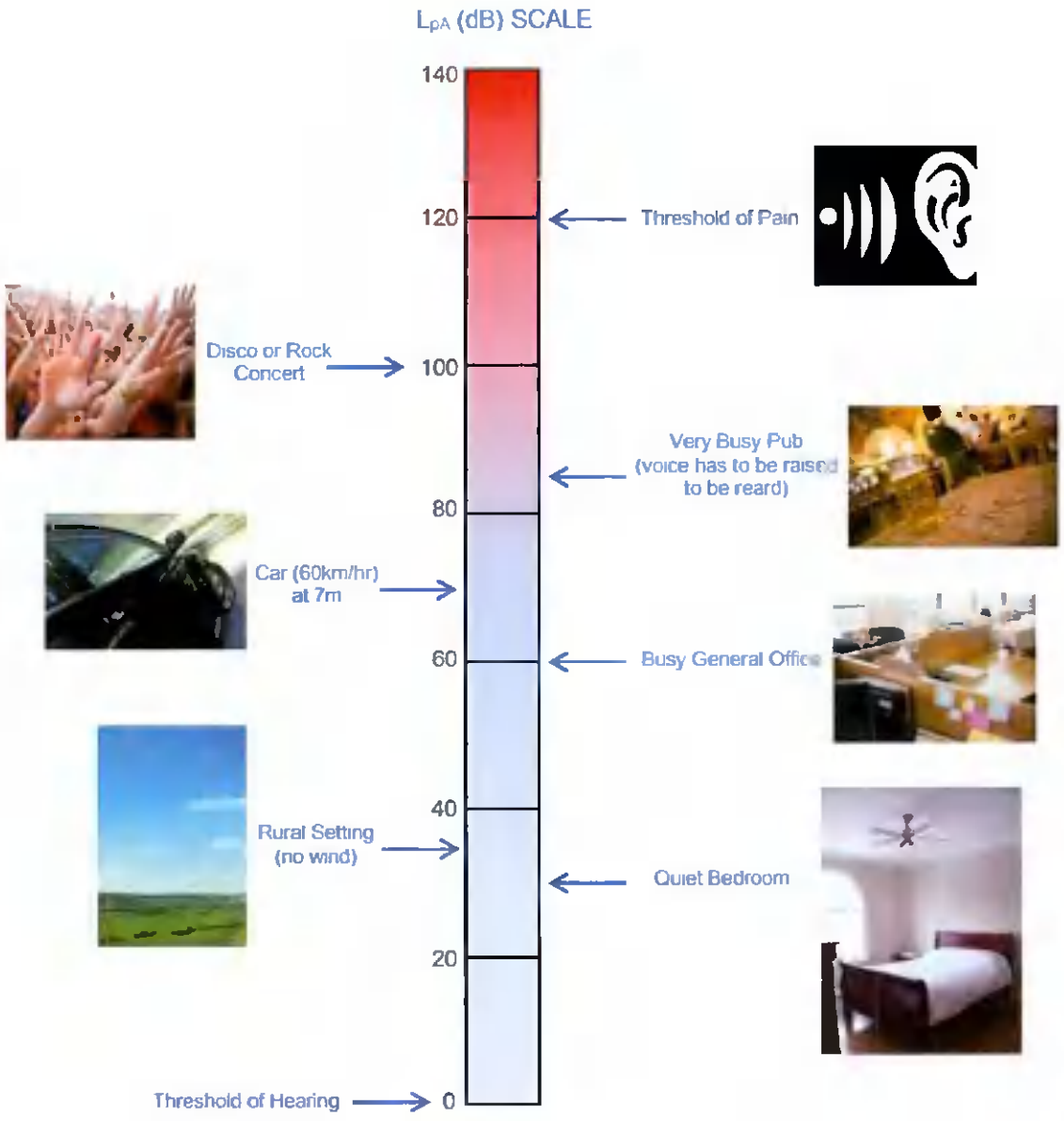


Figure A5.2.1: dB(A) Scale & Indicative Noise Levels – (EPA: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2016)

Appendix G: Generic Relationship between Noise Impact and Noise Effect

GENERIC RELATIONSHIP BETWEEN NOISE IMPACT (MAGNITUDE) AND NOISE EFFECT (MAGNITUDE + SENSITIVITY), INCLUDING THE EVALUATION OF EFFECT SIGNIFICANCE

MAGNITUDE (Nature of Impact)		DESCRIPTION OF EFFECT (on a specific sensitive receptor)	SIGNIFICANCE (as required within EIA)
Substantial	BENEFICIAL	**Receptor perception = Marked change** Causes a material change in behaviour and/or attitude, e.g. individuals begin to engage in activities previously avoided due to preceding environmental noise conditions. Quality of life enhanced due to change in character of the area.	More Likely to be Significant (Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a non-significant effect) ↕ (Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a significant effect) Less Likely to be Significant
Moderate	BENEFICIAL	**Receptor perception = Noticeable improvement** Improved noise climate resulting in small changes in behaviour and/or attitude, e.g. turning down volume of television; speaking more quietly; opening windows. Affects the character of the area such that there is a perceived change in the quality of life.	
Slight	BENEFICIAL	**Receptor perception = Just noticeable improvement** Noise impact can be heard, but does not result in any change in behaviour or attitude. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	
Negligible		N/A = No discernible effect on the receptor	**Not Significant**
Slight	ADVERSE	**Receptor perception = Non-intrusive** Noise impact can be heard, but does not cause any change in behaviour or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Less Likely to be Significant (Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a significant effect) ↕ (Greater justification needed – based on impact magnitude and receptor sensitivities – to justify a non-significant effect) More Likely to be Significant
Moderate	ADVERSE	**Receptor perception = Intrusive** Noise impact can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Potential for non-awakening sleep disturbance[81]. Affects the character of the area such that there is a perceived change in the quality of life.	
Substantial	ADVERSE	**Receptor perception = Disruptive** Causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	
Severe	ADVERSE	**Receptor perception = Physically Harmful** Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Significant

81 Further information on the effects of noise on sleep can be found in the World Health Organization's Guidelines on Community Noise (WHO, 1999) and Night Noise Guidelines for Europe (WHO, 2009)