CONTENTS

TABLES

10 NOISE AND VIBRATION

10.1 Introduction

10.1.1 This chapter reports the assessment of potential noise and vibration effects associated with the Proposed Development. This assessment has considered the potential effects arising from the Proposed Development during the construction, operation and decommissioning phases.

10.1.2 This chapter is intended to be read as part of the wider draft Environmental Statement, and with supporting information found in **Volume 4, Technical Appendix 10.1, Technical Appendix 10.2** and **Technical Appendix 10.3**.

10.2 Consultation, Scope and Study Area

10.2.1 A consultation request was sent to Flintshire Country Council on 07 February 2024, which outlined the baseline noise survey and assessment strategy for agreement. While acknowledgement of receipt of the request for consultation was given, no further comment on the baseline noise survey or assessment requirements in respect of noise or otherwise were provided. Subsequently meetings have been held between the Applicant, RSK and Flintshire County Council regarding the Proposed Development as a whole, however, no further comments specifically with regards to noise and vibration have been made.

10.3 Scope of the assessment

10.3.1 The scope of this assessment has been established through an ongoing scoping process. Further information can be found in **Volume 2, Chapter 4: Approach to EIA**.

10.3.2 This section provides a summary of the scope of the assessment (including in respect of updates made since the initial EIA scoping) and provides the basis on which any matters have been scoped out following further iterative assessment.

Receptors/ matters scoped out of further assessment

10.3.3 **Table 10.1** presents the matters that are scoped out of further assessment, together with appropriate justification.

Table 10.1 Receptor/matters scoped out of further assessment

Receptor /matter	Phase	Justification	Change since EIA Scoping?
Traffic Noise	Operational	There will be a limited number of additional vehicles accessing the Site as a result of the Proposed Development. These will arrive and depart the Site via the A5118 road. The influence of operational phase vehicle movements is not expected to give rise to significant effects. On this basis, the assessment of operational phase traffic flows has been scoped out of the EIA.	No
Vibration	Operational	The proposed equipment installations associated with the Proposed Development will be designed to be appropriately isolated so that the transmission of ground-borne vibration will not be significant.	No

Receptors/matters scoped into further assessment

10.3.4 **Table 10.2** presents the receptors/matters that are scoped into further assessment, together with appropriate justification. Where a change has occurred since EIA scoping, this is clearly stated and justified.

Table 10.2 Receptor/matters scoped into further assessment

Receptor/matter	Phase	Justification	Change since EIA Scoping?
Human receptors affected by noise	Construction	Potential for significant adverse noise effects on nearby human receptors resulting from construction traffic and the construction activities associated with the Proposed Development.	No
Human receptors affected by vibration	Construction	Potential for significant adverse vibration effects on nearby human receptors resulting from construction activities	No

Receptor/matter	Phase	Justification	Change since EIA Scoping?
		associated with the Proposed Development.	
Human receptors affected by noise	Operation	Potential for significant adverse noise effects due to noise emitting plant and equipment associated with the Proposed Development.	No

10.4 Extent of the Study Area

Construction and decommissioning phase

10.4.1 The Study Area for the construction and decommissioning phase assessments has considered noise and vibration sensitive receptors that are located within 300m of the Proposed Development. This has been determined based on the guidance set out in BS 5228-1[1], BS 5228-2[2] and using professional judgement. At distances of more than 300m, noise predictions have to be treated with caution due to the increasing importance of meteorological effects. There are sufficient receptors within 300m which can be regarded representative of the worst affected locations, and therefore assessment beyond this distance is not necessary. The Study Area is defined based on daytime construction working only, based on the proposed construction working hours set out in the Outline Construction Environmental Management Plan (as provided in **Volume 4, Technical Appendix 2.1**).

10.4.2 For certain construction activities such as activities associated with cable termination and commissioning stages there is a potential requirement for works to be undertaken on a 24-hour basis. To account for the more stringent threshold levels during the night as derived from BS 5228-1[3], the Study Area for night-time construction phase assessment has been extended to consider sensitive receptors inhabited by humans that are located within 800m of the Site boundary. At distances in excess of 800m, the construction noise levels would typically be below the lowest threshold levels for the night-time period as derived from BS 5228-1[4].

Operation phase

10.4.3 For the assessment of operational phase noise levels, the Study Area has been extended out to the nearest or most exposed noise sensitive receptors surrounding

[1] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

[2] https://knowledge.bsigroup.com/products/noise-and-vibration-control-on-construction-and-open-sites-guide-to-noise-and-vibration-control-legislation-for-construction-and-demolition-including-road-construction-and-maintenance?version=standard

[3] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

[4] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

the Proposed Development in each direction (up to 1km from the Proposed Development). The operational phase assessment has concentrated on the residential receptors located at Padeswood Drive, Plas Yn Rhos, Padeswood Lake Road and additional isolated dwellings to the south west of the Proposed Development. At receptors beyond the Study Area, it is expected that noise from the Site would be diminished to a magnitude that is unlikely to give rise to adverse effects; the receptors considered are the locations likely to be most affected by the Proposed Development.

10.5 Approach and Methodology

Applicable guidance

10.5.1 The following legislation, policy and guidance documents have been used during the preparation of this chapter. A detailed assessment of how the Proposed Development complies with this legislation, policy and guidance is provided within the **Planning, Design and Access Statement**, which is submitted as part of this planning application.

Legislation

10.5.2 This assessment has been carried out in accordance with the following legislation:

- The Control of Pollution Act 1974[5]; and
- The Environmental Protection Act 1990 (as amended)[6].

Policy

10.5.3 This assessment is carried out in accordance with the following policy:

- Planning Policy Wales[7];
- Planning Guidance, Wales (1997) *Technical Advice Note 11. Wales*: Welsh Government[8];
- Environment (Air Quality and Soundscapes) (Wales): Welsh Government[9]; and
- Secretary of State (1974) *Control of Pollution Act*[10].

Guidance

10.5.4 This assessment is carried out in accordance with the following guidance

- British Standards Institution (2014) Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (BS 5228-1);

[5] https://www.legislation.gov.uk/ukpga/1974/40/data.pdf

[6] https://www.legislation.gov.uk/ukpga/1990/43/contents

[7] https://www.gov.wales/planning-policy-wales

[8] https://www.gov.wales/technical-advice-note-tan-11-noise

[9] https://www.legislation.gov.uk/asc/2024/2

[10] https://www.legislation.gov.uk/ukpga/1974/40/data.pdf

- British Standards Institution (2014) Code of practice for Noise and Vibration Control on Construction and Open Sites – Part 2: Vibration (BS 5228-2)[11];
- British Standards Institution (2019) - Methods for rating and assessing industrial and commercial sound (BS 4142)[12];
- Department of Transport (1988). Calculation of Road Traffic Noise (CRTN)[13];
- Design Manual for Roads and Bridges (2019). LA 111 Noise and vibration (DMRB)[14];
- World Health Organisation (1999). Guidelines for Community Noise. WHO[15]; and
- World Health Organisation (2009). Night Noise Guidelines for Europe. WHO[16].

Desktop based research and data sources

10.5.5 Noise-sensitive receptors within the Study Area that have the potential to be affected by the Proposed Development have been identified through a combination of online aerial imagery, site visit, Ordnance Survey mapping data and ownership information provided by the Applicant. The baseline acoustic conditions have been informed by a baseline noise survey undertaken in September 2023.

10.5.6 The construction phase assessment has been based on the proposed construction methodologies and outline plant selections as advised by the Applicant and its supply chain. The noise emission data contained within BS5228-1[17] has subsequently been used to determine the typical noise emissions generated by the selected items of plant and equipment.

10.5.7 Baseline traffic flows on the public highway and peak construction phase traffic flows have been provided by the traffic and transport team.

10.5.8 Initial design information regarding the Proposed Development has been provided by the Applicant and its Front End Engineering Design (FEED) contractors; Worley and MHI. This has included an indicative site layout; equipment lists and noise emission data for each plant item.

10.6 Surveys to inform the EIA baseline characterisation

[11] https://knowledge.bsigroup.com/products/noise-and-vibration-control-on-construction-and-open-sites-guide-to-noise-and-vibration-control-legislation-for-construction-and-demolition-including-road-construction-and-maintenance?version=standard

[12] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

[13] https://n-somerset.gov.uk/sites/default/files/2022-11/CD13.02%20Department%20of%20Transport%20and%20Welsh%20Office%20%281988%29.%20Calculation%20of%20Road%20Traffic%20Noise..pdf

[14] https://www.standardsforhighways.co.uk/tses/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364

[15] https://www.who.int/publications/i/item/a68672

[16] https://iris.who.int/handle/10665/326486

[17] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

10.6.1 A baseline noise survey was undertaken at locations representative of noise sensitive receptors within the Study Area to establish the pre-development acoustic environment, against which the assessment of construction and operational phase noise impacts has been undertaken. The survey comprised unattended measurements at four locations as defined in the table below. The noise survey was undertaken between 07 September and 15 September 2023.

10.6.2 The baseline noise survey locations have been presented in **Table 10.3** below.

Table 10.3 Baseline noise survey locations

Noise Monitoring Location	Property Address	Co-ordinates
MP1	Field to west of Hanson Cement site (covering Hanson owned properties on Padeswood Drive)	53.154795, -3.06277
MP2	Dyke Farm	53.148569, -3.070141
MP3	Oak Tree Farm	53.152962, -3.052522
MP4	Agricultural land to SE of the cement works	53.147572, -3.051802

10.6.3 Noise monitoring locations can be found in **Volume 3, Figure 10.1**.

10.6.4 Further information regarding the survey methodology is presented in **Volume 4, Technical Appendix 10.1.**

10.6.5 The surveys were carried out using Class 1 sound level meters conforming to the requirements of BS EN 61672-1:2013[18]. The meters had been calibrated to traceable standards within the preceding two years and the calibrator within the previous 12 months. The sound level meters were field calibrated once set up in the measurement positions and on completion of the survey. No significant calibration drift was observed i.e. within a +/- 0.5 dB tolerance.

10.6.6 The noise monitoring equipment at two positions were located at least 3.5m from any significant reflective surfaces, other than the ground. The other two monitoring locations were located approximately 1m from the façade of the property. Where façade measurements were undertaken a free-field correction has been applied in accordance with BS 4142[19]. All measurements were taken with the microphone situated approximately 1.5m above the local ground level.

10.6.7 The weather conditions for the majority of the unattended baseline noise surveys were dry with average wind speeds not exceeding 5m/s. Where weather conditions

[18] https://knowledge.bsigroup.com/products/electroacoustics-sound-level-meters-specifications-1?version=standard

[19] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

were not conducive for noise monitoring, the associated results have been removed from the dataset.

10.7 Assessment methodology

Construction and decommissioning phases - noise

10.7.1 For the construction phase of the Proposed Development, noise predictions have been undertaken based on the methodology contained within BS 5228-1[20]. The noise predictions have been used to determine whether the construction phase activities have the potential to result in significant impacts at the surrounding noise sensitive receptors.

10.7.2 The significance criteria given in BS 5228-1[21] (Annex E.3.2) have been used to assess the noise effects during the construction phase. The methodology within Annex E.3.2 adopts the use of fixed threshold levels at noise sensitive receptors in the vicinity of the proposed construction works. Based on the survey results the threshold levels have been determined in accordance with the ABC method.

10.7.3 For the purpose of this assessment, the daytime criteria would apply 07:00-19:00 during a midweek day and 08:00-13:00 on Saturday. Some works may be required outside of the core hours, but this would be rare and of short duration. Activities include, but are not limited to the following:

- Concrete pours;
- Pipework hydrotesting;
- Commissioning activities;
- Delivery of abnormal loads;
- Plant testing/start up and shut down at the beginning and end of the day; and
- The completion of operations commenced during the core working hours which cannot be stopped for safety or efficiency reasons.

10.7.4 Other activities that may require 24/7 shift work could include radiography and pressure testing. As the Proposed Development enters commissioning stages, any works to be conducted outside of core hours will be subject to prior notification with residents and Flintshire County Council.

10.7.5 For the purpose of predicting the likely noise levels associated with the Proposed Development, the construction works have been divided into the following phases/activities:

- Site profiling;
- Access roadways;
- Laydown compound areas;
- Civil foundations;

[20] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

[21] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

- Demolition of existing structures;
- Erection of structures;
- Earthworks; and
- Construction traffic.

10.7.6 The Site layout can be found in **Volume 3, Figure 1.2** and provides a detailed site plan which presents the location and extent of the construction phase works, including laydown areas, parking areas and construction access points.

10.7.7 The properties present within the construction phase Study Area have been derived from publicly available mapping data and the online planning portal. **Table 10.4** presents the receptors that have been considered as part of the assessment and the approximate separation distances from the main work areas. Where individual properties are identified within the table, it should be noted that they may be representative of other receptors in the surrounding area which may experience similar effects, therefore this is not intended to be an exhaustive list of all locations.

10.7.8 The receptors that are located within the construction phase Study Area are listed below and are presented in **Volume 3, Figure 10.2**.

Table 10.4 Construction area separation distances

ID	Address	Approximate Separation Distance (m)			
		Topsoil Strip Area	Main Site Area	Laydown Area	Access Road
1	2 Padeswood Drive	55	605	69	95
2	3 Padeswood Drive	55	630	69	130
3	6 Padeswood Drive	60	655	74	160
4	7 Padeswood Drive	65	680	79	190
5	10 Padeswood Drive	55	555	69	20
6	11 Padeswood Drive	60	575	74	55
13	Bannel Farm – A5118 Roundabout	50	720	64	275
14	Beudy Coch, Padeswood Lake Road	1500	785	1300	1300
15	Camfa Rheinallt Farm, Padeswood Lake Road	1500	750	1300	1300
16	Dyke Farm, Padeswood Lake Road	920	180	750	700
17	Hendy Cottage, Padeswood Lake Road	1150	590	900	860
18	Homelea	105	565	119	30
19	Laburnam Cottage	570	410	360	300
22	Oak Tree Farm, Bannel Lane	455	755	415	635
23	Oak Tree Farm	505	365	260	230
24	Pen-yr-Allt Farm, Padeswood Lake Road	1470	780	1400	1200
25	The Gables, Padeswood Lake Road	1400	700	1200	1180
26	The Old Barn, Padeswood Lake Road	1450	770	1400	1200
27	Toll Bar Cottage, Chester Road	1500	765	1300	1350
28	Ty Gwyn Farm	790	490	565	495
29	Well House Farm, Padeswood Lake Road	1150	500	975	935
30	Springfield	290	710	240	490

10.7.9 Due to the nature of the land within the defined Study Area, soft ground attenuation has been assumed where the noise sensitive receptor is situated more than 25m from the works. No allowance has been made for acoustic screening provided by intervening landforms or structures; this is considered to result in a conservative and robust assessment which is likely to over-estimate the noise levels at some receptors given the topography and existing landscaping in certain areas.

10.7.10 The equipment installations will either be replaced or decommissioned at the end of its serviceable life. Decommissioning would typically involve removal of all plant and surface structures, with the Site returned to an undeveloped state. These activities are expected to generate broadly similar noise levels to the primary construction works for the substation (excluding the access road) and therefore the construction noise levels are considered to be representative of future decommissioning. No additional decommissioning assessment is therefore required.

10.7.11 In addition, Heavy Goods Vehicle (HGV) movements on the access road have been assessed using the access road calculation formula contained within BS 5228-1[22] (Section F.2.5). The assessment has been undertaken using the estimated peak and average HGV movements throughout the programme, which equates to 20 and 12 individual movements per hour respectively throughout the day.

Construction phase – off-site traffic noise

10.7.12 The influence of traffic flow fluctuations on the public highway during the construction phase of the Proposed Development has been calculated using the methodology set out in the Calculation of Road Traffic Noise (CRTN) publication to determine the change in noise level. Traffic noise predictions have been carried out at notional receptors located 10 m from the edge of the carriageway and 1.5 m above ground level.

10.7.13 Notional receptors are used because it is the change in traffic noise level that is of interest, not the absolute noise levels at any given receptor. The predicted changes in noise level would occur at noise sensitive receptors along each of the roads considered, regardless of whether they have specifically been identified as a receptor or not. The CRTN assessment utilises the 18 hour or one hour Annual Average Weekday Traffic (AAWT).

10.7.14 For the purpose of the traffic noise assessment, the following scenarios have been assessed:

- Scenario 1: 2024 baseline traffic flows; and
- Scenario 2: 2024 baseline traffic flows plus construction traffic.

10.7.15 The following road links were considered in the assessment:

- A5118: West of site access
- A5118: East of site access
- A550: North of Penymynydd
- A550: South of A55

[22] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

- Expressway (East towards Chester)
- Expressway (West towards Deeside)
- A541: South of A494
- A494: North of A541
- A494: East of A5119

10.7.16 The significance criteria for the construction phase traffic flow fluctuations are based on the magnitude of impact values set out in Table 3.17 of LA 111[23].

Construction phase - vibration

10.7.17 Construction works comprising activities such as compaction and hydraulic breaking can produce ground-borne vibration, which may be felt in nearby residential properties.

10.7.18 BS 5228-2 provides guidance on vibration levels that can be used to assess the likely impacts of construction activities. Annex E of the standard gives empirical formulae for the prediction of the resultant peak particle velocity (PPV) vibration levels for various types of work.

10.7.19 With reference to Annex E, the source which is likely to generate the highest level of vibration associated with the Proposed Development is expected to be attributable to vibratory compaction activities. This source has therefore been considered as part of a quantitative assessment.

Operational phase

10.7.20 The Proposed Development will introduce a range of noise sources that will operate on a 24-hour basis, generally under steady state conditions.

10.7.21 The location, dimensions and sound power level associated with noise generating equipment item has been provided by the design team, along with the typical operating duty for day and night time periods, operational requirements and number of each equipment operating simultaneously. Planning drawings reference **215000-00190-000-PI-PLN-00002_C1A**, submitted as part of this planning application is a plot plan is, which shows the equipment locations.

10.7.22 Further information surrounding the characteristics of noise emissions has been provided by the design team. It is understood that the blowers have the potential to have tonal characteristics. It is understood that all other proposed equipment is unlikely to have distinguishable sound characteristics.

10.7.23 The noise emitting sources are defined in **Table 10.5** below. Equipment associated with the ID items below can be found in **215000-00190-000-PI-PLN-00002_C1.**

Table 10.5 Noise emitting sources

[23] https://www.standardsforhighways.co.uk/tses/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364

ID Item	Number of Units Running Simultaneously	Noise Level SWL	Embedded Mitigation
710-BL-001	1	93	
720-BL-001	1	93	
720-PU-001AB	1	83	-20 dB(A) enclosure
720-PU-002AB	1	82	-15 dB(A) enclosure
720-PU-003AB	1	87	-20 dB(A) enclosure
720-PU-004AB	1	92	
720-PU-005AB	1	87	-20 dB(A) enclosure
720-PU-006	1	88	
720-PU-007AB	1	89	
720-PU-008AB	1	101	
720-PU-009AB	1	94	
720-PU-010AB	1	67	
720-PU-011ABC	2	79	-20 dB(A) enclosure
720-PU-012AB	1	85	
720-PU-013AB	1	100	
720-PU-014AB	1	92	
720-PU-016AB	1	85	-15 dB(A) enclosure
720-PU-017AB	1	87	
720-PU-018AB	1	66	
720-PU-019	1	65	
720-PU-021ABC	2	82	-20 dB(A) enclosure
720-PU-023AB	1	76	-20 dB(A) enclosure
720-PU-024AB	1	87	
720-PU-025AB	1	84	
720-PU-027AB	1	88	
720-PU-029AB	1	64	
720-PU-032AB	1	72	

ID Item	Number of Units Running Simultaneously	Noise Level SWL	Embedded Mitigation
720-PU-33	1	88	
720-PU-34	1	79	
720-PU-35AB	1	81	-15 dB(A) enclosure
720-PU-41	1	76	-20 dB(A) enclosure
720-PU-51	1	81	
720-PU-52	1	81	
720-PU-53	1	81	
720-PU-54	1	85	
Transformers	4	62	Low noise plant
Water Treatment Pumps - Small	4	76	
Water Treatment Pumps - Medium	6	87	
710-PU-002AB	1	105	
710-PU-003AB	1	80	
710-PU-004AB	1	90	
710-PU-005AB	1	76	
720-HE-201-A-F	1 bay	• Day: 87 • Night: 85	
720-HE-202-A-F	1 bay	• Day: 87 • Night: 85	
720-HE-204-A-E	1 bay	• Day: 87 • Night: 85	
720-HE-206-A-F	1 bay	• Day: 86 • Night: 84	
720-HE-211-AB	1 bay	• Day: 87 • Night: 85	
720-HE-212-A-F	1 bay	• Day: 87 • Night: 85	
720-HE-214-A-N	1 bay	• Day: 86 • Night: 84	
720-HE-215-AB	1	88	
740-PU-001AB	1	92	

ID Item	Number of Units Running Simultaneously	Noise Level SWL	Embedded Mitigation
740-PU-002AB	1	77	-15 dB(A) enclosure
740-PU-004AB	1	91	-15 dB(A) enclosure
740-PU-0010AB	1	82	
740-PU-0011ABC	2	78	
740-PU-0012AB	1	93	
740-PU-0013AB	1	86	
740-PU-0014AB	1	66	
740-PU-0015AB	1	91	
720-ZZ-002	1	85	
710-ME-002	1	58	
710-ME-003	1	58	
710-TB-001	1	• Turbine: 110 • Gearbox: 104 • Generator: 101	-67 dB(A) attenuation through building envelope and/ or enclosure combination
710-ZZ-001	2	113	-64 dB(A) attenuation through building envelope and/ or enclosure combination
710-ZZ-002	1	83	
720-ZZ-001	1	85	-20 dB(A) enclosure
720-ZZ-002	1	89	-20 dB(A) enclosure
740-TK-010-MX1	1	62	
720-MX-001-A	1	62	
720-MX-001-B	1	62	
720-MX-002	1	62	
720-MX-003	1	62	
720-MX-004	1	62	
720-ZZ-011	1	93	

ID Item	Number of Units Running Simultaneously	Noise Level SWL	Embedded Mitigation
730-CP-001 (motor only)	1	130	-67 dB(A) attenuation through building envelope and/ or enclosure combination
730-ZZ-001	1	81	-20 dB(A) enclosure
730-ZZ-002	1	83	-10 dB(A) enclosure
740-TW-001	1	• Wet air inlet: 101.8 dB(A) • Dry air inlet: 89.3 dB(A)	Water splash noise abatement and temperature based operations – 5dB(A)
740-ZZ-002	1	84	
740-ZZ-003	1	88	
740-ZZ-004	1	88	
740-ZZ-005	1	60	
740-ZZ-008	1	60	
800-BL-001	1	96	
800-PU-001AB	1	99	
800-PU-002AB	1	97	
800-PU-003AB	1	100	
800-PU-004	1	89	
800-PU-005	1	79	

Notes:

1) The sound power levels provided account for the embedded mitigation outlined above, with the exception of the following items:
   - 730-CP-001
   - 710-ZZ-001
   - 710-TB-001
2) Where day/night levels have been provided, it has been advised that temperature fluctuations will influence the operation of specific plant items

10.7.24 Operational phase noise levels have been predicted and assessed in accordance with the methodology set out in BS 4142[24] and TAN 11. The significance criteria for the operational phase assessment have been derived from BS 4142[25].

10.7.25 To inform the BS 4142[26] assessment for the Proposed Development, the noise emissions at surrounding sensitive receptors have been calculated using a noise prediction model. Modelling has been undertaken using nationally recognised modelling software (SoundPLAN) which implements widely accepted modelling algorithms. The modelling software calculates industrial noise in accordance with the methodology set out in ISO 9613-2[27].

10.7.26 The ISO 9613-2[28] method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind conditions. The modelling parameters are presented in **Table 10.6**.

Table 10.6 Modelling parameters

Element	Setting
Algorithm	International Standard: ISO 9613-2:1996 '*Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*'[29].
Met conditions	70 Humidity. 10°C Wind from source to receiver.
Ground absorption	The ground absorption in the noise model has been assumed 0 on-site and 0.8 across all areas surrounding the Site.
Receptors	Ground floor: 1.5m First floor: 4
Façade corrections	Free-field conditions.
Receptor height	The offsite receptors have been modelled as two storey buildings with a receiver height of 1.5m and 4m above external ground level, respectively.

[24] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

[25] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

[26] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

[27] https://www.iso.org/standard/74047.html

[28] https://www.iso.org/standard/74047.html

[29] https://www.iso.org/standard/74047.html

Element	Setting
Hours of operation	For the purpose of this assessment, it is assumed that the Site will operate 24-hours a day.
Site layout	As provided in **Volume 3, Figure 1.2**.
Terrain	1m DTM LiDAR data. It is not anticipated that there would be any significant changes to the terrain as a result of the Proposed Development.
Exclusions from the model	Operational vehicle movements have not been accounted for within the noise model as it is it identified in the transport assessment, **Volume 2, Chapter 11: Traffic and transport** that any increases in operational traffic will not be significant. Emergency pumps have been excluded as they will only be in operation on an ad-hoc basis during emergency periods and therefore is not considered a regular operation.

10.8 Significance criteria

10.8.1 The significance criteria for the operational phase assessment are derived from BS 4142[30], as summarised in **Table 10.7**.

Table 10.7 Receptor sensitivity

Receptor Sensitivity	Type of Receptor
High	Residential properties, educational establishments, hospitals, places of worship, hotels, children's nurseries, nursing homes
Medium	Commercial premises including offices, halls, public municipal areas, bars and restaurants
Low	Industrial premises
Negligible	All other areas such as those used primarily for agricultural purposes

Magnitude of impact

10.8.2 The magnitude of the impact within this assessment has been described using the following scale:

- High;
- Medium;

[30] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

- Low; and
- Very Low.

10.8.3 Although the lowest measure of magnitude of effect is defined as 'Very Low', it should be noted that noise and vibration levels may still be audible/perceptible during the construction and operational phases, even at this assigned magnitude.

10.8.4 The criteria in **Table 10.8** have been adopted for the assessment of magnitude of impact at the receptors.

Table 10.8 Magnitude of impact criteria

Impact	Magnitude Criteria			
	Very Low	Low	Medium	High
Construction phase – daytime noise	Less than 55 dB $L_{Aeq,T}$	Between 55 & 65 dB $L_{Aeq,T}$	Between 65 & 75 dB $L_{Aeq,T}$	Greater than 75 dB $L_{Aeq,T}$
Construction phase – Night-time noise	Less than 40 dB $L_{Aeq,T}$	Between 40 & 50 dB $L_{Aeq,T}$	Between 50 & 60 dB $L_{Aeq,T}$	Greater than 60 dB $L_{Aeq,T}$
Construction phase - road traffic noise	Less than 1 dB increase in road traffic noise	1.0 to 2.9 dB increase in road traffic noise	3.0 to 4.9 dB increase in road traffic noise	Greater than or equal to 5 dB increase
Construction phase - vibration	Less than 0.3 mm/s PPV	0.3 to less than 1.0 mm/s PPV	1.0 to 9.9 mm/s PPV	Greater than or equal to 10 mm/s PPV
Operational phase - noise	In excess of 5 dB(A) below background sound level	In the range of 5 dB(A) below and 5 dB(A) above background sound level	Between 5 and 10 dB(A) above background sound level	In excess of 10 dB(A) above background sound level

Notes:

1 Construction phase noise levels are based on a time period 'T' which equates to the duration of a working day on-site. I.e., 12hrs for midweek day, 6hrs for Saturday day and 8hrs for the night-time period.

2 The construction noise impact criteria will apply if the works occur for a duration exceeding 10 or more days or nights in any 15 consecutive days or nights; or a total number of days exceeding 40 in any 6 consecutive months.

Impact	Magnitude Criteria			
	Very Low	Low	Medium	High
3 Operational phase noise criteria is based on rating noise levels as defined in BS 4142[31]				

Significance of effects

10.8.5 The overall significance of an effect is determined by combining the sensitivity of the receptor and magnitude (as presented in **Table 10.9**). The assessment of significance relies on best practice and the relevant published standards and guidance documents.

10.8.6 The significance of an effect is reported as either 'significant' or 'not significant' under the terms of the EIA Regulations. Where impact significance is assessed as 'Negligible' or 'Minor', the overall effect is not significant. Where the impact significance is assessed as 'Moderate' or 'Major', the overall effect is significant.

Table 10.9 Determining significance of effects

Magnitude	Sensitivity of receptor/receiving environment to change			
	High	Medium	Low	Very Low
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

10.9 Assumptions and Limitations

10.9.1 The baseline noise survey has been undertaken on the premise that equipment on the existing Padeswood Cement Works was operating at a typical level in terms of the number of noise sources and duration.

10.9.2 The assessment assumes the use of standard construction techniques and practices commensurate for works of this nature. The final techniques, plant selection and programme would be determined by the Applicant and their contractors, in consultation with relevant authorities prior to commencement of construction.

10.9.3 Construction activities would involve the use of a variety of working methods, for which an estimate of the expected noise levels over a representative period has been prepared, in accordance with industry best practice. Noise levels from the

[31] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

construction works experienced by a receptor would vary over time as the distances to noise producing plant and the type of construction activity change.

10.9.4 At this stage in the design of the Proposed Development, specific and final vendor noise data is not available for the proposed operational equipment installations. To inform the operational phase assessment, where possible vendor data has been utilised regarding the expected plant/ equipment installations, including typical sound emission data and attainable acoustic attenuation measures, if required. In some instances, it has not been possible to provide spectral emission data. Where this has not been feasible, spectral emission data from similar equipment has been adopted.

10.9.5 The detailed design of the building including material specifications is not known at this stage. The assessment provides required attenuation values on the basis that this will be achieved through design.

10.9.6 The resulting information has been used as part of the assessment to demonstrate that a workable solution can be achieved which does not result in significant adverse effects.

10.10 Identifying Mitigation and Assessing Residual Significance

10.10.1 The assessment takes account of the embedded mitigation measures that will be incorporated into the design of the Proposed Development, which includes current best practice techniques to reduce noise and vibration. Embedded mitigation measures have been refined through a number of model iterations to reduce noise impacts as far as reasonably practicable at the considered noise sensitive receptors.

10.10.2 This process involved modelling the identified sources without mitigation initially to allow the extent of required noise reduction at each receptor to be quantified. A range of measures required to achieve these reductions were then discussed and agreed with the FEED team. The model was then re-run to test the effectiveness of the agreed mitigation. Finally, a further review and refinement of mitigation options was completed to reach the embedded mitigation measures referred to in this assessment.

10.10.3 The embedded mitigation identified comprises a combination of building fabric performance, enclosures or lagging and low noise alternative plant, where required. The specific means of achieving the required embedded mitigation will be determined through detailed design.

10.10.4 Any additional mitigation measures that would reduce the level of any significant effects are set out and considered prior to assessing residual effects. Residual effects, which are the effects that would remain following implementation of proposed mitigation measures, are outlined below, with a summary table and statement of significance provided in **Section 10.13**.

10.11 Existing Conditions

10.11.1 The Proposed Development is located within a rural setting, which primarily comprises agricultural land use and existing on-site operations. A baseline noise survey has been undertaken to define the existing sound levels at the closest noise sensitive receptors to the Site location. The cement works operation forms part of the baseline as established through this survey.

10.11.2 The resulting measurement data set has been used to inform the assessment. It is understood that the cement works was operating normally throughout the duration of the survey. The following sources were noted to characterise the existing soundscape at receptors surrounding the Site:

- Livestock;
- Farming activities;
- On-site operations from the existing cement works;
- Vehicular movements along the local road networks;
- Train movements along the train line to the east of the existing Site.

Baseline noise measurements MP1

10.11.3 A summary of the measured noise levels at MP1 (Padeswood Drive) are presented below. Further survey information is available at **Volume 4, Technical Appendix 10.3**.

10.11.4 The noise monitoring locations can be found in **Section 10.4.**

Table 10.10 Noise monitoring results at MP1

Date	MP1 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	13:30-23:00	55	85	51	58
	23:00-07:00	55.	84	51	57
08/09/2023	07:00-23:00	56	83	52	58
	23:00-07:00	54	78	49	56
09/09/2023	07:00-23:00	53	77	49	55
	23:00-07:00	51	73	48	53
10/09/2023	07:00-23:00	53	93	50	55
	23:00-07:00	55	74	50	56

Date	MP1 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
11/09/2023					
	07:00-23:00	56	86	52	58
	04:45-07:00*	58	72	55	60
12/09/2023	07:00-23:00	58	83	54	60
	23:00-07:00	55	79	51	57
13/09/2023	07:00-23:00	57	86	54	59
	23:00-07:00	55	80	52	57
14/09/2023	07:00-23:00	56	80	52	58
	23:00-07:00	54	78	50	57
15/09/2023	07:00-07:45	57	79	54	59

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.
3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.

**Considers data between 04:45-07:00 due to adverse weather conditions.*

10.11.5 During the installation and collection of the equipment, existing cement works site activities and vehicle movements accessing the Site were noted to be dominant at this location. It was noted that the A5118 road was not audible at this location.

10.11.6 Statistical analysis that has been used to determine a representative background sound level during the daytime and night-time periods for the measurements taken at MP1. For the distribution of data, a daytime $L_{A90,1hr}$ of 49 dB and a night-time $L_{A90,15min}$ of 48 dB are considered to be representative of the prevailing background sound level at MP1.

Baseline noise measurements MP2

10.11.7 A summary of the measured noise levels at MP2 (Dyke Farm) are presented below. Further survey information is available at **Volume 4, Technical Appendix 10.3**.

Table 10.11 Noise monitoring results at MP2

Date	MP2 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	12:45-23:00	71	87	42	47
	23:00-07:00	44	71	41	45
08/09/2023	07:00-23:00	48	83	41	46
	23:00-07:00	44	81	39	44
09/09/2023	07:00-23:00	51	85	41	46
	23:00-07:00	43	78	39	42
10/09/2023	07:00-23:00	47	85	40	46
	23:00-07:00	43	77	34	39
11/09/2023	07:00-23:00	48	83	40	46
	04:45-07:00*	47	66	45	49
12/09/2023	07:00-23:00	50	84	46	50
	23:00-07:00	46	84	41	44
13/09/2023	07:00-23:00	50	90	41	47
	23:00-07:00	43	76	37	42
14/09/2023	07:00-23:00	48	86	40	46
	23:00-07:00	44	67	42	45
15/09/2023	07:00-07:45	50	87	43	50

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.
3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.

**Considers data between 04:45-07:00 due to adverse weather conditions.*

10.11.8 During the installation and collection of the noise equipment a combination of both cement works operational activities and local farming activities adjacent to the location were noted to be dominant.

10.11.9 It is anticipated that local activities caused the elevated noise levels during the daytime on 07 September 2023, however, the origin of the increased noise levels is not known.

10.11.10 Statistical analysis has been used to determine a representative background sound level during the daytime and night-time periods for the measurements taken at MP2. For the distribution of data, a daytime $L_{A90,1hr}$ of 36 dB and a night-time $L_{A90,15min}$ of 34 dB are considered to be representative of the prevailing background sound level at MP2.

Baseline noise measurements MP3

10.11.11 A summary of the measured noise levels at MP3 (Oak Tree Farm) are presented below. Further survey information is available at **Volume 4, Technical Appendix 10.3**.

Table 10.12 Noise monitoring results at MP3

Date	MP3 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	14:45-23:00	60	98	49	54
	23:00-07:00	52	86	46	52
08/09/2023	07:00-23:00	59	99	49	54
	23:00-07:00	50	83	46	51
09/09/2023	07:00-23:00	69	101	46	54
	23:00-07:00	51	83	47	52
10/09/2023	07:00-23:00	61	101	49	55
	23:00-07:00	52	84	48	53
11/09/2023	07:00-23:00	58	100	48	54
	04:45-07:00*	56	81	50	56
12/09/2023	07:00-23:00	54	95	47	53
	23:00-07:00	52	82	47	51

Date	MP3 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
13/09/2023					
	07:00-23:00	65	102	52	58
	23:00-07:00	51	89	46	52
14/09/2023	07:00-23:00	67	103	48	55
	23:00-07:00	51	72	42	49
15/09/2023	07:00-07:45	60	81	57	61

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.
3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.

**Considers data between 04:45-07:00 due to adverse weather conditions.*

10.11.12 During installation and collection of the noise equipment, livestock from an adjacent field, an outdoor horse-riding area and barking dogs were noted during the noise equipment installation. Site activities from the cement works were not noted to be dominant at this location.

10.11.13 Although, no pass-bys were observed during the Site visit, it should be highlighted that there is a railway line directly west of the noise monitoring location. Train operations are approximately every 30 minutes between 06:00-00:00. The A550 road is also situated to the east of the monitoring location, which could have had influence during the rush hour morning periods.

10.11.14 Statistical analysis has been used to determine a representative background sound level during the daytime and night-time periods for the measurements taken at MP3. For the distribution of data, a daytime $L_{A90,1hr}$ of 43 dB and a night-time $L_{A90,15min}$ of 42 dB are considered to be representative of the prevailing background sound level at MP3.

Baseline noise measurements MP4

10.11.15 A summary of the measured noise levels at MP4 (agricultural land to the south east of the cement works) are presented below and in **Volume 4, Technical Appendix 10.3**.

Table 10.13 Noise monitoring results at MP4

Date	Measurement Summary MP4 - Agricultural land to SE of the cement works				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	15:30-23:00	68	85	57	71
	23:00-07:00	62	81	40	61
08/09/2023	07:00-23:00	68	99	58	71
	23:00-07:00	60	82	39	62
09/09/2023	07:00-23:00	68	100	57	71
	23:00-07:00	59	80	40	61
10/09/2023	07:00-23:00	67	100	55	70
	23:00-07:00	61	80	43	60
11/09/2023	07:00-23:00	68	87	58	71
	04:45-07:00*	67	79	55	70
12/09/2023	07:00-23:00	69	84	61	72
	23:00-07:00	63	81	44	62
13/09/2023	07:00-23:00	68	93	59	71
	23:00-07:00	62	80	40	61
14/09/2023	07:00-23:00	68	90	59	71
	23:00-07:00	62	80	40	61
15/09/2023	07:00-08:15	71	80	64	73

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.
3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.

**Considers data between 04:45-07:00 due to adverse weather conditions.*

10.11.16 During the installation and collection of the noise equipment, road traffic noise from the A550 (Wrexham Road) was noted to be the dominant noise source at this location. Activities at the cement works were not noted to be dominant at this location.

10.11.17 Statistical analysis has been used to determine a representative background sound level during the daytime and night-time periods for the measurements taken at MP4. For the distribution of data, a daytime $L_{A90,1hr}$ of 57 dB and a night-time $L_{A90,15min}$ of 36 dB are considered to be representative of the prevailing background sound level at MP4.

Sensitive receptors

10.11.18 The selected sensitive receptors have been chosen and assessed to represent properties within the vicinity of each location, owing to being exposed to the same existing conditions. The sensitive receptors have been presented in **Table 10.14** below.

Table 10.14 Noise sensitive receptors

ID Number	Address	Distance from Site	Direction	Representative monitoring location
R1	2 Padeswood Drive	605	NE	MP1
R2	3 Padeswood Drive	630	NE	MP1
R3	6 Padeswood Drive	655	NE	MP1
R4	7 Padeswood Drive	680	NE	MP1
R5	10 Padeswood Drive	555	NE	MP1
R6	11 Padeswood Drive	575	NE	MP1
R7	14 Ffordd Derwyn	910	E	MP4
R8	33 Ffordd Derwyn	905	SE	MP4
R9	34 Plas Yn Rhos	950	E	MP4
R10	38 Plas Yn Rhos	940	E	MP4
R11	40 Plas Yn Rhos	930	E	MP4
R12	44 Plas Yn Rhos	920	E	MP4
R13	Bannel Farm	720	N	MP1
R14	Beudy Coch, Padeswood Lake Road	785	S	MP2
R15	Camfa Rheinallt Farm, Padeswood Lake Road	750	S	MP2
R16	Dyke Farm, Padeswood Lake Road	180	SW	MP2
R17	Hendy Cottage, Padeswood Lake Road	590	SW	MP2
R18	Homelea	565	N	MP1
R19	Laburnam Cottage	410	NW	MP1
R20	Brook Meadow Housing Estate	900	SE	MP4
R21	Oak Drive	1,010	E	MP4
R22	Oak Tree Farm, Bannel Lane	755	NE	MP3

ID Number	Address	Distance from Site	Direction	Representative monitoring location
R23	Oak Tree Farm	365	NW	MP3
R24	Pen-Yr-Allt Farm, Padeswood Lake Road	780	SW	MP2
R25	The Gables, Padeswood Lake Road	700	SW	MP2
R26	The Old Barn, Padeswood Lake Road	770	SW	MP2
R27	Toll Bar Cottage, Chester Road	765	S	MP2
R28	Ty Gwyn Farm	490	W	MP1
R29	Well House Farm, Padeswood Lake Road	500	S	MP2
R30	Springfield	710	NE	MP3

10.11.19 The considered receptors include the new Brook Meadow residential housing estate to the east and south east of the Site (Receptor 20).

10.11.20 All key sensitive receptor locations are shown in **Volume 3, Figure 10.2**.

Embedded mitigation

Construction phase and decommissioning phase

10.11.21 Best practicable means (BPM) as defined by the Control of Pollution Act 1974[32] will be implemented which will serve to minimise the noise and vibration impacts at receptors in the vicinity of the construction and decommissioning phase works. The BPM measures that will be implemented are listed below which would be briefed to all relevant parties via site inductions, toolbox talks and at start of shift briefings:

- Where practicable, temporary enclosures should be used close to the noise source to screen all static or semi-static plant from noise sensitive receptor locations;
- Drop heights of materials should minimised i.e. lorry with lifting boom or dumper carefully depositing materials;
- Operators of moving plant to be briefed on a regular basis with an emphasis on the importance of noise mitigation, and avoiding movements over irregular surfaces (which tends to create more noise/vibration emissions);
- At all times, workers' shouting or raised voices to be kept to a minimum;
- All plant, equipment and noise control measures applied to plant and equipment should be maintained in good and efficient working order and operated such that noise and vibration emissions are minimised as far as reasonably practicable. Any plant, equipment or items fitted with noise control equipment found to be defective will not be operated until repaired;
- Machines in intermittent use should be shut down or throttled down to a minimum during periods between works;

[32] https://www.legislation.gov.uk/ukpga/1974/40/data.pdf

- As far as is reasonably practicable, the location and orientation of semi-static equipment should be chosen to minimise the noise impact on sensitive receptors;
- All personnel on-site should undergo site specific inductions and briefings. Where relevant, specific noise and vibration control measures should be incorporated into the contractor's method statements;

Operational phase

10.11.22 A series of noise reduction measures have been assumed as part of the Proposed Development with the objective of minimising the noise experienced by the surrounding sensitive receptors. The embedded mitigation measures are set out in **Table 10.5** and include:

- Use of low noise plant/equipment;
- Use of acoustic enclosures for dominant items of noise generating plant/equipment, with particular emphasis on their use for any prominent external installations;
- Use of onsite buildings to provide acoustic screening of external plant/equipment; and
- Enhanced building fabric to reduce noise breakout associated with internal plant/equipment installations.

10.11.23 At this stage of the design, the embedded mitigation measures are proposed as general measures that have been tested and demonstrated to be effective through the approach described. Further source specific measures are expected to emerge through the detailed design process. Any such source specific measures, will as a minimum, ensure that the source reduction levels identified through the embedded mitigation will be achieved.

10.12 Assessment of Potential Effects, Additional Mitigation and Residual Effects

Construction phase – noise

10.12.1 **Table 10.15** presents the predicted construction phase noise levels associated with the primary construction phases, at a reference distance of 10m. The full plant list provided in **Volume 4, Technical Appendix 10.2**.

Table 10.15 Construction phase noise predictions

Construction Activity	Activity Reference	Activity Noise level at 10m (dB $L_{Aeq,T}$)
Earthworks	T1	85
Laydown Compound Establishment	T2	87
Underground Utilities	T3	84
Civils Foundations	T4	83
Erection of Structures	T5	86
Pipework/ Flue Ductwork	T6	85

Construction Activity	Activity Reference	Activity Noise level at 10m (dB $L_{Aeq,T}$)
Piling Works	T7	82
Haul Road	T8	65

10.12.2 Based on the overall activity noise levels presented in **Table 10.15**. Free-field noise predictions have been made for all sensitive receptors within the defined daytime and night-time Study Areas, as presented in **Table 10.16**. It should be noted that all construction activities greater than 300m from the receptor have not been included below as the receptors are outside the assessment area. This is with the exception of T3 and T4, where up to 800m has been considered due to the potential for night-time working[33].

Table 10.16 Free field construction noise predictions

Receptor	Predicted Noise Levels / dB(A)[34]								
	Topsoil Strip	Laydown Area		Main Site Area					Access Road
	T1	T1	T2	T3	T4	T5	T6	T7	T8
2 Padeswood Drive	68	66	68	41	40	-	-	-	45
3 Padeswood Drive	68	66	68	41	40	-	-	-	41
6 Padeswood Drive	68	65	67	41	40	-	-	-	39
7 Padeswood Drive	67	65	67	40	39	-	-	-	37
10 Padeswood Drive	68	66	68	42	41	-	-	-	61
11 Padeswood Drive	68	65	67	42	41	-	-	-	50
Bannel Farm – A5118	70	67	69	40	39	-	-	-	33
Beudy Coch, Padeswood Lake Road	-	-	-	39	38	-	-	-	-
Camfa Rheinallt Farm, Padeswood Lake Road	-	-	-	39	38	-	-	-	-
Dyke Farm, Padeswood Lake Road	-	-	-	55	54	57	56	53	-
Hendy Cottage, Padeswood Lake Road	-	-	-	42	41	-	-	-	-
Homelea	61	60	62	42	41	-	-	-	57
Laburnam Cottage	-	-	-	46	45	-	-	-	32
Oak Tree Farm, Bannel Lane	39	38	-	-	-	-	-	-	-
Oak Tree Farm	47	46	-	-	-	-	-	-	35
Pen-yr-Allt Farm, Padeswood Lake Road	39	38	-	-	-	-	-	-	-
The Gables, Padeswood Lake Road	40	39	-	-	-	-	-	-	-
The Old Barn, Padeswood Lake Road	39	38	-	-	-	-	-	-	-

[33] Any night-time works will be agreed with the Local Authority prior to the commencement of works.

[34] '-' denotes where the properties are outside of the assessment area. I.e., greater than 300m for daytime periods or 800m or night time periods (T3 and T4 only).

Receptor	Predicted Noise Levels / dB(A)[34]								
	Topsoil Strip	Laydown Area		Main Site Area					Access Road
	T1	T1	T2	T3	T4	T5	T6	T7	T8
Toll Bar Cottage, Chester Road	39	38	-	-	-	-	-	-	-
Ty Gwyn Farm	44	43	-	-	-	-	-	-	-
Well House Farm, Padeswood Lake Road	44	43	-	-	-	-	-	-	-
Springfield	40	39	-	-	-	-	-	-	-

10.12.3 It can be seen from **Table 10.16** that the daytime 65 dB $L_{Aeq,T}$ threshold criterion has the potential to be exceeded at a limited number of receptors (Padeswood Drive receptors and Bannel Farm) for topsoil strip and laydown area works. While the topsoil strip works are anticipated to be undertaken for a limited duration, the works will still exceed the time periods defined in Note 2 of **Table 10.8**, and therefore, additional specific mitigation measures will be required for the duration of these tasks to reduce the noise levels at Padeswood Drive and Bannel Farm.

10.12.4 Based on a **'High'** receptor sensitivity for residential dwellings and a '**Medium'** impact magnitude for the daytime and night-time construction phase noise levels, this would represent a **'Moderate'** temporary adverse effect, which is **Significant.**

10.12.5 For all other works and other receptors, the predicted noise levels will not exceed the core hours 65 dB $L_{Aeq,T}$ threshold criterion and therefore the embedded measures are expected to be sufficient to control the noise levels generated by the construction works.

10.12.6 For the underground utilities and civils foundations that have the potential to extend beyond the core hours, the night-time 50 dB $L_{Aeq,T}$ threshold criterion is predicted to be exceeded at Dyke Farm. As the construction works will only occur on a limited number of days and are unlikely to extend beyond the permitted duration presented in Note 2 of **Table 10.8**. On this basis, embedded mitigation is sufficient to control the noise levels generated by these aspects of the construction works.

Construction phase – off-site traffic

10.12.7 The 2024 baseline traffic flows and 2024 baseline plus construction traffic flows on the public highway are presented in **Table 10.17**. The traffic flows are presented in terms of 18-hour AAWT flows.

Table 10.17 Construction phase traffic flows

Road Link		2024 Baseline		2024 Baseline +Construction	
		Flow	% HGV	Flow	% HGV
1	A5118: West of site access	6531	8.3%	6586	9.2%
2	A5118: East of site access	6363	10.6%	6583	14.1 %
3	A550: North of Penymynydd	12860	5.4%	13080	7.1%
4	A550: South of A55	15422	3.7%	15642	5.1%
5	Expressway (East towards Chester)	35586	6.0%	35723	6.4%
6	Expressway (West towards Deeside)	41666	4.9%	41803	5.2%
7	A541: South of A494	9041	4.9%	9096	5.5%
8	A494: North of A541	8947	5.7%	9002	6.3%
9	A494: East of A5119	16978	5.8%	17033	6.1%

10.12.8 The change in road traffic noise levels has been calculated based on the values presented in **Table 10.17** above and has been presented in **Table 10.18** below.

Table 10.18 Road traffic noise level changes

Ref	Road Link	Change in noise levels between traffic flow scenarios (dB $L_{A10,18hr}$)
1	A5118: West of site access	0.0
2	A5118: East of site access	0.1
3	A550: North of Penymynydd	0.1
4	A550: South of A55	0.1
5	Expressway (East towards Chester)	0.0
6	Expressway (West towards Deeside)	0.0
7	A541: South of A494	0.0
8	A494: North of A541	0.0
9	A494: East of A5119	0.0

10.12.9 The variation in road traffic noise for road links one to three range from 0.0 to +0.1 dB. The largest increase in noise of 0.1 dB(A) is predicted to occur on A518 East of site access, A550 North of Penymynydd and A550 South of A55. Based on a '**High**' receptor sensitivity and a '**Very Low'** impact magnitude, the predicted noise levels would correspond to a '**Negligible'** temporary adverse effect, which is **Not Significant.**

Construction phase – vibration

10.12.10 **Table 10.19** presents the predicted construction induced vibration levels associated with vibratory compaction works.

Table 10.19 Construction vibration predictions

Activity	Scaling factor & probability of exceedance	PPV at a range of setback distances, mm/s						
		10m	20m	30m	40m	50m	60m	70m
Vibratory compaction	Ks = 276 (5%)	7.5	3.1	1.7	1.2	0.8	0.7	0.5
	Ks = 143 (33.3%)	3.9	1.6	0.9	0.6	0.4	0.3	0.3
	Ks = 75 (50%)	2.0	0.8	0.5	0.3	0.2	0.2	0.1

Calculation Parameters

- Bomag BW 216 DH-5 single drum roller (17.9t gross weight), operating at the lower range compaction amplitude, equating to an amplification value of 1.1mm
- Calculations based on steady state compaction rather than start up and run down condition
- No allowance made for external to internal transfer function

10.12.11 The setback distance between the vibratory compaction works by large plant and the existing residential properties is anticipated to be approximately 65m for the closest receptors. On this basis, vibratory compaction works are unlikely to give rise to vibration levels which could result in disturbances for occupants of the adjacent properties i.e. PPV <1 mm/s.

10.12.12 Based on a **'High'** receptor sensitivity for residential dwellings and a **'Low'** impact magnitude, the predicted construction phase vibration levels would correspond to a **'Minor'** temporary adverse effect, which is **Not Significant**.

Potential effects - construction

10.12.13 Construction phase noise levels above the threshold criteria have been predicted in a number of areas whilst the Topsoil Strip and Laydown Compound Establishment works are being undertaken during the day and Underground Utilities and Civils Foundations during the night-time periods. To address this, specific additional mitigation measures are proposed to be implemented by the contractor. These measures would be expected to form part of a Noise Management Plan document which could be secured by planning condition.

Additional mitigation

10.12.14 To minimise the effects of construction noise at the affected receptors, the installation of temporary noise barriers will be explored. It is suggested these could be deployed in strategic locations, including the boundary of the working areas and around discrete areas which require work to be carried out beyond the core daytime hours. The barriers would be situated to ensure that an enhanced level of noise

attenuation is provided to the most exposed receptors. Temporary noise barriers typically comprise either solid fencing or proprietary acoustic screening systems.

10.12.15 BS 5228-1[35] states that the approximate acoustic attenuation provided by a barrier would be 5 dB when the top of the plant is just visible to the receiver over the noise barrier and 10 dB when the barrier completely hides the noise sources from the receiver.

Residual effects

10.12.16 Following the introduction of appropriate additional mitigation measures, it is considered that the significant construction phase noise effects that have been identified within this assessment can be controlled to achieve levels which do not exceed the threshold criteria at the surrounding sensitive receptors.

10.12.17 Based on a **'High'** receptor sensitivity for residential properties, and a '**Low**' impact magnitude, the residual noise levels associated with construction phase activities are considered to constitute a '**Minor**' temporary adverse effect, which is considered to be **Not Significant**.

10.12.18 **Operational phase**

10.12.19 The specific sound levels generated by the Proposed Development have been predicted at the nearest residential receptors.

10.12.20 The design team have identified that blowers have potential to be tonal. The specific noise level of these blowers is predicted to be >10dB below background, therefore any tonality is unlikely to be perceptible or distinguishable at the receptor locations. Proposed sources would be continuously operating and not intermittent or impulsive in nature. Given that the soundscape at the worst-affected existing receptors is already defined by noise from the existing plant, the magnitude of the overall specific level predicted indicates that noise from the Proposed Development is unlikely to be readily distinctive at the receptor locations. As a result, no acoustic character corrections are assumed to be applicable.

10.12.21 An assessment of predicted rated sound levels against the prevailing background sound level at the closest residential receptors during the night-time period is provided in **Table 10.20**. As some of the equipment operating duties are contingent on the ambient temperature, daytime and night-time periods have been considered for the determination of impacts.

Table 10.20 Operational predicted sound levels

Receptor	Period	Predicted Rating Level	Background Sound Level	Excess of Rating of Background Sound Level
2 Padeswood Drive	Daytime	36 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-13 dB

[35] https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

Receptor	Period	Predicted Rating Level	Background Sound Level	Excess of Rating of Background Sound Level
	Night-time	34 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-14 dB
3 Padeswood Drive	Daytime	36 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-13 dB
	Night-time	35 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-13 dB
6 Padeswood Drive	Daytime	35 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-14 dB
	Night-time	34 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-14 dB
7 Padeswood Drive	Daytime	35 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-14 dB
	Night-time	33 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-15 dB
10 Padeswood Drive	Daytime	37 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-12 dB
	Night-time	36 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-12 dB
11 Padeswood Drive	Daytime	37 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-12 dB
	Night-time	35 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-13 dB
14 Ffordd Derwyn, Penyffordd	Daytime	30 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-27 dB
	Night-time	30 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-6 dB
33 Ffordd Derwyn, Penyffordd	Daytime	31 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-26 dB
	Night-time	30 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-46 dB
34 Plas Yn Rhos, Penyffordd	Daytime	29 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-28 dB
	Night-time	29 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-7 dB
38 Plas Yn Rhos, Penyffordd	Daytime	30 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-27 dB
	Night-time	29 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-7 dB
40 Plas Yn Rhos, Penyffordd	Daytime	30 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-27 dB
	Night-time	29 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-7 dB
44 Plas Yn Rhos, Penyffordd	Daytime	30 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-27 dB
	Night-time	29 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-7 dB
Bannel Farm	Daytime	31 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-18 dB
	Night-time	29 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-19 dB
Beudy Coch	Daytime	34 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-2 dB
	Night-time	33 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	-1 dB
Camfa Rheinallt Farm	Daytime	33 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-3 dB
	Night-time	33 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	-1 dB
Dyke Farm	Daytime	38 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	+2 dB
	Night-time	37 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	+3 dB
Hendy Cottage	Daytime	33 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-3 dB
	Night-time	32 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	-2 dB
Homelea	Daytime	36 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-9 dB
	Night-time	34 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-10 dB
Laburnam Cottage	Daytime	40 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-5 dB
	Night-time	39 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-5 dB
Brook Meadow Housing Estate	Daytime	31 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-26 dB
	Night-time	30 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-6 dB
New Penyffordd Housing Estate	Daytime	29 dB $L_{Ar,Tr}$	57 dB $L_{A90,T}$	-28 dB
	Night-time	29 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-7 dB

Receptor	Period	Predicted Rating Level	Background Sound Level	Excess of Rating of Background Sound Level
Oak Tree Farm, A5118	Daytime	41 dB $L_{Ar,Tr}$	43 dB $L_{A90,T}$	-2 dB
	Night-time	40 dB $L_{Ar,Tr}$	42 dB $L_{A90,T}$	-2 dB
Oak Tree Farm, Bannel Lane	Daytime	27 dB $L_{Ar,Tr}$	43 dB $L_{A90,T}$	-16 dB
	Night-time	27 dB $L_{Ar,Tr}$	42 dB $L_{A90,T}$	-15 dB
Pen-Yr-Allt Farm	Daytime	32 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-4 dB
	Night-time	31 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	-3 dB
The Gables	Daytime	33 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-3 dB
	Night-time	32 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	-2 dB
The Old Barn	Daytime	32 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-4 dB
	Night-time	31 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	-3 dB
Toll Bar Cottage	Daytime	34 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	-2 dB
	Night-time	34 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	0 dB
Ty Gwyn Farm	Daytime	37 dB $L_{Ar,Tr}$	49 dB $L_{A90,T}$	-12 dB
	Night-time	37 dB $L_{Ar,Tr}$	48 dB $L_{A90,T}$	-11 dB
Well House Farm	Daytime	39 dB $L_{Ar,Tr}$	36 dB $L_{A90,T}$	+3 dB
	Night-time	38 dB $L_{Ar,Tr}$	34 dB $L_{A90,T}$	+4 dB
Springfield	Daytime	29 dB $L_{Ar,Tr}$	43 dB $L_{A90,T}$	-14 dB
	Night-time	27 dB $L_{Ar,Tr}$	42 dB $L_{A90,T}$	-15 dB

10.12.22 The predicted rating level of 37 dB $L_{Ar,Tr}$ at Dyke Farm and 38 dB $L_{Ar,Tr}$ at Well House Farm are predicted to be +3 dB above, and +4 dB above the prevailing background night-time sound levels respectively, dependent on context.

Context

10.12.23 In the context of the current Site, the existing soundscape is largely dominated by the existing cement works. Therefore, the character of noise within the current soundscape will not change with consideration to the Proposed Development as no new character of noise will be introduced.

10.12.24 The Proposed Development is projected to be above background noise levels, however is not predicted to cause a significant adverse impact. The increase in ambient noise levels is expected to be up to +2 dB(A), which would be experienced as a barely perceptible change.

Potential Effects

10.12.25 Based on a '**High'** receptor sensitivity for residential properties in the Study Area, and a '**Minor'** impact magnitude, the operational phase noise levels will constitute a '**Minor**' adverse effect, which is **Not Significant.**

Additional mitigation

10.12.26 No additional mitigation is considered to be necessary.

Residual effects

10.12.27 The operational phase effects associated with the project are **Not Significant.**

10.13 Difficulties and Uncertainties

10.13.1 BS 4142[36] requires that the assessment considers the level of uncertainty in the data and associated calculations. Consideration of the uncertainty can enable a more informed decision regarding the likely significance of impact, within the context of assessment. It is accepted that uncertainty may arise from all levels of measurement and assessment and reasonably practicable steps have therefore been made with the aim of reducing uncertainty.

10.13.2 It was confirmed by the client that operations on-site were typical of normal operating conditions for the duration of the background noise survey. Additionally, to ensure that all noise monitoring data was valid, weather conditions were noted throughout the monitoring period. Where weather conditions were unsuitable for noise monitoring, the data associated with the corresponding time periods were removed from the dataset. It was also ensured that the data either side of the bad weather was typical of the environment during periods where weather was conducive for noise monitoring.

10.13.3 In terms of the construction phase, equipment to be used for each of the construction activities has been derived based on construction methodologies provided and by professional experience on similar projects. Changes in final equipment and plant from those assessed is possible.

10.13.4 Furthermore, it is assumed that all works during the construction phase are being carried out simultaneously at the closest possible point within the works boundary to the receptor, which in reality is unlikely to occur. This is intended to be consistent with the principles of a conservative assessment.

10.13.5 At this stage in the design, specific vendor noise data for the operational phase is not available and hence there is uncertainty regarding the proposed equipment installations, including setting out, sound power levels and sound emission characteristics. To overcome this throughout the assessment phase, RSK has worked alongside the FEED contractor to ensure the input noise information and required mitigation can be achieved through design. The resulting information has been used as part of the assessment to demonstrate that a workable solution can be achieved which does not result in significant adverse effects.

10.13.6 If the noise emissions generated by certain items of plant exceed those used to inform the assessment, an enhanced level of acoustic mitigation could be introduced to offset this, for example, enhanced building fabric or enclosure. On this basis, it is considered that the uncertainty associated with the operational phase noise levels will not have a significant outcome on the assessment provided through this draft Environmental Statement chapter.

[36] https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

10.13.7 The prediction model assumes downwind propagation from source to receiver for all receptors included in the assessment. This may result in over prediction at some receptors during typical conditions.

10.14 Opportunities for Environmental Enhancement

10.14.1 No environmental enhancement is proposed with consideration to noise and vibration. The landscape bund to be constructed to the south of properties at Padeswood Drive may have some incidental acoustic benefit but this has not been specifically assessed, and is not relied upon to create any noise reductions at the receptors considered in this assessment.

10.15 Cumulative Effects

10.15.1 An assessment of the cumulative effects of noise and vibration is presented in **Volume 2, Chapter 15: Cumulative Effects**.

10.16 Summary of Effects

10.16.1 **Table 10.21** summarises the predicted likely effects associated with the Proposed Development and details the additional mitigation proposed and resultant residual effects.

10.17 Assessment Summary

10.17.1 **Table 10.21** provides a summary of the findings of the assessment.

Table 10.21 Summary of noise and vibration effects

Receptor	Potential Effects	Additional (Secondary and Tertiary) Mitigation	Residual Effects	Monitoring
Construction Phase - Noise				
Human Receptors	Receptors are predicted to noise levels that exceed the threshold criteria in accordance with BS 5228-1.	Supplementary acoustic screens around northern Site boundary covering topsoil strip and laydown working areas.	**Minor (not significant)** T / D / ST	Noise monitoring during site establishment works in line with Flintshire County Council requirements.
Construction Phase – Traffic Noise				
Human Receptors	Receptors are not predicted to exceed the threshold criteria.	No additional mitigation is required.	**Negligible (not significant)** T / I / ST	N/A
Construction Phase - Vibration				
Human Receptors	Receptors are not predicted to exceed the threshold criteria.	No additional mitigation is required	**Minor (not significant)** T / D / ST	N/A
Operational Phase - Noise				
Human Receptors	Receptors are predicted to experience noise levels with an adverse impact in accordance with BS 4142, subject to context.	No additional mitigation is required.	**Minor (not significant)** P / D / LT	The Site currently monitors noise on an ongoing basis. This would be extended to cover any additional receptors

Receptor	Potential Effects	Additional (Secondary and Tertiary) Mitigation	Residual Effects	Monitoring
				affected by the Proposed Development.

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

10.18 References

British Standards Institution (2013) British Standard EN 61672-1:2013, Electroacoustics - Sound level meters (Part 1: Specifications). London: British Standard Institution. Available at: https://knowledge.bsigroup.com/products/electroacoustics-sound-level-meters-specifications-1?version=standard

British Standards Institution (2014). *British Standard 5228:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites. Part 1: Noise*. Available at: https://knowledge.bsigroup.com/products/code-of-practice-for-noise-and-vibration-control-on-construction-and-open-sites-noise?version=standard

British Standards Institution (2014). *British Standard 5228:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration*. Available at: https://knowledge.bsigroup.com/products/noise-and-vibration-control-on-construction-and-open-sites-guide-to-noise-and-vibration-control-legislation-for-construction-and-demolition-including-road-construction-and-maintenance?version=standard

British Standards Institution (2019). *British Standard 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound*. Available at: https://knowledge.bsigroup.com/products/methods-for-rating-and-assessing-industrial-and-commercial-sound?version=standard

Department of Transport, Welsh Office (1988). *Calculation of Road Traffic Noise.* HMSO. Available at: https://n-somerset.gov.uk/sites/default/files/2022-11/CD13.02%20Department%20of%20Transport%20and%20Welsh%20Office%20%281988%29.%20Calculation%20of%20Road%20Traffic%20Noise..pdf

HM Government (1974). *Control of Pollution Act 1974*. Available at: https://www.legislation.gov.uk/ukpga/1974/40/data.pdf

HM Government (1990). Environmental Protection Act 1990. Available at: https://www.legislation.gov.uk/ukpga/1990/43/contents

International Organization for Standardization (2024). ISO 9613-2:2024 Acoustics — Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors. Geneva, Switzerland: International Organization for Standardization. Available at: https://www.iso.org/standard/74047.html

Transport Scotland (2019). Design Manual for Roads and Bridges, LA 111 Noise and Vibration. Highways England. Available at: https://www.standardsforhighways.co.uk/tses/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364

Welsh Government (1997). *Technical Advice Note (TAN) 11: Noise*. HMSO. Available at: https://www.gov.wales/technical-advice-note-tan-11-noise

Welsh Government (2024). Planning Policy Wales. Edition 12. Available at: https://www.gov.wales/planning-policy-wales

Welsh Government (2024). *Environment (Air Quality and Soundscapes) Act*. Available at: https://www.legislation.gov.uk/asc/2024/2

World Health Organisation (1999). *Guidelines for community noise*. Available at: https://www.who.int/publications/i/item/a68672

World Health Organisation (2009). *Night Noise Guidelines for Europe*. Available at: https://iris.who.int/handle/10665/326486