10 Noise and Vibration

10.1 Introduction

Enfonic Ltd. have been commissioned by ORS Consulting Engineers to conduct a noise impact assessment in relation to the proposed Anaerobic Digester Facility at Cappanihane, Bruree, Co. Limerick (the Proposed Development).

The noise and vibration impact during the construction and operational phases are considered in addition to taking account of mitigation measures to reduce or eliminate any residual impacts on the environment within the study area.

This assessment was prepared in accordance with the EIA Directive 2014/52/EC, current EPA guidelines and best practice.

10.2 Fundamentals of Noise

The audible range of sounds can be expressed in terms of Sound Pressure Levels (SPL) and ranges from 0dB (for the threshold of hearing) to 140dB (for the threshold of pain). It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

The frequency of sound is the rate at which a sound wave oscillates and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity is most sensitive to the frequency range of language (300Hz-3,000Hz) and decreases substantially as frequency falls.

It is necessary to adjust the measured noise level by an instrument to reflect the sensitivity response of human hearing and the ‘A-weighting’ system has been defined in the international standard ISO 226:2003 Acoustics. A SPL measured using ‘A-weighting’ is expressed in terms of dBA.

An indication of the level of some common sounds on the dBA scale is as follows:

Table 10-1. Common sounds and dBA scale

Source	Decibel Level (dBA)
Threshold of Hearing	0
Rustling Leaves	10
Whisper	20
Quiet Rural Setting	30
Quiet Living Room	40
Suburban Neighbourhood	50
Normal Conversation	60
Busy Street Traffic	70
Vacuum Cleaner	80
Heavy Truck	90
Jackhammer	100
Front Row of Rock Concert	110
Threshold of Pain	130

A glossary of acoustic terminology used in this report is provided in **Appendix A.**

10.3 Methodology

The assessment of impact effects has been undertaken with reference to the guidance documents relating to noise and vibration for the construction and operational phase of the Proposed Development, which are set out within the relevant sections of this chapter.

The methodology adopted for this noise impact assessment is summarised as follows:

- Review of appropriate guidance to identify appropriate noise and vibration criteria for the construction, operational and decommissioning phases;
- Quantify the receiving environment through baseline noise surveys at representative Noise Sensitive Locations (NSLs) surrounding the Proposed Development;
- Undertake predictive calculations to assess the potential effects associated with the construction phase of the Proposed Development;
- Undertake predictive calculations to assess the potential effects associated with the operational phase of the Proposed Development;
- Evaluate the potential noise and vibration effects;
- Specify mitigation measures to reduce, where necessary, the identified potential outward effects relating to noise and vibration from the Proposed Development; and
- Describe the significance of the residual noise and vibration effects associated with the Proposed Development.

In addition, the following guidelines were considered and consulted for the purposes of this chapter:

  - EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022); and
  - EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), (2003).

10.4 Guidance Documents and Assessment Criteria

10.4.1 Significance of Impact

The significance of effects of the Proposed Development shall be described in accordance with the Environmental Protection Agency (EPA) document *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), 2022* (EPA Guidelines).

The EPA Guidelines do not however quantify the impacts in decibel terms. In the absence of such information, reference is made to *Guidelines for Environmental Noise Impact Assessment (2014)* from the Institute of Environmental Management and Assessment (IEMA Guideline). The IEMA Guidelines references similar terminology to the EPA Guidelines and quantifies the effect categories in decibel terms for various receptor categories, with residential receptors having the greatest sensitivity to noise.

The effect descriptions and their respective noise level change for residential receptors are presented in **Table 10-2.**

Table 10-2: Effects Description (EPA Guidelines and IMEA Guidelines) and noise level change criteria

EPAs Significance of Effects	IEMA Guidelines	Noise Level change dB
Imperceptible	None/Not significant	Less than 2.9
Not Significant		
Slight Effects	Slight	3.0 – 4.9
Moderate Effects	Moderate	
Significant Effects	Substantial	5.0 – 9.9
Very Significant	Very Substantial	Greater than 10.0 dB
Profound Effects		

10.4.2 Construction Phase (Noise)

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of construction works and may consider noise limits at their discretion.

10.4.2.1 BS 5228-1:2009+A1:2014

In the absence of specific noise limits, appropriate construction limits adopted in this assessment make reference to *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Noise*. This provides information on the prediction and measurements of noise from construction sites and operations such as mines and quarries. It also includes a large database of source noise levels for commonly used equipment and activities on construction sites.

The standard provides guidance on the 'threshold of significant effect' in respect to noise impacts at dwellings. The proposed 'ABC method' derives appropriate construction noise limits from existing ambient noise levels and the relevant categories are provided in **Table 10-3.**

Table 10-3: BS 5228 Categorisation Table for construction noise limits.

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23.00−07.00)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07.00−19.00) and Saturdays (07.00−13.00)	65	70	75
NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. *NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.* *NOTE 3 Applied to residential receptors only.*			

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 B values.
D)	Category D: 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

In general, the noise impact due to the construction phase will be from the specific items of plant used, the duration and phasing of the construction methods, the time of day that each plant will be used and their location.

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5dB.

10.4.2.2 Construction Phase (Vibration)

The Transport Infrastructure Ireland (TII) (formally National Roads Authority) provides suitable criteria to prevent building damage from vibration in their *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA, 2014)* as given in **Table 10-4.**

Table 10-4: Summary of British Standard Vibration Criteria.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:		
<10Hz	**10-50Hz**	**>50-100Hz**
8mm/s	12.5mm/s	20mm/s

10.4.3 Operational Phase

Two separate assessments are appropriate for the Proposed Development as follows:

1. For the purposes of planning, noise emissions are assessed relative to the receiving environment.
2. Once operational, the emission license for the Proposed Development will fall within the remit of the Environmental Protection Agency (EPA) who will set noise emission criteria.

Assessment in relation to both is included herein.

10.4.3.1 EPA Noise Guidance

The Environmental Protection Agency (EPA) (2016), *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* provides noise guidance to operators' subject to IPPC, IE, or waste licences.

Typically noise emissions limits are set at Noise Sensitive Locations (NSLs) or at the site boundary as follows:

- Daytime: 55dB L_{Aeq}
- Evening: 50dB L_{Aeq}
- Night-time: 45dB L_{Aeq}

Quiet Area Screening of the Development Location

The NG4 Guidelines requires that the location of the Proposed Development be screened in order to determine if it is to be located in or near an area that could be considered a 'Quiet Area' in open country according to the Agency publication Environmental Quality Objectives - Noise in Quiet Areas.

This involves determining if the following criteria are all satisfied:

- At least 3 km from urban areas with a population >1,000 people; No
- At least 10 km from any urban areas with a population >5,000 people; No
- At least 15 km from any urban areas with a population >10,000 people; No
- At least 3 km from any local industry; No
- At least 10 km from any major industry centre; No
- At least 5 km from any National Primary Route, and; No
- At least 7.5 km from any Motorway or Dual Carriageway. No

The site does not meet these criteria and is not considered to be a quiet area as per the Agency definition.

Screening of the Development Location for Low Background Noise Areas
As per the NG4 Guidelines, if an area is not considered a Quiet Area, a noise survey should be completed, and the measured existing background noise levels should be checked against the following limits:

- Average Daytime Background Noise Level ≤40dB L_{AF90}, and;
- Average Evening Background Noise Level ≤35dB L_{AF90}, and;
- Average Night-time Background Noise Level ≤30dB L_{AF90}

If all three criteria above are satisfied at any of the measurement locations, then reduced noise limits apply as specified in Table 1 of the NG4 guidelines.

10.4.3.2 BS4142:2014

An appropriate noise impact assessment methodology is provided in *BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound*.

The procedure rates the 'Specific' noise (from the Biogas plant in this case) at Noise Sensitive Locations (NSLs) and compares it with the 'Background' noise levels. The level difference is an indication of the impact that the operation under investigation may have.

In addition, Rating penalties applied to the Specific noise level may be appropriate to provide for the increased significance that additional characteristics such as Tonality or Impulsivity have on noise in the community.

The 'context' of the development and its environs e.g. time of day, nature of the neighbourhood, local attitudes to the development, etc ought also to be considered. There is also a degree of uncertainty applicable to the results e.g. for weather, instrumentation, measurement duration, calculation errors etc which ought to be considered.

10.4.3.3 ISO 9613-2:2024

ISO 9613-2:2024 Acoustics - Attenuation of sound during propagation outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors describes a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions.

10.4.3.4 Local Guidance

Regional guidance and planning policy for the Limerick City and County administrative area

comes primarily from the following:

10.4.3.4.1 Limerick Agglomeration – Noise Action Plan 2024-2028

The Noise Action Plan 2024-2028 (NAP) is prepared as a requirement of Environmental Noise Regulations 2018. It is primarily concerned with road traffic noise but includes some useful guidance for other noise sources. The NAP is underpinned by a set of overarching noise policy principles outlined in the Noise Policy Statement as follows:

> **NOISE POLICY STATEMENT**
>
> Limerick City and County Council and Clare County Council will adopt a strategic approach to managing environmental noise within the Agglomeration of Limerick, and will aim to:
>
> - **Mitigation** – identify appropriate mitigation measures to reduce noise levels where they are potentially harmful to the health of communities.
> - **Prevention** - prevent additional members of the community being exposed to undesirable noise levels where it is likely to have a significant adverse impact on health and quality of life, and where practicable, improve or maintain the quality of sound in the public realm.
> - **Protection** - protect areas which are desirably quiet, or which offer a sense of tranquillity through a process of identification and validation followed by formal designation of "Quiet Areas".

Additionally, the results of the strategic noise mapping have been used to identify areas within the Agglomeration to be considered for preservation for environmental noise quality. These are referred to as Candidate Quiet Areas (CQAs) and 24no. potential CQAs have been identified within Limerick City and County Council area.

Limerick Development Plan 2022-2028:

According to Section 7.12.1, regarding Noise Sensitive Development, it states:

"..The WHO strongly recommends policy-makers to reduce population exposure to traffic-related environmental noise to below 53 dB L_{den} (a 24-hour noise indicator) and 45 dBL_{night} in accordance with the Environmental Noise Guidelines (2018). There is a significant proportion of the Limerick population (in the city and county) that is exposed to noise levels above these values. Careful consideration of traffic-related noise shall be given to major transport infrastructure projects at the design stage."

10.5 Receiving Environment

10.5.1 Noise Sensitive Locations

A Noise Sensitive Location (NSL) is defined in EPA NG4 as:

"any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels."

10.5.2 Study Area

A representative sample of the closest NSLs to the Proposed Development is used in this assessment. Noise levels diminish over distance therefore these locations represent a worse-case evaluation.

The locations assessed are shown in **Figure 10-1** below.

Figure 10-1: Noise Sensitive Locations (NSL) used for Assessment and the site boundary

10.5.3 Background Noise Survey

A noise survey has been conducted at the site in order to quantify the baseline noise levels within the study area. The survey was conducted in general accordance with *ISO 1996: 2017: Acoustics - Description, Measurement and Assessment of Environmental Noise* and followed the methodology contained in EPA NG4. Specific details are set out below.

10.5.3.1 Noise Monitoring Locations

A Noise Monitoring location was selected to represent the ambient noise conditions at the position shown in **Figure 10-2**.

Figure 10-2: Map of Noise Monitoring Location (NML) and the site boundary

Unattended noise monitoring was conducted at NML over several days to establish both daytime and night-time noise levels.

Noise measurements were taken using class 1 Bruel & Kjaer Type 2250 Sound Level Meters (SLMs). Each meter was calibrated prior to measurements and the sensitivity checked afterwards for any significant drift; none was found. Weather conditions were generally calm and dry throughout the survey period.

Monitoring was conducted between 22-11-2024 and 29-11-2024. However, data from 23rd November and 24th November was excluded due to adverse weather conditions, including storms and snowfall. Images of the installations are provided in **Appendix B**

10.5.4 Survey Results

Daytime and nighttime noise levels were determined using data collected from the unattended noise monitor.

- **Daytime Noise Levels:**
  The typical daytime background noise level (L_{A90}) was measured at **38dB** (rounded).

- **Night-time Noise Levels:**
  The typical nighttime background noise level (L_{A90}) was measured at **29dB** (rounded).

A time-history plot of the average noise levels is given in **Appendix C**.

10.6 Impact Assessment

In general, noise impact is a result of the noise levels of the sources, the distance from the source to a receiver, the intervening topography and built environment, the time of day and the

existing background noise levels.

The impact assessment considers the construction and operational phases separately.

10.6.1 Do-Nothing Scenario

If the development is not progressed the existing noise environment (as measured in the baseline assessment) in the vicinity of the Proposed Development will remain largely unchanged. Traffic flows on the road network in the area are expected to grow over time with associated increase in noise level.

10.6.2 Construction Phase

The appropriate methodology for the impact assessment of the construction phase is set out in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1 Noise*. The standard sets out sound power levels and L_{Aeq} noise levels of plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

Subject to agreement with the local authority, it is anticipated that the following times will constitute the standard working hours on the construction site:

- Monday to Friday 07:00 to 19:00
- Saturdays 08:00 to 16:00 pm

Typical construction phases and timeframe have been provided and are set out as follows:

- Site Preparation / Clearance: 6-8 weeks
- Civil / Structural Works: 6 months
- Mechanical and Electrical Installation: 3 months
- Commissioning and testing: 2 months

The Site Preparation/Clearance and Civil/Structural works represent the noisiest phases of construction and are assessed herein.

10.6.3 Construction Noise Limits

Following a review of the baseline noise survey results in **Table 10-3** the appropriate BS5228 construction noise category is A i.e. 65dB L_{Aeq}.

10.6.4 Construction Noise

An outline CEMP has been submitted in relation to the Proposed Development and will be updated to reflect the mitigation measures set out in this chapter. As a working initial hypothesis, the impact of assumed typical construction phases of work has been assessed.

Table 10-5 outlines typical plant items associated with each relevant phase, their noise levels and assumed operational times. Noise levels have been taken from BS5228 and table references included.

Table 10-5: Summary of predicted noise levels from construction plant

Description	Item of Plant (BS5228 Table Ref.)	L_{Aeq} Noise Level @10m	Percentage on-time [1]
Phase 1a – Site Preparation / Clearance	Tracked Excavator – 25t (C2.19)	77	50
	Tracked Excavator – 21t (D10.9)	75	50
	Dozer - 239kW (D3.27)	81	80
	Articulated Dump Truck (2no.) (C2.33)	81	50
	Tipper Lorry - 75kW (D3.112)	85	50
Phase 1b – Road Development for Construction Access	Tracked Excavator – 25t (C2.19)	77	80
	Excavator (C10.9)	75	50
	Articulated Dump Truck (C2.33)	81	50
	Excavator (C4.67)	74	80
	Dump Truck (C2.30)	79	50
	Roller (C5.27)	67	80
Phase 2a – Instate Finished Road Surface	Dump Truck (C2.30)	79	50
	Roller (C5.27)	67	80
	Asphalt Paver + Tipper Lorry (C5.31)	77	80
	Lorry (C11.9)	82	50
	Road Roller (C5.19)	80	80
Phase 2b – Civil / Structural works	Tracked Excavator (C2.19) (3no.)	82	50
	Tracked Excavator – 21t (D10.9)	75	50
	Dozer - 239kW (D3.27)	81	80
	Articulated Dump Truck (2no.) (C2.33)	81	50
	Tipper Lorry - 75kW (D3.112)	85	30
	Concrete mixer truck etc (C4.32)	78	80
	Telescopic Handler (C4.54)	79	80
	Angle grinder (C4.93)	80	50

1Best-practice assumptions.

As a worst-case assessment, construction noise levels at the closest NSL (NSL01) which is approximately 120m south of the site boundary is considered, with NSLs further away receiving a commensurate reduction in noise level. A suitably constructed hoarding around the construction perimeter has been assumed.

The predicted noise levels for each construction phase and comparison with the criteria are given in **Table 10-6.**

Table 10-6: Summary of Predicted Construction Noise at the closest NSL.

Phase	Predicted Noise Level $L_{Aeq, 1hr}$ @120m	Construction Noise Criteria	Criteria Exceeded?
Phase 1a - Site Preparation / Clearance	64dB	65dB	No
Phase 1b – Road Development for Construction Access	61dB	65dB	No
Phase 2a – Instate Finished Road Surface	62dB	65dB	No
Phase 2b – Civil / Structural works	66dB	65dB	Yes

Construction-related noise levels comply with the established criteria for all phases except phase 2b – Civil/Structural Works, where they exceed the limit by 1dB. However, the noise control and mitigation measures provided in BS 5228-1:2009, described in in **Section 10.7** and set out in the CEMP will be implemented during the construction phase to further reduce any adverse impact.

10.6.5 Construction Traffic

For the main construction phase, the site will be accessed via the R518 Road. The most significant sources of construction traffic are Heavy Good Vehicles (HGVs) accessing the site, and to assess the associated impact it is necessary to estimate the number of vehicles. It has been estimated that during the course of an average day during construction, that up to 10no. HGVs will access the site to deliver materials i.e. 20no. movements per day.

Additional light goods and contractor related vehicles would be expected in the morning and evening peak periods. The impact from these vehicle movements is expected to be negligible.

The closest identified property has been identified as NSL1, approximately 10m from the site access road. Using formula F.2.5 from BS 5228-1:2009+A1:2014 the noise level associated with the HGV movements has been calculated as $L_{Aeq,1hr}$ = **47dB** at this location. Combined with the other construction works set out in **Table 10-6,** the construction noise criteria are not expected to be exceeded.

10.6.6 Construction Vibration

Empirical data provided in BS5228-2 demonstrates that ground borne vibration waves are attenuated rapidly as they propagate from a source through the substrate. The magnitude of source vibration levels, ground attenuation and distance to the nearest NSL are such that no signification vibration impact will occur.

10.6.7 Description of Effects – Summary

With respect to the EPA's criteria for description of effects, the potential worst-case effects at the nearest NSLs associated with the above aspects of the construction phase are described **Table 10-7**.

Table 10-7:Summary of Description of Effects (Construction Phase).

Aspect	Quality	Significance	Duration
Construction Phase	Negative	Not Significant	Temporary
Construction Traffic	Negative	Not Significant	Temporary

10.6.8 Operational Phase

Anaerobic digestion is a continuous process and therefore the digestion and gas upgrade and injection processes will operate continuously.

Feedstock deliveries and the removal of digestate will only occur from 08:00 to 18:30 hrs Monday to Friday and from 09:00 to 13:00 hrs on Saturday.

The most stringent noise impact assessment is for the Night-time period due to the lower measured Background (L_{A90}) noise levels compared with the Daytime period.

10.6.9 Noise Sources

Each of the potential operational noise sources were identified and reference sound power data assigned. The data has been sourced from manufacturers datasheets and noise source databases.

Several noise sources will be installed inside enclosures and estimates of the acoustic performance of these structures to attenuate the noise within, based on manufacturers datasheets and published data, have been included.

Noise sources that are contained within buildings are estimated to have negligible significance due to the attenuation of the building fabric. The Flare Stack and associated Biogas Blower operate only in an emergency or for testing purposes. Their operation is expected to be no more than 2% annually as a worst-case scenario and it is therefore appropriate not to include these sources in the noise impact assessment.

The associated noise sources with the Proposed Development are described in **Table 10-8** below.

Table 10-8: Summary of Significant Noise Sources.

Grouping	Item	#	Location Details	Run Time
Primary Digester	Agitator motor	8	Digester (Primary) Tank	Continuous
Post Digester	Agitator motor	8	Digester (Secondary) Tank	Continuous
Pasteurisation Units	Agitator motor	2	External	2/24 hrs
	Pasteuriser Outlet Pump	1	Sound Proofed Container	30min/hr - 4/24 hrs
	Pasteuriser Inlet Pump	1	Sound Proofed Container	30min/hr - 4/24 hrs
Biogas Upgrading System	Biogas Blower	1	Sound Proofed Container	Continuous
	Biogas Blower	2	External	Continuous
	Cooling Fan	1	External	Continuous
	Gas Chiller	1	Sound Proofed Container	Continuous

Grouping	Item	#	Location Details	Run Time
Digestate Treatment System	Digestate Transfer Pump	2	Within Building	8/24 hrs
	Internal Pump	1	Within Building	8/24 hrs
	Reverse Osmosis System	1	Within Building	8/24 hrs
	Nanofiltration	1	Within Building	8/24 hrs
CO2 Liquefaction System	Biogas Compressor	1	Sound Proofed Container	Continuous
	Plate Heat Exchanger	1	Sound Proofed Container	Continuous
	Reboiler	1	Sound Proofed Container	Continuous
	Condenser	1	Sound Proofed Container	Continuous
	Biogas Blower	1	Sound Proofed Container	Continuous
	Cooling Fan	4	Roof mounted	Continuous
Biogas Flare	Biogas Blower	1	Sound Proofed Cover	Emergency 2% pa
	Flare Stack	1	External - Enclosed by stainless steel stack	Emergency 2% pa
CHP	Biogas Blower	1	External motor	Continuous
	Exhaust Stack	2	External	Continuous
Odour Abatement	Extract Fans	1	External	Continuous

10.6.10 Acoustic Characteristics

Particular acoustic qualities including Tonal, Intermittent and Impulsive characteristics may attract a penalty to reflect an increased risk in annoyance. Appropriate penalties are provided in BS4142:2014.

The schedule of significant noise sources in **Table 10-8** are not expected to exhibit any such characteristics however, there is a risk that intermittent noise sources may be present occasionally and should be avoided to minimise any noise impact. A list of potential sources has been considered and appropriately mitigated as set out in **Table 10-9.**

Table 10-9: List of expected Intermittent Noise Sources.

Item	Comment
Fire alarm	Only audible in the event of an emergency or during routine maintenance/testing. Tests will be occasional and take place during the day-time period only to eliminate noise nuisance.
Truck reversing beepers	Trucks will be fitted with white-noise reversing alarms and will operate during the day-time period only to eliminate noise nuisance.
Operational alarms	External audible alarms are not scheduled. Operational alarms will be communicated on the site's SCADA system to personal mobile devices.

10.6.11 Earth Bund

It is proposed to include an earth bund around the southern, eastern and northern boundaries of the site which, depending on its height, can significantly affect the noise propagation from

the site.

The minimum heights have been assumed as 1.6m on the southern boundary and 1.2m on the eastern and northern boundaries.

10.6.12 CHP Attenuation

The CHP was identified as the highest noise-emitting equipment and is to be housed inside an acoustic enclosure which will sufficiently attenuate the noise emissions. However, acoustic attenuators are required to the air-intake and air-exhaust and the following minimum performances have been assumed:

- Air-intake: 27dB
- Air-exhaust: 36dB

The exact specification of the attenuators will be considered in the detailed design stage but the above performance should be readily possible with standard designs.

10.6.13 Noise Prediction

A computer-based noise propagation model has been prepared to predict the noise levels. This section discusses the methodology behind the noise modelling process and presents the results.

10.6.14 Noise Prediction Software

The proprietary software used, DGMR's iNoise Pro (V2024.2.1), calculates noise levels in accordance with ISO 9613:1996 Acoustics – Attenuation of sound during propagation outdoors. The resultant noise levels are calculated considering a range of factors affecting the propagation of the sound, including:

- The magnitude of the noise source in terms of A-weighted sound power levels (LWA);
- The distance between the source and the receiver;
- The presence of obstacles such as screens or barriers in the propagation path;
- The presence of reflecting surfaces;
- The acoustic property of the ground between the source and receiver;
- Attenuation due to atmospheric absorption

10.6.15 Input Data

Octave band sound power levels (L_{WA}) as provided by the manufacturers or from empirical measurements as used in the noise model are presented in **Table 10-10.**

Table 10-10: Summary of Noise Source Sound Power Data.

Grouping	Item	Octave Band (Hz) Sound Power Levels L_w (dB)								Weighting
		63	125	250	500	1k	2k	4k	8k	
Digester (Primary)	Agitator motor	44	58	65	73	77	77	73	58	A
Digester (Secondary)	Agitator motor	44	58	65	73	77	77	73	58	A
Digestate Storage	Agitator motor	44	58	65	73	77	77	73	58	A

Grouping	Item	Octave Band (Hz) Sound Power Levels L_w (dB)								Weighting
		63	125	250	500	1k	2k	4k	8k	
Pasteurisation Unit	Agitator motor	85	78	77	76	82	80	73	66	A
Biogas Upgrading System	Biogas Blower	65	73	83	86	80	78	77	55	A
CHP	Biogas Blower	77	81	81	80	79	76	76	79	A
CHP	Exhaust Stack	84	78	82	77	76	68	66	63	A
CO2 Liq. System	Biogas Blower	65	73	83	86	80	78	77	55	A
Odour Abatement	Fans	85	78	77	76	82	80	73	66	A
Biogas Boiler		59	72	93	93	85	89	77	62	A

In addition, HGV movements associated with Feedstock Intake, Biobased Fertiliser export and Gas export were modelled along the site access road. The associated traffic flows are given in **Table 10-11.**

Table 10-11: Operational Traffic Flows

Feedstock in	Tonnes/year	Max. Loads Per Annum	Mean Deliveries/Day	Total In/Out Movements
Cattle Manure	5,000	179	1	
Cattle Slurry	10,000	357	2	
Dairy Production Residues	5,500	183	1	
Drinks Production Residues	11,000	367	2	
Food Production Residues	5,500	183	1	
Grass Silage	20,000	714	3	
Pig Slurry	18,000	600	2	
Poultry Litter	10,000	357	2	
Whole Crop Silage	5,000	179	1	
Subtotal	**90,000**	**3,119**	**15**	**30**

Fertiliser Out	Tonnes per annum	HGV/Trailer/day	Total in/out Movements
Digestate Liquid	53,500	6	12
Digestate Fibre	24,500	3	6
Subtotal	**78,000**	**9**	**18**

Product	Loads per annum	Loads/day (vehicles/day)	Total in/out Movements
CO_2	120	0.4 (1 trip)	**2**
CH4	360	1 (1 trip)	**2**

10.6.16 Results

The predicted Specific L_{Aeq} noise levels at the NSLs, the measured Background (L_{A90}) levels as well as the BS4142 impacts and EPA Significance of Effect categories are presented for the Daytime (07:00 – 23:00) and Night-time (23:00 – 07:00) periods in **Table 10-12** and **Table 10-13** respectively.

Table 10-12: Summary of Noise Impact – Daytime Period

Location	Measured Background L_{A90} (dB)	Predicted Specific L_{Aeq} Noise Level (dB)	BS4142 Impact	EPA Significance of Effects
NSL01	38	42	4	Slight/Moderate
NSL02		37	-1	Imperceptible/Not Significant
NSL03		37	-1	Imperceptible/Not Significant
NSL04		37	-1	Imperceptible/Not Significant
NSL05		31	-7	Imperceptible/Not Significant
NSL06		29	-9	Imperceptible/Not Significant
NSL07		27	-11	Imperceptible/Not Significant
NSL08		26	-12	Imperceptible/Not Significant
NSL09		27	-11	Imperceptible/Not Significant
NSL10		32	-6	Imperceptible/Not Significant
NSL11		33	-5	Imperceptible/Not Significant
NSL12		33	-5	Imperceptible/Not Significant
NSL13		29	-9	Imperceptible/Not Significant
NSL14		22	-16	Imperceptible/Not Significant
NSL15		22	-16	Imperceptible/Not Significant
NSL16		22	-16	Imperceptible/Not Significant
NSL17		21	-17	Imperceptible/Not Significant
NSL18		25	-13	Imperceptible/Not Significant
NSL19		28	-10	Imperceptible/Not Significant
NSL20		30	-8	Imperceptible/Not Significant

Table 10-13: Summary of Noise Impact – Night-time Period.

Location	Measured Background L_{A90} (dB)	Predicted Specific L_{Aeq} Noise Level (dB)	BS4142 Impact	EPA Significance of Effects
NSL01	29	32	3	Slight/Moderate
NSL02		29	0	Imperceptible/Not Significant
NSL03		27	-2	Imperceptible/Not Significant
NSL04		28	-1	Imperceptible/Not Significant
NSL05		26	-3	Imperceptible/Not Significant
NSL06		26	-3	Imperceptible/Not Significant
NSL07		26	-3	Imperceptible/Not Significant
NSL08		26	-3	Imperceptible/Not Significant
NSL09		26	-3	Imperceptible/Not Significant
NSL10		32	3	Slight/Moderate
NSL11		32	3	Slight/Moderate
NSL12		33	4	Slight/Moderate
NSL13		28	-1	Imperceptible/Not Significant
NSL14		21	-8	Imperceptible/Not Significant
NSL15		21	-8	Imperceptible/Not Significant
NSL16		21	-8	Imperceptible/Not Significant
NSL17		20	-9	Imperceptible/Not Significant
NSL18		24	-5	Imperceptible/Not Significant
NSL19		27	-2	Imperceptible/Not Significant
NSL20		29	0	Imperceptible/Not Significant

Colour noise contour plots of the noise propagation are provided in **Appendix D.**

The assessment criteria can be summarised as follows:

- **Daytime**

  There are no Significant adverse noise impacts during the daytime period at any of the NSLs. There is a **Slight-Moderate** impact at NSL01 which is primarily due to the associated traffic.

  NSL01 is immediately adjacent to the R518 road and no change in character of the noise environment is expected.

- **Night-time**

  There are no Significant adverse noise impacts during the daytime period at any of the NSLs. There is a **Slight-Moderate** impact at NSL01 to the south and NSL10, NSL11 and NSL12 to the east.

The increase above the existing night-time background noise level is between 3-4dB which likely to be imperceptible. There is no risk to sleep disturbance at the range of noise levels in question.

- **EPA IE License**

  The measured existing background noise levels do not satisfy the Low Background Noise criteria as outlined in Section 10.4.3.1. Standard operational noise emissions levels will therefore apply and the site is expected to operate below the likely EPA license conditions.

10.6.17 Description of Effects

With respect to the EPA's criteria for description of effects, the potential worst-case effects at the nearest NSLs associated with the Proposed Development are described in **Table 10-14** in the absence of mitigation.

Table 10-14: Summary of Description of Effects.

Aspect	Quality	Significance	Duration
Daytime Period	Negative	Imperceptible to Moderate	Long-term
Night-time Period	Negative	Imperceptible to Moderate	Long-term

10.7 Mitigation & Monitoring

The following mitigation measures may be considered to minimise the noise impact to nearby noise sensitive locations.

10.7.1 Operational Phase

The impact assessment herein assumes a worst-case with all noise sources associated with the site operating simultaneously and continuously. In reality, the site will not operate in this way and the noise levels and the impact will therefore be less.

Noise emissions associated with deliveries will be subject to operational restrictions including timings to minimise any adverse impacts.

There is no further mitigation measures required to minimise the impact of the operational phase with the exception of regular maintenance of the plant and suitable assessment of any replacement plant that may be required in the future.

10.7.2 Construction Phase

The Construction Environmental Management Plan (CEMP) will deal specifically with management processes and strategic mitigation measures to remove or reduce significant noise and vibration impacts, and cumulative noise and vibration impacts from the construction works. The Plan will also define noise and vibration monitoring and reporting. The CEMP will also include method statements for each phase of the works, the associated specific measures to minimise noise and vibration in so far as is reasonably practicable for the specific works covered by each plan and a detailed appraisal of the resultant construction noise and vibration generated.

The contract documents shall specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures when deemed necessary to

comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction on open sites - Noise.* The following list of measures will be implemented, where necessary, to ensure compliance with the relevant construction noise criteria:

- No plant used on site will be permitted to cause an on-going public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working for the duration of the contract.
- Compressors will be attenuated models, fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
- During the construction programme, supervision of the works will be include ensuring compliance with the limits detailed in Section 6.2.1 using methods outlined in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Noise.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00hrs and 19:00hrs weekdays and between 08:00hrs and 16:00hrs on Saturdays. However, any necessary or emergency out of hours working will be agreed in advance with the local Planning Authority.

10.7.3 Decommissioning Phase

It is anticipated that the decommissioning phase will adopt a similar approach to the construction phase of this assessment including the same noise criteria. To minimise the potential impact on noise sensitive locations, mitigation measures in line with those proposed for the construction phase are proposed.

10.7.4 Monitoring

Noise and vibration emissions may be monitored by the planning and/or licensing authority as required to ensure compliance with conditions and in the event of complaint.

10.8 Residual Impacts

The assessment identified that there is potential for elevated noise levels during the construction phase and mitigation measures are prescribed as applicable. However, given the nature of the construction works there may be occasions where residual effects exist. It is therefore considered that the residual impact will be slight and for a brief period.

During the operational phase, the Night-time predicted noise levels may be marginally above the existing baseline noise levels at the limited number of the Noise Sensitive Locations closest to the facility. Despite a new noise source being introduced into the environment, its impact on

the vast majority of NSLs will be insignificant

Appendix A

Glossary of Terms:

Terminology	Description
Acoustic Character	One or more distinctive features of a sound (e.g. tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
Ambient Noise	Encompassing sound, at a given place. Usually, a composite of sounds from many sources near and far.
Attenuation	The reduction in level of a sound between the source and a receiver due to any combination of effects including distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
A-weighting	Frequency weighting scale to account for non-linear response of the human ear. Used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. Denoted by suffix A in parameters such as L_{Aeq}, L_{AF10}, etc.
Background Noise	A-weighted noise level of exceeded for 90% of the measurement time. Denoted LAF90. Often classed according to daytime, evening, or nighttime periods.
dB	Abbreviation for ‘decibel’
dB(A)	Abbreviation for the decibel level of a sound that has been A-weighted
Decibel	The unit normally employed to measure the magnitude of sound
Directivity	The property of a sound source that causes more sound to be radiated in one direction than another
$L_{Aeq, T}$	Equivalent continuous A-weighted sound pressure level. The value of the sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time
L_{AF}	The RMS (root mean square) of the instantaneous sound pressure over a given period of time (T). T is usually Fast (0.125sec) or Slow (1sec)
L_{A10}	The noise level just exceeded for 10% of the measurement period, A-weighted and calculated by Statistical Analysis.
L_{A90}	The noise level exceeded for 90% of the measurement period, A-weighted and calculated by Statistical Analysis.
$L_{Ar,T}$	The Rated noise levels. The A-weighted, L_{eq}, Sound Pressure Level of an industrial noise during a specified time period, adjusted for Tonal, Impulsiveness and other characteristics.
External Noise	The noise level, in decibels, measured outside a building
Ground Effects	The modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver
Hertz	The unit normally employed to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
Impulsive Sound	A sound having all its energy concentrated in a very short time period
Tonal	Tonal noise is commonly referred to as discrete frequency noise and is characterised by spectral tones that are pure tone in nature. Pure tones are wave forms that occur at a single frequency.
Intermittent	Noise that stops and starts, usually at irregular intervals, is considered to be an intermittent noise

Appendix B

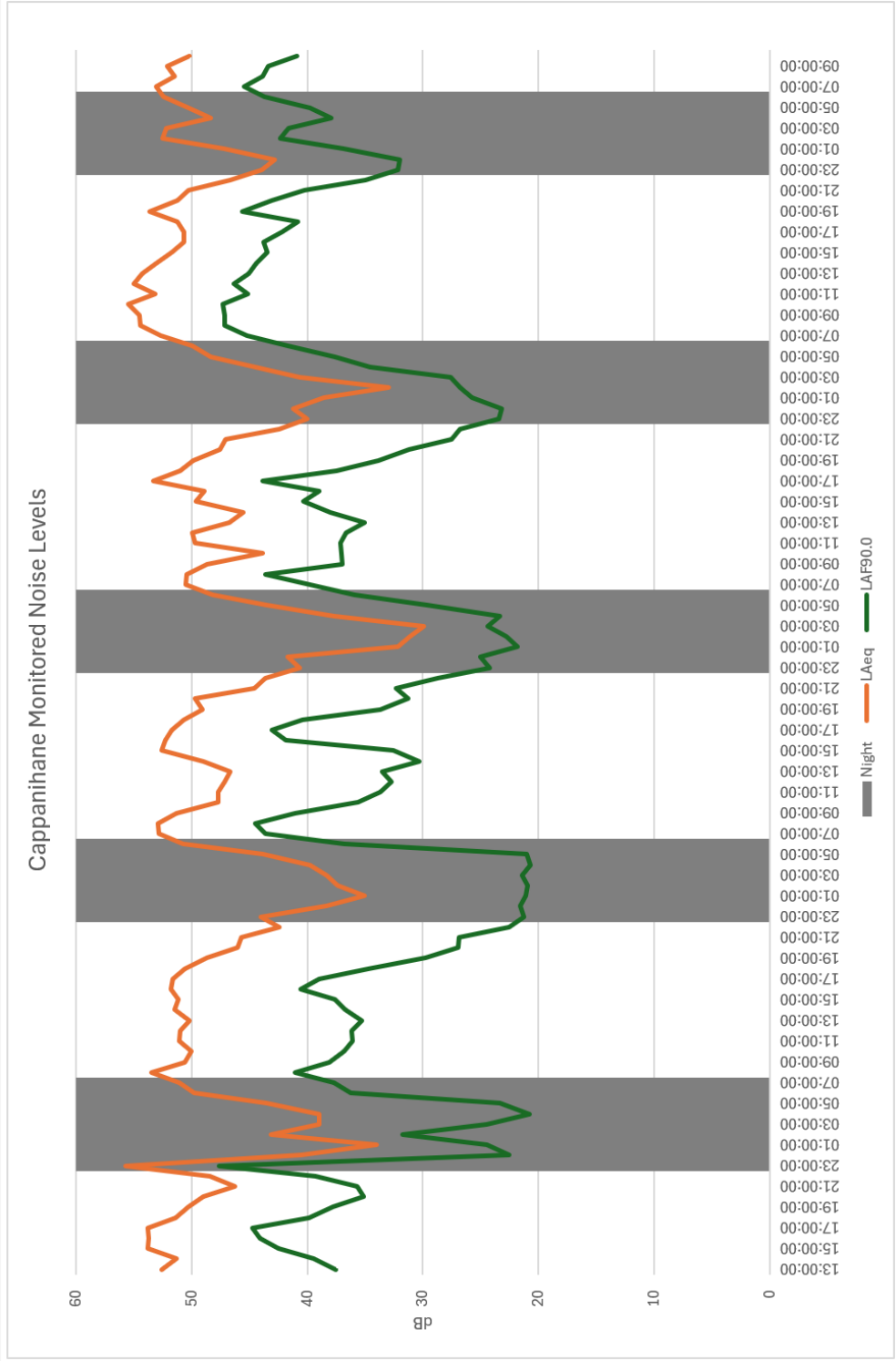
Noise Monitoring Location:

NML	
	
	

ORS

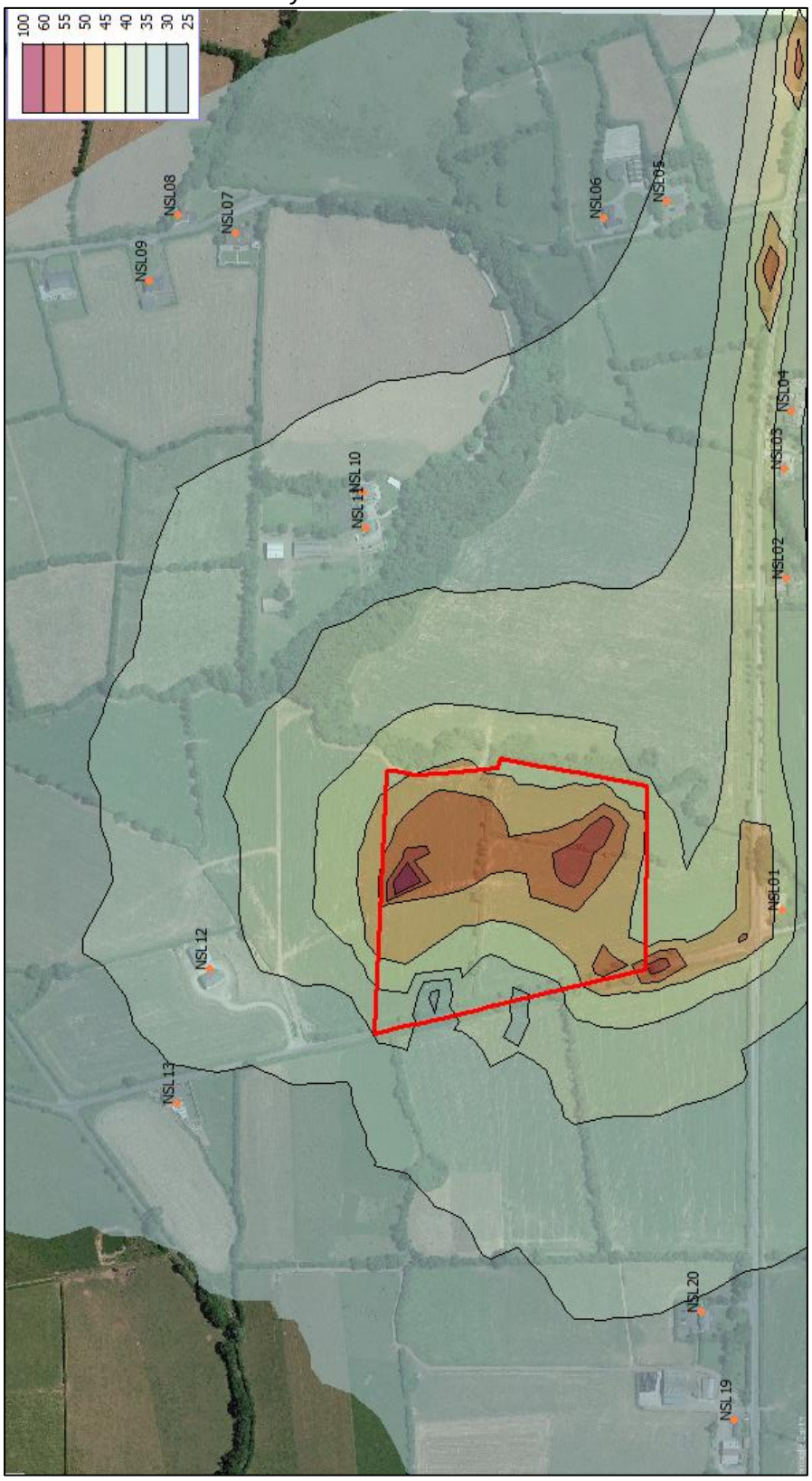
Appendix C

Time-history plot of monitored noise levels:



Appendix D

Noise Contour Plot – Day Period:



Noise Contour Plot – Night Period: