14 NOISE AND VIBRATION

14.1 Introduction

14.1.1 This Chapter of the Environmental Appraisal assesses the likely adverse effects upon sensitive receptors of noise and vibration associated with the construction, operation, and overhead line (OHL) removal and future decommissioning as part of the Visual Impact Provision (VIP), Snowdonia Project (here on referred to as the Proposed Project).

14.1.2 As a result of the nature of the Proposed Project, operational noise impacts relate primarily to the operation of ventilation fans in the tunnel head house at Cilfor. Ventilation fans will not be located in the tunnel head house at Garth and therefore operational noise impacts from the Garth tunnel head house do not require consideration. Tunnel head house ventilation plant is not a source of vibration and it is proposed to scope out vibration from the operational assessment.

14.1.3 The Appraisal considers operational noise from the terminal pylon and new section of OHL between the proposed sealing end compound (SEC) and replacement pylon 4ZC027R at the eastern SEC.

14.1.4 The eastern SEC at Cilfor will form the transition between the cables as they emerge from underground and the OHL wires (conductors). SECs do not vibrate when in operation. It is therefore proposed to scope out vibration from the proposed Cilfor SEC from the appraisal.

14.1.5 This Chapter sets out relevant policy and legislation, and outlines the data gathering methodology adopted as part of the noise and vibration assessment. This leads on to an assessment of noise and construction vibration impacts associated with the Proposed Project.

14.2 Scope and Methodology

14.2.1 The '*Visual Impact Provision: Snowdonia National Park, Overhead Line 4ZC Screening & Scoping Report October 2018*'[1] was submitted to Gwynedd Council to request a Scoping Opinion in October 2018. The Scoping Report included the proposed scope of the noise and vibration assessment that will be included within the Environment Appraisal. A Screening and Scoping Opinion was issued on 27 November 2019 by Environmental Health Services at Gwynedd Council (C18/0962/08/SS VIP Snowdonia - Screening and Scoping Opinion)**.**

14.2.2 Noise and vibration impacts from the construction, operation and decommissioning of the Proposed Project have been assessed at the closest worst case sensitive receptors which are considered representative of all noise sensitive receptors within the immediate vicinity of the Proposed Project.

The Study Area

Construction and Decommissioning Phases

14.2.3 The study area for the construction and decommissioning assessment comprises identified sensitive receptors within 300m from the project Limits of Deviation, to ensure potentially affected receptors are identified.

[1] National Grid (2018) 'Visual Impact Provision: Snowdonia National Park, Overhead Line 4ZC Screening & Scoping Report October 2018''.

14.2.4 This study area for the construction and decommissioning phases was determined in accordance with guidance provided in:

- British Standards (BS) 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Noise* (British Standards Institution, 2014)[2]; and,
- BS5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Vibration* (British Standards Institution, 2014)[3].

Operational Phase

14.2.5 The operational phase study area includes the closest sensitive residential receptor locations to the identified operational noise sources; namely the tunnel head house fan building at Cilfor.

14.2.6 As no significant noise sources are identified associated with the tunnel head house building at Garth, no specific modelling or assessment has been undertaken.

14.2.7 Following commissioning the main aspect of the Proposed Project, the tunnel under the estuary will not generate any discernible noise.

14.2.8 The operational noise study area has been set in order to allow the undertaking of a BS4142: 2014 +A1:2019 *Methods for rating and assessing industrial and commercial sound* (British Standards Institution, 2014)[4] assessment.

14.2.9 As explained in Section 14.3 as operational vibration has been scoped out of the study due to inherent controls, no study area for operational vibration requires to be set.

14.3 Baseline Data Collection

14.3.1 The monitoring of baseline and ambient noise was undertaken in the vicinity of the site in accordance with the guidance set out within BS7445-1:2003 Description and measurement of environmental noise. Guide to quantities and procedures. British Standards Institute[5], which sets requirements for noise monitoring. BS4142:2014[4] and BS5228-1[2] have also been considered in determining the baseline noise survey data collection methodology. The sound level meters used to quantify noise were programmed to monitor over 15-minute intervals.

14.3.2 Monitoring locations representative of noise sensitive receptors were selected in consultation with the Environmental Health Officers (EHO) at Gwynedd Council (see Consultation in Section 14.3).

14.3.3 The noise surveys consisted of both longer term and short-term surveys at the locations presented on Figure 14.1. Due to the longer-term nature of some of the surveys undertaken meteorological data was also recorded; with data recorded during any periods of precipitation or excessive wind (speeds exceed 5m.s^{-1}) excluded from the data analysis.

[2] British Standards Institution (2014) 'BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1 – Noise'.

[4] British Standards Institution (2014) 'BS4142: 2014 +A1: 2019 Methods for rating and assessing industrial and commercial sound'

[4] British Standards Institution (2014) 'BS4142: 2014 +A1: 2019 Methods for rating and assessing industrial and commercial sound'

[5] BS7445-1:2003 Description and measurement of environmental noise. Guide to quantities and procedures. British Standards Institute

14.3.4 The noise monitoring equipment used was set to record the following parameters;

L_{A10} is the A-weighted sound level that is exceeded for 10% of the sample period; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic;

L_{A90} is the A-weighted sound level that is exceeded for 90% of the sample period; generally used to quantify background noise;

$L_{Aeq,T}$ is the A-weighted equivalent continuous sound level during the sample period (T) and effectively represents an average value;

$L_{Amax,f}$ is the A-weighted maximum noise level measured during the sample period (T);

$L_{Amin,f}$ is the A-weighted minimum noise level measured during the sample period (T).

14.3.5 The measurement equipment used complies with the performance specifications for Class 1 devices in accordance with BS EN 61672-1:2003[6] Electroacoustics, Sound Level Meters, specifications.

14.3.6 With regard to the concurrent measurement of meteorological conditions, the equipment was set up with both an anemometer and precipitation sensor, set to record:

- Wind speed and direction;
- Precipitation rates as average and maximum per period;

14.3.7 The equipment used to undertake the survey is as detailed within Appendix 14.A

14.3.8 The instruments were calibrated at the start and at the end of each noise survey period to 94dB using a NC-74 calibrator. Calibration drift was within acceptable limits. Calibration certificates for the above instruments can be provided on request.

Construction and Decommissioning

14.3.9 There is a potential for adverse noise and vibration impacts from fixed and/or mobile plant required temporarily on site for the installation of the Proposed Project.

14.3.10 Noise and vibration impacts could also occur associated with the movement of construction vehicles on access tracks and the surrounding public road network.

14.3.11 The magnitude and extent of noise and vibration effects on any individual receptor would depend on the nature of the works, the location of plant and equipment, and the time of day that construction works are carried out.

14.3.12 A Construction Environmental Management Plan (CEMP) has been prepared and will be used to manage environmental impacts to air, land and water from construction and decommissioning operations. This includes a commitment to follow appropriate industry best practice and published guidelines to reduce predicted noise and vibration impacts during construction.

14.3.13 As part of the embedded mitigation outlined within the CEMP, the contractor will be obliged to implement Best Practicable Means (BPM) as set out in BS5228-1[2] and BS5228-2[3] to minimise construction noise and vibration levels to the lowest levels possible; BPM is discussed in Section 14.10.

[6] BSEN 61672-1:2013 Electroacoustics. Sound level meters. Specifications. British Standards Institute

Construction Noise Prediction

14.3.14 Within the scope of this study, cconstruction noise predictions have been carried out in accordance with the guidance of BS5228-1[2] . The assessment of airborne construction noise is concerned with the impact on human receptors; with predicted impacts calculated at the external façades of sensitive receptors. Hence resulting internal noise levels would be lower due to attenuation through the façade.

14.3.15 Based on available information, and experience from similar projects, reasonable and appropriate assumptions have been made regarding construction plant to be used. The typical noise levels of such plant has been taken from Annexes C and D of BS5228-1[2].

14.3.16 The estimation of construction and dismantling activity noise levels has been calculated in accordance with the methodologies described within Annex F of BS5228-1[2], accounting for distance propagation over hard reflective ground, appropriate percentage on-time and other pertinent factors outlined within the Standard. The assumptions made produce a precautionary, worst case assessment since most plant does not ordinarily operate constantly and ground attenuation from soft ground or other structures for example, would in very many cases be present.

14.3.17 With regard to the intensity of activities and the associated noise level fluctuations through a typical day BS5228-1[2] provides a method for estimating the effects of this on the noise levels predicted; in this instance a high percentage on-time has been assumed, adopting a precautionary approach.

14.3.18 Estimations of noise levels from construction (and decommissioning) activities have been calculated at all noise sensitive receptors identified within the Study area as detailed within Section 14.3. Furthermore, in accordance with BS5228-1[2] a façade correction of +3dB has been applied to the presented prediction levels within this Chapter.

Construction Noise Assessment Criteria

14.3.19 Construction noise impacts are considered in accordance with the methodologies presented within Annex E of BS5228-1[2].

- The ABC Method has been used to identify criteria for determining the significance of the effect of construction noise at residential receptors.
- Construction noise impacts on non-residential buildings such as schools, offices, health care facilities and places of worship is considered according to the 5dB change method, subject to lower cut off values of 65dB, 55dB and 45dB $L_{Aeq, T}$ from site noise alone for the daytime, evening and night-time periods respectively.

14.3.20 Both of these methods identify criteria for determining the adverse effects of construction noise and are described in detail below.

ABC Method for Residential Receptors

14.3.21 The ABC Method involves rounding the existing ambient noise levels to the nearest 5dB(A) for the appropriate time period (night, evening/weekends or day) and then comparing these levels to the total noise level, including construction noise. The categories of threshold values are shown in Table 14.1.

Table 14.1: Threshold categories of effect at dwellings from construction noise (BS5228) – ABC Method

Assessment Category and Threshold Value Period	Threshold Value, in decibels (dB $L_{Aeq,T}$)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

The categories set out above are applied as follows:

- Category A is the threshold value to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values;
- Category B is the threshold value to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values; and
- Category C is the threshold value to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.

14.3.22 Where the existing ambient noise levels are higher than the upper threshold values presented for Category C (Table 14.1) then an adverse effect is deemed to have occurred if the total L_{Aeq} noise level for the period (including construction noise contribution) increases by more than 3dB due to the construction activity.

14.3.23 If the including construction contribution at any residential receptor exceeds the appropriately defined threshold value as presented within Table 14.1 then an adverse effect is deemed to have occurred.

5dB Change Methodology for Non-Residential Receptors

14.3.24 For non-residential receptors (health care facilities, places of worship and educational facilities) construction noise is deemed to be potentially significant as defined in BS5228-1 if the construction noise exceeds the ambient noise by 5dB or more, subject to minimum limits of 65dB, 55dB and 45dB $L_{Aeq,\ T}$ from site noise alone, for the daytime, evening and night-time periods respectively.

14.3.25 If the construction noise contribution at any of these other sensitive receptors exceeds the appropriately defined threshold value, then an adverse effect is deemed to have occurred.

Excessive Noise Conditions

14.3.26 Additionally, BS5228-1[2] Annex E also provides threshold trigger levels above which there is a responsibility on the developer to provide noise insulation or a scheme to facilitate temporary re-housing.

14.3.27 For the time periods proposed for the core construction hours associated with the Proposed Project this equates to limits of 75dB L_{Aeq} and 85dB L_{Aeq} respectively for insulation provision and temporary rehousing for weekday daytime construction works, based upon a period of ten or more days of working in any fifteen consecutive days, or for a total of days exceeding 40 in any six-month period.

Construction Traffic Noise Methodology

14.3.28 As a result of the nature of the Proposed Project the construction phase will generate additional HGV traffic, which has been considered in relation to existing traffic volumes.

14.3.29 A separate Transport and Transport Appraisal (Chapter 12) has been prepared for the Proposed Project to support the planning application.

14.3.30 The Calculation of Road Traffic Noise (CRTN)[7] sets out procedures for predicting road traffic noise. CRTN[8] enables calculations of hourly L_{I0} dB(A) and $L_{10\ 18\ hour}$ dB(A) to be made for road schemes where traffic flows are greater than or equal to 50 vehicles/hour or 1000 vehicles/18 hour[8].

14.3.31 Where traffic flows fall below the low flow criteria in CRTN[8] the calculation method for mobile plant on a defined line in Annex F of BS5228-1[2] has been used.

Construction Traffic Assessment Criteria

14.3.32 The noise impacts associated with increased construction traffic volumes on the wider road network (off site) have been assessed in accordance with the Design Manual for Roads and Bridges (DMRB)[9]. DMRB[9] is used to assess the impact of changes in traffic levels as the result of a scheme and the associated changes in the road traffic noise climate, making DMRB the appropriate assessment method. The DMRB[9] provides classification for the magnitude of changes in road traffic noise. A change in road traffic noise of 1dB(A) in the short-term is defined as the Threshold Criteria for assessment, and is the smallest that is considered perceptible. The magnitudes of noise change in the short-term is reproduced from the DMRB[9] in Table 14.2.

Table 14.2: DMRB criteria to consider magnitude of noise change in the short-term

Noise Change (dB) $L_{A10, 18\ Hour}$)	Magnitude of Impact
0	No Change
0.1 - 0.9	Negligible
1 - 2.9	Minor
3 - 4.9	Medium
5 +	Major

14.3.33 Magnitude of impacts for changes in road traffic noise attributable to the construction of the Proposed Project are therefore defined as within Table 14.2 above.

[7] Department for Transport and Welsh Office (1988) The Calculation of Road Traffic Noise (CRTN)

[8] CRTN further warns that when calculating noise levels from roads where the flow is low, i.e. below 200 vehicles/hour or 4000 vehicles/18 hour day an additional correction may be required.

[9] Highways England et al (2011) 'Design Manual for Roads and Bridges (DMRB) (Volume 11 Environmental Assessment Section 3 Environmental Assessment Techniques; Part 7 HD 213/11 Revision1: Noise and Vibration'.

Construction Ground-borne Vibration Methodology

14.3.34 Most general construction activities are not significant sources of ground-borne vibration. Activities such as earth-working, crane activities and concreting would produce relatively low levels of ground borne vibration but these would not be discernible outside of the immediate vicinity of the operation.

14.3.35 Piling for shaft construction and Tunnel Boring Machine (TBM) activities associated with the Proposed Project, however, could produce perceptible levels of vibration at nearby sensitive receptors depending on the method used. These have been predicted and assessed within the scope of this Chapter as below.

Vibration from Shaft Construction (Secant Piling)

14.3.36 BS5228-2 describes procedures for predicting vibration impacts from secant piling which would be required during construction of the tunnel shafts at Garth and Cilfor.

14.3.37 Indicative predictions have been made using the following formula, to calculate the vibration levels at distance from source.

$$Vres = kp \left[\frac{\sqrt{W}}{r^{1.3}}\right]$$

Where:

Kp	A constant where 1 ≤ kp ≤ 3 (kp has been taken as 3 for this assessment, presenting worst case)
W	The source energy per blow in Joules
r	The radial distance between the source and the receiver in metres
Vres	The particle velocity in mm/s

Tunnelling Vibration (Tunnel Boring Machine)

14.3.38 Vibration impacts from the passage of the TBM will be assessed using the methodology set out in BS5228-2.

14.3.39 BS5228-2 sets empirical formulae for predicting vibration from tunnelling activities, and not specifically for TBM activities which typically generate lower levels of vibration than other tunnelling methods. Vibration from tunnelling has been predicted using the following formula:

$$Vres = \frac{180}{x^{1.3}}$$

Where

x = The slant distance in metres (m) between the TBM and the foundation

Construction Ground Borne Vibration Assessment Criteria

14.3.40 Typically impacts of ground borne vibration relate to the potential for building/structural damage and the potential for human perception. The assessment criteria relative to both of these facets of ground borne vibration are presented and discussed below.

Building Response and Damage Criteria

14.3.41 The response of a building to ground-borne vibration is affected by various features including, the type of foundation, underlying ground conditions, type of building

construction, the state of repair, floor construction etc. The response also depends upon whether the vibration is continuous or transient/intermittent.

14.3.42 BS7385 -2: 1993 'Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'[10] sets guideline values for building vibrations based on the lowest vibration above which damage has been credibly demonstrated. The limits for transient vibration above which cosmetic damage could occur to a light framed structure or a residential building is 15mm/s PPV (Peak Particle Velocity) at 4Hz increasing to 20mm/s at 15Hz; for continuous vibration these levels could be reduced by as much as 50%.

14.3.43 BS7385[10] also considers that there is little probability of fatigue damage occurring in residential buildings due to construction activities. For this reason, the assessment of structural damage to buildings is **scoped out** from further consideration.

Human Perception Criteria

14.3.44 This aspect of construction vibration is considered in accordance with BS5228-2[3] which provides guidance in relation to the effects of construction vibration upon human perception. The criteria, presented in Table 14.3, is set for residential buildings, but equally applies for other occupied buildings such as schools.

Table 14.3: Vibration effect levels for residential buildings

Vibration Level	Effect
0.14 – 0.3 mms^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 – 1.0 mms^{-1}	Vibration might be just perceptible in residential environments.
1.0 – 10.0 mms^{-1}	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
>10mms^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

14.3.45 Vibration at sensitive receptors would only be classified as an adverse effect if it is in excess of the levels quoted above, specifically a significant effect for a residential receptor would be expected where predicted/measured vibration levels are in excess of 1.0mms^{-1}.

Operational Noise Methodology

14.3.46 There is a potential for adverse noise impacts from fixed and/or mobile plant required during the operational phase of the Proposed Project.

[10] British Standards Institution (1993) 'BS7385-2: 1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration

14.3.47 It is reiterated that operational vibration is not a subject requiring consideration and for the reasons stated in Section 14.3 has been scoped out of this assessment.

Operational Noise Prediction

14.3.48 The prediction of the operational noise scenario was undertaken using 3-dimensional noise modelling techniques, with a representative model of the site and surrounding area constructed within the commercially available Braunstein + Berndt GmbH computer noise mapping software SoundPLAN 8.0.

14.3.49 Within the scope of this modelling exercise acoustic propagation has been calculated in accordance with the following standard:

- ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors: Part 2: General method of calculation[11].

14.3.50 The operational noise model was constructed utilising the following information:

- OS 1:10,000 scaled raster mapping (The OS VectorMap® District ESRI Shapefile);
- Commercial scaled terrain mapping data at 1m resolution (LIDAR Composite DTM 1m);
- Site layout plan detailed within National Grid design drawing ref PDD-33494-ARC-106 (see Figure 2.9);
- Proposed East and West Elevations detailed within National Grid design drawing reference number PDD-33494-ARC-120 (see Figure 2.11);
- Proposed North and South Elevations detailed within National Grid design drawing reference number PDD-33494-ARC-121 (see Figure 2.10);
- Noise data for the Tunnel Head House operational plant supplied by WSP (ventilation engineers on Project);
- Elevations of Existing and Proposed Pylons 4ZC27 and 4ZC27R detailed within National Grid design drawing PDD-33494-OHL-012 (see Figure 14.2);
- Proposed Position of Pylons 4ZC27R Clearances to New Cable Sealing End Compound Infrastructure detailed within National Grid design drawing PDD-33494-OHL-14 (see Figure 14.3);
- Pylon Outline Diagram Pylon 4ZC27R within National Grid design drawing PDD-33494-OHL-016 (see Figure 14.4);
- Noise data for operational OHL conductors provided in according the methods described in TR(T)94.

14.3.51 Acoustics has been a key facet of the design and specification of the tunnel head house at the Cilfor site, with an iterative process being followed. Through this process a number of inherent design measures, designed into the facility, have been assumed to form what is classified as “inherent mitigation provision” (Section 14.6). This includes:

- Façade construction specification to be achieving a minimum Rw sound reduction factor of 40dB;

[11] International Organisation for Standards ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors: Part 2: General method of calculation

- Personnel doors and access on western face of the building structure to perform to a minimum Rw sound reduction of 37dB;
- Acoustic louvres are to be specified on the western face of the building structure to achieving a minimum Rw sound reduction factor of 26dB;
- The fan plant itself would be attenuated within the ductwork by the use of an attenuator to provide a noise level at the inside face of the louvre of no more than 77.6dB(A); and,
- Whilst the casement breakout noise from the fan/duct system into the building has not been advised a conservative value of 85dB within the reverberant room environment has been assumed within the modelling as this accords with the requirements of the Noise at Work Regulations.

Operational Noise Assessment Criteria

14.3.52 The operational noise assessment has been carried out in accordance with BS4142[4].

14.3.53 This BS describes the methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations. The methods described in this BS use outdoor sound levels to assess the likely effects of sound on people, residing at dwellings or premises used for residential purposes upon which sound is incident.

14.3.54 The Standard quantifies the typical reference periods (for the purposes of the standard) to be used in the assessment of noise:

- Typical Daytime (0700-2300) 1hr assessment period
- Typical Night-time (2300-0700) 15-minute assessment period

14.3.55 The Standard is based around the premise that the significance of the impact of an industrial/commercial facility can be derived from the numerical subtraction of the background noise climate level (not necessarily the lowest background level measured, but the typical background of the receptor) from the measured/calculated rating level of the specific sound under consideration; this difference is then considered as follows:

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

14.3.56 BS4142[4] further states that "*where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact*" again depending upon the specific context of the site. Conditions to the comparative assessment state that "*not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact*", thus implying that all sites should be assessed on their own merits and specifics.

14.3.57 The Standard outlines a number of methods for defining appropriate "*character corrections*" within the derivation of the Rating Level to account for tonal qualities, impulsive qualities, other sound characteristics and/or intermittency. These are a) the Subjective Method, b) the Objective Methods for tonality, and c) the Reference

Method. It is noted by the Standard that where multiple features are present the corrections should be added in a linear fashion to the Specific level.

14.3.58 As a result of the level of information available relating to the plant and equipment proposed within the Proposed Project the Subjective Method has been used, and is based on the following corrections set out in Table 14.4:

Table 14.4: BS4142 Subjective Method Rating Corrections

Level of Perceptibility Level	Tonal Correction	Impulsivity Correction	Correction for "Other sound characteristics"	Intermittency Correction
No Perceptibility	+0 dB	+0 dB	Where neither tonal nor impulsive but clearly identifiable +3 dB	If intermittency is readily identifiable +3 dB
Just Perceptible	+2 dB	+3 dB		
Clearly Perceptible	+4 dB	+6 dB		
Highly Perceptible	+6 dB	+9 dB		

14.3.59 Noise from tunnel head houses would be due to the operation of ventilation mechanical services within the head house and would be broadband in nature. The noise from the operational fan units would be contained within a bespoke designed, and acoustically treated building structure. As such any tonal noise associated with the operational fans would be controlled through appropriately specified acoustic façade treatment to ensure a commensurate level of attenuation, specifically in any key frequencies, to reduce these to a point where it would be no more than "just perceptible" in the surrounding environment.

14.3.60 However, to present a possible worst-case, with regard to the study of the operational fan noise at the Cilfor site the following "Rating" correction has been applied to the assessment presented within Section 14.8.

- Just Perceptible Tonality Correction of +2dB.

Tunnel head ventilation will run continuously and therefore no corrections are required for intermittency (in reality - the fans would operate depending upon the ambient temperature within the tunnel, but would generally run continuously).

14.3.61 BS4142 states that the assessment methodology provided is not intended for the derivation of internal noise levels arising from sound levels outside or "*where background sound levels and rating levels are low*", however, with regard to the latter no definition of "*low*" is provided[12].

14.3.62 Where these situations prevail, it is considered appropriate to reference the absolute guidance levels provided in British Standard BS8233[13]; the World Health Organisation

[12] Within the 1997 revision of the BS4142 Standard "(very) low" was defined as a background level of below 30dB LA90 and a Rating level below approximately 35dB LAr,T.

[13] British Standard BS8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'

(WHO) Guidelines for Community Noise (WHO, 1999)[14] and the WHO Night Noise Guidelines for Europe (WHO, 2009)[15] which provide guidance on absolute noise levels suitable for outside amenity spaces, indoor living areas and conditions required for good sleeping conditions necessary for well-being and good health.

14.3.63 The magnitude of effect criteria in Table 14.5 are consistent with the criteria presented in BS4142.

Table 14.5: Magnitude of Impact – Operational Noise

BS4142:2014 Assessment	Example Outcome	Actions
In excess of L_{A90} – 10dB	No effect – not noticeable	No specific measures required
Rating level of between L_{A90}-10dB and L_{A90} +/- 0dB	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	
Rating level of between L_{A90} +/- 0dB and L_{A90} + 5dB	Noise can be heard and causes small changes in behaviour and/or attitude. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Mitigate and reduce to a minimum
Rating Level of between L_{A90} + 5dB and L_{A90} + 10dB	The noise causes a material change in behaviour and/or attitude. Quality of life diminished due to change in the acoustic character of the area.	
Rating level of greater than L_{A90} + 10dB	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects.	

14.4 Consultation Undertaken

14.4.1 The '*Visual Impact Provision: Snowdonia National Park, Overhead Line 4ZC Screening & Scoping Report, October 2018'*[1] was submitted to Gwynedd Council to request a Scoping Opinion relating to the Proposed Project. A Screening and Scoping Opinion was issued on 27/11/2019 by Environmental Health Services at Gwynedd Council (C18/0962/08/SS VIP Snowdonia - Screening and Scoping Opinion)**.**

14.4.2 The Scoping Report included the proposed scope of the noise and vibration Assessment to be included within the Environment Appraisal. Specifically, it was noted that assessment would include:

[14] World Health Organisation (1999) WHO Guidelines for Community Noise World Health Organization. Edited by Berglund, Birgitta, Lindvall, Thomas, Schwela, Dietrich H.

[15] World Health Organisation (1999) Night Noise Guidelines for Europe. WHO Regional Office for Europe.

- Construction and Decommissioning Phases: Both noise and vibration would be considered within the scope of the Environmental Appraisal where appropriate, including associated with Tunnel Boring Machine (TBM) activities; as such these aspects are **scoped in**; and,
- Operational Phase: this would cover the following activities with the appropriate level of assessment as detailed:
    - ***Underground Cables:*** the operation of the underground cabling would not generate any level of noise or vibration discernible at the nearest sensitive receptors as a result of the depth and construction of the tunnel: **scoped out**;
    - ***Sealing End Compound (SEC):*** Cable sealing ends are the transition point between overhead conductors and the cables which would pass into the cable tunnel. Cable sealing ends and cables do not make noise or vibration. Within the SEC there would also be post mounted insulators, bushings and small current transformers and small voltage transformers used for monitoring system operating conditions. These items of equipment do not generate any level of vibration. Although they are energised and may make some low-level noise which may be just audible at the site boundary, noise is not at a level to have any discernible effect at nearby receptors: **scoped out**;
    - ***Terminal Pylons and OHL conductors:*** These features generate no discernible operational vibration due to the nature of operation: **scoped out**. Noise due to the OHL would be reduced by the removal and undergrounding of the VIP subsection. However, the new terminal pylon would be approximately 20 m closer to the nearest noise sensitive receptor, Tan-Yr-Allt, which lies approximately 120m to the north-north east, while the new span which diverts the OHL into the new SEC would pass approximately 110m from Tan-Yr-Allt: **scoped in**;
    - ***Tunnel Head House Garth:*** The tunnel head house at Garth will contain no significant plant or equipment that would generate either noise or vibration: **scoped out**.
    - ***Tunnel Head House Cilfor:*** The tunnel head house at Clifor would contain fans which would operate depending upon the ambient temperature within the tunnel. These fans would be designed and installed in such a way to prevent vibration transmission into the ground, the reasons for this are for the protection of the equipment itself as excessive levels of vibration can be detrimental to the longevity of the fan and are controlled as a function of design. As such:
        - *Operational Noise Clifor* – **Scoped in**; and,
        - *Operational Vibration Clifor* – **Scoped out**.

14.4.3 In accordance with the proposals set out in the above document, noise and vibration impacts from the construction, operation and decommissioning of the Proposed Project have been considered to noise sensitive receptors within the vicinity of the Proposed Project.

14.4.4 Further to the formal Screening and Scoping report additional consultation, specific to noise and vibration, was carried out with the Environmental Health Officers (EHO) at Gwynedd Council. This consultation is summarised in Table 14.6 below.

Table 14.6: Summary of the construction noise and vibration consultation

Representation	Response/Comment
17th August 2018 Consultation document issued setting out proposed noise monitoring strategy and monitoring locations. E-mail transmission to EHO at Gwynedd Council.	29th August 2018 Response received by e-mail EHO at Gwynedd Council acknowledging receipt.
29th August 2018 E-mail of the 17th August 2018 resent to EHO at Gwynedd Council to progress consultation and agree monitoring.	6th November 2018 E-mail response from EHO at Gwynedd Council setting out some criteria for baseline surveys and assessment.
26th November 2018 Telephone conversation with EHO at Gwynedd Council to finalise noise monitoring locations and construction noise limits.	26th November 2019 Confirmation e-mail response from EHO at Gwynedd Council requesting 15 days monitoring under suitable weather conditions for the long-term surveys. Agreement on baseline noise survey locations confirmed.
13th September 2019 Meeting at Pentir Substation with Gwynedd Council to discuss and confirm assessment and use of pre-existing baseline data.	Criteria in BS5228 considered appropriate for construction noise assessment. BS4142 method considering modal L_{A90} values deemed appropriate for operational noise assessment. Agreement on use of RPS noise survey data collected in 2017 subject to a verification survey. Cumulative vibration assessment to consider blast vibration from quarry in proximity to Garth site not required. Council request Ysgol Hafod Lon, a special needs school is considered as a sensitive receptor location.

14.4.5 The agreements made within this extensive consultation exercise with Gwynedd Council Environmental Health Officers have been used to inform the scope of this Chapter of the Environmental Appraisal as specified below.

14.5 Statutory and Planning Context

National Policy

Planning Policy Wales

14.5.1 Planning Policy Wales (PPW) (Welsh Government, 2018) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes. The objective is to minimise emissions and reduce ambient noise levels to an acceptable standard.

Technical Advice Note (Tan 11) Noise

14.5.2 Technical Advice Note (TAN) 11, Noise Planning Guidance Wales (Welsh Assembly Government,1997) states that Local Planning Authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone would require special consideration.

Environmental Protection Act 1990

14.5.3 Under Part III of the Environmental Protection Act 1990 local authorities have a duty to investigate noise complaints from premises (land and buildings) and vehicles, machinery or equipment in the street.

Control of Pollution Act 1974

14.5.4 Where it appears to a local authority that works to which the Control of Pollution Act 1974 applies are being, or are going to be, carried out on any premises, the local authority may serve a notice imposing requirements as to the way in which the works are to be carried out and may, if it thinks fit, publish notice of the requirements in such way as appears to the local authority to be appropriate.

14.5.5 Embedded mitigation measures presented in Section 14.6 and additional mitigation measures presented in Section 14.10 are designed to keep any noise generated by the Proposed Project to a minimum.

Technical Guidance

B 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise, British Standards Institution, 20142.

14.5.6 Part 1 of BS5228-1[2] provides guidance on the methods that can be used to predict and measure noise from construction activities and how to assess the impact on those exposed to it. In particular Annex F sets out the methods of estimating noise from construction sites taking into account distance, ground effects, and reflections from surfaces, and screening by obstacles.

*BS5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Vibration, British Standards Institution, 2014****Error! Bookmark not defined.****.*

14.5.7 Part 2 of BS5228[3] gives recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels, including industry specific guidance. Guidance is provided on methods of measuring vibration and assessment of its effects on the environment.

Calculation of Road Traffic Noise (CRTN), Department for Transport and Welsh Office, 19888

14.5.8 Calculation of Road Traffic Noise (CRTN) is the standard method for calculating road traffic noise in the UK. It is the Design Manual for Roads and Bridges (DMRB) recommended method for calculating road traffic noise.

Design Manual for Roads and Bridges, Volume 11 Section 3 Part 7 (HD213/11) 'Noise and Vibration'9

14.5.9 DMRB[9] provides guidance on the appropriate level of assessment to be used when considering the noise and vibration impacts arising from all road projects, including new construction, improvements and maintenance.

BS4142:2014 +A1: 2019 Code of practice for noise and vibration control on construction and open sites. Vibration, British Standards Institution, 20144

14.5.10 BS4142 describes the methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations, i.e. mechanical and electrical plant and equipment. The methods described in this BS use outdoor sound levels to assess the likely impacts of sound on people residing at dwellings or premises used for residential purposes upon which sound is incident.

Local Policy

14.5.11 Local policy relevant to the potential effects of noise and vibration is outlined below:

The Anglesey and Gwynedd Local Plan

14.5.12 The Joint Local Plan was adopted in July 2017. The Plan indicates planning permission will be refused where the proposed development would have an unacceptable adverse impact on the health, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance, vibration, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance.

14.6 Existing Environment

14.6.1 A desktop review of the study area has been carried out and sensitive receptors identified. These primarily relate to isolated receptors which have the potential to be affected by noise from construction, operation and decommissioning works.

14.6.2 Existing sources of noise include quarrying at the Western Compound end, road traffic on major roads such as the A487, activity on the local railway line and at the Minffordd, Penrhyndeudraeth and Llandecwyn rail stations, and local road traffic.

14.6.3 Baseline noise surveys have been carried out at locations agreed with Gwynedd Council; as shown on Figure 14.1.

14.6.4 Longer duration surveys were carried out at locations LT1 – LT7 as shown on Figure 14.1. Baseline surveys were undertaken at these locations on the basis of the following, to obtain 15 days of usable data as requested by the LPA:

- Between 12th December 2018 and 19th December 2018; and,
- Between 9th January 2019 and the 5th February 2019.

14.6.5 The long-term surveys ceased over the festive period between the 19th December 2018 and the 9th January 2019 as it was considered baseline noise conditions would not be representative of the typical climate.

14.6.6 The long-term baseline noise survey data is presented in full in Appendix 14.A and is summarised in Table 14.7 below.

Table 14.7: Summary of baseline noise survey data (dB(A))

Location	Period	Time	LAeq	LAmin	LAmax	LA90	LA10
LT1 6 Syenite Terrace	Weekday Daytime	0700 -1900	54.0	44.2	64.2	47.8	54.0
	Weekday Evening	1900-2300	46.3	32.5	56.0	35.5	48.2
	Weekend Daytime	0700-1900	56.4	39.2	62.1	43.7	53.2
	Weekend Evening	1900-2300	46.7	32.6	56.8	34.8	48.8
	Night-time	2300-0700	44.4	31.3	53.2	32.8	42.4
LT2 Rhos	Weekday Daytime	0700-1900	49.2	37.0	57.9	38.0	48.3
	Weekday Evening	1900-2300	40.8	35.2	51.9	35.8	42.1
	Weekend Daytime	0700-1900	45.4	36.2	56.3	37.2	47.3
	Weekend Evening	1900-2300	43.8	34.8	52.1	35.3	40.8
	Night-time	2300-0700	39.3	35.0	47.4	35.5	38.8
LT3 Y Graig	Weekday Daytime	0700- 1900	54.7	44.1	61.4	47.5	54.5
	Weekday Evening	1900-2300	48.9	35.3	57.0	39.8	50.1
	Weekend Daytime	0700-1900	51.2	39.2	59.5	42.9	51.9
	Weekend Evening	1900-2300	48.6	33.9	56.4	38.4	50.0
	Night-time	2300-0700	42.2	28.7	53.2	30.5	42.8
LT4 Trem-Y-Garth	Weekday Daytime	0700- 1900	48.7	33.0	63.3	36.1	50.4
	Weekday Evening	1900-2300	41.8	31.1	58.9	32.4	41.5
	Weekend Daytime	0700-1900	48.8	37.1	63.4	39.8	50.9
	Weekend Evening	1900-2300	42.9	30.3	58.2	31.5	40.8
	Night-time	2300-0700	38.7	31.6	52.0	32.7	39.0
LT5 Beudy Gil	Weekday Daytime	0700- 1900	47.3	30.7	52.9	32.9	42.4
	Weekday Evening	1900-2300	44.0	30.9	56.3	34.2	45.5
	Weekend Daytime	0700-1900	49.3	32.2	54.2	34.5	43.4
	Weekend Evening	1900-2300	45.5	32.5	58.2	36.3	47.8
	Night-time	2300-0700	44.0	29.4	50.9	31.2	41.3
LT6 Tan-Yr-Allt	Weekday Daytime	0700- 1900	57.6	35.2	54.8	36.1	44.1
	Weekday Evening	1900-2300	46.0	35.3	57.9	36.3	48.1

Location	Period	Time	LAeq	LAmin	LAmax	LA90	LA10
	Weekend Daytime	0700-1900	51.6	30.6	53.3	31.1	38.7
	Weekend Evening	1900-2300	48.4	30.0	59.7	30.5	43.0
	Night-time	2300-0700	44.2	33.9	54.6	34.4	40.5
LT7 Bron-y-Garth	Weekday Daytime	0700- 1900	52.5	36.1	61.0	37.9	47.8
	Weekday Evening	1900-2300	51.5	35.7	66.2	38.1	51.5
	Weekend Daytime	0700-1900	49.1	34.9	59.1	36.8	45.3
	Weekend Evening	1900-2300	53.5	35.8	65.5	38.1	52.0
	Night-time	2300-0700	47.4	34.8	60.4	36.6	46.9
RPS Lloc Meirig	Weekday Daytime	0700- 1900	51.0	-	62.6	52.8	47.3
	Weekday Evening	1900-2300	44.0	-	57.2	47.1	35.9
	Night-time	2300-0700	40.1	-	56.1	43.1	31.5

14.6.7 Short duration attended baseline surveys were carried out for a duration of 4 hours at a further 6 locations, representative of sensitive receptors potentially affected by transient works on the overhead lines; represented by ST1 – ST6 as shown on Figure 14.1 and summarised in Table 14.8 below.

Table 14.8: Summary of baseline noise survey data (dB(A))

Location	Date/ Time	LAeq	LAmin	LAmax	LA90	LA10
ST1 Osmond Terrace	09/01/2019 09:45	52.0	41.9	79.8	44.6	51.0
ST2 Hen Gaeau	09/01/2019 10:30	49.8	33.4	77.1	37.9	45.6
ST3 Bron Turnor	10/01/2019 09:30	57.3	38.7	81.8	47.8	60.3
ST4 Cae Ednyfed	09/01/2019 12:30	54.6	35.8	75.8	46.1	57.7
ST5 Fron Oleu	09/01/2019 14:45	48.3	28.6	72.7	35.0	51.7
ST6 Trem-Yr-Wyddfa	09/01/2019 15:00	43.3	32.4	72.7	36.5	42.4

14.7 Key Parameters for Appraisal

14.7.1 The assessment considers the noise and vibration effects associated with the following:

- Construction of tunnel shafts sprayed with concrete at the start and end points of the tunnel by a combination of Secant pile walling (embedded retaining wall made of overlapping circular piles), the use of mechanical excavators (using a 360° digger with a breaker) and a drill and blast technique;
- Construction of an up to 4.4m diameter tunnel between the two tunnel shafts. The tunnelling will employ the use of a tunnel boring machine (TBM);

- Construction and decommissioning of a tunnel head house at ground level above each tunnel shaft. The tunnel head house at Cilfor will accommodate ventilation plant for tunnel temperature control, along with operational services such as a control room; shaft access and Uninterrupted Power Supplies (UPS). The tunnel head house at Garth will be limited to services such as a control room; shaft access and Uninterrupted Power Supplies (UPS) with no ventilation plant;
- Direct burial of a short section (approximately 100m) of cable to connect the High Voltage System in the tunnel to the existing cables at Garth SEC, as well as decommissioning should this section be removed;
- The reconfiguration of the existing SEC at Garth;
- Construction and decommissioning of a new SEC on the eastern side of the estuary near Cilfor to achieve the transition from an underground connection to 4ZC OHL;
- Construction of a terminal pylon (Pylon 4ZC027R) located approximately 30m from the existing pylon 4ZC027, which is likely to have piled foundation;
- Removal of the existing infrastructure (the VIP subsection i.e. removal of the OHL from Pylon 4ZC027 to 4ZC037), which will take place following installation and commission of the new underground cables.
- Construction of temporary bridges.

14.7.2 Embedded mitigation has been considered in the design of the Proposed Project. The preferred corridor alignment is based on engineering and environmental constraints.

14.7.3 The design of the tunnel head house at Cilfor has considered incorporating acoustic mitigation measures into the design. Modelling of the ventilation noise from the tunnel head house has informed design and resulted in the incorporation of an attenuator, acoustic louvres and acoustic doors into the proposed design.

14.7.4 A Construction Environmental Management Plan (CEMP) has been prepared and used to manage environmental impacts noise and vibration during construction.

14.7.5 As part of the embedded mitigation, the contractor will be obliged to implement Best Practicable Means (BPM) as set out in BS5228-1[2] and BS5228-2[3] to minimise construction noise and vibration levels to the lowest levels possible. BPM is discussed in Section 14.10.

14.8 Predicted Impacts During Construction

14.8.1 Core construction working hours are anticipated to be between 0800 and 1800 Mondays to Fridays and between 0800 and 1300 on Saturdays. Piling will be undertaken between 0900 and 1700 during weekdays. Construction noise impacts have been presented on this basis.

14.8.2 Tunnelling activities will be a continuous operation seven days a week (24 hours a day). Tunnelling activities will involve above ground plant and equipment, tunnelling means testing of machinery, excavation and operation and maintenance of the TBM and excavation systems and plant.

14.8.3 Construction noise impacts have been considered and assessed on this basis.

14.8.4 In accordance with the ABC Method in BS5228-1, the baseline noise survey data established within the area has been used to calculate appropriate limits for construction activity, this is presented within Table 14.9.

14.8.5 As the data from the survey is available, limits have been calculated for the following periods as defined within BS5228-1:

- Daytime: 07:00 – 19:00 Monday to Friday, 07:00 – 13:00 Saturday;
- Evening: 19:00 – 23:00 Monday to Friday, 13:00 – 23:00 Saturday and 07:00 – 23:00 Sunday; and,
- Night-time: 23:00 – 07:00 Monday – Sunday.

Table 14.9: ABC Method analysis of baseline noise survey data

Location	Period	LAeq	Nearest 5 dB	Category
LT1 6 Syenite Terrace	Daytime	54.0	55	Category A
	Evening	46.3	45	Category A
	Night-time	44.4	45	Category A
LT2 Rhos	Daytime	49.2	50	Category A
	Evening	40.8	40	Category A
	Night-time	39.3	40	Category A
LT3 Y Graig	Daytime	54.7	55	Category A
	Evening	48.9	50	Category A
	Night-time	42.2	40	Category A
LT4 Trem-Y-Garth	Daytime	48.7	50	Category A
	Evening	41.8	40	Category A
	Night-time	38.7	40	Category A
LT5 Beudy Gil	Daytime	47.3	50	Category A
	Evening	44.0	45	Category A
	Night-time	44.0	45	Category A
LT6 Tan-Yr-Allt	Daytime	57.6	50	Category A
	Evening	46.0	45	Category A
	Night-time	44.2	45	Category A
LT7 Bron-y-Garth	Daytime	52.5	55	Category A
	Evening	51.5	50	Category A
	Night-time	47.4	45	Category A
RPS Lloc Meirig	Daytime	51.0	50	Category A
	Evening	44.0	45	Category A

Location	Period	LAeq	Nearest 5 dB	Category
	Night-time	40.1	40	Category A
ST1 Osmond Terrace	Daytime	52.0	50	Category A
ST2 Hen Gaeau	Daytime	49.8	50	Category A
ST3 Bron Turnor	Daytime	57.3	60	Category A
ST4 Cae Ednyfed	Daytime	54.6	55	Category A
ST5 Fron Oleu	Daytime	48.3	50	Category A
ST6 Trem-Yr-Wyddfa	Daytime	43.3	45	Category A

14.8.6 The appropriate noise categories presented in Table 14.9 indicates that noise climate in the area would identify Category A construction noise limits. An adverse impact would therefore be identified if this limit is breached during construction.

14.8.7 It is noted that only the construction of the horizontal tunnel and operation of the TBM will require continual working, with activities to take place 24/7 for the 17-month duration of the tunnelling works.

14.8.8 A description of the typical construction plant used for each construction activity is presented in Appendix 14.B and the detailed construction noise predictions are presented in Appendix 14.D which represent unmitigated construction noise levels.

14.8.9 It is noted that the predicted impacts from the TBM tunnelling are confined purely to the 17-month period of construction and are therefore considered to be temporary in nature.

Garth: Infrastructure Western Side of the Dwyryd Estuary

14.8.10 Within this section consideration is given to the reconfiguration to the existing Garth SEC (including removal of the existing gantries), construction of the temporary access route and use of the existing permanent access to the SEC, construction of the tunnel shaft (potentially using a drill and blast techniques), tunnel head house (including temporary and permanent access) and tunnelling activities between the western and eastern shafts (TBM). Furthermore, direct burial of the cable between the tunnel head house and the existing SEC is also considered.

14.8.11 The TBM will be launched from the western shaft at Garth, and tunnel in an easterly direction toward Cilfor. The launch shaft at Garth will also therefore be used for removing excavated tunnel material, supplying materials to the TBM and allowing personnel access for construction of the tunnel. Impacts from tunnelling are therefore presented in this sub section.

Construction Noise

14.8.12 Construction noise impacts associated with enabling and site set up works for the Garth tunnel head compound are shown in Table 14.1A (Appendix 14.D).

- Enabling works and site set up will be confined to daytime core construction hours only, and are not predicted to result in any exceedance of the weekday daytime

construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

14.8.13 Construction noise impacts associated with shaft construction at the Garth tunnel head compound are shown in Table 14.2A (Appendix 14.D).

- Shaft construction will be confined to daytime core construction hours only and are not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. Piling works will be restricted to between 0900 and 1700 during weekdays. As such impacts, as assessed, would be within acceptable limits and additional mitigation is not required for weekday daytime works.

14.8.14 During tunnelling work surface plant located at the Garth tunnel head compound will operate 24 hours a day. Only essential plant will operate at night and where possible activities will be restricted to daytime core construction hours. Plant to be operated during the day and at night-time is identified in Appendix 14.B.

14.8.15 Construction noise impacts associated with daytime tunnelling works at the Garth tunnel head compound are shown in Table 14.3A (Appendix 14.D).

- Daytime tunnelling construction activities are not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. As such impacts, as assessed, would be within acceptable limits and additional mitigation is not required for weekday daytime works.

14.8.16 Construction noise impacts associated with night-time tunnelling works at the Garth tunnel head compound are shown in Table 14.4A (Appendix 14.D).

- Night-time tunnelling construction activities would result in an exceedance of the night-time limit of 45 dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.
- The predicted noise levels are below the noise insulation threshold of 55dB for night-time works.

  As such impacts associated with the night-time tunnelling works, as assessed, would require additional mitigation to control noise. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

14.8.17 Construction noise impacts associated with *in situ* surface activities associated with the construction of secondary linings for the tunnel works at the Garth tunnel compound are shown in Table 14.5A for daytime and Table 14.6A for night-time (Appendix 14.D).

- Daytime fabrication of secondary linings is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.
- Night-time fabrication of secondary linings is not predicted to result in any exceedance of the night-time construction noise limit of 45dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

  As such impacts associated with the fabrication of secondary linings during the daytime and night-time, as assessed, would be within acceptable limits and no additional mitigation would be required.

14.8.18 Construction noise impacts associated with the construction of the access roads to tunnel construction compounds, SECs and temporary access roads to pylons for removal are shown in Table 14.7A (Appendix 14.D). It is noted that the construction of access roads will be confined to core daytime hours only, and will be transient in nature, with works moving along the linear extent of the access road.

14.8.19 Construction of the access to pylon 4ZC034 will not result in any adverse effects on Ysgol Hafod Lon with predicted construction noise at the school perimeter below 60dB(A).

14.8.20 Access to pylon 4ZC035 is presented with two options, with the first option including a rail possession to install a temporary bridge over the railway line north of Cae Ednyfed and Minfford Station Barn Hall. The installation of the temporary bridge during the rail possession is assessed under bridge construction in paragraphs 14.7.28 and 14.7.29. The predictions have considered noise impacts as works are in closest proximity to the given receptor locations so would not occur simultaneously at all locations at the same time at this level, noise would be lower as works are further from the given receptor.

- Daytime construction activities associated with the construction of the access roads would result in an exceedance of the weekday daytime limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. However, this would only occur for the short period where the works are at closest separation distance to the given receptor.

  As such impacts associated with the construction of the access roads, as assessed, would be concluded to require additional mitigation to control noise. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

14.8.21 The daytime trigger for noise insulation of 75dB(A) is predicted to be exceeded at The Saltings for the construction of the access road to Pylon 4ZC030R. Given that the noise exposure is of short duration and defined in the absence of any mitigation it is concluded that with the implementation of acoustic mitigation associated with the works adverse impacts could be avoided. The mitigation options are considered in Section 14.10.

14.8.22 The daytime trigger for noise insulation of 75dB(A) is also predicted to be exceeded at Minffordd Station Barn Hall for access Option 1 to pylon 4ZC035, however, this is a non-residential receptor and is likely to have limited occupied during the daytime period. As such there is a potential to schedule works when this receptor is not in use.

14.8.23 Access Option 2 (existing access that may require improvement works) to pylon 4ZC035 is likely to result in a marginal exceedance (of less than 1dB(A)) of the weekday daytime limit of 65dB(A) at Bronturnor as calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. This will however be for the duration of the road works, if required, and will be of short duration.

14.8.24 Construction noise impacts associated with the reconfiguration of the existing Garth SEC are shown in Table 14.8A (Appendix 14.D).

- Daytime construction activities associated with the SEC will result in a marginal exceedance (of less than 1dB(A)) of the weekday daytime limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. “Cable Jointing” activities present the largest impact due to use of angle grinders, which will be of short duration.
- The predicted noise levels are below the noise insulation threshold of 75dB for daytime works.

As such impacts associated with the construction of the SEC, as assessed, additional mitigation would be necessary to control noise. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

14.8.25 Construction noise impacts associated with the undergrounding of the section of cable between the Garth tunnel head house and the SEC are shown in Table 14.9A (Appendix 14.D).

14.8.26 It is noted that the undergrounding activities will be confined to core daytime hours only, and will be transient in nature, with works moving along the linear extent of the route. The predictions have considered noise impacts as works are in closest proximity to the given receptor locations so would not occur simultaneously at all locations at the same time at this level, noise would be lower as works are further from the given receptor.

- Daytime construction activities associated with the undergrounding activities between the THH and the SEC will result in an exceedance of the weekday daytime limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. However, this only relates to a programmed activity of 4 weeks.
- The predicted noise levels are below the noise insulation threshold of 75dB for daytime works.

  As such impacts associated with the undergrounding activities between the THH and the SEC, as assessed, would require additional mitigation. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

14.8.27 It is noted that these impacts would only occur at Y Graig and Rhos for the short duration that works are in closest proximity to these receptor locations. Given that the noise exposure is transient and of short duration and defined in the absence of any mitigation it is concluded that with the implementation of acoustic mitigation associated with the works, noise impacts can be mitigated. The mitigation options are considered in Section 14.10.

14.8.28 Construction noise impacts associated with bridge construction are shown in Table 14.10A (Appendix 14.D). Apart from the temporary bridge over the railway line for access to pylon 4ZC035, bridge construction will be confined to daytime core construction hours.

- Daytime bridge construction works are not predicted to result in any exceedance of the weekday daytime construction weekday daytime noise limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

14.8.29 The installation of the temporary bridge across the railway line for access Option 1 to pylon 4ZC035 will result in an exceedance of the night-time noise limit of 45dB(A) and the night-time noise insulation trigger level of 55dB(A) and therefore additional mitigation will be required.

14.8.30 Construction noise impacts associated with construction of the Garth tunnel head house are shown in Table 14.11A (Appendix 14.D). Tunnel head house construction will be confined to daytime core construction hours.

- Daytime construction of the tunnel head house will result in an exceedance of the daytime limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area at one receptor

(Syenite Terrace). However, this only relates to a programmed activity of 4 months.

- The predicted noise levels are below the noise insulation threshold of 75dB for daytime works.

  As such Impacts associated with the construction of the tunnel head house at Garth, as assessed, would require additional mitigation to control noise. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

Construction Vibration

14.8.31 Vibration impacts associated with secant piling for the construction of the tunnel shaft at Garth are shown in Table 14.12A (Appendix 14.D).

- The predicted Peak Particle Velocity vibration levels at the closest receptor locations (Y Graig and Rhos) are predicted to be below 1.0mms^{-1} and as such are not concluded to represent significant impacts.

14.8.32 There is a potential for the use of drill and blast during shaft construction. The prediction of blast vibration impacts requires on-site test blasts. Prediction are therefore not possible at this stage. Vibration from blasting would be managed by adopting best practice and setting blast charges to suit local circumstances.

Underground Infrastructure through Dwyryd Estuary

14.8.33 Within this section consideration is given to noise and vibration for the 3.4km length of the tunnel between the eastern and western shafts.

14.8.34 Through this section the TBM would be operating at a minimum depth of 23m, at Garth dropping to a maximum depth of 65m at Cilfor. Consequently, airborne noise would not be an issue as it would be mitigated through the intervening ground cover, and therefore not require consideration.

14.8.35 However, impacts associated with vibration as the TBM passes along the line of the tunnel do present the potential for impacts and as such requires consideration. The calculations have been undertaken based upon the distance from the crest of the tunnel to the receptor under consideration.

14.8.36 Vibration impacts from TBM activity underground are shown in Table 14.13A (Appendix 14.D).

- At most receptor locations considered, the vibration levels from TBM activity are predicted to be below 1.0mms^{-1} and as such are not concluded to represent significant impacts.

14.8.37 Vibration from TBM activities will not result in any adverse effect at Ysgol Hafod Lon.

14.8.38 However, vibration levels from TBM activity are predicted to be above 1mms^{-1} at the following locations when the TBM is at closest approach (slant distance):

- Y Graig (1.8mms^{-1});
- 20 Trem-Yr-Wyddfar (1.1mms^{-1}); and,
- BUPA Dental Care Penrhyn (1.5mms^{-1}) non-residential.

14.8.39 The vibration levels presented for these three receptors are above that considered under BS5228-2 to represent the situation where vibration would not be a material factor. However, these locations are only in breach of this level by a small amount and only for a short duration relative to the overall tunnelling programme.

14.8.40 Further consideration of the TBM vibration at these receptors, referencing the separation distance within which level above 1.0mms^{-1} would be predicted and the expected progression rate of the TBM concludes the following. At a slant distance 55m from the TBM, vibration levels will be below 1.0mms^{-1}. Typically, the TBM would advance at a rate of 12.5m to 20m per 24hr period. Based upon this, impacts could be felt at these receptors for the following approximate time periods, and close liaison with the occupiers would be required.

- Y Graig: 2 to 3 days out of the tunnelling programme,
- 20 Trem-Yr-Wyddfar: 1 to 2 days out of the tunnelling programme; and,
- BUPA Dental Care Penrhyn: 2 days out of the tunnelling programme.

Cilfor: Infrastructure Eastern Side of the Dwyryd Estuary

14.8.41 The tunnel boring machine will be received into the eastern shaft and limited activity will take place at the Cilfor site during tunnel construction. The majority of the plant and equipment associated with the tunnel construction will be located at the Garth tunnel head compound.

14.8.42 Construction noise impacts associated with enabling and site set up works for the Cilfor tunnel head compound are shown in Table 14.1A (Appendix 14.D).

- Enabling works and site set up will be confined to daytime core construction hours only and are not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. No additional mitigation would be required.

14.8.43 Construction noise impacts associated with shaft construction at the Cilfor tunnel head compound are shown in Table 14.2A (Appendix 14.D).

- Shaft construction will be confined to daytime core construction hours only and are not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

14.8.44 There will be limited site activity at the Cilfor tunnel head compound during tunnelling works. Construction noise impacts associated with daytime tunnelling works at the Cilfor tunnel head compound are shown in Table 14.3A (Appendix 14.D).

- The limited site activity at Cilfor during tunnel construction is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. As such impacts, as assessed, would be within acceptable limits and no additional mitigation would be required.

14.8.45 There will be limited site activity at the Cilfor tunnel head compound during construction of the secondary lining for the tunnel. Construction noise impacts associated with daytime secondary lining works at the Cilfor tunnel head compound are shown in Table 14.5A and night-time noise levels are shown in Table 14.6A (Appendix 14.D).

- Daytime fabrication of secondary linings is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.
- Night-time fabrication of secondary linings is not predicted to result in any exceedance of the night-time construction noise limit of 45dB(A) calculated in

accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

As such impacts associated with the fabrication of secondary linings during the daytime and night-time, as assessed, would be within acceptable limits and additional mitigation would not be required.

14.8.46 Construction noise impacts associated with the construction of access roads are shown in Table 14.7A (Appendix 14.D). The construction of access roads will be confined to core daytime construction hours and will be transient in nature. The predictions have considered noise impacts where works are in closest proximity to receptor locations.

- Daytime construction activities associated with the construction of the access roads will result in an exceedance of the daytime limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area at Bron-Y-Garth. However, this would only occur for the short period where the works are at closest separation distance to the given receptor.

  As such impacts associated with the construction of the access roads, as assessed, would be concluded to require additional mitigation to control noise. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

14.8.47 Construction noise impacts associated with the construction of the new SEC at Cilfor are shown in Table 14.8A (Appendix 14.D).

- Construction of the SEC at the Cilfor site is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

14.8.48 Construction noise impacts associated with construction of the Cilfor tunnel head house are shown in Table 14.11A (Appendix 14.D). Construction will be confined to daytime core construction hours.

- Construction of the Cilfor tunnel head house is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

14.8.49 Removal of the TBM at the eastern shaft site will take place during the daytime. The predicted noise levels associated with TBM removal are shown in Table 14.14(A) (Appendix 14.D).

- Removal of the TBM at Cilfor is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

  As such impacts, as assessed, would be within acceptable limits and additional mitigation is not required.

14.8.50 Construction noise impacts associated with construction of the replacement pylon 4ZC027R are shown in Table 14.15A (Appendix 14.D). Construction will be confined to daytime core construction hours, with piling restricted to 0900 to 1700 during weekdays.

- Construction of replacement pylon 4ZC027R is not predicted to result in any exceedance of the weekday daytime construction noise limit of 65dBA) calculated

in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area.

Construction Traffic

14.8.51 The noise predictions for road traffic on the public road network are presented in Table 14.16A (Appendix 14.D).

14.8.52 The change in road traffic noise as a result of construction traffic movements is shown in Table 14.10 below.

Table 14.10: Construction traffic noise increase on public roads

Location	Without Construction Traffic	With Construction Traffic	Change in road traffic noise attributable to the Construction activities	Magnitude of Change
	$L_{A10\ 18\ hour}$	$L_{A10\ 18\ hour}$		
A487	70.9	71.1	0.3	Negligible
A497	65.4	65.9	0.5	Negligible
A497	67.1	67.1	0.0	No Change
A487	68.8	69.2	0.4	Negligible
A487	67.2	67.6	0.3	Negligible
Pont Briwet	64.9	65.2	0.4	Negligible
A4085	61.0	61.0	0.0	No Change
A487	67.7	68.0	0.3	Negligible
Cambrian View	55.4	55.7	0.3	Negligible
A496N	59.1	59.2	0.1	Negligible
A496N	59.1	59.1	0.0	No Change
A496S	64.4	64.5	0.0	No Change
A497	66.4	66.8	0.4	Negligible
NCR8	Flows below CRTN thresholds			
	$L_{A10\ 1\ hour}$	$L_{A10\ 1\ hour}$		
A487	74.4	74.7	0.3	Negligible
A497	69.0	69.6	0.6	Negligible
A497	70.3	70.4	0.1	Negligible

Location	Without Construction Traffic	With Construction Traffic	Change in road traffic noise attributable to the Construction activities	Magnitude of Change
A487	72.4	72.5	0.1	Negligible
A487	70.0	70.1	0.1	Negligible
Pont Briwet	68.5	68.9	0.5	Negligible
A4085	64.3	64.1	-0.3	Negligible Beneficial
A487	70.7	70.8	0.1	Negligible
Cambrian View	61.6	61.9	0.3	Negligible
A496N	62.8	63.3	0.5	Negligible
A496N	62.8	62.8	0.0	No Change
A496S	68.0	68.1	0.0	No Change
A497	69.7	69.8	0.1	Negligible
NCR8*	Flows below CRTN thresholds	57.7	-	-
Appendix 14.D Table 14.16A conversion to L_{Aeq1hr}: 57.3 dB(A) at 10m.				

14.8.53 The noise changes due to construction vehicle movements on the public road network, as presented in Table 14.10, are shown to be Negligible (No Change) and therefore concluded to not present an adverse impact.

14.8.54 Construction traffic will use NCR8 to access the Garth compound, with traffic movements presented in Table 14.10 approaching from the west. The construction traffic will turn into the Garth site and will not proceed along NCR8 towards Osmond Terrace and Glandon. The predicted construction traffic noise level at 10m of 57.3 dB(A), calculated as a line source, would result in the following noise levels at receptor locations:

- Lloc Meirig 51.1
- Osmond Terrace 50.1

14.8.55 Construction traffic movements on NCR8 would be restricted to core hours and the stated exceptions.

14.8.56 Construction traffic movements beyond the Garth compound access would be associated with OHL removal and would occur after 2026. The OHL line removal would require two HGV and two LGV movements per hour. Current peak traffic flows

on NCR8 (as presented in Appendix 14.D (Table 14.16A)) indicate 27 vehicles per hour with 2% HGVs.

14.8.57 The 'with construction' traffic volumes are below the thresholds in CRTN and therefore cannot be assessed in accordance with DMRB. BS5228 provides a method for assessing noise from mobile plant, which has been presented in Table 14.15A to consider HGV movements during OHL removal. The noise change as a result of the increase in HGV movements during OHL removal (Table 14.15A, Appendix 14.D) would be 1.5dB, which is considered minor.

14.8.58 No further mitigation is required relating to road traffic noise changes on public roads during the construction phase.

Removal of Existing Infrastructure (VIP subsection)

14.8.59 Construction noise impacts associated with overhead line (conductor) removal, dismantling of pylon structures and removal of pylon foundations are shown in Table 14.17A (Appendix 14.D). Construction will be confined to daytime core construction hours.

- Daytime activities associated with the removal of existing infrastructure will result in an exceedance of the daytime weekday limit of 65dB(A) calculated in accordance with the ABC method from BS5228-1 and referencing the ambient noise climate of the area. However, this would only occur for the short period where the works are at closest separation distance to the given receptor. The removal of pylon 4ZC034 will not result in any adverse effect on Ysgol Hafod Lon with noise levels predicted at the school perimeter to be below 60dB(A).
- As such impacts, as assessed, would require additional mitigation to control noise. Additional mitigation options are considered in Section 14.10 which would be implemented through the scope of the CEMP.

14.9 Predicted Impacts During Operation

Tunnel Head House, Sealing End Compounds and 400kV Cable (Undergrounding)

Infrastructure Western Side of the Dwyryd Estuary

14.9.1 As noted earlier within this Chapter within the design of the Proposed Project, there is no significant plant within the Garth Tunnel Head House to the west of the Dwyryd Estuary requiring consideration. As such assessment of operational noise from the tunnel head house on the western side of the Dwyryd Estuary has been scoped out of the study.

14.9.2 The undergrounded 400kV cable will not generate operational noise and therefore is **scoped out** from assessment.

14.9.3 The existing SEC at Garth is to be reconfigured. Cable sealing ends are the transition point between overhead conductors and the cables which would pass into the cable tunnel. Cable sealing ends and cables do not make noise. Within the SEC there would also be post mounted insulators, bushings and small current transformers and small voltage transformers used for monitoring system operating conditions. These items of equipment are energised and may make some low-level noise which may be just audible at the site boundary but not at a level to have any discernible effect at nearby receptors.

Infrastructure Eastern Side of the Dwyryd Estuary

Tunnel Head House

14.9.4 Following commissioning the operational aspects of the Proposed Project, the tunnel head house ventilation at Cilfor would operate 24 hours a day, 7 days a week basis

14.9.5 Assessment of the impacts of the operational phase of the Proposed Project have been undertaken in accordance with the methodology of BS4142 2014 (+A1: 2019). In support of this a 3-dimensional noise model has been constructed of the site and an extensive baseline noise survey undertaken to quantify the prevailing noise climate of the area.

14.9.6 With regard to the baseline noise climate used within the scope of any BS4142 assessment, the Standard states that:

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

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

14.9.7 The background (L_{A90}) noise data collected around the Cilfor Tunnel Head House site has therefore been analysed to determine the modal value recorded at each of the monitoring locations where sufficient data has been amassed. The facility would operate 24/7 following commissioning, therefore, design in accordance with lower overnight noise levels would control both daytime and night-time impacts; as the daytime climate is generally higher. The modal analysis of the night-time L_{A90} noise levels is presented in Table 14.11 below and will be used in the operational assessments.

Table 14.11: Modal Analysis of Background L_{A90} Data

Location (Around Cilfor THH)	Representative Monitoring Position number (Figure 14.1)	Night-time Modal $L_{A90, 15\ min}$ in dB
Beudy Gil	LT5	31
Bron-Y-Garth	LT7	35
Tan-Yr-Allt	LT6	32
Trem-Y-Garth	LT4	31

14.9.8 As noted earlier within this Chapter within the design of the Proposed Project, provision is made for tunnel ventilation plant within the Cilfor tunnel head house to the east of the Dwyryd Estuary. As such an assessment of operational noise has been undertaken as outlined within Section 14.2.

14.9.9 The assessments undertaken within Table 14.12 below assume that the inherent mitigation provision within the design, as outlined within Section 14.6 has been included within the predicted noise levels.

14.9.10 Also, the Rating level corrections (+2dB for just perceptible tonality) as outlined in paragraph 14.2.70 have also been included within the assessments presented within Table 14.12 .

14.9.11 The assessments have been undertaken for the typical night-time period between 23:00 and 07:00. This has been undertaken on the basis that the plant would operate at a constant output 24hours a day following commissioning, so control of noise during this period would represent the worst-case scenario and consequently control daytime levels also.

Table 14.12: BS4142 Assessment – Night-time

Location	Modal Measured $L_{90, 15mins}$ 'Background' noise level [1], dB	Predicted BS4142 Specific Noise Level [1], dB	Corrected BS4142 Rating Level [1], dB	Difference, dB	Likelihood of Complaints
Beudy Gil	31	16	18	-13	Indication of the specific sound source having a low impact
Bron-Y-Garth	35	15	17	-18	
Tan-Yr-Allt	32	27	29	-3	
Trem-Y-Garth	31	18	20	-11	

[1] **Note: Noise levels rounded to nearest whole dB in accordance with the guidance of BS4142**

14.9.12 It can be seen from the table above that the BS4142 assessment indicates noise arising from operation of the facility during the most sensitive overnight period (23:00 – 07:00) would be rated by the BS4142 Standard as being:

Sensitive Overnight - Between -3dB below and -18dB below the existing background noise climate of the area between 07:00 and 23:00, depending upon assessment location.

14.9.13 This would therefore be considered an acceptable impact and under the BS4142 Standard rated as being an '*Indication of the specific sound source having a low impact*'.

14.9.14 It is demonstrated that in all cases, due to the levels of inherent mitigation within the design of the facility, noise would not be concluded to represent a significant impact associated with the typical operation of the Cilfor Tunnel Head House plant following commissioning.

14.9.15 As such no additional mitigation, above that already inherent within the design of the Cilfor Tunnel Head House as specified within Section 14.6, would be necessary to control noise.

Overhead Line (OHL) Between SEC and Replacement Pylon 4ZC027R

14.9.16 The design details for the pylon and OHL spans referred to in this section are taken from the National Grid design drawings referenced in paragraph 14.3.51.

14.9.17 It is proposed that a new terminal pylon (4ZC027R) is constructed approximately 32m to the east northeast of the existing tension pylon 4ZC027, which would be removed. Consequently, the alignment of the existing OHL conductors to the east of 4ZC027R would move approximately 7.8m laterally to the north at that location. The existing conductors to the west of the pylon would be removed as part of the VIP project. The

nearest noise sensitive receptor, Tan-Yr-Allt, lies approximately 120m to the north-northeast of the pylon.

14.9.18 The terminal pylon would be of similar construction to the existing pylon, the main difference being the steel lattice construction will be slightly larger and more robust to allow the conductors (wires) to be diverted on to the gantry embedded in the tunnel head house building connecting onto a new Sealing End Compound (SEC) which would be located alongside the proposed tunnel head house building.

14.9.19 It should be noted that OHLs are not inherently noisy. An external, usually weather related, factor is required for noise to occur. It is therefore not straight forward to calculate and quantify noise levels suitable for traditional noise modelling or noise assessment. This section therefore discusses the potential for noise effect due to the diverted replacement pylon and OHL in qualitative terms.

14.9.20 OHLs, pylons, cables and equipment within the SEC are not sources of operational vibration and hence this section only considers operational noise.

Terminal pylon and fittings

14.9.21 The terminal pylon fittings (e.g. insulators, dampers and arching horns) would be of a similar type and in a similar formation to the existing pylon fittings. They would be fully type-registered designs and therefore they would exhibit similar audible noise characteristics as the existing fittings.

14.9.22 New fittings tend to be quieter than old fittings due to the lack of surface corrosion and a new, cleaner surface, hence it is expected that the occurrence and duration of noise-producing corona discharge would be reduced meaning the replacement pylon is likely to be quieter in operation compared to the existing pylon.

14.9.23 The existing pylon 4ZC027 is approximately 140m from Tan-Yr-Allt, while the replacement pylon 4ZC027R would be approximately 20m closer. When considered in isolation, the reduction in distance attenuation (from 140m to 120m) would result in a small increase (less than 2 dB) in predicted noise level incident at Tan-Yr-Allt, however this needs to be considered alongside other elements of the OHL realignment where an overall reduction of effect is predicted as discussed below.

OHL conductors (wires)

14.9.24 The 4ZC OHL carries a 400 kV circuit on twin 'Araucaria' all aluminium alloy conductors (AAAC) on its northern side and a 132 kV circuit on quad 'Zebra' steel reinforced aluminium conductors (ACSR) on its southern side. Both circuits would be diverted from the new terminal pylon into the new SEC where they would terminate at the OHL connection point at the south-eastern façade of the head house building.

14.9.25 The removal of the VIP subsection between 4ZC027 at Cilfor and 4ZC037 at Minffordd would result in an overall noise benefit at receptors closest to the VIP subsection. The purpose of this section, therefore, is to appraise the potential for any adverse effect due to the operation of the new terminal span between the replacement pylon and the tunnel head house. on the nearest noise sensitive receptor Tan-Yr-Allt, which lies approximately 115m to the north northeast.

14.9.26 The new terminal span from 4ZC027R to the OHL connection point in the tunnel head house would use a type-registered twin AAAC conductor design on both the 400 kV and 132 kV circuits, similar to the twin Araucaria AAAC used on the existing 400 kV circuit.

14.9.27 The conductor surface electrical gradient (electrical stress, measured in kV/cm) is the principal noise generating mechanism for high voltage OHL. The higher the electrical stress, the more likely it is that corona discharge and hence audible noise may occur. In UK conditions, corona discharge inception is typically regarded to occur in the range

17 to 20 kV/cm. OHL are designed to operate below this level, however surface contamination, typically due to dust, pollens or bird droppings, and wet or damp weather causing water droplets to reside on the conductor surface, may cause temporary enhancement of electrical stress causing corona discharge, and hence increasing the likelihood that audible noise may occur.

14.9.28 Electrical stress is a function of voltage and geometry; i.e. pylon geometry, conductor diameter and conductor bundle size and geometry (number of sub-conductors and spacing). In short, the larger the geometry, the lower the electrical stress for any given voltage.

14.9.29 The electrical stresses on the 132kV circuit are very low (typically in the range 5 to 6 kV/cm, so low that corona discharge would virtually never occur); hence this circuit can be considered to be practically quiet in operation. Audible noise from the 132kV circuit on the new terminal span is therefore not considered further.

14.9.30 The electrical stresses on the conductors on the existing twin Araucaria 400 kV circuit are higher and therefore corona discharge and hence audible noise may occur from this circuit. The calculated electrical stress (Emax) is calculated to be 14.8 kV/cm, this can be compared to the corona inception level of 17 to 20 kV/cm in UK conditions. The electrical stress on the 400kV circuit can therefore be regarded as low compared the typical corona inception level.

OHL spans 4ZC026 to 4ZC027 / 4ZC027R and 4ZC027 to 4ZC028

14.9.31 It can be assumed that the 4ZC OHL presents a 'line noise source' at nearby noise sensitive receptors. The conductors on span 4ZC026 to 4ZC027R would not be replaced as a result of the VIP project and therefore it can be assumed that the noise characteristics would be the same as existing.

14.9.32 The nearest noise sensitive receptor, Tan-Yr-Allt, lies approximately 115m to the north of the existing OHL span 4ZC026 to 4ZC027 at the closest point. This minimum distance would reduce marginally by approximately 5m to 110m while the length of the span, and hence the length of the line noise source, would reduce by 32m as a result of the VIP project.

14.9.33 Any small reduction in distance attenuation between span 4ZC026 to 4ZC027 and Tan-Yr-Allt would be offset by the reduction in the length of the noise line source due to the longitudinal relocation of pylon 4ZC027R.

14.9.34 It is therefore concluded that there would not be a net adverse effect due to audible noise at Tan-Yr-Allt due to OHL span 4ZC026 to 4ZC027 being realigned to become 4ZC026 to 4ZC027R.

14.9.35 The adjacent span, 4ZR027 to 4ZR028, which currently presents a diminishing line noise source at minimum distance of 130m and a maximum distance of 460m from Tan-Yr-Allt, would be removed and replaced by the shorter terminal span which diverts into the new tunnel head house compound.

New terminal span 4ZC027R to new OHL connection point.

14.9.36 From indicative drawings (Figure 2.13 and Figure 2.14) it is reasonable to assume the new terminal span would also be a twin ACCC design passing at a minimum distance of approximately 110m to the southwest of Tan-Yr-Allt. The conductors would transition from a vertical formation on 4ZC027R to a horizontal formation at the OHL connection point. The transition from one formation to another means there would be a gradual change in calculated Emax value along the span, which would depend on the final detailed geometrical arrangement.

14.9.37 The phase-to-phase clearance (the distance between the three sets of conductors on the 400 kV circuit) and phase-to-ground clearances would be maintained to ensure the

electrical stresses are maintained as low as practicable. It is anticipated that this can be achieved by using the slightly larger 'twin Redwood' conductor design, depending on the final detailed design.

14.9.38 Based on indictive electrical stress calculations for the terminal span, worst-case would be a gradual increase from 14.8 kV/cm at 4ZC027R to approximately 16.3 kV/cm at the OHL connection point if using twin Araucaria. If using the larger twin Redwood formation, electrical stress would drop to 13.7 kV/cm at 4ZC027R, increasing to approximately 15 kV/cm at the OHL connection point.

14.9.39 Indicative 3-dimensional noise modelling has been undertaken for the existing and proposed OHL alignments using worst-case OHL wet weather noise data to determine the likely change in noise contribution due to the OHL at Tan-Yr-Allt. The modelling takes into account the removal of span 4ZC027 to 4ZC028, the shortening and realignment of span 4ZC026 to 4ZC027/4ZC027R and the introduction of the new terminal span from the replacement pylon 4ZC027R to the tunnel head house gantry. This model predicts a net reduction in the noise contribution from the OHL at Tan-Yr-Allt of 4.8 dB. This reduction is principally due to a combination of OHL design choice and the reduction in height of the new OHL terminal span compared to the removed OHL span.

14.9.40 It is therefore concluded that by using an appropriate conductor design, combined with the lower height of the new terminal span, the noise impact at Tan-Yr-Allt of the realigned 4ZC OHL would be slightly beneficial compared to the existing 4ZC OHL.

Cable sealing end compound (SEC) and OHL connection point

14.9.41 The terminal span terminates at the OHL connection point incorporated within the SEC located adjacent to the tunnel head house building. The 132 kV and 400 kV circuits would connect via down droppers and bus bars to the cable sealing ends located just outside the tunnel head house building.

14.9.42 Cable sealing ends are the transition point between overhead conductors and the cables which would pass into the cable tunnel. Cable sealing ends and cables do not make noise.

14.9.43 Within the SEC there would also be post mounted insulators, bushings and small current transformers and small voltage transformers used for monitoring system operating conditions. These items of equipment are energised and may make some low-level noise which may be just audible at the site boundary but not at a level significant enough to have any discernible effect at nearby receptors.

Removal of Existing Infrastructure (VIP subsection)

14.10 Predicted Impacts during Decommissioning

14.10.1 The expected design life of the Proposed Project is as follows, with design life defined as the mean time before major maintenance

- The tunnel, shaft and headhouses have a design life of 120 years;
- The Underground transmission medium has a life expectancy of approximately 40-60 years:
- The SEC has a design life of approximately 40 years (or maintained to extend its useful life).

14.10.2 Decommissioning activities are likely to include removal of the cables from the tunnel, SEC and terminal pylon, tunnel head houses and permanent accesses.

14.10.3 The detailed decommissioning methodology cannot be finalised until immediately prior to decommissioning, but would be in line with relevant policy at that time.

- Noise impacts associated with decommissioning works associated with the cables, shaft and headhouses are likely to be similar to those expected during tunnel construction.
- Noise impacts associated with decommissioning of the SECs are likely to be similar to those predicted for construction.

14.10.4 A considerable sum of resources will be expended to construct the tunnel and shafts, therefore a highly compelling reason would need to be found for decommissioning.

14.10.5 However, if it is decided to decommission the Proposed Project then the shafts and tunnel can be either capped off at the top of the shafts and flooded with water or filled with foamed concrete, depending on the situation at that time.

14.11 Mitigation and Summary of Residual Effects

Construction and Decommissioning

14.11.1 The mitigation measures applied for construction noise is in accordance with BS5228-1[2] and BS5228-2[3]. Best Practicable Means (BPM) would be adopted to minimise construction noise and vibration levels to the lowest levels possible. BPM is defined by reference to the following provisions in Section 79(9) of the Environmental Protection Act 1990:

"'Practicable' means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;

The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures;

The test is to apply only so far as compatible with any duty imposed by law; and

The test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances."

14.11.2 Typical mitigation measures and the associated sound reduction are included in Appendix 14.C. Selection of the appropriate mitigation measures would be made by the Contractor based on the construction method and plant used and local circumstances. Mitigating measures associated with BPM would typically include the following types of measures; however, it is noted that the list is not exhaustive:

- Working hours restricted to core hours so far as appropriate. The core working hours for general construction work (including but not limited to, site establishment, shaft construction, headhouse and sealing end compound construction and reinstatement) be limited to between 0800 and 1800 Monday to Friday, 0800 and 1300 Saturday, and no working on a Sunday or bank holidays, unless otherwise approved by the relevant planning authority. Piling will be undertaken between 0900 and 1700 during weekdays. The following operations may take place outside the core working hours referred to above (exempt activities):
    - Tunnelling, including associated above ground plant and equipment required to enable this activity. This can be 24 hours 7 days per week;

  - Completion of operations commenced during the core working hours which cannot safely be stopped;
  - Any highway works requested by the highway authority or requested by third parties such as network rail, police escorts etc;
  - Security monitoring;
  - The completion of works delayed or held up by severe weather conditions which disrupted or interrupted normal construction activities;
  - Getting workers to and from the site, and activities such as briefings, setting to work, maintenance of equipment and machinery (excludes running engines) etc.;
  - Any surveys such as continuous baseline monitoring or ecology surveys which are required to take place at night.;
  - In all instances, there will be no movement of excavated material offsite during weekends and no HGV deliveries outside of the core working hours.

- Careful selection of plant and construction methods. Only plant conforming to relevant national, European Union or international standards, directives and recommendations on noise and vibration emissions will be used. The contractor will ensure that each item of plant used on the scheme complies with the noise limits quoted in the Noise Emissions in the Environment by Equipment for Use Outdoors Regulations. The contractor will maintain a register of plant and equipment and statutory certification.
- Noisy activities will be staggered in time and space where practicably feasible.
- Design and use of acoustic screening measures where practicable and necessary. Acoustic screening measures may include site hoardings, acoustic barriers, acoustic enclosures, acoustic housing for plant and temporary stockpiles. Such measures can be particularly appropriate for stationary or near-stationary plant such as piling rigs and compressors. Barriers should be specified as outlined within BS5228-1[2].
- Selection of appropriate piling techniques and the timing of piling works will minimise vibration impacts (piling will be undertaken between 0900 and 1700 during weekdays).
- All vehicles and mechanical plant used for the purpose of the work will be fitted with effective exhaust silencers and will be maintained in good and efficient working order and operated to minimise noise emissions.
- All compressors and generators will be "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use, and all pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers.
- All machines in intermittent use will be shut down in the intervening periods between works or throttled down to a minimum. Noise emitting equipment which is required to run continuously will be housed in a suitable acoustic enclosure, where practicable.
- Static plant and equipment liable to create noise and/or vibration whilst in operation will, as far as reasonably practicable, be located away from sensitive receptors and away from walls which could reflect noise towards sensitive receptors.

- Where reasonably practicable, fixed items of construction plant will be electrically powered in preference to diesel or petrol driven.
- Vehicles will not wait or queue on the public highway with engines idling.
- Only designated access routes will be used.
- One-way systems to be used as far as possible to minimise reversing. Where required, reversing alarms incorporating one of more of the features listed below or any other comparable system will be used where reasonably practicable:
    - highly directional sounders
    - use of broad band signals
    - self-adjusting output sounders
    - flashing warning lights
- Direct communication with adjacent residents explaining what can be expected, its duration and identifying a complaints procedure including a person to contact with any direct concerns; this can aid to improve the public response to works.
- All site personnel will receive training appropriate to the nature of their roles and responsibility. The training will include specific information in relation to noise and vibration management. If their work activities are assessed as being particularly noise/vibration emission prone, all staff will receive induction training that will incorporate environmental awareness training, plus additional training in relation to noise and vibration.

During Construction

Tunnel Construction

14.11.3 During construction of the tunnel, the tunnelling works and operation of surface plant at the Garth tunnel head compound are shown to exceed the night-time threshold of 45dB(A) at a number of locations. Construction noise impacts associated with night-time tunnelling works are shown in Table 14.4A (Appendix 14.D).

14.11.4 Given the duration of tunnelling works and the potential for night-time effects on residential properties, appropriate mitigation measures were developed in consultation with the Engineering and Design Team. Various mitigation options were considered with the most appropriate identified as a full enclosure (structure) around surface plant and activities that allowed for enclosure without detriment to the activity. However, mobile plant and certain other plant items associated with the tunnel construction do not lend themselves to being enclosed in a structure.

14.11.5 While the mitigation is required to meet the night-time noise threshold limit of 45dB(A), the same mitigation would be permanent for the duration of the activity, and as such will have acoustic benefit to receptors for daytime tunnelling activities also.

14.11.6 A list of plant to be used for the tunnelling works is presented in Appendix 14.B. The plant to be enclosed within the structure has been indicated in the plant list in Appendix 14.B. The predicted noise levels with the inclusion of the acoustic attenuation of this structure is shown in Table 14.13.

Table 14.13: Predicted noise levels for Night-time Construction at Garth Tunnel Head Compound: Tunnelling Works including mitigation provision

Receptor	Floor	Leq dB(A)	Breach of Night-time Construction Noise Limit of 45dB(A)
Y Graig	GF	39.3	No
Y Graig	F 1	39.6	No
Rhos	GF	31.3	No
Rhos	F 1	35.8	No
Glandon	GF	35.8	No
Glandon	F 1	37.7	No
Syenite Terrace	GF	31.4	No
Syenite Terrace	F 1	35.3	No
Osmond Terrace	GF	41.2	No
Osmond Terrace	F 1	41.5	No
Lloc Meirig	GF	41.6	No
Lloc Meirig	F 1	42.0	No

14.11.7 Enclosure of the items of plant and activities as indicated in Appendix 14.B would be predicted to provide the required level of reduction to achieve acceptable impacts. The predicted levels including this mitigation provision are shown to be below the limit calculated in accordance with BS5228-1 and therefore are not indicative of an adverse impact.

14.11.8 In addition, at certain locations predicted worst case, closest approach TBM activity has the potential to produce ground borne vibration levels specified in BS 5228-2 as indicating that "*vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents*". However, this is only at a limited number of receptors (3) considered along the length of the tunnel and only for a short period of time whilst the TBM is operational at closest approach. The predominant mitigation to control the impacts of this would be a programme of community liaison and briefing conforming with BPM. Implementation of this technique to control TBM vibration would control impacts to a position where they would not be classified as significant.

Construction of Access Roads

14.11.9 Construction noise impacts during daytime associated with construction of access roads to the tunnel compounds and pylon locations are shown in Table 14.1A (Appendix 14.D). Locations where the proposed daytime noise threshold limit of 65dB(A) are predicted to be breached are shown below:

- Osmond Terrace: 69.2dB $L_{Aeq, 1hr}$;
- Hen Gaeau: 66. 1dB $L_{Aeq, 1hr}$;

- Bronturnor: 65.4dB $L_{Aeq, 1hr}$;
- Bronturnor 65.8dB $L_{Aeq, 1hr}$; (access Option 2 to pylon 4ZC035)
- Cae Ednyfed: 69.7dB $L_{Aeq, 1hr}$;
- Trem Yr Wyddfar 65.4dB $L_{Aeq, 1hr}$;
- Fron-oleu 71.8dB $L_{Aeq, 1hr}$;
- The Saltings: 80.0dB $L_{Aeq, 1hr}$; and,
- Bron-Y-Garth: 65.5dB $L_{Aeq, 1hr}$.

14.11.10 At 'The Saltings' the daytime noise insulation threshold of 75dB is predicted to be exceeded when works are in the closest proximity to the receptor location. For any works between 0700-0800 and 1800-1900 the noise insulation threshold would be 70dB(A) and would therefore include Cae Ednyfed and Fron-oleu where predicted unmitigated levels are above 70dB(A). The temporal criteria for noise insulation are unlikely to be triggered as the works are transient and of short duration, but mitigation would be required to achieve the daytime threshold of adverse effect of 65dB(A).

14.11.11 It is further noted that the daytime noise threshold was also breached at Minffordd Station Barn Hall, however, this is not a residential receptor. Where possible works will be programmed to not coincide with sensitive usage of the space through ongoing liaison with the facilities manager/coordinator for the hall.

14.11.12 In order to achieve acceptable noise levels at these receptors, BPM mitigation measures need to be implemented through the scope of the CEMP to achieve between 2dB and 16dB of noise reduction. Measures that could be used, and their approximate performance are listed below, however, further consideration of this would be covered within the CEMP and typical mitigation measures in Appendix 14C.

- Bespoke/Specific Acoustic Screening appropriately specified and located (including acoustic curtains) could provide between 5 – 10dB of noise reduction at receptors; and,
- Specification of quieter plant and techniques could provide between 5 – 10dB of noise reduction at receptors.

14.11.13 In addition to the more specific measures above, additional general controls implemented through the CEMP and typical mitigation measures in Appendix 14C would also aid to reduce noise.

14.11.14 The predicted noise levels presented in Table 14.1A, and discussed above, represent the highest noise levels generated when road construction takes place at the closest point to each specific receptor location. The road construction will be transient in nature and impacts will be of short duration. With mitigation in place and scheduling works to times they are likely to be less intrusive, noise impacts will be controlled to levels not considered to represent adverse impacts.

Construction of SEC

14.11.15 Construction noise impacts associated with reconfiguration of the SEC at Garth are shown in Table 14.8A (Appendix 14.D). Locations where the proposed daytime noise threshold limit of 65dB(A) are predicted to be breached are shown below:

- Syenite Terrace: 65.8 $L_{Aeq, 1hr}$; and,
- Rhos: 65.7 $L_{Aeq, 1hr}$.

14.11.16 In order to achieve acceptable weekday daytime noise levels at these receptors, BPM mitigation measures need to be implemented through the scope of the CEMP to

achieve approximately 2dB of noise reduction. Measures that could be used, and their approximate performance are listed below, however, further consideration of this would be covered within the CEMP and typical mitigation measures in Appendix 14C.

- Bespoke/Specific Acoustic Screening appropriately specified and located (including acoustic curtains) could provide between 5 – 10dB of noise reduction at receptors; and/or,
- Specification of quieter plant and techniques could provide between 5 – 10dB of noise reduction at receptors.

Cable installation Between Garth THH and SEC

14.11.17 Construction noise impacts associated with the undergrounding of the connection between the tunnel head house and SEC at Garth are shown in Table 14.9A (Appendix 14.D). Locations where the proposed daytime noise threshold limit of 65dB(A) are predicted to be breached are shown below:

- Rhos: 66.7 $L_{Aeq, 1hr}$; and,
- Y Graig: 70.8 $L_{Aeq, 1hr}$.

14.11.18 In order to achieve acceptable weekday daytime noise levels at these receptors, BPM mitigation measures need to be implemented through the scope of the CEMP to achieve between 2dB and 6dB of noise reduction. At Y Graig the unmitigated daytime noise levels are predicted to be marginally above 70dB which is the noise insulation threshold between 0700-0800 and 0800-1900 and mitigation will be required.

14.11.19 Measures that could be used to mitigate to below the daytime thresholds for adverse effect, and their approximate performance are listed below, however, further consideration of this would be covered within the CEMP and typical mitigation measures in Appendix 14C.

- Bespoke/Specific Acoustic Screening appropriately specified and located (including acoustic curtains) could provide between 5 – 10dB of noise reduction at receptors; and/or,
- Specification of quieter plant and techniques could provide between 5 – 10dB of noise reduction at receptors.

Construction of Tunnel Head Houses

14.11.20 Construction noise impacts associated with tunnel head house at Garth are shown in Table 14.11A (Appendix 14.D). Locations where the proposed daytime noise threshold limit of 65dB(A) are predicted to be breached are shown below:

- 1-6 Syenite Terrace: 65.5 $L_{Aeq, 1hr}$.

14.11.21 The exceedance is marginal and in order to achieve acceptable weekday daytime noise levels at these receptors, BPM mitigation measures need to be implemented through the scope of the CEMP to achieve a 1dB noise reduction. The general controls implemented through the CEMP would aid to reduce noise; and with mitigation in place, noise impacts will be controlled to levels not considered to represent adverse impacts.

Removal of OHL and Pylons

14.11.22 Construction noise impacts associated with the removal of the OHL and Pylons are shown in Table 14.17A (Appendix 14.D). Locations where the proposed daytime noise threshold limit of 65dB(A) are predicted to be breached are shown below:

- Pylon 4ZC036 - Hen Gaeau: 65.2 $L_{Aeq, 1hr}$;

- Pylon 4ZC035 - Cae Ednyfed: 68.4 $L_{Aeq, 1hr}$;
- Pylon 4ZC034 - 17-20 Trem Yr Wyddfar: 66.9 $L_{Aeq, 1hr}$; and,
- Pylon 4ZC034 - Fron-Oleu: 66.4 $L_{Aeq, 1hr.}$

14.11.23 In order to achieve acceptable weekday daytime noise levels at these receptors, BPM mitigation measures need to be implemented through the scope of the CEMP to achieve approximately 4dB of noise reduction. Measures that could be used, and their approximate performance are listed below, however, further consideration of this would be covered within the CEMP and typical mitigation measures in Appendix 14C.

- Bespoke/Specific Acoustic Screening appropriately specified and located (including acoustic curtains) could provide between 5 – 10dB of noise reduction at receptors; and/or,
- Specification of quieter plant and techniques could provide between 5 – 10dB of noise reduction at receptors.

Bridge Construction

14.11.24 Construction noise impacts associated with the construction of bridges is shown in Table 14.10A (Appendix 14.D). There are no exceedances of the daytime threshold value of 65dB(A).

14.11.25 Construction noise impacts associated with the installation of the temporary bridge across the railway line for the access to pylon 4ZC035 are shown Table 14.10A (Appendix 14.D). Work will be carried out during rail possessions and locations where the proposed night-time noise threshold limit of 45dB(A) and night-time noise insulation trigger of 55dB(A) are predicted to be breached are shown below:

- Cae Ednyfed 67.3 $L_{Aeq, 1hr}$.

14.11.26 In order to achieve acceptable noise levels at this receptor, BPM mitigation measures need to be implemented through the scope of the CEMP to achieve approximately 23dB of noise reduction to achieve the 45dB and 13dB to achieve the noise insulation threshold of 55dB. Measures that could be used, and their approximate performance are listed below, however, further consideration of this would be covered within the CEMP and typical mitigation measures in Appendix 14C.

- Bespoke/Specific Acoustic Screening appropriately specified and located (including acoustic curtains) could provide between 5 – 10dB of noise reduction at receptors; and,
- Specification of quieter plant and techniques could provide between 5 – 10dB of noise reduction at receptors.

During Operation

14.11.27 Iterative acoustic modelling has informed the design of the tunnel head house at Cilfor. This has resulted in the incorporation of an attenuator, acoustic louvres and acoustic doors into the proposed design. No additional acoustic mitigation is proposed for the tunnel head house at Cilfor.

14.11.28 The proposed technology for the new section of OHL between the tunnel head house and terminal pylon presents an option that will present a slight improvement on the technology for the current OHL. No further mitigation is therefore proposed.

During Decommissioning

14.11.29 The detailed decommissioning methodology cannot be finalised until immediately prior to the activity commencing; however, the commitment is made that it would be in line with relevant policy at that time.

14.11.30 For assessment purposes, this Chapter assumes that noise impacts associated with decommissioning works are likely to be similar to those predicted for construction and the mitigation measures recommended would also be applicable.

14.12 Cumulative Effects

14.12.1 Consultation with Gwynedd Council has indicated that there are no other developments within the area to consider, and the cumulative effects for noise and vibration are therefore scoped out.