Curraghinalt Project
County Tyrone

Prepared for Dalradian Gold Limited

Environmental Statement - Volume 3

C18 Noise Impact Assessment and Baseline Report (presented as an annex)

November 2017

DALRADIAN
GOLD

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PROJECT: Curraghinalt Gold Mine Project

Noise Impact Assessment.

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1 Introduction

Envest was commissioned by SRK (UK) Consulting Ltd. (SRK) on behalf of Dalradian Gold Ltd. (DGL) to complete a Noise Impact Assessment to provide input to the Environmental Impact Assessment (EIA) and the IPPC Application for the proposed Curraghinalt Project in County Tyrone, Northern Ireland.

The Curraghinalt deposit and associated infrastructure are located within an area comprising a topographic ridge that forms the drainage divide between the Owenkillew River and the Owenreagh River. It is understood that the project has the following components:

- An underground mine;
- A decline, a sloping shaft/ tunnel that will be developed as the main access to the mineral deposit, it will extend from a portal at surface and near to the mineral process plant;
- An existing adit, a horizontal passage that provides access to the mineral deposit, originally developed for exploration of the deposit that will be retained to provide initial access for mine development and secondary/safety access to the mine workings in the operational phase;
- Three ventilation raises that will be used to ventilate the mine workings, one of these exists having been developed as part of the underground exploration programme;
- A mineral processing plant;
- A Dry Stack Facility (DSF) for storage of filtered tailings/ dry stack tailings and uneconomic rock – this facility will contain some of the flotation Facility from the plant, after they have been dewatered (85% of water removed) by means of a filtration process, and uneconomic rock from development of the mine workings;
- Paste backfill placed in the mine workings, this cement bound material will provide support in the workings and will be derived from Facility from the plant, specifically some of Facility from the flotation process and all of the Facility from the cyanide leaching process, mixed with binders;
- Ancillary infrastructure and services required to support the activities (administrative buildings, mobile maintenance shop, warehouse facilities, chemical and explosive stores, a mine dry, parking, site roads, water supply, water treatment and telecommunications);
- Connections, to offsite infrastructure including the Northern Ireland road network and the electrical grid;
- Passing bays on the Camcosy Road developed for the underground exploration programme and to be retained for the mine development.

A detailed Project Description has been prepared by SRK Consulting.

2 Statutory Consultees Comments

In defining the scope of noise baseline monitoring and impact assessment, Envest consulted with the following individuals and statutory bodies;

- [redacted] and [redacted] of the Fermanagh & Omagh District Council (FODC) Environmental Health Department (EHD);
- [redacted] and [redacted] of the Northern Ireland Environment Agency (NIEA) Industrial Pollution and Radiochemical Inspectorate (IPRI)[1]; and
- [redacted] and [redacted] of the Department for Infrastructure (DfI), Strategic Planning Division, which was formerly within the Department of Environment (DoE).

In response to the Pre-Application Discussion (PAD) (LA10/2016/0030/PAD) the Department of Environment compiled a letter dated 26th February 2016 that presented the following comments from the Industrial & Radiochemical Protection Inspectorate (IPRI)in relation to noise:

The Inspectorate requires a representative noise baseline survey to be carried out to establish the ambient and background sound levels in accordance with BS4142: 2014, ideally during each of the seasons, to account for any variations in weather, activities, etc.

The above comments were coupled with the following note about a Pollution Prevention and Control (PPC) permit, which DGL will have to obtain for listed activities:

Informative:

A PPC Permit issued under The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 (PPC Regulations) covers the activities listed in Schedule 1 of the PPC Regulations. From review of the scoping document these are likely to include:

Site Activities	***Schedule in PPC Regulation 2013***	***Description of Schedule in PPC Regulations 2013***
Crushing and Screening Activities	*Section 3.5 Part B(a)*	*Unless falling within Part A of any section in this Schedule, the crushing, grinding or other size reduction, screening or heating of any designated mineral or mineral product except where the operation of the activity is unlikely result in the release into the air of particulate matter.*
Carbon-in-leach /	*Section 2.2 Part*	*Producing non-ferrous metals form ore, concentrates or*

[1] NIEA IPRI is a management unit within the Northern Ireland Environmental Agency (NIEA). Following recent government restructuring, the NIEA has transferred from the former Department of Environment (DOE) to the Department of Agriculture, Environment & Rural Affairs (DAERA).

Carbon strip	*A(a)*	*secondary raw materials by metallurgical, chemical or electrolytic activities.*
Electrowinning	*Section 2.2 Part A(a)*	*Producing non-ferrous metals form ore concentrates or secondary raw materials by metallurgical, chemical or electrolytic activities.*
Smelting using a furnace (details to be confirmed by the operator during discussions regarding the PPC application process)	*Section 2.2 Part C*	*Melting, including making alloys of non-ferrous metals (other than tin or any alloy which in molten form contains 50 percent or more by weight of tin), including recovered products (refining, foundry casting, etc.) in plant with a melting capacity of 4 tonnes or less per day for lead or cadmium or 20 tonnes or less per day for all other metals and where the designed holding capacity of molten metal is less than 0.5 tonnes (together with any additional refining).*
Use of cement in backfill paste	*Section 3.1 Part B(a)*	*Blending cement in bulk or using cement in bulk other than at a construction site, including the bagging of cement and cement mixtures, the batching of ready mixed concrete and the manufacture of concrete blocks and other cement products where the activity is not related to an activity described in paragraph (a) of Part A of this section and is carried on at the same location as an activity described in Paragraph (a) of Part B of Section 3.5*

IPRI is a management unit within the Northern Ireland Environmental Agency (NIEA). Following recent government restructuring, the NIEA has transferred from the former Department of Environment (DOE) to the Department of Agriculture, Environment & Rural Affairs (DAERA). IPRI will permit and control noise emissions from the proposed process plant in accordance with the Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance for Noise: Part 1 Regulation and Permitting and Part 2 Noise Assessment and Control. This guidance is given in two parts:

- Part 1: Regulation and Permitting, outlines the main considerations relating to the Regulation and Permitting of noise.
- Part 2: Noise Assessment and Control, describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. The principle of noise control and nuisance prevention is primarily based on the BS 4142: 2014 'Method of Rating and Assessing Industrial and Commercial Noise' methodology.

In correspondence dated 5th May 2016, Envest sought clarification from Fermanagh & Omagh District Council (FODC) Environmental Health Department (EHD) in relation to appropriate use of BS4142: 2014 *Methods for rating and assessing industrial and commercial sound* and the Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014). The following comments were received from the FODC EHD in correspondence dated 10th June 2016:

The Environmental Health Department (EHD) has considered correspondence of 5 May 2016

entitled Consultation Response in respect of Planning Application LA10/2016/0030/PAD.

The correspondence discussed various procedures to assess noise from proposed operations. EHD's understanding is that the process is iterative and aspects of the development proposal will be regulated by the Northern Ireland Environment Agency (Industrial Pollution and Radiochemical Inspectorate), whilst other aspects will be regulated by the EHD.

The correspondence makes reference to:
- *BS4142: 2014 Methods for rating and assessing Industrial and Commercial Sound*
- *Planning Practice Guidance – Assessing Environmental Impacts from Mineral Extraction*

The correspondence considers that all mineral extraction activities including the underground mining activities, crushing, screening refining cement operations and dry stack facility should be assessed in accordance with Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' rather than BS4142: 2014.

EHD considers that BS4142: 2014 does have a role in considering environmental impact. The consultancy should consider potential noise impact from various parts of the process and present narrative on the appropriate assessment methodology. It may be the case that aspects of the development will be considered as mineral extraction whilst other aspects may be considered to be industrial noise and BS4142: 2014 would be more appropriate as an assessment methodology.

EHD suggests that the developer considers both assessment methodologies in presenting impact from the mineral processing aspects of the development.

EHD will liaise closely with the Industrial Pollution and Radiochemical Inspectorate in terms of considering noise impact. The views of the Industrial Pollution and Radiochemical Inspectorate should be sought.

3 Fundamentals of Noise

3.1 What is Noise?

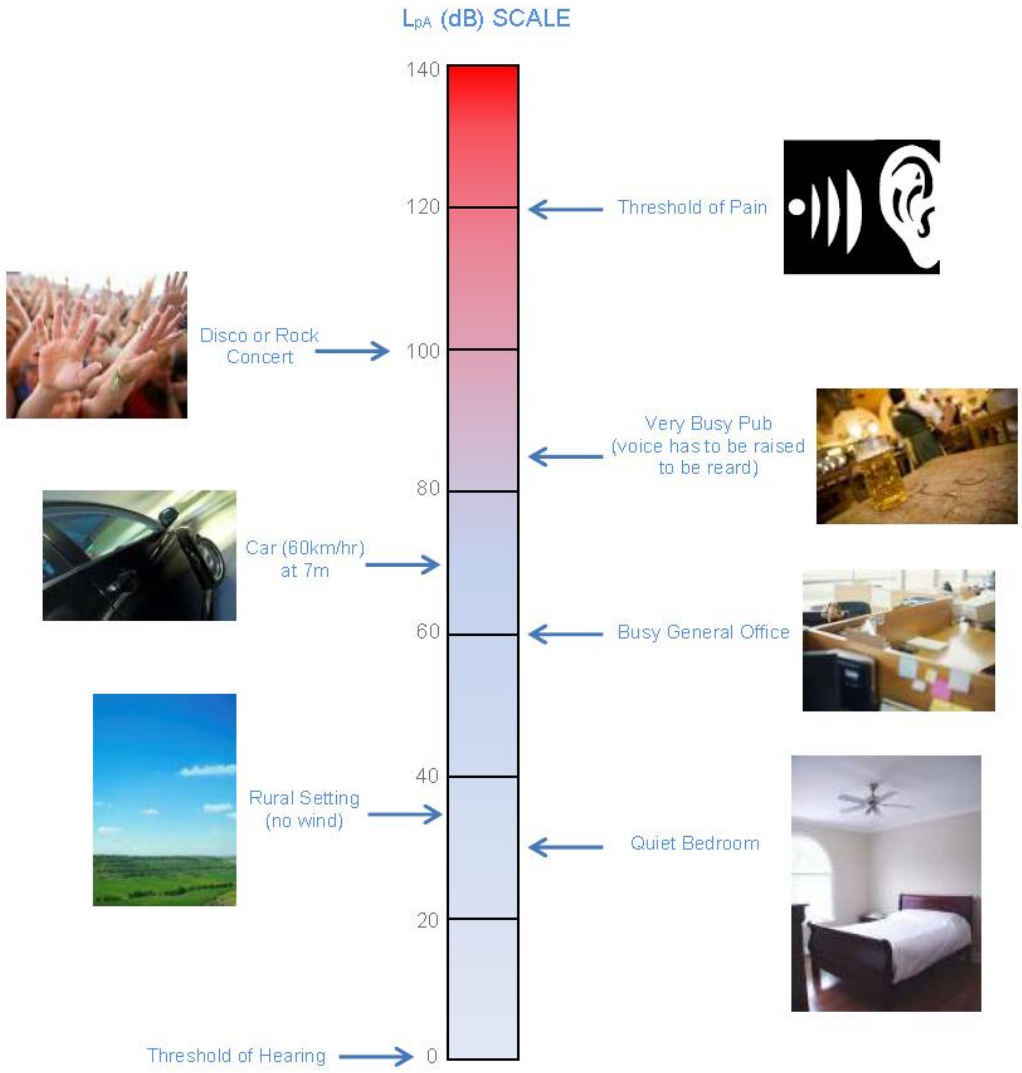
Noise is regarded as a form of manmade pollution and can be defined as *'noise … which is a nuisance or would endanger human health or damage property or harm the environment'*. In a modern developed and industrial society, a certain level of noise is a universal by-product of many normal everyday activities. Whether the noise is considered as impacting upon health or quality of life, or indeed gives rise to annoyance, depends not just upon the level of noise but also the human reaction to it, whether this be sub-conscious physiological reactions or conscious reactions such as annoyance. Conscious reactions, such as annoyance, most often occur when the noise could be considered unwanted, due to the level, the location, character, the time of day, or interference with other activities. It is recognised that in many urban and industrialised areas, the general population is increasingly exposed to high levels of environmental noise. In addition, the health effects of this exposure are considered to be an increasingly important public health problem.

Sound may be described as a variation in atmospheric pressure that is detected by the human ear and results in the sensation of hearing. The human ear is very sensitive and can detect a wide

range of fluctuations in pressure levels, from the quietest whisper to a jet engine take off. 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 (L_P) in decibels (dB). 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 level.

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. 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'. This weighting mechanism conforms approximately to the response of the human ear at moderate levels. Sound pressure levels measured using 'A-weighting' are expressed as L_{pA} (dB). An indication of the level of some common sounds on the Sound Pressure Level (L_{pA} dB) scale is presented in Figure 1. This provides a 'reference' against which some of the predicted future noise levels as a result of the proposed Curraghinalt Project can be gauged against.

Figure 1: Sound Pressure Level (L_{pA} dB) scale and Indicative Noise Levels (Source; Environmental Protection Agency)



4 Legislation and Standards

4.1 Legislation

Industrial emissions	• Industrial Pollution Control (Northern Ireland) Order 1997 SI 2777 (including updates to 2004) • Industrial Pollution Control (Prescribed Processes and Substances) Regulations (Northern Ireland) 1998 (SR28) • Pollution Prevention And Control (Industrial Emissions) Regulations (Northern Ireland) 2013 (SR 160) • Pollution Prevention (Industrial Emissions) (Amendment) Regulations (Northern Ireland) 2014 (SR 304)
Additional noise legislation	• Environmental Noise Regulations (Northern Ireland) 2006 (SR 387) • Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002 (No 303)

Industrial Emissions Directive	Directive 2010/75/EU of the European Parliament and the Council on industrial emissions is the main EU instrument regulating pollutant emissions from industrial installations. It recasts seven previously existing directives, including the Integrated Pollution Prevention and Control (IPPC) Directive and directives concerning large combustion plants, waste incineration, solvent emissions and waste from the titanium dioxide industry.	The 2013/160 Regulations transpose Directive 2010/75/EU
Environmental Noise Directive	Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise.	The 2006/ 387 Regulations transpose Directive 2002/49/EC

4.2 Planning Policy, Standards and Guidelines Applicable to the Noise Impact Assessment

The policy documents, standards, and guidelines considered in development of the approach to the noise impact assessment were;

- Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014)
- Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance for Noise: Part 1 Regulation and Permitting and Part 2 Noise Assessment and Control.
- British Standard BS 4142: 2014 'Method of Rating and Assessing Industrial and Commercial Noise'
- British Standard BS 7445: 2003 *Description and Measurement of Environmental Noise*
- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, Institute of Acoustics (May 2013).
- World Health Organisation - Guidelines for Community Noise, 1999.
- World Health Organisation - Night Noise Guidelines for Europe, 2009.

- Calculation of Road Traffic Noise (CRTN): Department of Transport (Welsh Office), 1988.
- British Standard BS 5228-1:2009+A1: 2014 Noise and Vibration Control on Construction and Open Sites Part 1: Noise
- British Standard BS 8233: 2014: Guidance on Sound Insulation and Noise Reduction for Buildings
- Noise Policy Statement for Northern Ireland, Department of the Environment (September 2014)
- Institute of Environmental Management & Assessment – Guidelines for Environmental Noise Impact Assessment 2014.

Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014)

There is no contemporary guidance for assessing noise from mineral workings and associated activities indigenous to Northern Ireland. Therefore, mineral developers in Northern Ireland consider published guidance from England. Minerals Policy Statement 2 (MPS 2) has been superseded by the Technical Guidance to the National Planning Policy Framework (TGNPPF) since March 2012; and these have both been replaced by the Planning Practice Guidance on Assessing Environmental Impacts from Mineral Extraction (herein referred to as PPG) published in March 2014. The fundamental principles and standards of assessing noise provided for within MPS2 are replicated within the TGNPPF and PPG.

Under the heading of Noise Emissions – How should minerals operators seek to control noise emissions the PPG provides that:

'Those making mineral development proposals should carry out a noise impact assessment, which should identify all sources of noise and for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood'.

The guidance states that proposals for the **control** or mitigation of noise emissions should:

- *'Consider the main characteristics of the production process and its environs, including the location of noise sensitive properties and sensitive environmental sites;*
- *Assess the existing acoustic environment around the site of the proposed operations including background noise levels at nearby noise sensitive properties;*
- *Estimate the likely future noise from the development and its impact on the neighbourhood of the proposed operations;*
- *Identify proposals to minimise, mitigate or remove noise emissions at source;*
- *Monitor the resulting noise to check compliance with any proposed or imposed conditions'.*

Prevailing guidance advises that mineral planning authorities should take account of the prevailing acoustic environment and in doing so consider whether or not noise from the proposed operations would:

- *'Give rise to significant adverse effect;*
- *Give rise to an adverse effect;*
- *enable a good standard of amenity to be achieved'.*

It is understood from prevailing guidance (see paragraph 021 of PPG [reference ID 27-021-20140306]) that mineral planning authorities *'should aim to establish a noise limit, through a planning condition, at the noise sensitive property that does not exceed the background noise level ($L_{A90, 1hr}$) by more than 10dB (A) during normal working hours (0700 – 1900). Where it will be difficult not to exceed the background noise level by more than 10dB(A), without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55dB $L_{Aeq, 1hr (Free Field)}$. For operations during the evening (19.00-22.00) the noise limits should not exceed the background noise level ($L_{A90, 1hr}$) by more than 10dB(A) and should not exceed (55) dB $L_{Aeq, 1hr (Free Field)}$. For any operations during the period 22.00 – 0700 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event, the noise limit should not exceed 42dB $L_{Aeq, 1hr (Free Field)}$ at a noise sensitive property.*

Where the site noise has a significant tonal element, it may be appropriate to set specific limits to control this aspect. Peak or impulsive noise, which may include some reversing bleepers, may also require separate limits that are independent of background noise (e.g. L_{max} in specific octave or third octave frequency bands – and that should not be allowed to occur regularly at night). Care should be taken, however, to avoid any of these suggested values being implemented as fixed thresholds as specific circumstances may justify some small variation being allowed.

It is accepted within prevailing guidance that all operators will have some noisier short term activities that cannot meet the limits set for normal operations e.g. soil stripping, perimeter bund construction, etc. As a result, where these activities can bring a longer term environmental benefit an increased temporary daytime limit of 70 dB L_{Aeq} for up to 8 weeks a year is suggested'.

The NPPF recommends that cumulative impacts also need to be considered to *'take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality'.* Therefore, there is a need to consider a requirement to undertake a cumulative assessment. Table 1 outlines the absolute noise limits in the Minerals Guidance

Table 1: Absolute Noise Limits from Planning Practice Guidance on Assessing Environmental Impacts from Mineral Extraction (March 2014).

Time Period	Absolute Limit ($L_{Aeq, 1hour}$)
Daytime	55 dB
Evening	55 dB
Night time	42 dB
Temporary extended limit	70 dB

Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance for Noise: Part 1 Regulation and Permitting and Part 2 Noise Assessment and Control.

Integrated Pollution Prevention and Control (IPPC) is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single Permitting process. To gain a Permit, Operators must show that they have systematically developed proposals to apply the Best Available Techniques (BATs) and meet certain other requirements, taking account of relevant local factors. The purpose of the IPPC Horizontal Guidance Note for Noise Assessment and Control is to provide supplementary information, relevant to all sectors, to assist Applicants in preventing and minimising emissions of noise and vibration as described in the IPPC Sector Guidance Notes (or the General Sector Guidance Note). The guidance is in two parts:

Part 1 Regulation and Permitting outlines the main considerations relating to the setting of Permit conditions and subsequent regulation of noise. It is aimed primarily at the information needs of Regulators.

Part 2 Noise Assessment and Control, this document, describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. It forms a background to Part 1 and assists in determining BAT for a given installation. BS 4142: 2014 'Method of Rating and Assessing Industrial and Commercial Noise' is defined as the fundamental method of assessing noise impact from IPPC permitted installations.

BS 4142: 2014 '*Method of Rating and Assessing Industrial and Commercial Noise*'

BS 4142: 2014 describes methods for rating and assessing sound of an industrial or commercial nature. It enables the effects on people nearby to be assessed and the associated risks to be minimised. It is designed to give consistent results across situations ranging from a single air-conditioning unit to a large installation such as a Gold Mining Project.

BS 4142: 2014 states that '*the significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the*

background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context'.

BS 4142: 2014 states that you should '*obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level',* and consider the following;

(a) Typically, the greater this difference between the rating level of the specific sound source and the background sound level, the greater the magnitude of the impact.

(b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

(c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

(d) 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.

BS 4142: 2014 states that '*adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact'.*

In relation to Baseline Noise Monitoring Surveys, BS 4142: 2014 states the following in relation to the **Background Sound Level.**

"The background sound level is an underlying level of sound over a period, T, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.

Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes.

Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Care is necessary in circumstances where background sound levels are low to ensure that self-generated and electrical noise within the measurement system does not unduly influence reported values, which might be the case if the measured background sound levels are less than 10 dB above the noise floor of the measuring system.

8.1.1 As appropriate, for each of the following situations conduct background sound level measurements under weather conditions that are representative and comparable to the weather conditions when the specific sound occurs or could occur:

a) a new specific sound source is to be commissioned (see 8.2); or

b) a change or modification is to be made to an existing sound source (see 8.2); or

c) there is an existing specific sound source not operating continuously (see 8.3); or

d) there is an existing specific sound source operating continuously (see 8.4); or

e) a new noise-sensitive receptor is being introduced to an environment already experiencing, or that will at a future time experience, industrial and/or commercial sound (see **8.5**).

8.1.2 Where possible, measure the background sound level at the assessment location(s). If this is not possible measure at an alternative location where the residual sound is comparable to the assessment location(s). A detailed justification for considering this should be reported.

NOTE: In determining whether an alternative location is suitable for carrying out measurements of the background sound level it is important to take account of all contributing factors that might influence the measurement and assessment procedure. As far as is practicable, uncertainty in any measurement at an alternative location ought to be minimized and the extent of uncertainty reported.

8.1.3 Ensure that the measurement time interval is sufficient to obtain a representative value of the background sound level for the period of interest. This should comprise continuous measurements of normally not less than 15 min intervals, which can be contiguous or disaggregated.

8.1.4 The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed.

NOTE 1 To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value.

NOTE 2 The mean average of a series of measured background sound levels is not numerically equal to the overall period background sound level that would otherwise be obtained by a single measurement spanning individual measurement periods.

NOTE 3 Background sound can be significantly affected by meteorological conditions, particularly where the main sources of residual sound are remote from the assessment location(s).

8.1.5 To fully understand the context in which the sound from an industrial and/or commercial source(s) is being assessed, describe and report the sources of sound which comprise the acoustic environment".

BS 4142: 2014 states the following in relation to *'Weather conditions';*

'Record the weather conditions that could affect measurements. Monitor wind speed at the measurement location, using an anemometer, and record the wind speed together with the wind direction. Exercise caution when making measurements in poor weather conditions such as wind speeds greater than 5 m/s.

Visually estimate cloud cover by eye as either a percentage of sky covered by cloud or in oktas. Record all forms of precipitation together with the period over which the precipitation occurred, having regard to how this might affect uncertainty (see Clause 10 and Annex B).

Record the temperature at the measurement location, in °C, at the beginning and the end of the measurement period, and at any other appropriate time if there is a change in the weather conditions. Where appropriate, use instruments for measuring meteorological parameters during long-term unattended measurements by means of a logging meteorological station at the measurement location'. BS 4142: 2014 states that *'weather conditions can affect sound levels by influencing sound propagation or generating sound which can be pertinent to the assessment'.*

BS 7445: 2003 *Description and Measurement of Environmental Noise*

BS 7445: 2003 defines the basic quantities to be used for the description of noise in community environments and describes basic assessment procedures. It also specifies methods to assess environmental noise and gives guidance on predicting the potential annoyance response of a community to long-term exposure from various types of environmental noises. Application of the method to predict annoyance response is limited to areas where people reside and to related long-term land uses. BS 7445: 2003 describes adjustments for sounds that have different characteristics. The term rating level is used to describe physical sound predictions or measurements to which one or more adjustments have been added. Based on these rating levels,

the long-term community response can be estimated. The potential noise is assessed either singly or in combination, allowing for consideration, when deemed necessary by responsible authorities, of the special characteristics of their impulsiveness, tonality and low-frequency content, and for the different characteristics of road traffic noise, other forms of transportation noise (such as aircraft noise) and industrial noise. BS 7445: 2003 does not specify limits for environmental noise.

A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, Institute of Acoustics (May 2013).

The procedures for the interpretation of background noise levels at increasing wind speeds during the daytime (07:00-19:00), evening (19:00-23:00) and night-time (23:00-07:00) monitoring periods as outlined in the Institute of Acoustics, Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IoA GPG) have been used. These background noise levels at increasing wind speeds have been used to interpret appropriate noise limits at receptor locations in the area.

The IoA GPG outlines a detailed methodology for the measurement of background noise level including the following;

- Scoping for Background Noise Surveys
- Timing of Surveys
- Noise Measuring Equipment
- Siting Noise Measuring Equipment
- Wind Speed Measurement
- Rain Measuring Equipment
- Synchronisation of Noise, Wind and Rainfall Measurements
- Durations of Surveys
- Analysis of Background Noise Data, and
- Determining the ETSU-R-97 Noise Limits.

World Health Organisation - *Guidelines for Community Noise* 1999

The World Health Organisation (WHO) has published *Guidelines for Community Noise*, the outcome of a WHO expert task force meeting in April 1999. The WHO guidelines recommend a daytime limit of 50 – 55 dB(A) for outdoor living areas. The report states that "*to protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower*

outdoor sound level should be considered the maximum desirable sound level for new development". According to the WHO guidelines noise impacts within dwellings include annoyance, speech interference and sleep disturbance. WHO considers that for bedrooms, the critical effect is sleep disturbance. Guideline values for bedrooms consider that the sleep disturbance criteria should be taken as internal noise levels of 30 dB L_{Aeq} or 45 dB L_{Amax} or external levels of 45 dB L_{Aeq} or 60 dB L_{Amax}. Table 2 shows the WHO Guideline noise levels applicable to residential properties.

Table 2: Guideline values for community noise in specific environments (World Health Organisation, 1999)

Specific Environment	Critical Health Effects	L_{Aeq} (dB)	Time (Hrs)	L_{Amax} (dB)
Outdoor Living Area during daytime	Serious Annoyance, daytime & evening Moderate Annoyance, daytime & evening	55 50	16 16	- -
Outside Bedrooms during night time	Sleep disturbance, window open (outdoor values)	45	8	60

World Health Organisation - Night Noise Guidelines for Europe, 2009

The recommended night noise guidelines for Europe for the protection of public health from night noise, based on the exposure-effects relationship, as outlined below;

- Night noise guideline $L_{night,\ outside}$ = 40 dB
- Interim target $L_{night,\ outside}$ = 55 dB

The WHO recommends that for the primary prevention of subclinical adverse health effects related to night noise in the population, it is recommended that the population should not be exposed to night noise levels greater than 40 dB of $L_{night,\ outside}$ during the part of the night when most people are in bed. The lowest observed adverse effect level (LOAEL) of night noise, 40 dB $L_{night,\ outside}$ can be considered a health-based limit value of the night noise guidelines necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise. An interim target of 55 dB $L_{night,\ outside}$ is recommended in the situations where the achievement of night noise guidelines is not feasible in the short run for various reasons. It should be emphasized that the interim target is not a health-based limit value by itself. Vulnerable groups cannot be protected at this level. Therefore, the interim target should be considered only as a feasibility-based intermediate target which can be temporarily considered by policy-makers for exceptional local situations.

Calculation of Road Traffic Noise (CRTN): 1988

The guidance provided within Calculation of Road Traffic Noise (CRTN) provides a method for the calculation of road traffic noise levels, considering factors such as distance between the road and receptor, road configuration, ground cover, screening, angle of view, reflection from façades and

traffic flow, speed and composition. The noise parameter calculated is the $L_{A10\text{-}18\ hour}$ and is based on the 18-hour Annual Average Weekday Traffic (18hr-AAWT).

BS 5228-1:2009 + A1:2014 'Code of practice for noise and vibration control on construction and open sites'

BS 5228 provides generic source noise data for various items of plant used on open sites along with methods for calculating the effects of these activities and their respective noise levels at nearby noise sensitive properties. It also provides methods for calculating the noise levels of plant and vehicles moving along haul roads. The calculation method considers distance, ground effects, reflections from surfaces, and screening by obstacles.

Annex E of BS 5228-1:2009 + A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 1" presents various methods of determining the significance of noise effects due to construction works. The 'ABC method' outlines that the measured ambient noise level is rounded to the nearest 5 dB(A) for the appropriate day, evening, night and weekend period. This is then compared with the predicted construction noise level. If the construction noise level exceeds the appropriate category value, then there is potential for a significant effect to occur. The example threshold for significant effects at dwellings is shown below in Table 3. The values in Category A, B and C are the threshold values to be used to determine the potential for significance at a noise sensitive receptor, based on ambient noise levels rounded to the nearest 5 dB(A). A receptor is categorised by comparing its rounded ambient noise level with the values assigned to Category for the relevant time period, and is then categorised depending on whether the rounded ambient noise levels are less than, equal to, or higher than the values in Category A column, respectively. For example, if the rounded daytime ambient noise level is below 65 dB(A), then it is a Category A receptor and the threshold for potential significance is 65 dB(A). If the rounded daytime ambient noise level is equal to 65 dB(A), then the receptor is assigned to Category B and the threshold level is 70 dB(A).

Table 3: BS 5228-1:2009 + A1:2014 "Code of practice for noise and vibration control on construction and open sites, Threshold values for significant effects at dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, decibels (dB)		
	Category A	Category B	Category C
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Evenings (19:00-23:00 weekdays) and weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)	55	60	65
Night-time (23:00-07:00)	45	50	55

BS8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings:

British Standard 8233: 2014 *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when

unoccupied. Noise from common sources in the environment such as road traffic is dealt with in detail in BS8233: 2014. The standard states that for steady external noise sources such as road traffic it is desirable that the internal ambient noise level does not exceed the guideline values for living and dining rooms for daytime use and bedrooms for night time as outlined in Table 4. The levels shown in Table 1 are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise.

Table 4: BS8233: 2014 indoor ambient noise levels for dwellings.

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq, 16\ hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16\ hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16\ hour}$	30 dB $L_{Aeq, 8\ hour}$

Noise Policy Statement for Northern Ireland

The Noise Policy Statement for Northern Ireland was published in September 2014. The noise policy statement sets out the following objectives:

"Through the effective management and control of environmental, neighbour and neighbourhood noise the Noise Policy aims to:

1. Avoid or mitigate significant adverse impacts on health and quality of life;

2. Mitigate and minimise adverse impacts on heath and quality of life; and

3. Where possible, contribute to the improvement of health and quality of life".

- The first aim of the NPSNI states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.
- The second aim of the NPSNI refers to the situation where the impact lies somewhere between LOAEL[2] (Lowest Observed Adverse Effect Level) and SOAEL[3] (Significant Observed Adverse Effect Level). It requires that all reasonable steps should be taken to mitigate and minimise adverse effects in health and quality of life while together considering the guiding principles of sustainable development. This does not mean that adverse effects cannot occur but that effort should be focused on minimising such effects.
- This third aim seeks, where possible, to improve health and quality of life through the proactive management of noise, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this

[2] *LOAEL – Lowest Observed Adverse Effect Level - the level above which adverse effects on health and quality of life can be detected.*

[3] *SOAEL – Significant Observed Adverse Effect Level - the level above which significant adverse effects on health and quality of life occur.*

aim. However, attempts to improve the acoustic environments should not be to the detriment of other potential environmental impacts.

The noise policy statement states that the planning system addresses the issue of development and noise nuisance through several Planning Policy Statements (PPSs) which are material considerations in the determination of planning applications and inform the preparation of development plans. All PPSs have been amalgamated into a single Strategic Planning Policy Statement (SPPS) published in September 2015.

5 Methodology

5.1 Baseline Noise Monitoring Methodology

The baseline noise monitoring surveys were carried out in the vicinity of the proposed Curraghinalt Project in close proximity to noise sensitive residential properties to establish the current ambient noise levels for the area. Meteorological data including the measurement of wind speed and rainfall was collected during the survey period.

The noise monitoring surveys were conducted using the methodologies outlined in BS 7445: 2003 *Description and Measurement of Environmental Noise* with reference to BS 4142: 2014 *Method of Rating and Assessing Industrial and Commercial Noise* and the Institute of Acoustics *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (May 2013).

A detailed Baseline Noise Monitoring Report is presented in Annex A.

On 18th April 2016, a meeting was held with representatives of FODC EHD, NIEA IPRI and DfI at the DGL office in Omagh to provide a detailed project description of the Curraghinalt Project, discuss the matters raised by NIEA IPRI and FODC EHD and to introduce and discuss the baseline noise and air quality monitoring undertaken to date. A field visit to the proposed Curraghinalt Project and existing baseline monitoring locations in the surrounding area was also undertaken. The importance of providing a comprehensive baseline study with long-term monitoring data was agreed and monitoring methodologies and location selection were discussed in detail with various recommendations proposed by the statutory consultees. The relevance of specific guidance documents and standards was also discussed.

Long-term baseline noise monitoring was undertaken at five locations in proximity to representative noise sensitive properties near to the proposed Curraghinalt Project during February / March 2016 and May 2016. Short-term daytime and night-time noise monitoring surveys have been undertaken in proximity to the proposed entrance and access road to the proposed infrastructure site along the Crockanboy Road.

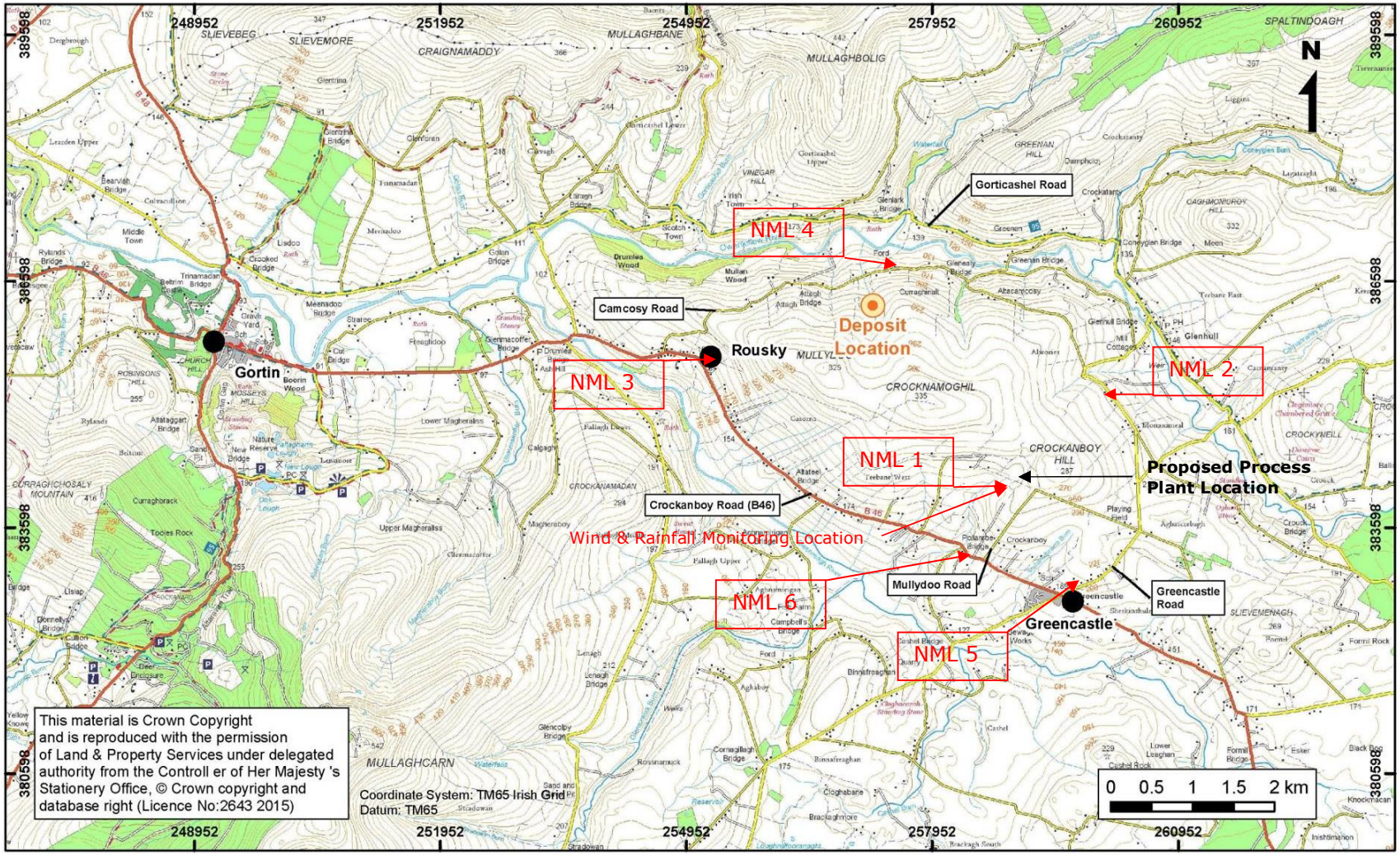
Table 5: Dalradian Gold – Noise Monitoring Locations

Monitoring Location	Address & Location Description	Grid Reference	Monitoring Parameters & Dates
NML 1	Pollan Rua Cottage, ~600m north-west of 216 Crockanboy Rd. (At process plant site)	258452, 384298	Baseline Noise Level (24th Feb to 2nd March & 17th May to 23rd May 2016)
NML 2	216 Greencastle Road (~1,300m north of process plant site)	260066, 385218	Baseline Noise Level (24th Feb to 2nd March & 23rd May to 31st May 2016)
NML 3	114 Crockanboy Road (At Rousky, ~3,925m west of process plant site)	255229, 385679	Baseline Noise Level (2nd March to 9th March & 17th May to 23rd May 2016)
NML 4	48 Camcosy Road (~450m E of exploration adit and ~2,625m north-west of process plant site)	257514, 386778	Baseline Noise Level (2nd March to 9th March & 23rd May to 31st May 2016)
NML 5	146 Greencastle Road (~1,750m south-east of process plant site)	259642, 382914	Baseline Noise Level (17th May to 23rd May 2016)
NML 6	Near to 225 Crockanboy Road (50m south-west of proposed infrastructure site access)	258138, 383470	Baseline Noise Level (8th & 9th June 2016 & 21st September 2016)

Table 6: Dalradian Gold – Wind Speed & Rainfall Monitoring Locations

Monitoring Location	Address	Grid Reference	Monitoring Parameters & Dates
Wind Speed & Rainfall Mon. Loc.	Pollan Rua Cottage, ~600m NW of 216 Crockanboy Rd. (At process plant site)	258404, 384309	Wind Speed & Rainfall (24th Feb to 9th March & 17th May to 31st May 2016)

Figure 2: Noise, wind speed and rainfall monitoring locations in proximity to the proposed Curraghinalt Project location.



5.2 Noise Prediction Modelling Methodology

Construction and operational noise prediction modeling was undertaken using CadnaA noise prediction modeling software. This allows for detailed prediction of noise levels to be undertaken for large numbers of receptor points and different noise emission scenarios. Construction and operational noise level predictions enables the potential impact on the noise climate near the proposed Curraghinalt Project to be determined. Noise modeling has been used to predict impacts from future noise sources on the nearest noise sensitive receptors to the site and to determine appropriate noise mitigation measures to achieve relevant noise limits.

Noise prediction models were run for worst-case scenarios to determine if the future noise impact will comply with the relevant guidelines and standards as outlined above. The modeling software calculates noise levels based on the emission parameters and spatial settings. Table 7 outlines the parameters, sources, settings and assumptions that have been incorporated into the model.

Table 7: Modeling Parameters, Sources and Assumptions

Parameter	Details
Horizontal distances	Scaled development drawings in AutoCad format.
Proposed development dimensions	Scaled development drawings in AutoCad format. Including location of buildings and dimensions.
Receptor Locations	1m from building façades at 4m receptor height.
Reflections	First order reflections applied
Façade Correction	Façade corrections have been incorporated into the modeling. All surfaces have been assumed to be "smooth, reflective surfaces".
Traffic Flows	As supplied by Traffic Consultant
On-site noise sources	As supplied by JDS and the design team.

5.3 Noise Sensitive Receptor Locations

The grid coordinates for all noise sensitive receptors within approximately 5 km of the proposed infrastructure site has been provided by Quod. Of these 738 noise sensitive receptors it is realistic to assume that the vast majority will be completely unaffected in terms of noise impact. This is because noise from the proposed infrastructure site (Area A), the proposed mineral extraction area (Area B), the existing surface infrastructure site (Area C), the passing bays along the Camcosy Road (Area D) and/or the proposed mineral exploration area (Area E)will not propagate to the vast majority of these noise sensitive receptors and existing noise sources in proximity to such locations will continue to be dominant above any project associated noise sources. Therefore, 42 noise sensitive receptor locations (NSR 1 – NSR 42) have been selected for specific reporting of the noise impact from the proposed infrastructure site within this report.

These 42 noise sensitive receptor locations are within approximately 2 km of the proposed infrastructure site and are located to the west, south-west, south, south-east, east and north-east to represent the nearest receptors to the proposed infrastructure site. It can be assumed that all other receptors further from the proposed infrastructure site than these locations will experience a lower and insignificant noise impact than those listed in Table 8.

Table 8 indicates that there are significant offset distances between the nearest receptors to the proposed infrastructure site and the main noise sources on the proposed infrastructure site, as follows;

- The nearest noise sensitive receptor to the DSF is 216 Crockanboy Road which is 400m to the south-west.
- The nearest noise sensitive receptor to the centre of the Crusher Building is 56 Mullydoo Road which is 885m to the east.
- The nearest noise sensitive receptor to the centre of the Processing Building is 56 Mullydoo Road which is 690m to the east.
- The nearest noise sensitive receptor to the site access to the proposed infrastructure site is 225 Crockanboy Road which is 50m to the west.
- The nearest noise sensitive receptor to the decline portal is 216 Crockanboy Road which is 895m to the south.

Such significant offset distances between the nearest receptors to the proposed infrastructure site and the main noise sources on the proposed infrastructure site will allows for a significantly reduced potential for noise impact.

The existing surface infrastructure site (Area C) was developed for the underground exploration programme and will be retained for use. Area C will be used as an early works base and for underground development and future training. Therefore, 15 noise sensitive receptor locations (NSR 43 – NSR 57) have been selected for specific reporting of the noise impact from the existing surface infrastructure site within this report. These 15 noise sensitive receptor locations are within approximately 1 km of the existing surface infrastructure site and are located to the west, north-west, north, north-east and east to represent the nearest receptors in the area. It can be assumed that all other receptors further from the existing surface infrastructure site than these locations will experience a lower and insignificant noise impact than those listed in Table 9.

The noise impact at ecologically sensitive receptors have been reported and assessed in the Ecology Impact Assessment.

Table 8: Noise sensitive receptors in proximity to the proposed infrastructure site input to the noise prediction model (See Figure 3).

Noise IA Ref No.	Address	Receptor ID	X Grid Coordinate (m)	Y Grid Coordinate (m)	Distance to Nearest Area of DSF (m)	Distance to Crusher Building (m)	Distance to Processing Building (m)	Distance to Site Access (m)	Distance to Adit Portal (m)
NSR 1	184 Crockanboy Road	D-R-0037	256766	384014	1370	1985	2240	1405	1575
NSR 2	191 Crockanboy Road	D-R-0020	256858	383785	1355	1970	2215	1250	1625
NSR 3	186 Crockanboy Road	D-R-0024	256885	383970	1265	1885	2135	1280	1495
NSR 4	193 Crockanboy Road	D-R-0013	256970	383732	1280	1890	2130	1130	1575
NSR 5	200 Crockanboy Road	D-R-0047	257413	383746	885	1485	1715	705	1280
NSR 6	184 Crockanboy Road	D-R-0048	257408	384176	710	1325	1580	965	950
NSR 7	204 Crockanboy Road	D-R-0010	257526	383955	675	1285	1525	725	1040
NSR 8	210 Crockanboy Road	D-R-0028	257586	383752	745	1335	1555	555	1180
NSR 9	207 Crockanboy Road	D-R-0045	257619	383594	860	1504	1620	465	1315
NSR 10	213 Crockanboy Road	D-R-0041	257757	383505	870	1370	1565	310	1345
NSR 11	212 Crockanboy Road	D-R-0053	257830	383621	725	1230	1425	285	1215
NSR 12	216 Crockanboy Road	D-R-0030	257965	383915	400	935	1155	460	900
NSR 13	225 Crockanboy Road	D-R-0051	258011	383448	860	1250	1410	50	1360
NSR 14	231 Crockanboy Road	D-R-0050	258306	383314	905	1255	1355	280	1490
NSR 15	234 Crockanboy Road	D-R-0054	258760	383569	550	930	955	700	1385
NSR 16	238 Crockanboy Road	D-R-0036	258761	383426	700	1080	1095	695	1515
NSR 17	244 Crockanboy Road	D-R-0043	258829	383385	740	1125	1130	770	1585
NSR 18	256 Crockanboy Road	D-R-0009	258765	383131	995	1370	1385	775	1795
NSR 19	254 Crockanboy Road	D-R-0016	259040	383323	825	1225	1180	985	1735
NSR 20	260 Crockanboy Road	D-R-0044	259153	383254	915	1325	1260	1100	1855
NSR 21	268 Crockanboy Road	D-R-0022	259259	383040	1155	1570	1495	1270	2090
NSR 22	264 Crockanboy Road	D-R-0018	259262	383261	950	1365	1275	1210	1925
NSR 23	56 Mullydoo Road	D-R-0133	259402	383973	480	885	690	1435	1525

Table 8 (Continued): Noise sensitive receptors in proximity to the proposed infrastructure site input to the noise prediction model. (See Figure 3).

Noise IA Ref No.	Address	Receptor ID	X Irish Grid Coordinate (m)	Y Irish Grid Coordinate (m)	Distance to Nearest Area of DSF (m)	Distance to Crusher Building (m)	Distance to Processing Building (m)	Distance to Site Access (m)	Distance to Adit Portal (m)
NSR 24	276 Crockanboy Road	D-R-0011	259487	383042	1245	1665	1555	1480	2225
NSR 25	146 Greencastle Road	D-R-0064	259644	382933	1415	1830	1710	1665	2410
NSR 26	164 Greencastle Road (Presbytery)	D-R-0565	259995	383017	1555	1975	1810	1980	2580
NSR 27	170 Greencastle Road	D-R-0550	260247	383307	1550	1960	1760	2190	2600
NSR 28	172 Greencastle Road	D-R-0566	260373	383547	1535	1935	1710	2310	2575
NSR 29	46 Mullydoo Road	D-R-0684	260416	383560	1570	1965	1735	2350	2605
NSR 30	188 Greencastle Road	D-R-0072	260432	384134	1415	1780	1520	2465	2400
NSR 31	198 Greencastle Road	D-R-0076	260268	384516	1255	1575	1310	2435	2160
NSR 32	200 Greencastle Road	D-R-0070	260387	384621	1395	1700	1440	2600	2270
NSR 33	204 Greencastle Road	D-R-0071	260340	384839	1410	1680	1415	2655	2210
NSR 34	208 Greencastle Road	D-R-0073	260171	385070	1365	1580	1325	2640	2055
NSR 35	216 Greencastle Road	D-R-0062	260065	385223	1395	1550	1315	2660	1975
NSR 36	K/2012/0141/RM Adjacent to 208 Crockanboy Road	D-Prop-0031	257400	384225	720	1320	1570	1010	925
NSR 37	St Patrick's GFC	D-NR-0043	260322	383649	1440	1835	1615	2260	2475
NSR 38	Greencastle Amateur Boxing Club	D-NR-0044	260371	383622	1465	1860	1640	2285	2485
NSR 39	Greencastle Community Association	D-NR-0045	260346	383637	1490	1885	1665	2310	2515
NSR 40	St Patrick's Church, Sheskinshule	D-NR-0046	260145	383153	1565	1985	1800	2100	2605
NSR 41	Green Elves Nursery School	D-NR-0048	259345	382813	1405	1810	1735	1435	2340
NSR 42	Greencastle School	School	259372	382880	1360	1750	1675	1430	2290

Figure 3: Noise sensitive receptors adjacent to the proposed infrastructure site input to the noise prediction model.

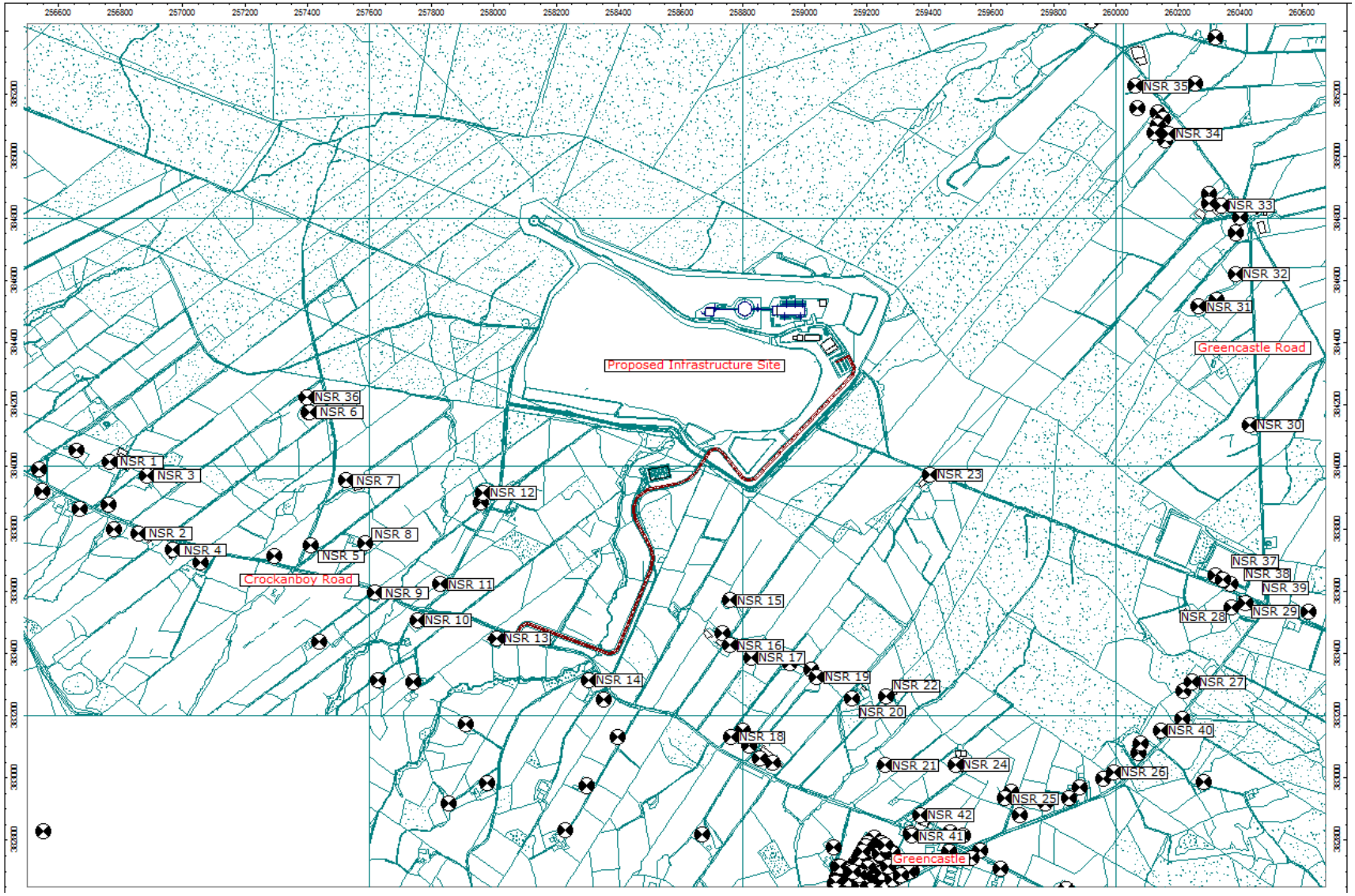
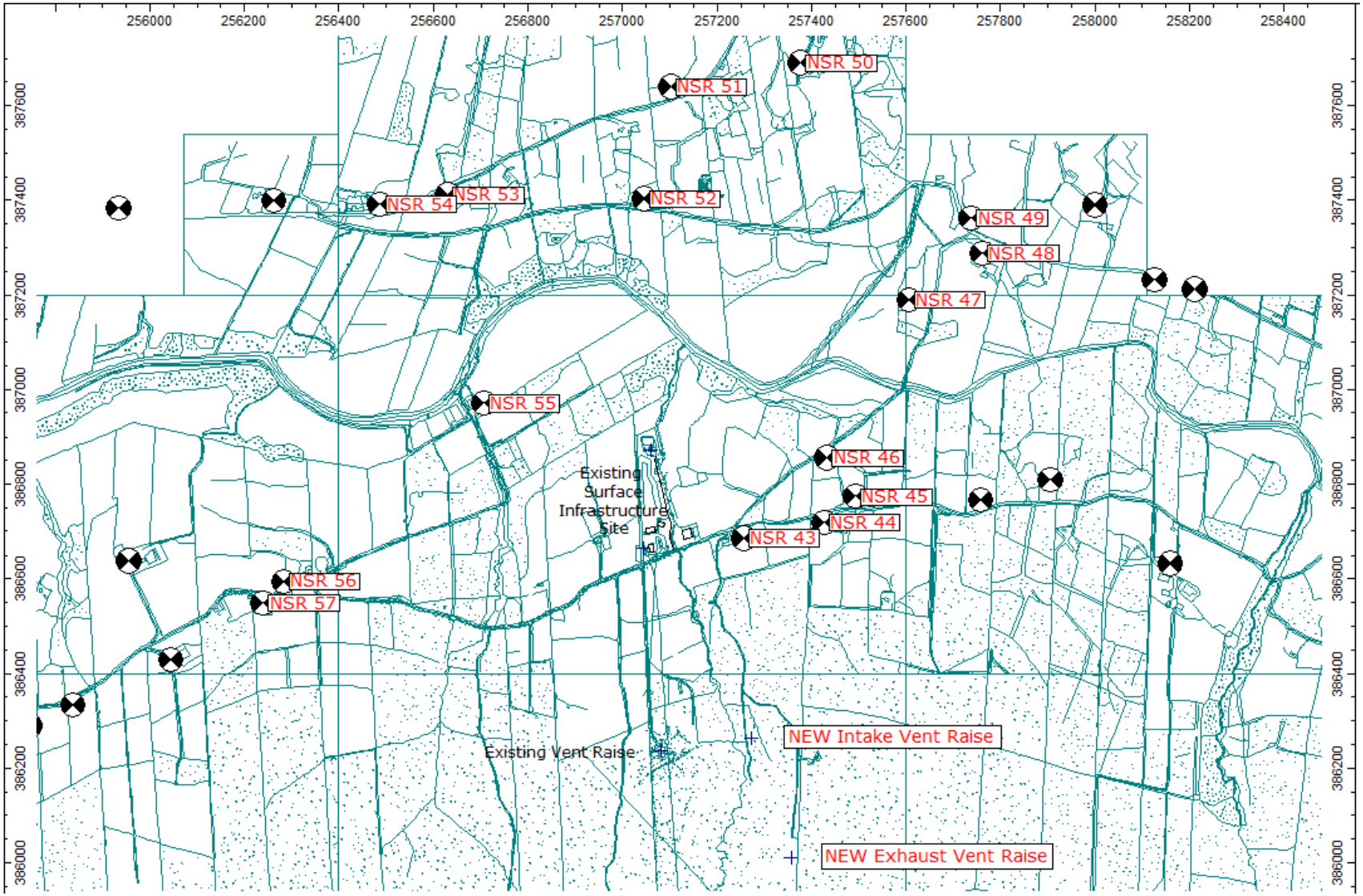


Table 9: Noise sensitive receptors in proximity to the existing surface infrastructure site input to the noise prediction model (See Figure 4).

Noise IA Ref No.	Address	Receptor ID	X Grid Coordinate (m)	Y Grid Coordinate (m)	Distance to existing surface infrastructure site (m)
NSR 43	45 Camcosy Road	D-R-0290	257257	386686	190m
NSR 44	49 Camcosy Road	D-R-0286	257427	386718	365m
NSR 45	48 Camcosy Road	D-R-0275	257494	386773	440m
NSR 46	46 Camcosy Road	D-R-0297	257433	386856	400m
NSR 47	129 Gorticashel Road	D-R-0528	257607	387189	730m
NSR 48	131 Gorticashel Road	D-R-0518	257762	387287	910m
NSR 49	128 Gorticashel Road	D-R-0480	257739	387362	945m
NSR 50	17 Glencullin Road	D-R-0443	257378	387690	1030m
NSR 51	12 Glencullin Road	D-R-0444	257103	387639	930m
NSR 52	122 Gorticashel Road	D-R-0485	257046	387403	700m
NSR 53	5 Glencullin Road	D-R-0442	256630	387411	820m
NSR 54	4 Glencullin Road	D-R-0446	256488	387390	890m
NSR 55	38 Camcosy Road	D-R-0280	256707	386970	440m
NSR 56	34 Camcosy Road	D-R-0291	256284	386594	780m
NSR 57	35 Camcosy Road	D-R-0269	256240	386548	830m

Figure 4: Noise sensitive receptors adjacent to the existing surface infrastructure site input to the noise prediction model.



6 Existing Environment

6.1 Summary of Background Noise Level Monitoring

Long-term background noise monitoring was undertaken at the five locations in proximity to representative noise sensitive properties near to the proposed Curraghinalt Project during various periods+ in 2016. The area is rural with traffic noise on the Crockanboy Road, Camcosy Road and Greencastle Road with agricultural noise sources dominating the background noise climate of the area. The noise level data recorded at the five noise monitoring locations is representative of the background noise levels in the area of the proposed Curraghinalt Project.

The prevailing daytime, evening and night-time background noise level has been determined using the methodology contained within *'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'*. This guidance defines how the measured noise data should be divided into the following subsets:

- Amenity hours 18.00 – 23.00 hours every day
  13.00 – 18.00 hours Saturday
  07.00 – 18.00 hours Sunday
- Night-time hours 23.00 – 07.00 hours every day

Based on a modification of the ETSU-R-97 methodology, Envest has determined the prevailing background noise level based on recorded wind speed and the corresponding noise levels ($L_{A90,\ 10\ min}$) plotted on a scatter graph with a polynomial regression best fit trendline applied during the following periods;

- Daytime period (07.00 – 19.00),
- Evening (19.00 – 23.00) period, and
- Night-time (23.00 – 07.00) period.

From the polynomial regression best fit trendline, average L_{A90} so sound pressure levels derived from wind speeds of 0m/s – 10m/s during daytime, evening and night-time hours.

The lowest recorded background noise level versus wind speed data at each location is presented in Table 10.

Table 10A: NML 1 – Pollan Rua Cottage, Lowest Measured Background L_{A90} Sound Pressure Levels during Daytime, Evening and Night-time hours at increasing wind speeds.

Wind Speed	0m/s	1m/s	2m/s	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s
Daytime	29.5	29.5	30	30.5	31.5	33	34.5	35.5	38.5	41.5	
Evening	25	26.5	28	30	31.5	33.5	35	37	39		
Night-time	24.5	25.5	27	28	30	32	34	37	40	42.5	

Noise Sources noted –

Leaf rustle, agricultural noise such as livestock and farming practices, running water in streams and distant traffic on the Crockanboy Road.

Table 10B: NML 2 – 216 Greencastle Road - Lowest Measured Background L_{A90} Sound Pressure Levels during Daytime, Evening and Night-time hours at increasing wind speeds.

Wind Speed	0m/s	1m/s	2m/s	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s
Daytime	29.5	29.5	30.5	32	33.5	35.5	38.5	40	44	47	51
Evening	27.5	27.5	27.5	27.5	31	32	34	36	39		
Night-time	22.5	22.5	22.5	23.5	25	28.5	32.5	37	43		

Noise Sources noted –

Agricultural noise such as livestock and farming practices and traffic on the Greencastle Road.

Table 10C: NML 3 – 114 Crockanboy Road - Lowest Measured Background L_{A90} Sound Pressure Levels during Daytime, Evening and Night-time hours at increasing wind speeds.

Wind Speed	0m/s	1m/s	2m/s	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s
Daytime	30	30.5	31.5	33	34.5	36	38	40	44	46.5	49
Evening	29	29	29.5	32	33	35	40	41.5	43		
Night-time	25.5	5.5	25.5	26.5	28	30	35	38			

Noise Sources noted –

Agricultural noise such as livestock and farming practices and traffic on the Crockanboy Road.

Table 10D: NML 4 – 48 Camcosy Road - Lowest Measured Background L_{A90} Sound Pressure Levels during Daytime, Evening and Night-time hours at increasing wind speeds.

Wind Speed	0m/s	1m/s	2m/s	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s
Daytime	34	34	34	33.5	36	36	37	37.5	38.5	39.5	41
Evening	34	34	33	34	35	35.5	37	39	41		
Night-time	34	34	33.5	34	34	34.5	35.5	37			

Noise Sources noted –

Owenkillew river, leaf rustle, agricultural noise such as livestock and farming practices and very occasional traffic on the Camcosy Road.

Table 10E: NML 5 – 146 Greencastle Road, background L_{A90} sound pressure levels at increasing wind speeds during Daytime, Evening and Night-time hours from 17th May to 25th May 2016.

Wind Speed	0m/s	1m/s	2m/s	3m/s	4m/s	5m/s	6m/s	7m/s
Daytime	33.5	34.5	36	37.5	39	41	43	45
Evening	31.5	32.5	33.5	35	37	39	41	-
Night-time	27.5	27.5	28	29.5	33.5	36.5	-	-

Noise Sources noted –

Traffic on the Crockanboy and Greencastle Roads, leaf rustle, agricultural noise sources. This is a more 'urbanised' area than the other long-term monitoring locations.

Short-term early morning, daytime, late-evening and night-time noise monitoring surveys have been undertaken at NML 6, in proximity to the entrance and access road to the proposed infrastructure site. This nearest property is located directly adjacent to the Crockanboy Road and existing traffic flows on the Crockanboy Road together with agricultural noise sources dominate the baseline noise climate in this area.

Table 11: Early morning, daytime, late-evening and night-time noise monitoring surveys results at NML 6, in proximity to the entrance and access road to the proposed infrastructure site.

Location	Start Time	L_{Aeq} dB	L_{A10} dB	L_{A90} dB	Subjective Commentary Notes
In field of proposed site access opposite the nearest noise sensitive receptor. Approximately 15m from road-side.	08/06/2016 10:15 – 10.45	51.8	50.2	27.4	Passing traffic on Crockanboy Road - 68 Cars, 10 HGVs - Birdsong, sheep bleating.
	08/06/2016 15:31 – 16.01	65.6	49.9	28.3	Passing traffic on Crockanboy Road - 58 Cars, 6 HGVs - Birdsong, sheep bleating.
	08/06/2016 22:34 – 23.04	43.5	40.9	25.6	13 Cars, 0 HGVs - Occasional sheep bleating
	09/06/2016 01:54 – 02.09	34.3	26.7	20	0 Cars, 0 HGVs – no noise sources audible apart from occasional mooing and movements of cows in adjacent field.
	21/09/2016 06.00 – 08.30	47.6	40.8	32.4	Passing traffic on Crockanboy Road – Light traffic flow at 06.00 increasing to ~40 Cars & 5 HGVs / hour from 07.30 – 08.30, Birdsong.

7 Impact Assessment

7.1 Construction Noise Impact Assessment

7.1.1 Introduction

During construction, potential sources of noise impact, will be under the jurisdiction of FODC EHD. In terms of potential Construction Noise Impact Assessment, consideration has been given to the following potential noise impacts at the nearest residential receptors during the Construction Phase including;

- Site clearance works such as excavations, foundation works and spoil movements associated with the construction of the proposed site buildings and access roads. The initial construction stage will include a small amount of above ground blasting to create the building pads at the ground levels proposed;
- Construction traffic movements associated with excavation and construction works as well as those associated with the delivery of construction plant, equipment and materials etc.
- Mine shaft construction including excavations, haul road movements and stockpiling of excavated materials;
- Potential blast-induced noise and air overpressure impacts during the construction of the mine shafts, vent raise and blasting associated with excavation of the building pad areas beneath the proposed site buildings; and

7.1.2 Construction Noise Limits

The potential for noise sensitive receptors to be affected during the approximate 2-year construction phase will depend on where within the application site the activity takes place, the nature of the activity and controls and meteorological conditions. There are no statutory limits regarding construction noise.

BS5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open site – Part 1: Noise'*, provides guidance on assessing the potential significance of noise effects from construction activities in Annex E.

In relation to Construction Noise Limits, BS 5228-1:2009+A1: 2014 Noise and Vibration Control on Construction and Open Sites Part 1: Noise details the 'ABC method', which recommends a construction noise limit based on the existing ambient noise level. General and short term construction noise impacts that are deemed typical of any construction site noise sources, including activities such as ground preparation, site clearance, demolition, foundation earthworks,

roadway construction, erection of new buildings, etc. are assessed in accordance with the 'ABC method' defined in BS 5228. The ambient noise levels have been determined through the baseline noise surveys near the nearest residential properties and then rounded to the nearest 5dB to determine the appropriate category (A, B or C) and subsequent threshold value. This is then compared with the noise level predicted from construction activity. A potential significant effect is indicated if the construction noise level exceeds the appropriate category threshold value. If the existing ambient level exceeds the threshold category threshold values, then a potential significant impact is indicated if the total noise level, including both the ambient noise and the various contributions of construction noise, is greater than the ambient noise level by more than 3dB. Table 12, reproduced from BS 5228, demonstrates the criteria for selection of a noise limit for a specific receptor location.

Table 12: Construction noise threshold levels based on the BS 5228 'ABC' method.

Assessment Category and Threshold value period (L_{Aeq})	**Threshold value, in decibels (dB)**		
	Category A (A)	**Category B (B)**	**Category C (C)**
Night time (23.00 to 07.00)	**45**	50	55
Evening and weekends (D)	**55**	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 - 13.00)	**65**	70	75

Notes:

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

At each of the noise sensitive receptors, the ambient noise levels (rounded to the nearest 5 dB) are less than 65 dB $L_{Aeq,T}$ during daytime, 55 dB $L_{Aeq,T}$ during evening and 45 dB $L_{Aeq,T}$ during night-time. Therefore, all noise sensitive receptors fall into Category A of the 'ABC' assessment methodology. Hence, daytime construction noise will be subject to a limit of 65 dB $L_{Aeq,T}$. Evening and night-time construction noise would be subject to a limit of 55 dB $L_{Aeq,T}$ and 45 dB $L_{Aeq,T}$ respectively at the nearest noise sensitive receptors.

7.1.3 Noise Impact from Construction Activities

There is the potential for a temporary increase in noise levels during the construction phase at the nearest residential properties.

The main sources of noise during construction will be from activities such as earth movement and excavations, foundations and building erection, access road construction and general construction activities.

There will also be a small amount of blasting undertaken initially at the proposed infrastructure site to allow for the creation of the building pads at the ground levels proposed for the Laydown area, the Crusher Building, the Covered Stockpile and the Processing Plant Building as well as the freshwater pond, the east water pond and the west water pond. This will take place during initial stages of construction and will allow for a small volume of rock removal. Any other blasting will take place below ground which will significantly attenuate any potential noise impact.

The majority of the potentially significant sources of noise will occur throughout the initial months of construction. Noise impact as a result of the construction phase of the development will be perceptible at nearby properties but this will be intermittent and temporary.

The following construction practices have the potential to produce intermittent and temporary noise impacts:

- Excavation / Infilling / Levelling — Excavators, jack-hammers, concrete trucks, dozers & dump trucks & concrete vibrators
- Steel Erection — Cranes & Delivery vehicles
- General Construction — Masonry, services, drainage and surfacing, etc.
- Blasting — Instantaneous noise impact due to intermittent blasts. (only for a short period at early construction stage).

The construction of the proposed infrastructure site will include associated construction site traffic, comprising of contractors' vehicles, excavators, diggers, cranes, possibly generators and other diesel-powered vehicles. During the construction phase, the development will generate HGV movements throughout the duration of the construction period.

The significance of the noise impact of the various construction activities will depend on the duration of each activity, the particular sources of noise and the time at which the activity occurs. Construction noise can be assessed in terms of the equivalent continuous sound level and/or in terms of the maximum level. The level of sound in the neighbourhood that arises from a

construction site depends on a number of factors and the estimation procedures need to take into account the following significant factors;

- the sound power outputs of processes and plant;
- the periods of operation of processes and plant;
- the distances from sources to receptor;
- the presence of screening by barriers;
- the reflection of sound;
- ground attenuation
- meteorological conditions (particularly wind speed and direction), and
- atmospheric absorption

Typical noise levels from construction works likely to take place during construction phase of development have been referenced from BS 5228-1:2009, Annex C & D and the DEFRA Update on Noise Database from prediction of Noise on Construction and Open Sites.

For construction noise impact prediction purposes, various construction phase scenarios at the proposed infrastructure site have been assessed using CadnaA noise prediction models. Using sound pressure levels (dB L_{Aeq} at 10m) from the various typical construction activity sources as outlined in BS5228 and the DEFRA Update on Noise Database from prediction of Noise on Construction and Open Sites, an appropriate sound power level (L_w) has been determined for each source. Subsequently, worst-case construction noise levels have been predicted at the nearest residential properties which may occur at some stages during the construction schedule.

Construction noise impact predictions have been undertaken to represent stages of the construction process.

1. ***Construction Scenario 1 – Blasting for creation of the building pads and water ponds at the proposed infrastructure site***

It is predicted that there will be a requirement to blast in the construction stage to allow for the creation of the building pads at the ground levels proposed for the Laydown area, the Crusher Building, the Covered Stockpile and the Processing Plant Building as well as the freshwater pond, the east water pond and the west water pond.

It is proposed that these rock cuttings will be accomplished by means of drilling and blasting. Detonation of the explosive during blasting may generate airborne vibration or air overpressure. The effect of blasting operations in terms of both ground borne and airborne vibration depends on the distance to the receptor, the meteorological conditions prevailing, the explosive charge

weight, the detonating cord and the depth of charge. The adoption of good blasting practices will reduce the inherent and associated impulsive noise.

Accurate prediction of noise levels that will occur from blasting is not straight-forward due to the many individual factors that affect noise levels from a single blast. The noise impact from a blast results in an instantaneous impact rather than a longer-term noise impact such as may occur from continuous machinery activity.

Table 13: Location of the nearest receptors to the proposed areas of blasting at the proposed infrastructure site.

Receptor	To Crusher Building (m)	To Covered Stockpile (m)	To Processing Building (m)	To freshwater pond (m)	To east water pond (m)	To west water pond (m)
NSR 12 - 216 Crockanboy Road	935	1030	1155	1320	705	340
NSR 15 - 234 Crockanboy Road	930	940	955	960	460	710
NSR 23 - 56 Mullydoo Road	885	860	690	510	545	1030

Blasting results in a very short–term and instantaneous increase in noise levels with immediate reversion back to preceding noise levels during daytime hours. A typical sound level from blasting, measured at 15 m from the source, is ~95 - 100 dB(A) (Hoover 1996). Table 14 shows the estimated noise levels in the vicinity of an active blasting site. The accepted reduction in noise levels with distance from a blast is based on the assumption that the sound level drop off rate equates to 6 dB per doubling of distance.

Table 14: Predicted instantaneous noise level from blasting in the vicinity of the proposed infrastructure site.

Distance to receiver (m)	Predicted Sound Level at Receptor Location dB(A)
15	approximately 95 - 100
30	approximately 89 - 94
60	approximately 83 - 88
120	approximately 77 - 82
240	approximately 71 - 76
480	approximately 65 - 70
960	approximately 59 - 64

As indicated in Table 14, sensitive receptors within 450m - 500m of the blasting site could be exposed to instantaneous noise levels of approximately 65 - 70 dB(A). However, these blasts will

result in very short–term and instantaneous noise impacts at all residential receptors in the vicinity of the quarry and do not constitute a significant noise impact.

Blasting impact parameters including Peak Particle Velocity (vibration), Air Overpressure (Noise) and the potential for flyrock during blasting will be monitored and controlled by the blasting contractor. The blasting contractor will take precautions for the protection of persons and property, including proper loading and stemming of holes and the use of blasting mats or other effective means of controlling the blast or resultant flying material. The blasting contractor will ensure that the danger area is clear of workers and residents during the blasting period. These measures are common practise on projects such as quarrying and road construction. Due to large offset distance to the nearest receivers there is no potential for flyrock impact.

Blasted rock will be used on site for construction activities such as haul and access roads, building foundations, etc. In terms of noise from crushing the blasted rock on site, the following data has been taken from BS 5228. This data represents sound pressure levels standardised to 10m from rock crushing.

Table 15: Sound Level Data for a Tracked Crusher as presented in BS 5228.

Ref No.	Equipment	Power Rating kW	Equipment size, weight (mass) capacity	Octave band Sound Pressure Levels dB								A-weighted Sound Pressure Level, L_{Aeq} dB at 10m
				63	125	250	500	1K	2K	4K	8K	
Crushing Concrete / Rubble												
14	Tracked Crusher	172	47t	93	86	79	81	75	71	66	59	82
15	Tracked Crusher	-	-	86	84	84	81	78	75	71	66	84

For the purposes of noise impact assessment, the Sound Power level (L_w) can be determined by measuring the Sound Pressure Level (L_p) at a specific distance (e.g. 10m) from the source and using the following equation.

$$L_w = L_p + (20 \times \text{Log}_{10}(\text{Distance})) + 8$$

Therefore, the A-weighted Sound Pressure Level, L_{Aeq} dB, presented in Table 15 above equates to a Sound Power Level (L_w) of approximately 112 dB(A). Similarly, the predicted noise level at a receptor location can be calculated if the L_w of the source and the distance between source and receptor are both known.

$$L_p = L_w - (20 \times \text{Log}_{10}(\text{Distance})) - 8$$

Adjustments can be made for the presence of any barriers and the nature of the ground the noise has to travel over. The corrections for barriers requires a knowledge of sound pressure levels at different frequencies and of the precise geometry of the receptor in relations to the source and barrier. These adjustments are quite complex, and are outlined in detail in Annex D of BS 5228: Part 1: 1997. However, the Standard suggests that as a working approximation, an attenuation of 10dB can be made if a screen completely hides the source from the receiver. If the top of the source is just visible to the receiver, then an attenuation of 5dB can be assumed.

Any rock crushing of the blasted rock on site will occur intermittently throughout the day. The nearest receptors are located at approximately 750m from the likely nearest location of rock crushing of the blasted rock on site, i.e. near the farm shed close to the existing Pollan Rua cottage. Therefore, assuming no screening, a noise level of 47 dB L_{Aeq} is predicted due to rock crushing of the blasted rock on site assuming this activity occurs at approximately 500m from nearest receptors.

$$L_p = 112 - (20 \times \text{Log}_{10}(750)) - 8 = 47 \text{ dB(A)}$$

A worst-case predicted noise level of 48 dB(A) at the nearest noise sensitive receptors to the proposed infrastructure site due to the crushing of the blasted rock will be well in accordance with the daytime construction noise limit of 65 dB $L_{Aeq,T}$.

2. ***Construction Scenario 2 – Site Access, Access Road & Haul Road Construction.***

The early stages of the construction on site will commence with the construction of the access road, which will start at the site and progress in a southerly direction down to the Crockanboy Road. The main haul road will run from the decline portal to the crusher. Additional site roads will be constructed to access the Topsoil/Peat stockpile, Waste Rock Berm and the DSF area.

A CadnaA noise model has been prepared to represent lorry movements, excavator and asphalt paver operations at various locations along the proposed access road and haul roads to the proposed infrastructure site using the following Sound Power Levels (L_w) based on DEFRA Update on Noise Database from prediction of Noise on Construction and Open Sites. This model assumes no noise abatement procedures are employed on site and assumes a realistic worst-case assumption that excavator and asphalt paver operations occur for on average 45 minutes in every 1 hour throughout the working day.

Table 16: Excavator and Asphalt Paver Sound Power Levels (L_w) derived from BS 5228.

Source	Octave Spectrum (dB)								
	63	125	250	500	1000	2000	4000	8000	A
Asphalt Paver (+Tipper Lorry)	118.0	115.0	101.0	111.0	110.0	107.0	105.0	96.0	114.5
Tracked Excavator	112.0	102.0	101.0	99.0	99.0	100.0	91.0	84.0	104.7

Lorry movements have been represented assuming 10 HGV movements per hour with a *'moving line source'* sound power level (L_w) = 105 dB(A). This model has included four individual haul routes throughout the site.

The predicted noise levels at each of the noise sensitive receptor locations are presented in Table 18 (See Annex B – Figure 1).

The worst-case predicted noise level of 66 dB(A) at the nearest noise sensitive receptor to the site access to the proposed infrastructure site will occur during the construction of the access junction on the Crockanboy Road. A 1dB(A) exceedance of the BS5228 construction noise limit is an indiscernible noise level difference. Noise levels will decrease considerably as the access road construction moves northwards and away from this location. Management of the construction process in proximity to the site access using the mitigation measures outlined in Section 8.1 will allow for the daytime construction noise limit of 65 dB $L_{Aeq,T}$ to be achieved.

3. ***Construction Scenario 3 – Earthworks, Site Clearance, Mobile Crusher & Embankment Construction*** **–**

The earthworks, site clearance, mobile crusher & embankment construction on the proposed infrastructure site will include:

- Stripping and stockpiling of topsoil/peats (where unavoidable) (for use in restoration of the site);
- Stripping and stockpiling of subsoil (for use in restoration of the site);
- Cut and fill earthworks along roads;
- Excavations at the plant site, crusher pad, ore pad and placement of overburden from the excavations into a visual and acoustic screening bund;
- Cut and fill earthworks at the plant site, crusher pad and ore pad;
- Excavation of overburden (soft material) at the portal site establishment of a mine platform on a terraced embankment; and
- Excavation in the basin of the DSF and construction of embankments.
- A mobile crusher which will be set up in or near the farm shed close to the existing Pollan Rua cottage.

A CadnaA noise model has been prepared to represent lorry movements, excavator and bulldozer operations at various locations within the proposed infrastructure site and a mobile crusher to represent the activities as outlined above using the following sound power levels (L_w) based on the DEFRA Update on Noise Database from prediction of Noise on Construction and Open Sites. This model assumes no noise abatement procedures are employed on site and assumes a realistic worst-case assumption that excavator and bulldozer operations occur continuously for on average 45 minutes in every 1 hour throughout the working day. The mobile crusher is also assumed to operate for on average 45 minutes in every 1 hour throughout the working day.

Table 17: Excavator, Bulldozer & Crusher Sound Power Levels (L_w) derived from BS 5228.

Source	Octave Spectrum (dB)								
	63	125	250	500	1000	2000	4000	8000	A
Bulldozer	109.0	118.0	107.0	107.0	114.0	112.0	105.0	99.0	117.4
Tracked Excavator	112.0	102.0	101.0	99.0	99.0	100.0	91.0	84.0	104.7
Tracked Crusher	116	114	114	111	108	105	101	96	113.5

Lorry movements have been represented assuming 10 HGV movements per hour with a *'moving line source'* Sound Power Levels (L_w) = 105 dB(A). This model has included four individual haul routes throughout the site.

The predicted noise levels at each of the noise sensitive receptor locations are presented in Table 18 (See Annex B – Figure 2).

A worst-case predicted noise level of 53 dB(A) at the nearest noise sensitive receptors to the proposed infrastructure site to represent lorry movements, excavator and bulldozer operations at various locations will be well in accordance with the daytime construction noise limit of 65 dB $L_{Aeq,T}$.

4. Construction Scenario 4 – General Building Construction & Concrete Pour

Based on a review of BS 5228-1:2009, Annex C & D and the DEFRA Update on Noise Database from prediction of Noise on Construction and Open Sites, the General Building Construction and Concrete Pour operations have been assigned a worst-case sound pressure level (L_p) of 90 dB L_{Aeq} at 10m => sound power level (L_w) = 121 dB(A). This noise model was run for General Building Construction and Concrete Pour operations at 10 separate locations between the crusher building, the covered stockpile, the processing building, the mine dry building and the proposed offices at 8m height on the façade of the proposed development buildings in closest proximity to the nearest residential receptors. This model assumes no noise abatement procedures are employed on site and assumes a realistic worst-case assumption that General Building

Construction and Concrete Pour operations occur for on average 45 minutes in every 1 hour throughout the working day.

Lorry movements have been represented assuming 10 HGV movements per hour with a *'moving line source'* Sound Power Levels (L_w) = 105 dB(A). This model has included four individual haul routes throughout the site.

The predicted noise levels at each of the noise sensitive receptor locations are presented in Table 18 (See Annex B – Figure 3).

A worst-case predicted noise level of 56.4 dB(A) at the nearest noise sensitive receptors to the proposed infrastructure site to represent General Building Construction and Concrete Pour operations at various locations will be well in accordance with the daytime construction noise limit of 65 dB $L_{Aeq,T}$.

5. ***Construction Scenario 5 – Noise Impact from Construction of Proposed Portal and Vent Raises***

As well as the existing exploration adit portal and the ventilation raise to surface, the development will include a new decline portal and two additional ventilation raises, designed to deliver fresh air volumes and flows required to dilute dust and particulates, carbon monoxide and oxides of nitrogen to provide a safe working environment underground.

It will take approximately one year to excavate the planned decline to link the mine workings with the portal at the proposed infrastructure site. Ventilation fans will be required in the decline until the decline connects with the mine workings such that a flow through ventilation circuit can be established. The two new ventilation raises will be developed after the decline is connected to the mine workings and will take 2-3 months each to complete. Development of the ventilation raises may require temporary infrastructure on surface depending on the method used. This infrastructure would include a raise bore machine and a power generator. Above-ground construction works will take place during daytime periods only, but underground construction works will take place during daytime and night time working hours.

It has been assumed that a realistic worst-case noise level from the operation of a small compound including a raise bore machine and a power generator in proximity to the new decline portal and two additional ventilation raises during construction would result in a noise level of 80 dB(A) at 10m from the noise sources. Hence, a resultant noise level has been predicted at the nearest noise sensitive receptors to each of these locations as presented in Tables 18 & 19 (See Annex B – Figures 4 & 5).

A worst-case predicted noise level of 39.4 dB(A) at the nearest noise sensitive receptors to the existing surface infrastructure site (Area C) from the construction of the two additional ventilation raises will be well in accordance with the daytime construction noise limit of 65 dB $L_{Aeq,T}$.

A worst-case predicted noise level of 38.2 dB(A) at the nearest noise sensitive receptors to the proposed infrastructure site from the construction of the new portal will be well in accordance with the daytime construction noise limit of 65 dB $L_{Aeq,T}$.

The mitigation measures outlined in Section 8 for the construction of the new decline portal and two additional ventilation raises together with individual daily blasts underground during daytime will result in no significant noise impact from portal construction. The nearest residential property to the proposed portal area is 895m to the south. At such distances, together with the proposed construction mitigation measures, no significant noise impact will occur and the relevant construction noise limits will not be exceeded.

Table 18: Predicted noise levels at the noise sensitive receptors during the Construction Phase of the proposed infrastructure site (See Annex B – Figures 1 - 4).

Noise IA Ref No.	Address	Receptor ID	Construction Scenario 2 – Site Access, Access Road & Haul Road Construction.	Construction Scenario 3 – Earthworks, Site Clearance, Crusher & Embankments.	Construction Scenario 4 – General Building Construction & Concrete Pour.	Construction Scenario 5 –Construction of Proposed New Portal & Vent Raises.
NSR 1	184 Crockanboy Road	D-R-0037	28.8	29.1	36	29.5
NSR 2	191 Crockanboy Road	D-R-0020	30.3	34.5	37.4	31.7
NSR 3	186 Crockanboy Road	D-R-0024	30.9	34.7	39.5	32.6
NSR 4	193 Crockanboy Road	D-R-0013	32.5	36	39.5	32
NSR 5	200 Crockanboy Road	D-R-0047	41.2	41.3	48.1	34.5
NSR 6	184 Crockanboy Road	D-R-0048	32.7	45.6	49.8	37.6
NSR 7	204 Crockanboy Road	D-R-0010	33.3	46.3	51.7	36.7
NSR 8	210 Crockanboy Road	D-R-0028	35.1	44.2	51.7	35.3
NSR 9	207 Crockanboy Road	D-R-0045	45.8	42.7	47.4	34.2
NSR 10	213 Crockanboy Road	D-R-0041	50	42.9	48.2	33.8
NSR 11	212 Crockanboy Road	D-R-0053	38	44.8	51	35
NSR 12	216 Crockanboy Road	D-R-0030	34.8	53	46.7	38.2
NSR 13	225 Crockanboy Road	D-R-0051	66.3	43.4	48.8	33.8
NSR 14	231 Crockanboy Road	D-R-0050	53.9	43.7	52	32.7
NSR 15	234 Crockanboy Road	D-R-0054	37.1	44	52.6	29.3
NSR 16	238 Crockanboy Road	D-R-0036	34.9	43.6	51.6	32.5
NSR 17	244 Crockanboy Road	D-R-0043	37.6	40.9	51.2	32
NSR 18	256 Crockanboy Road	D-R-0009	37.5	39.6	48.9	30.6
NSR 19	254 Crockanboy Road	D-R-0016	26.9	37.4	50.5	28.5
NSR 20	260 Crockanboy Road	D-R-0044	34.1	39.1	49.8	30.1
NSR 21	268 Crockanboy Road	D-R-0022	32.4	37.5	47.9	<10
NSR 22	264 Crockanboy Road	D-R-0018	33.2	38.8	49.7	29.7
NSR 23	56 Mullydoo Road	D-R-0133	34.8	46.2	56.4	32.5

Table 18 (Continued): Predicted noise levels at the noise sensitive receptors during the Construction Phase of the proposed infrastructure site (See Annex B – Figures 1 - 4).

Noise IA Ref No.	Address	Receptor ID	Construction Scenario 2 – Site Access, Access Road & Haul Road Construction.	Construction Scenario 3 – Earthworks, Site Clearance, Crusher & Embankments.	Construction Scenario 4 – General Building Construction & Concrete Pour.	Construction Scenario 5 –Construction of Proposed New Portal & Vent Raises.
NSR 24	276 Crockanboy Road	D-R-0011	31.1	37.4	47.4	<10
NSR 25	146 Greencastle Road	D-R-0064	28.1	35.4	46.3	<10
NSR 26	164 Greencastle Road (Presbytery)	D-R-0565	26.1	33.9	45.5	<10
NSR 27	170 Greencastle Road	D-R-0550	17.9	33.4	45.8	<10
NSR 28	172 Greencastle Road	D-R-0566	18.4	33.7	46.1	<10
NSR 29	46 Mullydoo Road	D-R-0684	16.4	25.4	35.1	<10
NSR 30	188 Greencastle Road	D-R-0072	24.3	30.9	46	<10
NSR 31	198 Greencastle Road	D-R-0076	26.2	32.2	44.1	<10
NSR 32	200 Greencastle Road	D-R-0070	24.9	31.9	41.3	<10
NSR 33	204 Greencastle Road	D-R-0071	19	23.9	35.3	<10
NSR 34	208 Greencastle Road	D-R-0073	23.9	31.9	41.5	<10
NSR 35	216 Greencastle Road	D-R-0062	19.5	31	43.7	26.9
NSR 36	K/2012/0141/RM Adjacent to 208 Crockanboy Road	D-Prop-0031	38.4	45.8	51.8	37.9
NSR 37	St Patrick's GFC	D-NR-0043	19.1	34.3	46.7	<10
NSR 38	Greencastle Amateur Boxing Club	D-NR-0044	18.8	34	46.4	<10
NSR 39	Greencastle Community Association	D-NR-0045	19	34.1	46.6	<10
NSR 40	St Patrick's Church, Sheskinshule	D-NR-0046	20.7	33.8	45.6	<10
NSR 41	Green Elves Nursery School	D-NR-0048	30.9	36.3	46.1	<10
NSR 42	Greencastle School	School	31.2	36.7	46.6	<10

Table 19: Predicted noise level at receptor locations in the area of the existing surface infrastructure site (Area C) from the construction of the two additional ventilation raises (See Annex B – Figure 5).

Noise IA Ref No.	Address	Receptor ID	Construction Scenario 5 –Construction of Proposed New Portal & Vent Raises.
NSR 43	45 Camcosy Road	D-R-0290	39.4
NSR 44	49 Camcosy Road	D-R-0286	38.2
NSR 45	48 Camcosy Road	D-R-0275	36.1
NSR 46	46 Camcosy Road	D-R-0297	35.8
NSR 47	129 Gorticashel Road	D-R-0528	31.8
NSR 48	131 Gorticashel Road	D-R-0518	30.4
NSR 49	128 Gorticashel Road	D-R-0480	29.8
NSR 50	17 Glencullin Road	D-R-0443	27.8
NSR 51	12 Glencullin Road	D-R-0444	28.1
NSR 52	122 Gorticashel Road	D-R-0485	30
NSR 53	5 Glencullin Road	D-R-0442	28.7
NSR 54	4 Glencullin Road	D-R-0446	28.2
NSR 55	38 Camcosy Road	D-R-0280	32.4
NSR 56	34 Camcosy Road	D-R-0291	31.4
NSR 57	35 Camcosy Road	D-R-0269	31.1

6. ***Summary of 'Above Ground' Construction Noise Impact***

It is most likely that the above outlined construction activities will occur separately over the proposed 18 – 24 month period of construction. By its nature, construction phases of such a development are transient in terms of locations of precise activities on site from time to time. Therefore, the scenarios outlined above are aimed at presenting a range of noise levels that have the potential to occur throughout the construction period.

The only potential for a marginal and indiscernible exceedance of the recommended construction noise limits that may occur will be during a brief period of the site access construction process at the nearest residential property along the Crockanboy Road which is approximately 50m from the proposed site entrance. However, a 1dB(A) exceedance of the BS5228 construction noise limit is imperceptible to the human ear. Because there is a very large buffer distance to all other noise sensitive receptors from the proposed areas of construction activities on the proposed infrastructure site, there is no potential for exceedance of the BS5228 construction noise limits.

The predicted noise level in Table 18 of 66.3 dB(A), at the nearest noise sensitive receptor along Crockanboy Road during site access road construction due to the simultaneous use of excavators

and asphalt pavers in the area assumes no construction noise mitigation measures. However, prior to the commencement of the construction phase of the project, a 2.5m high closed boarded wooden perimeter fence will be constructed along the site boundary in this area. There shall be no gaps in this perimeter fencing and the fencing will have a density of approximately 25 kg/m^2. The 2.5m high closed boarded wooden perimeter fence should allow for a 5 - 10 dB(A) reduction in noise level at the nearest residential properties. Hence, there will be no exceedance of the recommended construction noise limits at the nearest residential properties.

Appropriate construction noise mitigation measures which should be implemented as part of a site-specific Construction Site Management Plan are outlined in Section 8 of this report.

7.1.4 Noise Impact from Construction Traffic on Public Roads

It will take approximately one year to excavate the planned decline to link the existing mine workings with the proposed portal entrance. During this time, the existing exploration adit will be used to provide access points for underground mine development and up to 35 HGVs per day to carry waste rock from the mine development to the DSF during the construction phase. Waste rock and ore generated from mine development will be trucked to surface using mine haul trucks. Once on surface the waste will be stockpiled and then re-loaded into HGVs. Waste and ore will be transported Monday to Saturday and approximately 35 trucks loads per day that will travel from the existing portal site along the Camcosy Road to Crockanboy Road and then onto the site access road. For safety reasons, the HGVs will be required to turn right onto the Crockanboy road and then use a specific turning area off the main road to turn and continue towards the new mine infrastructure area. The waste rock will be used for road and berm construction with any excess reporting to the DSF. Ore will be delivered to the ore stock pile in preparation for the start of the process plant operation. Waste rock and ore will be hauled from the exploration portal. Once construction is complete, no further waste or ore will be hauled from the exploration portal.

A prediction of the relative noise impact at the residential receptors in proximity to public roads in the area due to the increase in total traffic flows has been undertaken in accordance with the *'Calculation of Road Traffic Noise'* CRTN methodology. The relative noise impact predictions have been based upon the existing and predicted Annual Average Daily Traffic (AADT) flows which have been taken from the Transport Impact Assessment.

The *'Base AADT'* flows & the *'Base AADT + Generated Construction Traffic'* flows inclusive of HGVs, deliveries and construction staff movements have been used to determine the relative increase in daily noise levels at the nearest residential receptors to the public roads as outlined in Table 20.

Table 20: Relative increase in daily noise levels at the nearest residential receptors to the public roads during the construction phase.

Location	Arm	Base AADT	Generated	% increase	Relative noise impact – difference between *'Base AADT'* flows & the *'Base AADT + Generated Construction Traffic'* flows
Junction 1 – A5 Killymore Road	A	15250	42	0.3%	+0 dB(A) $L_{10\text{-}18\ hour}$
	B	1515	63	4.2%	
	C	15250	22	0.1%	
Junction 2 – Gortin Village	A	750	8	1.1%	+0.2 dB(A) $L_{10\text{-}18\ hour}$
	B	1653	111	6.7%	
	C	1365	40	2.9%	
	D	1515	63	4.2%	
Junction 3 – Rousky Village	A	293	65	22%	+0.8 dB(A) $L_{10\text{-}18\ hour}$
	B	1098	139	12.7%	
	C	1193	110	9.2%	
Junction 4 – Development Access	A	0	172	-%	+0.7 dB(A) $L_{10\text{-}18\ hour}$
	B	1098	49	4.5%	
	C	1098	8	0.7%	
Junction 5 – Greencastle Village	A	959	1	0.1%	+0.1 dB(A) $L_{10\text{-}18\ hour}$
	B	1205	40	3.3%	
	C	1311	1	0%	
	D	1098	41	3.7%	
Junction 6 – A505 Crockanboy Road	A	3456	19	0.6%	+0.1 dB(A) $L_{10\text{-}18\ hour}$
	B	959	1	0.1%	
	C	3456	19	0.6%	
	D	1210	40	3.3%	
Lenagh Road Junction at HGV Turning Circle	A	1098	198	18%	+1.1 dB(A) $L_{10\text{-}18\ hour}$
	B	0	78	100%	
	C	1098	120	10.9%	
Camcosy Road	A	293	78	26.6%	+1 dB(A) $L_{10\text{-}18\ hour}$

As shown in Table 20, the highest predicted relative noise impact due to increased construction traffic volumes on the surrounding road network will be from Rousky Village to the proposed turning circle at Lenagh Road. The relative traffic noise level difference between the *'Base AADT'* flows & the *'Base AADT + Generated Construction Traffic'* flows indicates a noise level difference of plus 1.1 dB(A) $L_{10\text{-}18\ hour}$. An increase of plus 1.1 dB(A) $L_{10\text{-}18\ hour}$ will be a negligible increase in noise levels along this road. Traffic exiting Camcosy Road from the existing site will turn right towards the turning circle at Lenagh Junction and then return along the Crockanboy Road through Rousky village. This will occur for a period of approximately 18 – 24 months. Traffic returning from the proposed infrastructure site to the existing surface infrastructure site on the Camcosy Road will turn right as normal.

At all other properties in the area, the relative traffic noise level difference between the *'Base AADT'* flows & the *'Base AADT + Generated Construction Traffic'* flows indicates a noise level difference of less than 1 dB(A) $L_{10\text{-}18\ hour}$. An increase of less than 2 - 3 dB(A) $L_{10\text{-}18\ hour}$ is 'not significant' and is a 'negligible' increase in noise levels.

7.2 Operational Noise Impact

7.2.1 Introduction

In terms of potential sources of noise impact, particular components of the Curraghinalt Gold Mining Project will be under the jurisdiction of FODC EHD while other components will be under the jurisdiction of NIEA IPRI.

The components of the project under the jurisdiction of FODC EHD will be the subject of compliance with the Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014). The components under the jurisdiction of FODC EHD during the Operation Phase will include the following mineral extraction operations;

- Underground mineral extraction operations;
- Haulage of extracted mineral from the adit to the crushing plant;
- Crushing activities;
- Conveying of crushed materials to the PPC permitted process plant;
- The placement of waste rock and filtered tailings in the DSF including haul road movements;
- Development generated road traffic, including employee access and associated HGV movements to and from the site; and
- Mine shaft and process plant noise sources, such as generators, vents, etc.

As specific planning guidance is in place for mineral extraction (Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014)), BS4142: 2014 'Method of Rating and Assessing Industrial and Commercial Noise' is not applicable to the specific mineral extraction activities.

The components of the project permitted by NIEA IPRI according to the Schedule in The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 (PPC Regulations) and subject to compliance with BS4142: 2014 will include;

- Part A Permit Activities; i.e. mineral processing operations including Carbon-in-leach / Carbon strip & Electrowinning.

Therefore, all potential noise impacts from the activities involved in the processing of gold from the Crusher Building to the activities within the Processing Plant Building including associated externally located treatment tanks, are subject to compliance with BS4142: 2014. The externally located treatment tanks at the Processing Building include the Thickener tank at the CN Detox & Leach Area, the Flotation Thickener Tanks, the Tailings Filtration Tanks, the CIL Tanks and the Paste Holding Tanks.

7.2.2 Operational Noise Limits

Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014) Noise Limits;

Section 4.2 outlines the methodology by which mineral planning authorities should aim to establish a noise limit, through implementation of a planning condition, at noise sensitive properties. In summary, during daytime and evening the operational noise level at the noise sensitive property should not exceed the background noise level ($L_{A90, 1hr}$) by more than 10dB (A). In any event, the total noise from the operations should not exceed 55dB $L_{Aeq, 1hr (Free Field)}$. During night time, noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator and the noise limit should not exceed 42dB $L_{Aeq, 1hr (Free Field)}$ at a noise sensitive property.

Table 21: Derived Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014) noise limits based on baseline noise monitoring data, assuming an average annual wind speed in the area of approximately 3 m/s, i.e. Background L_{A90} sound pressure level +10 dB(A) = PPG Limit.

Period	NML 1 – At Properties in closest proximity to site	NML 2 – At Properties along Greencastle to East & North-East of site	NML 3 – At Properties along Crockanboy Road to the West of site	NML 4 - At Properties along Camcosy Road to the North of site	NML 5 – At properties in the area of Greencastle Village
Daytime Measured Noise Level L_{90} dB(A)	30.5	32	33	33.5	37.5
PPG Daytime Noise Limit dB(A)	**41**	**42**	**43**	**43.5**	**48**
Evening Measured Noise Level L_{90} dB(A)	30	27.5	32	34	35
PPG Evening Noise Limit dB(A)	**40**	**38**	**42**	**44**	**45**
Night-time Measured Noise Level L_{90} dB(A)	28	23.5	26.5	34	29.5
PPG Night-time Noise Limit dB(A)	**38**	**34**	**37**	**44**	**40**

Based on the measured daytime and night-time noise levels data, a noise limit of 42 dB(A) $L_{Aeq,\ 12\ hour}$ during daytime, 42 dB(A) $L_{Aeq,\ 4\ hour}$ during evening and 42 dB(A) $L_{Aeq,\ 8\ hour}$ during night-time should be applied at all noise sensitive receivers in proximity to the proposed infrastructure site.

In terms of potential daytime and evening noise impact, a noise limit of 42 dB(A) L_{Aeq} is in accordance with the PPG suggested limit of background noise level plus 10dB(A) without imposing unreasonable burdens on the mineral operator. This suggested noise limit does not exceed the absolute night-time noise limit of 42dB $L_{Aeq,\ 1hr\ (Free\ Field)}$ at a noise sensitive property.

A noise limit for all operations of 42 dB(A) $L_{Aeq,\ 12\ hour}$ during daytime, 42 dB(A) $L_{Aeq,\ 4\ hour}$ during evening and 42 dB(A) $L_{Aeq,\ 8\ hour}$ during night-time is also in accordance with WHO Guidelines. Such noise levels would not have the potential to cause a justifiable noise nuisance at noise sensitive receptor locations. An external noise level of 42 dB(A) $L_{Aeq,\ 8\ hour}$ during night-time does not have the potential to cause sleep disturbance and equates to less than the recommended internal noise level of 30 dB(A) within a bedroom as outlined in British Standard 8233: 2014

Guidance on Sound Insulation and noise reduction for buildings, even assuming an open bedroom window.

Throughout the lifetime of the project, any temporary construction works lasting up to 8 weeks during a 12-month period that provide long term environmental benefits, such as bunds providing acoustic and/or visual screening, can be allowed to generate noise levels of up to 70 dB $L_{Aeq,1\ Hour}$ during normal day-time hours in accordance with Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014).

BS 4142: 2014 Noise Limits;

Section 4.2 outlines the methodology by which BS 4142: 2014 determines the background noise level in an area and establishes the corresponding appropriate noise limit values. Using the background noise monitoring data, the following noise limit is based on the BS 4142: 2014 methodology, assuming an average wind speed in the area of 3 m/s. [Note: the meteorological data that exists for this area indicates that an average wind speed of 3 m/s]

Table 22: Derived BS 4142: 2014 noise limits based on baseline noise monitoring data, assuming an average wind speed in the area of 3 m/s, i.e. Background L_{A90} sound pressure level +0 dB(A) = BS 4142 Limit.

Period	**NML 1 – At Properties in closest proximity to site**	**NML 2 – At Properties along Greencastle Road to East & North-East of site**	**NML 3 – At Properties Along Crockanboy Road to the West of site**	**NML 4 - At Properties Along Camcosy Road to the North of site**	**NML 5 – At properties in the area of Greencastle Village**
Daytime Measured Noise Level L_{90} dB(A)	30.5	32	33	33.5	37.5
BS4142 Daytime Noise Limit dB(A)	**31**	**32**	**33**	**34**	**38**
Evening Measured Noise Level L_{90} dB(A)	30	27.5	32	34	35
BS4142 Evening Noise Limit dB(A)	**30**	**28**	**32**	**34**	**35**
Night-time Measured Noise Level L_{90} dB(A)	28	23.5	26.5	34	29.5
BS4142 Night-time Noise Limit dB(A)	**28**	**24**	**27**	**34**	**30**

As the measured background sound levels are low, especially during night-time, an absolute external BS4142 limit of 35 dB(A) during daytime, evening and night-time is more relevant than the margin by which the rating level exceeds the background.

A noise limit of 35 dB(A) for all is very low and equates to the recommended daytime resting noise level as outlined in British Standard 8233: 2014 *Guidance on Sound Insulation and noise reduction for buildings*. An external noise level of 35 dB(A) from site related activities will not be audible indoors and will not result in sleep disturbance.

7.2.3 Modelled Noise Sources

The following individual components have been input to the noise prediction model based on information supplied by the project team. These individual noise sources have been assigned appropriate sound power levels as outlined in Table 23.

Table 23: Noise sources and sound power levels as input to noise prediction model.

POINT SOURCES		
Name	**Location**	**Sound Power Level**
Vibrating Packer / Roller	Will operate in DSF Area	111.9 dB(A)
Tracked Dozer	Will operate in DSF Area	117.4 dB(A)
Dust Collectors (x 2)	On conveyors - #1 – from Crusher to Covered Store and #2 from Covered Store to SAG Mill in Process Building	105 dB(A)
Exhaust Vent Raise	Exhaust Vent Raise	90 dB(A)
Thickener (CN Detox & Leach)	External Treatment Tank at Process Building	90 dB(A)
Flotation Thickener Tanks	External Treatment Tank at Process Building	90 dB(A)
Tailings Filtration Tanks	External Treatment Tank at Process Building	90 dB(A)
CIL Tanks	External Treatment Tank at Process Building	90 dB(A)
Paste Holding Tanks	External Treatment Tank at Process Building	90 dB(A)
Pumps in WTP Area (x2)	WTP related pumps that will be housed in enclosure on the RO Skid. <85 dB(A) @ 1m without enclosure.	105 dB(A)
Generator	On existing surface infrastructure site	91 dB(A)
WTP Generators	On existing surface infrastructure site	82 dB(A)
MOVING LINE SOURCES		
Name	**Location**	**Sound Power Level**
40 T Articulated Trucks (Up to 2,160tonnes of ore and waste per day / 54 truck-loads/day)	Will operate from Portal to ROM, 8 movements / hour during 12-hour daytime period & 3 movements / hour during 4 hour evening period @ 30 km/hour.	105 dB(A)
Loader to Crusher Building	Will operate from ROM to Crusher Building (20 movements / hour @ 25 km/hr)	105 dB(A)
40 T Articulated Trucks (To and from DSF Area from Processing Building)	Will operate from Processing Building to DSF Area (6 movements / hour @ 25 km/hr)	105 dB(A)

Table 23 (Continued): Noise sources and sound power levels as input to noise prediction model.

LINE SOURCES		
Name	**Location**	**Sound Power Level**
Stockpile Feed Conveyor	Stockpile Feed Conveyor	87 dB(A)
Sag Mill Feed Conveyor	Sag Mill Feed Conveyor	87 dB(A)
AREA SOURCES		
Name	**Internal Sound Level**	**Sound Reduction**
Crusher Building Roof	97.8 dB(A)	R_w = 25 dB(A)
SAG Mill in Process Building (Roof)	100 dB(A)	R_w = 25 dB(A)
Covered Storage	70 dB(A)	R_w = 20 dB(A)
Process Building (Roof)	80 dB(A)	R_w = 25 dB(A)
VERTICAL AREA SOURCES		
Name	**Internal Sound Level**	**Sound Reduction**
Crusher Building	97.8 dB(A)	Wall – R_w = 24 dB(A)
SAG Mill in Process Building	100 dB(A)	Wall – R_w = 24 dB(A)
Covered Storage	70 dB(A)	20dB(A)
Processing Building	80 dB(A)	Wall – R_w = 24 dB(A)

Table 24: Vibrating Packer and Tracked Dozer Octave Band Sound Power Levels (L_w).

Source	**Octave Spectrum (dB)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**A**
Vibrating Packer	121.5	115.5	108.5	112.5	104.5	99.5	96.5	92.5	111.9
Tracked Dozer	109	118	107	107	114	112	105	99	117.4

Table 25: Internal Octave Band Sound Power Levels in the Crusher Building, SAG Mill Area in Process Building and in the remainder of the Processing Building on the proposed infrastructure site.

Source	**Octave Spectrum (dB)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**A**
Dal1 - Crusher Building	85	90	93	95	93	90	88	83	97.8
Dal2 - SAG Mill Area in Process Building	87	92	95	97.5	95	92	90	85	100
Process Building	68	72	75	77.5	75	72	70	65	80

Table 26: Sound Attenuation Levels provided by the proposed Kingspan wall and roof cladding of the Crusher Building, SAG Mill Area in Processing Building and in the remainder of the Process Building on the proposed infrastructure site.

Roof / Wall Structure	**Octave Spectrum (dB)**								
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**R_w**
Wall - Kingspan KS1000 AWP/60 + No Lining	15	16	19	23	26	22	39		24
Roof - Kingspan KS1000 RW/80 + No Lining	-	18	21	23	20	38	42		25

7.2.4 Noise Impact from the components requiring compliance with Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014).

As outlined above, the components of the project subject to compliance with the Planning Practice Guidance '*Assessing Environmental Impacts from Mineral Extraction – Noise Emissions*' (March 2014) will be under the jurisdiction of FODC EHD.

A detailed noise impact prediction model has been prepared for scenarios as the proposed infrastructure site progresses from commencement of operation in Year 1 to Year 20. It is assumed that at the commencement of the operation phase, the access road, the haul road from the portal to the ROM, the crusher building, the covered stockpile, the processing building, the admin, office and dry mine buildings, etc. as well as all associated components of the project will be constructed and operational. These components will remain unchanged during the remainder of the working life of the project. It will only be the DSF that will evolve and enlarge as the development progresses from commencement of operation to Year 20. AutoCad layouts of the various phases of the DSF have been provided by the project engineers responsible for the design of the DSF, specifically SRK Consulting (Canada) Inc. It can be expected that as the DSF evolves as the development progresses it will act as a noise barrier to activities further to the north of the site. Therefore, a range of noise prediction models have been prepared to assess the changes in the DSF, considering Year 20 as the final extent of the DSF.

A range of noise prediction models have been prepared to assess the effects of changes in the DSF, including Year 1, Year 5, Year 9, Year 16 and Year 20, considering Year 20 as the final extent of the DSF. The selected years correspond to the finish of a specific phase of DSF construction. As shown in Table 27, there is no predicted exceedance of the suggested limit of 42 dB(A) $L_{Aeq,\ 12\ hour}$ during daytime, 42 dB(A) $L_{Aeq,\ 4\ hour}$ during evening and 42 dB(A) $L_{Aeq,\ 8\ hour}$ during night-time as recommended at noise sensitive receptor locations. The noise prediction models assume a worst-case scenario that all site traffic will occur during a single 1 hour period during daytime and night-time.

It is also assumed in this noise prediction model that the Vibrating Packer and Tracked Dozer will operate 24/7 on the DSF. It is unlikely that the Vibrating Packer and Tracked Dozer will operate during night-time hours. However, if such workings are required intermittently this will only occur if meteorological conditions (i.e. the prevailing south-westerly wind direction) and continuously measured noise levels allow for this to occur in order to ensure that noise limits are not exceeded. As a result, the typical night-time noise levels may be lower than predicted by up to 3 - 5 dB(A) at the nearest noise sensitive receptor locations.

Table 27: Predicted noise level at receptors due to components of the proposed project subject to compliance with the Planning Practice Guidance '*Assessing Environmental Impacts from Mineral Extraction – Noise Emissions*' (See Annex C – Figures 1 - 5).

Noise IA Ref No.	Address	Receptor ID	Year 1 - Day	Year 1 - Night	Year 5 - Day	Year 5 - Night	Year 9 - Day	Year 9 - Night	Year 16 - Day	Year 16 - Night	Year 20 - Day	Year 20 - Night
NSR 1	184 Crockanboy Road	D-R-0037	20	17	20	17	22	21	23	22	23	22
NSR 2	191 Crockanboy Road	D-R-0020	24	23	27	26	28	27	28	27	29	28
NSR 3	186 Crockanboy Road	D-R-0024	27	26	27	26	27	27	28	27	29	28
NSR 4	193 Crockanboy Road	D-R-0013	29	28	29	28	30	29	30	30	30	30
NSR 5	200 Crockanboy Road	D-R-0047	33	32	33	32	34	33	34	34	34	34
NSR 6	184 Crockanboy Road	D-R-0048	33	33	34	33	35	34	33	32	33	32
NSR 7	204 Crockanboy Road	D-R-0010	29	27	30	29	34	33	34	34	35	34
NSR 8	210 Crockanboy Road	D-R-0028	34	33	34	33	35	34	35	35	35	35
NSR 9	207 Crockanboy Road	D-R-0045	34	33	34	33	34	33	34	34	35	34
NSR 10	213 Crockanboy Road	D-R-0041	35	34	35	34	35	34	35	34	35	35
NSR 11	212 Crockanboy Road	D-R-0053	36	35	36	35	36	36	36	35	36	36
NSR 12	216 Crockanboy Road	D-R-0030	31	29	30	29	30	29	30	29	31	29
NSR 13	225 Crockanboy Road	D-R-0051	38	35	38	35	38	36	38	36	38	36
NSR 14	231 Crockanboy Road	D-R-0050	42	39	42	39	42	39	42	38	42	39
NSR 15	234 Crockanboy Road	D-R-0054	31	30	31	29	30	28	30	28	30	28
NSR 16	238 Crockanboy Road	D-R-0036	34	34	34	33	35	34	35	34	35	34
NSR 17	244 Crockanboy Road	D-R-0043	32	31	33	32	31	30	32	32	33	32
NSR 18	256 Crockanboy Road	D-R-0009	31	30	31	30	31	30	32	31	32	31
NSR 19	254 Crockanboy Road	D-R-0016	29	28	31	31	26	25	25	24	26	24
NSR 20	260 Crockanboy Road	D-R-0044	29	28	31	31	29	28	30	29	30	30
NSR 21	268 Crockanboy Road	D-R-0022	29	28	31	30	29	28	29	29	29	29
NSR 22	264 Crockanboy Road	D-R-0018	29	28	31	31	28	28	30	29	30	29
NSR 23	56 Mullydoo Road	D-R-0133	38	38	38	37	35	35	35	34	35	34

Table 27 (Continued) Predicted noise level at receptors due to components of the proposed project subject to compliance with the Planning Practice Guidance '*Assessing Environmental Impacts from Mineral Extraction – Noise Emissions*' (See Annex C – Figures 1 - 5).

Noise IA Ref No.	Address	Receptor ID	Year 1 - Day	Year 1 - Night	Year 5 - Day	Year 5 - Night	Year 9 - Day	Year 9 - Night	Year 16 - Day	Year 16 - Night	Year 20 - Day	Year 20 - Night
NSR 24	276 Crockanboy Road	D-R-0011	31	30	31	30	30	29	29	29	29	29
NSR 25	146 Greencastle Road	D-R-0064	30	30	30	29	28	28	25	25	26	25
NSR 26	164 Greencastle Road (Presbytery)	D-R-0565	29	29	29	29	24	24	24	24	24	24
NSR 27	170 Greencastle Road	D-R-0550	27	27	27	27	21	20	21	20	21	21
NSR 28	172 Greencastle Road	D-R-0566	27	26	28	27	22	22	22	22	22	22
NSR 29	46 Mullydoo Road	D-R-0684	21	21	23	23	20	20	20	20	20	20
NSR 30	188 Greencastle Road	D-R-0072	27	26	28	28	24	23	21	20	22	21
NSR 31	198 Greencastle Road	D-R-0076	27	26	29	29	25	24	25	24	26	25
NSR 32	200 Greencastle Road	D-R-0070	26	26	28	28	25	24	23	22	23	22
NSR 33	204 Greencastle Road	D-R-0071	20	18	24	24	20	19	20	18	20	18
NSR 34	208 Greencastle Road	D-R-0073	28	28	29	29	27	26	26	26	27	26
NSR 35	216 Greencastle Road	D-R-0062	28	28	29	28	26	25	27	26	26	25
NSR 36	K/2012/0141/RM Adjacent to 208 Crockanboy Road	D-Prop-0031	33	33	34	33	35	34	36	35	36	35
NSR 37	St Patrick's GFC	D-NR-0043	28	28	28	28	27	27	23	22	24	23
NSR 38	Greencastle Amateur Boxing Club	D-NR-0044	28	28	28	28	23	22	23	22	23	22
NSR 39	Greencastle Community Association	D-NR-0045	28	28	28	28	27	27	23	22	23	22
NSR 40	St Patrick's Church, Sheskinshule	D-NR-0046	29	28	29	28	24	23	24	23	24	24
NSR 41	Green Elves Nursery School	D-NR-0048	29	29	30	29	29	29	29	28	29	28
NSR 42	Greencastle School	School	30	29	30	30	29	29	29	28	29	29

Noise Impact from Ventilation Fans;

Planned air flows into and out of the mine will utilise the existing exploration portal, the proposed new mine portal, the existing ventilation raise and two additional new ventilation raises. The ventilation raises will be designed to deliver the required air volumes and flows required to dilute dust and particulates, carbon monoxide and oxides of nitrogen to provide a safe working environment underground.

- Existing exploration portal (257050, 386660) 200m to NSR 43, 45 Camcosy Road
- Proposed new mine portal (258125, 384805) 895m to NSR 12, 216 Crockanboy Road
- Existing Ventilation Raise (257083, 386236) 475m to NSR 43, 45 Camcosy Road
- New Intake Ventilation Raise (257274, 386263) 420m to NSR 43, 45 Camcosy Road
- New Exhaust Ventilation Raise (257357, 386011) 680m to NSR 43, 45 Camcosy Road

The ventilation fans will be located underground (after the construction phase) to minimise potential noise impacts on surface. The new intake ventilation raise will have a fan located underground with a vertical distance from the fan to the surface of 63m. The other intake ventilation raise will have the fan installed in the existing exploration adit 220m from the portal. The ventilation system is a 'push system'. Therefore, the exhaust ventilation raise does not have a fan associated with it. This design measure will negate the potential for noise impact from ventilation. The main ventilation system will be augmented by underground secondary ventilation fans that will further distribute fresh air to the individual work areas. The ventilation fans will not be audible at ground level.

7.2.5 Noise Impact from the components requiring compliance with BS 4142: 2014 *Methods for rating and assessing industrial and commercial sound noise.*

A detailed noise prediction model has been prepared to assess the potential noise impact at all receptor locations from the operation of the components of the proposed infrastructure site subject to compliance with the BS4142: 2014, including the activities involved in the processing of gold from the Crusher Building to the activities within the Processing Plant Building including associated externally located treatment tanks.

Table 28: Predicted noise level at receptors due to components of the proposed infrastructure site subject to compliance with BS 4142: 2014 (See Annex D – Figures 1 - 5).

Noise IA Ref No.	Address	Receptor ID	Day, Evening & Night – 24–Hour Process				
			Year 1	Year 5	Year 9	Year 16	Year 20
NSR 1	184 Crockanboy Road	D-R-0037	24	24	24	16	14
NSR 2	191 Crockanboy Road	D-R-0020	26	26	26	22	19
NSR 3	186 Crockanboy Road	D-R-0024	27	27	27	23	21
NSR 4	193 Crockanboy Road	D-R-0013	27	27	27	23	21
NSR 5	200 Crockanboy Road	D-R-0047	31	31	31	29	29
NSR 6	184 Crockanboy Road	D-R-0048	32	32	32	25	22
NSR 7	204 Crockanboy Road	D-R-0010	35	35	32	30	30
NSR 8	210 Crockanboy Road	D-R-0028	34	34	32	29	29
NSR 9	207 Crockanboy Road	D-R-0045	32	32	32	29	29
NSR 10	213 Crockanboy Road	D-R-0041	32	32	32	29	29
NSR 11	212 Crockanboy Road	D-R-0053	34	34	33	29	30
NSR 12	216 Crockanboy Road	D-R-0030	31	31	23	21	21
NSR 13	225 Crockanboy Road	D-R-0051	33	33	33	29	29
NSR 14	231 Crockanboy Road	D-R-0050	34	33	33	29	30
NSR 15	234 Crockanboy Road	D-R-0054	33	29	30	24	25
NSR 16	238 Crockanboy Road	D-R-0036	34	30	32	25	25
NSR 17	244 Crockanboy Road	D-R-0043	32	27	30	25	25
NSR 18	256 Crockanboy Road	D-R-0009	32	31	31	26	27
NSR 19	254 Crockanboy Road	D-R-0016	29	23	24	24	24
NSR 20	260 Crockanboy Road	D-R-0044	28	23	24	24	25
NSR 21	268 Crockanboy Road	D-R-0022	27	24	25	25	25
NSR 22	264 Crockanboy Road	D-R-0018	28	24	25	25	26
NSR 23	56 Mullydoo Road	D-R-0133	34	34	34	34	34
NSR 24	276 Crockanboy Road	D-R-0011	26	26	26	26	26
NSR 25	146 Greencastle Road	D-R-0064	25	25	25	25	25
NSR 26	164 Greencastle Road (Presbytery)	D-R-0565	24	24	24	24	24
NSR 27	170 Greencastle Road	D-R-0550	24	24	24	24	24
NSR 28	172 Greencastle Road	D-R-0566	24	24	24	24	24
NSR 29	46 Mullydoo Road	D-R-0684	16	16	16	16	16
NSR 30	188 Greencastle Road	D-R-0072	19	19	19	19	19
NSR 31	198 Greencastle Road	D-R-0076	19	19	19	19	19
NSR 32	200 Greencastle Road	D-R-0070	19	19	19	19	19
NSR 33	204 Greencastle Road	D-R-0071	17	17	17	17	17
NSR 34	208 Greencastle Road	D-R-0073	23	23	23	23	23
NSR 35	216 Greencastle Road	D-R-0062	22	22	22	22	22
NSR 36	K/2012/0141/RM Adjacent to 208 Crockanboy Road	D-Prop-0031	35	35	35	32	31

Table 28 (Continued): Predicted noise level at receptors due to components of the proposed infrastructure site subject to compliance with BS 4142: 2014 (See Annex D – Figures 1 - 5).

NSR 37	St Patrick's GFC	D-NR-0043	25	25	25	25	25
NSR 38	Greencastle Amateur Boxing Club	D-NR-0044	25	25	25	25	25
NSR 39	Greencastle Community Association	D-NR-0045	25	25	25	25	25
NSR 40	St Patrick's Church, Sheskinshule	D-NR-0046	24	24	24	24	24
NSR 41	Green Elves Nursery School	D-NR-0048	25	25	25	25	25
NSR 42	Greencastle School	School	25	25	25	25	25

Based on the low predicted noise levels from the operation of the components of the proposed infrastructure site under the jurisdiction of NIEA IPRI and subject to compliance with the BS4142: 2014, these components will be inaudible at the majority of noise sensitive receptor locations.

A BS4142: 2014 assessment has been carried out for the nearest noise sensitive receptor location to assess the potential for '*significant adverse impact'*, due to the specific noise levels from the activities involved in the processing of gold from the Crusher Building to the activities within the Processing Plant Building including associated externally located treatment tanks. A BS4142; 2014 Assessment has been undertaken for NSR 23, 56 Mullydoo Road, i.e. a noise sensitive receptor location at which the highest noise levels have been predicted. All other noise sensitive receptor locations will experience a lower noise level from these components of the development.

Table 29: BS 4142: 2014 assessment of the specific noise levels due to the processing of gold at NSR 23, 56 Mullydoo Road, during daytime, evening and night-time.

BS4142: 2014 Assessment	Daytime	Evening	Night-time	Commentary
Measured Ambient Sound Level	43 dB L_{Aeq}	43 dB L_{Aeq}	43 dB L_{Aeq}	*Average measured L_{Aeq} at NML 1 in close proximity to NSR 23.*
Residual Sound Level	43 dB L_{Aeq}	43 dB L_{Aeq}	43 dB L_{Aeq}	*Project not yet operational.*
Background Sound Level L_{A90}	30.5 dB L_{A90}	30 dB L_{A90}	28 dB L_{A90}	*Measured Background Noise level in proximity to NSR 23*
Predicted 'Specific sound level' from operations	34 dB L_{Aeq}	34 dB L_{Aeq}	34 dB L_{Aeq}	*Based on CadnaA noise model outputs*
Acoustic Feature Correction	+0 dB	+0 dB	+0 dB	*No Tonal, Impulsive or Intermittent Impact expected at receptor 665m from Processing Building.*
Rating Level	34 dB L_{Aeq}	34 dB L_{Aeq}	34 dB L_{Aeq}	*Specific Noise Level + Acoustic Feature Correction*
Background Sound Level L_{A90}	30.5 dB L_{A90}	30 dB L_{A90}	28 dB L_{A90}	*Measured Background Noise level in proximity to NSR 23*
Excess of Rating Level over Background	+3.5 dB	+4dB	+6 dB	Potential 'adverse impact, depending on the context'

Note: No 'On Time Correction' as the processing of gold in the Processing Building and associated treatment tanks will operate 24/7/365.

The BS 4142 assessment for NSR 23, 56 Mullydoo Road, indicates potential *'adverse impact, depending on the context'*. However, in terms of context, the 'Rated Level' of 34 dB(A) at the receiver location is a very low noise level that will not affect the residents enjoyment of their outdoor amenity area in comparison to the measured background noise level in proximity to NSR 23. At night-time, a 'Rated Level' of 34 dB(A) at the receiver location will not have the potential to cause sleep disturbance even with a window open.

7.2.6 Noise Impact from Operational Traffic on Public Roads

Daily Average Traffic Noise Impact;

A prediction of the relative noise impact at the residential receptors in proximity to public roads due to increased operational traffic flows has been undertaken in accordance with the *'Calculation of Road Traffic Noise'* CRTN methodology. The relative noise impact predictions have been based upon the existing and predicted Annual Average Daily Traffic (AADT) flows which have been taken from the Transport Impact Assessment.

The *'Base AADT'* flows & the *'Base AADT + Generated Operational Traffic'* flows have been used to determine the relative increase in daily noise levels ($L_{A10,\ 18\ Hour}$) at the nearest residential receptors to the public roads as outlined in Table 30. The relative increase in daily noise levels has been based on the Traffic Survey results and impacts on the surrounding road network including all traffic, HGVs and construction staff.

Table 30: Relative increase in daily noise levels ($L_{A10,\ 18\ Hour}$) at the nearest residential receptors to the public roads in proximity to the proposed Curraghinalt Project site.

Location	Arm	Base AADT	Generated	% increase	Relative noise impact – difference between *'Base AADT'* flows & the *'Base AADT + Generated Operation Traffic'* flows
Junction 1 – A5 Killymore Road	A	1,5250	46	0.3%	+0 dB(A) $L_{10\text{-}18\ hour}$
	B	1,515	76	5.0%	
	C	1,5250	29	0.2%	
Junction 2 – Gortin Village	A	750	14	1.9%	+0.2 dB(A) $L_{10\text{-}18\ hour}$
	B	1,653	147	8.9%	
	C	1,365	58	4.2%	
	D	1,515	76	5.0%	
Junction 3 – Rousky Village	A	293	0	0.0%	+0.4 dB(A) $L_{10\text{-}18\ hour}$
	B	1,098	155	14.1%	
	C	1,193	147	12.3%	
Junction 4 – Development Access	A	0	221	N/A	+0.5 dB(A) $L_{10\text{-}18\ hour}$
	B	1,098	66	6.0%	
	C	1,098	0	0.0%	
Junction 5 – Greencastle Village	A	959	1	0.1%	+0.1 dB(A) $L_{10\text{-}18\ hour}$
	B	1,205	64	5.3%	
	C	1,311	1	0.1%	
	D	1,098	66	6.0%	
Junction 6 – A505 Crockanboy Road	A	3,456	31	0.9%	+0.1 dB(A) $L_{10\text{-}18\ hour}$
	B	959	2	0.3%	
	C	3,456	31	0.9%	
	D	1,210	64	5.3%	

As shown in Table 30, the most significant predicted relative noise impact due to increased operational traffic volumes on the surrounding road network based on the difference between the *'Base AADT'* flows & the *'Base AADT + Generated Operational Traffic'* flows indicates a noise level difference less than 1 dB(A) $L_{10\text{-}18\ hour}$. An increase of less than 2 - 3 dB(A) $L_{10\text{-}18\ hour}$ is 'not significant' and is a 'negligible' increase in noise levels.

Worst-case Hourly Traffic Noise Impact;

As indicated in the Traffic Flows for the development the following staggered traffic flows will result during the operation phase of the development;

- Proposed Hourly Flows: Cars 7 – 8 AM & 6 - 7 PM = 54 (Operatives)
  8 – 9 AM & 5 - 6 PM = 24 (Admin)
  6 – 7 AM & 7 - 8 PM = 45 (Operatives)
  HGVs (throughout daytime only) = 14 two-way movements.

  Existing Hourly Flows: 6 – 7 AM = 36 (10.7% HGV)
  7 – 8 AM = 82 (7.6% HGV)
  8 – 9 AM = 107 (8.4% HGV)
  5 - 6 PM = 117 (4.4% HGV)
  6 - 7 PM = 93 (3.8% HGV)
  7 – 8 PM = 61 (2.6% HGV)

As a worst-case assumption, it has been assumed that all daytime and night-time traffic will enter and exit the site during one hour in these periods. The predicted relative increase due to the worst-case 1 hour traffic flow at the noise sensitive receptors located closest to the site access is as shown in Table 31.

Table 31: The predicted relative increase due to the worst-case proposed hourly traffic flow at the noise sensitive receptors located closest to the site access.

Noise IA Ref No.	Address	Time	*'Base Hourly'* flows	Generated	% increase	Relative noise impact – difference between *'Base Hourly'* flows & the *'Generated Hourly@* flows
NSR 13	225 Crockanboy Road (Opposite Site Entrance)	6 – 7 AM	36 (10.7%)	45	125%	+2.5 dB(A) $L_{10\text{-}1\ hour}$
		7 – 8 AM	82 (7.6%)	54	65%	+1.5 dB(A) $L_{10\text{-}1\ hour}$
		8 – 9 AM	107 (8.4%)	24	22%	+0.6 dB(A) $L_{10\text{-}1\ hour}$
		5 - 6 PM	117 (4.4%)	24	20.5%	+0.6 dB(A) $L_{10\text{-}1\ hour}$
		6 - 7 PM	93 (3.8%)	54	58%	+1.7 dB(A) $L_{10\text{-}1\ hour}$
		7 - 8 PM	61 (2.6%)	45	73%	+2.2 dB(A) $L_{10\text{-}1\ hour}$

As shown in Table 31, the most significant predicted relative noise impact due to increased operational traffic volumes on the surrounding road network based on the difference between the *'Base AADT'* flows & the *'Base AADT + Generated Operational Traffic'* flows indicates a noise level difference of 2.5 dB(A) $L_{10\text{-}1\ hour}$. An increase of less than 2 - 3 dB(A) $L_{10\text{-}18\ hour}$ is 'not significant' and is a 'negligible' increase in noise levels.

7.2.7 Total Noise Impact from the Proposed Infrastructure Site

A total noise impact prediction including all activities covered in Sections 7.2.4, 7.2.5 and traffic movements on the access road has been prepared for scenarios as the proposed infrastructure site progresses from commencement of operation to Year 20. A range of noise prediction models have been prepared to assess the changes in the DSF, including Year 1, Year 5, Year 9, Year 16 and Year 20, considering Year 20 as the final extent of the DSF. The selected years correspond to the finish of a specific phase of DSF construction.

As shown in Table 32, the worst-case total noise level of 43 dB(A) $L_{Aeq,\ 1\ hour}$ during daytime and 40 dB(A) $L_{Aeq,\ 1\ hour}$ during night-time will occur at the worst-affected noise sensitive receptor location. The noise prediction models assume a worst-case scenario that all site traffic will occur during a single 1-hour period during daytime and night-time. It is also assumed in this noise prediction model that the Vibrating Packer and Tracked Dozer will operate 24/7 on the DSF even though it is likely that the Vibrating Packer and Tracked Dozer will not operate during night-time hours.

These predicted levels are not significant noise levels, even in the relatively quiet rural area surrounding the proposed infrastructure site. The proposed operations will be continuous and as stated in Section 4, the World Health Organisation (WHO) *Guidelines for Community Noise* states that "*to protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}*". In terms of guideline values for bedrooms WHO considers that the sleep disturbance criteria should be taken as external levels of 45 dB L_{Aeq} or 60 dB L_{Amax}. Therefore, it is predicted that the WHO guideline noise levels will not be exceeded at any nearby residential properties and the worst-case total noise levels will be well below these levels.

Table 32: Predicted total noise level at receptors due to all components of the proposed infrastructure site (See Annex E – Figures 1 - 5).

Noise IA Ref No.	Address	Receptor ID	Year 1 - Day	Year 1 - Night	Year 5 - Day	Year 5 - Night	Year 9 - Day	Year 9 - Night	Year 16 - Day	Year 16 - Night	Year 20 - Day	Year 20 - Night
NSR 1	184 Crockanboy Road	D-R-0037	25	25	25	25	26	26	23	23	24	23
NSR 2	191 Crockanboy Road	D-R-0020	28	28	30	29	30	30	29	28	29	29
NSR 3	186 Crockanboy Road	D-R-0024	30	29	30	29	30	30	29	29	29	29
NSR 4	193 Crockanboy Road	D-R-0013	31	31	31	31	32	31	31	30	31	30
NSR 5	200 Crockanboy Road	D-R-0047	35	35	35	35	35	35	35	35	35	35
NSR 6	184 Crockanboy Road	D-R-0048	36	35	36	35	36	36	33	33	33	33
NSR 7	204 Crockanboy Road	D-R-0010	36	36	36	36	36	36	36	36	36	36
NSR 8	210 Crockanboy Road	D-R-0028	37	37	37	37	37	36	36	36	36	36
NSR 9	207 Crockanboy Road	D-R-0045	36	35	36	35	36	36	36	35	36	35
NSR 10	213 Crockanboy Road	D-R-0041	37	36	37	36	37	36	36	35	36	36
NSR 11	212 Crockanboy Road	D-R-0053	38	38	38	37	38	38	37	36	37	37
NSR 12	216 Crockanboy Road	D-R-0030	34	33	33	33	31	30	31	29	31	30
NSR 13	225 Crockanboy Road	D-R-0051	39	37	39	37	39	38	39	36	39	37
NSR 14	231 Crockanboy Road	D-R-0050	43	40	43	40	43	40	42	39	42	39
NSR 15	234 Crockanboy Road	D-R-0054	35	34	33	32	33	32	31	29	31	29
NSR 16	238 Crockanboy Road	D-R-0036	37	37	35	34	37	36	35	35	35	35
NSR 17	244 Crockanboy Road	D-R-0043	35	35	34	33	33	33	33	32	34	33
NSR 18	256 Crockanboy Road	D-R-0009	35	34	34	33	34	34	33	32	33	32
NSR 19	254 Crockanboy Road	D-R-0016	32	31	32	31	28	27	28	27	28	27
NSR 20	260 Crockanboy Road	D-R-0044	32	31	32	32	30	30	31	31	31	31
NSR 21	268 Crockanboy Road	D-R-0022	31	30	32	31	30	30	31	30	31	30

Table 32 (Continued) Predicted cumulative noise level at receptors due to all components of the proposed infrastructure site (See Annex E – Figures 1 - 5).

Noise IA Ref No.	Address	Receptor ID	Year 1 - Day	Year 1 - Night	Year 5 - Day	Year 5 - Night	Year 9 - Day	Year 9 - Night	Year 16 - Day	Year 16 - Night	Year 20 - Day	Year 20 - Night
NSR 22	264 Crockanboy Road	D-R-0018	31	31	32	32	30	30	31	30	31	31
NSR 23	56 Mullydoo Road	D-R-0133	40	39	39	39	38	37	37	37	37	37
NSR 24	276 Crockanboy Road	D-R-0011	32	32	32	32	31	31	31	31	31	31
NSR 25	146 Greencastle Road	D-R-0064	31	31	31	31	30	30	28	28	28	28
NSR 26	164 Greencastle Road (Presbytery)	D-R-0565	30	30	30	30	27	27	27	27	27	27
NSR 27	170 Greencastle Road	D-R-0550	29	29	29	29	26	26	26	26	26	26
NSR 28	172 Greencastle Road	D-R-0566	29	28	29	29	26	26	26	26	26	26
NSR 29	46 Mullydoo Road	D-R-0684	22	22	24	24	22	21	22	21	22	21
NSR 30	188 Greencastle Road	D-R-0072	27	27	28	28	25	24	23	23	24	23
NSR 31	198 Greencastle Road	D-R-0076	27	27	30	29	26	25	26	25	26	26
NSR 32	200 Greencastle Road	D-R-0070	27	27	29	29	26	26	24	24	24	24
NSR 33	204 Greencastle Road	D-R-0071	21	20	25	24	22	21	22	21	22	20
NSR 34	208 Greencastle Road	D-R-0073	29	29	30	30	28	28	28	27	28	28
NSR 35	216 Greencastle Road	D-R-0062	29	29	30	29	27	27	28	28	27	27
NSR 36	K/2012/0141/RM Adjacent to 208 Crockanboy Road	D-Prop-0031	37	37	37	37	38	38	37	37	37	37
NSR 37	St Patrick's GFC	D-NR-0043	30	30	30	30	29	29	27	27	27	27
NSR 38	Greencastle Amateur Boxing Club	D-NR-0044	29	29	30	29	27	27	27	27	27	27
NSR 39	Greencastle Community Association	D-NR-0045	30	30	30	30	29	29	27	27	27	27
NSR 40	St Patrick's Church, Sheskinshule	D-NR-0046	30	30	30	30	27	27	27	27	27	27
NSR 41	Green Elves Nursery School	D-NR-0048	31	31	31	31	30	30	30	30	30	30
NSR 42	Greencastle School	School	31	31	31	31	31	30	30	30	30	30

7.2.8 Cumulative Noise Impact

Proposed developments in the area in include residential buildings, agricultural buildings and wind turbine developments. There is no potential for a significant cumulative noise impact from the operation of the proposed Curraghinalt Project together with any such development in the area. These proposed developments have no potential noise impacts in common with the proposed Curraghinalt Project. Also, the potential for cumulative noise impacts of any significance is negated by the distance of these developments from the proposed Curraghinalt Project.

7.2.9 Noise Impact during Decommissioning

On cessation of mining and processing of gold at the site the plant will be decommissioned and closed. The equipment to be used for the decommissioning of the plant is expected to be similar to the equipment used during the construction phase. As such, the noise levels during the decommissioning operations will be the same or similar to the construction related noise levels and as with the construction phase this impact will be of short duration. As such, no significant noise impacts are expected during the decommissioning phase of the plant. With the termination of the mining and processing of gold activities, the noise levels within and around the site are expected to revert back to those that existed prior to the operations. Therefore, no residual noise impacts are expected.

8 Mitigation Measures

8.1 CONSTRUCTION MITIGATION MEASURES

Appropriate mitigation measures have been recommended to ensure the Construction Phase target noise limits are not exceeded. The contractor should take note of the control measures recommended in BS 5228 and apply the appropriate measures where applicable. Other measures recommended include:

- Working hours during noise generating construction operations taking place above ground will be restricted to daytime hours from 07.30 hours to 19.00 hours (Monday to Friday) and 07.00 hours to 13.00 hours (Saturdays).
- An on-site speed limit will be enforced for all traffic. Drivers of vehicles will be advised of the speed limits through the erection of signs i.e. a typically recommended on site speed limit of 10 mph.
- Best practicable means will be employed to minimise noise emissions and will comply with the general recommendations of BS 5228.

- By positioning potentially noisy plant as far as possible from noise sensitive receivers the transmission of sound can be minimised. Earth mounds and/or stacks of material or buildings on site will be used in such a way that they act as a physical barrier between the source and the receiver.
- Vehicle reverse alarms will be silenced appropriately to minimise noise breakout from the site while still maintaining their effectiveness.
- Where practicable, machines will be operated at low speeds and will be shut down when not in use.
- If required, compressors will be fitted with properly lined and sealed acoustic covers.
- In all cases engine and/or machinery covers will be closed whenever the machines or engines are in use.
- All pneumatic percussive tools will be fitted with mufflers or silencers as recommended by the equipment manufactures. Where practicable all mechanical static plant will be enclosed by acoustic sheds or screens.
- Employees working on the site will be informed about the requirement to minimise noise and will undergo training on the following aspects:
    - The proper use and maintenance of tools and equipment
    - The positioning of machinery on-site to reduce the emission of noise to the noise sensitive receptors
    - Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment
    - The use and maintenance of sound reduction equipment fitted to power pressure tools and machines
- Cognisance should also be taken of the 'Environmental good practice on site guide' 2015 compiled by CIRIA. This guide provides practical information regarding the control of noise at construction sites.
- It is recommended that should complaints be received from nearby residential properties, periodic noise monitoring should be undertaken during construction works to determine noise levels at noise sensitive receptors. Based on the findings of such noise monitoring, appropriate noise mitigation measures should be implemented to reduce noise impacts. Where excessive noise levels are recorded, further mitigation measures should be employed which may include temporary screening of the nearest receptor to on-site activities.
- Responsible Person - It is recommended that the Contractor should appoint a responsible and trained person who will be present on site and who will be willing to answer and act upon complaints and queries from the local public.

During the construction phase, should the need for additional acoustic screening be identified due to a noise impact from a significant construction noise sources close boarded fencing will be erected around the noise source. Such wooden close boarded fencing should be at least 2.5m

high and/or at least 1m higher than the noise source in question. There shall be no gaps in this acoustic fencing and will have a density of approximately 25 kg/m^2. The closed boarded wooden fencing should allow for a 5 - 10 dB(A) reduction in noise level at the nearest residential properties and hence, negate any exceedance of the recommended construction noise limits at the nearest residential properties.

In addition, good construction noise management will be adhered to this will include measures such as

- Informing local residents about the construction works, including the timing and duration of any particularly noisy elements such as blasting, and providing a contact telephone number.
- Avoiding operating particularly noisy equipment at the beginning and end of the day.
- Keeping potentially noisy deliveries to the middle or less sensitive times of the day, where possible, and
- Locating noisy static plant, such as diesel generators, if required, away from residential properties and behind temporary acoustic fencing.

It is proposed that underground construction of the proposed decline to link the mine workings with the main portal entrance will take place during daytime and night-time working hours. If there are items of plant (e.g. dewatering pumps, compressors, generators or similar) in use during night-time hours they will be sited and enclosed underground such that noise levels at the nearest properties do not exceed the measured background noise levels and the suggested night-time construction noise limits. It will take approximately two years to excavate the planned decline to link the mine workings with the main portal entrance. During this time, the current exploration portal entrance will be used to provide access for underground mine development. The mitigation measures during portal construction will include the following:

- Ventilation fans equipped with silencers to minimise noise – these fans will be required during the construction phase only until the new ramp connects with the mine workings such that a flow through ventilation circuit can be established;
- Air compressors on individual drilling units will be utilised to eliminate the need for a surface compressor; and
- An overhead power line to supply an electrical transformer located near the portal.

8.2 OPERATION MITIGATION MEASURES

Throughout the project design process, a series of noise mitigation measures have been developed. Operational noise mitigation measures include the following;

8.2.1 Building Envelope Design & Orientation:

The Crusher Building and the Process Building will be constructed of the following materials;

- Façade -Kingspan AWP/60 + No Lining
- Roof - Kingspan KS1000 RW/80 + No Lining

The proposed Kingspan wall and roof cladding of the Crusher Building, SAG Mill Area in Processing Building and in the remainder of the Process Building will provide a high level of sound attenuation. If required in the future these buildings can be fitted with suitable internal lining on the required facade to reduce noise breakout further.

Roof / Wall Structure	Octave Spectrum (dB)								
	63	125	250	500	1000	2000	4000	8000	R_w
Wall - Kingspan AWP/60 + No Lining	15	16	19	23	26	22	39		24
Roof - Kingspan KS1000 RW/80 + No Lining	-	18	21	23	20	38	42		25

The Crusher Building will be orientated so that any opening to allow for access will not face directly towards any noise sensitive receptor.

Any doors in the Processing Building, especially the SAG Mill area, will stay closed the majority of the time, and it will be a procedural/management requirement to keep the door closed whenever not in use.

8.2.2 Dry Stack Facility (DSF) Design & Orientation:

The DSF will be constructed in an east – west direction. The DSF will be situated on the hill-side immediately downslope of the plant site. The facility layout was established considering the topographic constraints, as well as the spatial requirements related to access and water management. The DSF will constructed in phases and cells to ensure that noise and dust potential can be controlled and limited.

The operation of the DSF will include specific procedures such as developing approximately 3m high berms in each working area as the facility develops to reduce noise impacts associated with dozer and vibratory packer activity as well as haul truck movements. All operations will take place 'behind' these temporary berms in each working area. Only during daytime hours will these berms be moved and re-constructed as appropriate.

8.2.3 Noise Berm along Haul Route from the new portal to the crusher:

The site design includes a 5m high waste rock berm that will be constructed along the south side of the haul route between the new portal and the process plant site to act as noise/visual berm. This berm will significantly reduce noise from haul road movements which will entail 40 T trucks transporting up to 2,160 tonnes of ore and waste per day., i.e. 54 truck-loads/day.

8.2.4 Ventilation Raise Design:

Air flows into and out of the mine will utilise the existing exploration portal, the planned new mine portal, the existing ventilation raise to surface and two additional ventilation raises. Main ventilation fans will be located underground (after the construction phase) to minimise noise impacts on surface. The 4m x 4m diameter ventilation raises will be designed to deliver the required air volumes and flows required to dilute dust and particulates, carbon monoxide and oxides of nitrogen to provide a safe working environment underground.

8.2.5 On-going Noise Monitoring:

Dalradian Gold Ltd. are committed to installing continuous noise level monitoring equipment at a location(s) along the proposed infrastructure site boundary in the direction of the closest noise sensitive receptors. This continuous noise level monitoring equipment will be used to establish if the recommended noise limits are achieved at the nearest noise sensitive receptors. Therefore, during periods of calm weather when noise is likely to have more of a potential to give rise to nuisance, operations such as dozer and vibratory packer activities on the DSF may be curtailed if necessary. Alternatively, during windy or wet periods when a high background noise level prevails, operations such as dozer and vibratory packer activities on the DSF can proceed as a potential to give rise to nuisance complaint is unlikely.

9 Residual Impacts

9.1 SUMMARY OF IMPACT ASSESSMENT

The noise levels from the operation of the components of the proposed infrastructure site under under the jurisdiction of FODC EHD and subject to compliance with the Planning Practice Guidance 'Assessing Environmental Impacts from Mineral Extraction – Noise Emissions' (March 2014) are predicted to be lower than the relevant 42 dB L_{Aeq} daytime, evening and night-time noise limits at all locations.

The noise levels from the operation of the components of the proposed infrastructure site under the jurisdiction of NIEA IPRI and subject to compliance with the BS4142: 2014 'Method of Rating

and Assessing Industrial and Commercial Noise' are predicted to be lower than the relevant 35 dB L_{Aeq} noise limits at all locations.

A worst-case cumulative noise level of 43 dB(A) $L_{Aeq, 1\ hour}$ during daytime and 40 dB(A) $L_{Aeq, 1\ hour}$ during night-time will occur at the worst-affected noise sensitive receptor location. This is a low noise level during daytime and night-time and is below a level that could constitute a significant noise nuisance level at a residential property.

A negligible noise impact is deemed to occur when a noise impact is imperceptible. A minor adverse impact occurs where the change in noise climate is deemed to be perceptible. For a moderate or substantial adverse impact to occur there would need to be a significant increase in noise level of up to or greater than a doubling of loudness. When compared to the measured baseline noise levels in the area of the proposed Curraghinalt Project, the increased noise level at nearby properties will cause a ***minor*** noise impact at the nearest noise sensitive receptors throughout the lifetime of the gold mine and processing operations. At all locations in excess of 1,000m from the proposed Curraghinalt Project the noise impacts will be ***negligible***.

Table 33: Summary of Residual Impacts

Impact Description	Impact before Mitigation	Key Mitigation Measures	Residual Impact
Impacts on noise sensitive receptors during construction	*Minor*	Specific mitigation measures are advised during construction phase including: • Consideration of noise in site layout, selection and location of construction equipment; • Avoiding noisy activities at night, • Advising local noise sensitive receptors of any necessary potentially noisy construction activity; • Speed limits on site roads used by construction traffic; • Regular maintenance to avoid increase in noise from equipment and vehicles; and • Strict adherence to achieving recommended construction noise limits.	*Minor / Negligible*
Impacts on noise sensitive receptors during operation – daytime & night-time.	*Minor*	Specific mitigation measures are advised during operation including: • The Crusher Building and the Process Building will be constructed of materials to attenuate noise breakout; • Buildings will be orientated and operated so that any opening to allow for access will not face directly towards any noise sensitive receptor. • The operation of the DSF will include developing 3m high berms in working areas to reduce noise associated with dozer, vibratory packer and haul truck activity. • The site design includes a 5m high waste rock berm along the south side of the haul route between the new portal and the process plant site. • Ventilation fans will be located underground. • Continuous noise monitoring at the site boundary in the direction of the closest noise sensitive receptors. • Site traffic will be staggered throughout the day so as not to cause a significant traffic noise impact.	*Minor / Negligible*