Appendix 11B

Sound Modelling Procedure

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3D Noise Modelling Procedure

Prediction Methodology

Modelling of noise levels from the development was undertaken using CadnaA (2022 MR2) acoustic modelling software. This software implements the sound propagation calculation methodology set out in ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.

The propagation model described in ISO 9613-2:1996 provides for the prediction of sound pressure levels based on either short-term downwind (i.e. worst-case) conditions, or long-term overall averages. For a downwind condition (for wind blowing between 1 to 5 ms^{-1} from the site towards the nearby receptors) worst-case noise levels will occur, and these have been adopted within the model.

When the wind is blowing in the opposite direction, noise levels may be significantly lower than those predicted. The ISO propagation model calculates the predicted sound pressure level by taking the source sound power level for each source and subtracting a number of attenuation factors according to the following:

$$\text{Predicted Noise Level} = L_{WA} + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$$

The Sound Power Level (L_{WA}) defines the total acoustic power radiated by a sound source expressed in decibels (dB re 1 pW).

The directivity factor (D) allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. No directivity factor is considered within this assessment.

The geometrical divergence (A_{geo}) accounts for spherical spreading of the sound from the source within free-field conditions. Different sources at the installation have been modelled to take account of their geometry, as area, line or point sources. The divergence factor is calculated from the distance from the source to the receiver, and the relationship between the attenuation provided and distance is dependent on the type of sound source assumed.

The atmospheric absorption factor (A_{atm}) considers the attenuation offered by the atmosphere as a result of the conversion of sound to heat. The degree of attenuation is dependent on the relative humidity and temperature of the air through which the noise is travelling and is frequency dependent. Increasing attenuation occurs towards the higher frequencies of sound.

Modelling parameters have assumed an ambient temperature of 10 °C and 70% relative humidity which are found to result in worst-case sound propagation. The corresponding atmospheric attenuation factors are summarised below.

Atmospheric Attenuation (dB/km) at 10°C and 70% Relative Humidity

OCTAVE BAND CENTRE FREQUENCY / HZ	**63**	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
Atmospheric Absorption Coefficient dB / km	0.122	0.411	1.04	1.93	3.68	9.66	32.8	117

The ground effect (A_{gr}) is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver, and the interaction of the sound with porous and absorptive ground cover. The prediction of ground effects depends on the source height, receiver height, propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as *G*, which varies between 0 for 'hard' ground (includes paving, water, ice, concrete and any locations with low porosity) and 1 for 'soft' ground (includes ground covered by grass, trees or other vegetation).

The effect of any barrier or topographical obstruction (A_{bar}) between the sound source and the receiver position is that sound will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the sound.

A_{misc} is the attenuation due to miscellaneous other effects, such as propagation through a built up area of housing. No miscellaneous attenuation has been considered within this assessment.

Acoustic model settings

Acoustic modelling has been undertaken using the following model settings:

- Maximum search radius of 2000 m
- Maximum number of reflections: 1
- Noise predictions carried out at the top floor of the selected receptors (1.5 m above ground for 1 storey and 4.0 m for 2 storey).
- Ground absorption has been set to G=0.0 (corresponding to 100% hard ground) to represent reflective surfaces such as roads and hardstanding within the proposed site boundary. For the remaining areas ground absorption has been set to G=1 acoustically soft ground.