Sure Partners Limited

ARKLOW BANK WIND PARK PHASE 2 **ONSHORE GRID INFRASTRUCTURE**

VOLUME III
Chapter 11 APPENDICES

Appendix 11.3 Operational Noise Modelling

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Appendix 11.3

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Modelling methodology and assumptions

Substation operational noise levels have been predicted at the nearest noise-sensitive receptors (e.g. residential properties) using the computer modelling software SoundPlan 8.2 which implements the calculation procedures of ISO 9613 'Acoustics – Attenuation of Sound During Propagation Outdoors' to predict the propagation of noise away from the site in all directions and to quantify resultant noise levels at the identified noise sensitive receptor locations.

The noise model has included the following data inputs and assumptions:

- The default ground absorption was set to 1 to reflect grassed areas/soft ground, i.e. acoustically absorptive;
- Built-up areas (e.g. the existing industrial estate and the Proposed Development) with hard ground have been modelled as acoustically reflective, with a ground absorption of 0;
- Receptor positions have been modelled at heights (above local ground level) of 1.5m (representative of a ground floor ('GF') living/dining room during the daytime and evening) and 4.0m (representative of a first-floor ('F1') bedroom during the night-time). R4 is a bungalow so was modelled at 1.5 m for daytime, evening and night;
- A platform level of +3.8 mAOD has been modelled;
- No existing boundary fences or walls have been included in the noise model;
- The maximum order of reflections was set to '2' (this is a standard modelling assumption for environmental sound propagation);
- Both the broadband and octave sound level data for the substation plant have been informed by previous studies undertaken by AECOM for similar rated equipment or provided by Sure Partners Limited (SPL) based on similar plant used on other projects; and
- Modelling has assumed all plant is operational 24-hours per day.

Table 1 presents the main sound sources included in the noise modelling, and the locations of the sources can be seen in **Figure 1.** The site and receptor locations

are shown in **Figure 2**. Octave band levels for plant items as used in the modelling are summarised in **Table 2**.

Table 1: Plant list

Plant	Number of items	Sound pressure level L_p at 1m, dB(A)	Sound power level L_w, dB(A)	Description of sound source characteristics	Notes
220kV Voltage regulation device	2	75	88	Continuous, not tonal	Open enclosure surrounding the voltage regulation device
220kV Harmonic filter	2	80	98	Continuous, tonal	-
220kV Gas insulated switchgear (GIS) building	2	-	-	-	There is possibility for occasional noise breakout from circuit breakers operating inside the GIS buildings. However, this will typically occur only a few times per year and the noise duration should not exceed 1 second per time. Noise breakout from the building itself is expected to be minimal.
House transformer	1	70	78	Continuous, not tonal	-
220/33 kV transformer	2	80	93	Continuous, not tonal	-
33kV Gas insulated switchgear (GIS) building	2	-	-	-	No noisy plant associated with this building
Pre-insertion resistors (PIR)	2	-	-	-	No noisy plant associated with this building
33kV STATCOM building	2	-	-	-	Noise breakout from plant within the building itself is expected to be minimal.
33kV STATCOM reactors	2	85	98	Continuous, tonal	-
33kV STATCOM cooling fans	2	90	102	Continuous, not tonal	External coolers and fans associated with the STATCOM reactors.

Note to table: Sound power level L_w determined from sound pressure level L_p at 1m using formulae $L_w = L_p + 10.\log(A)$ where A is the approx. surface area of the plant item.

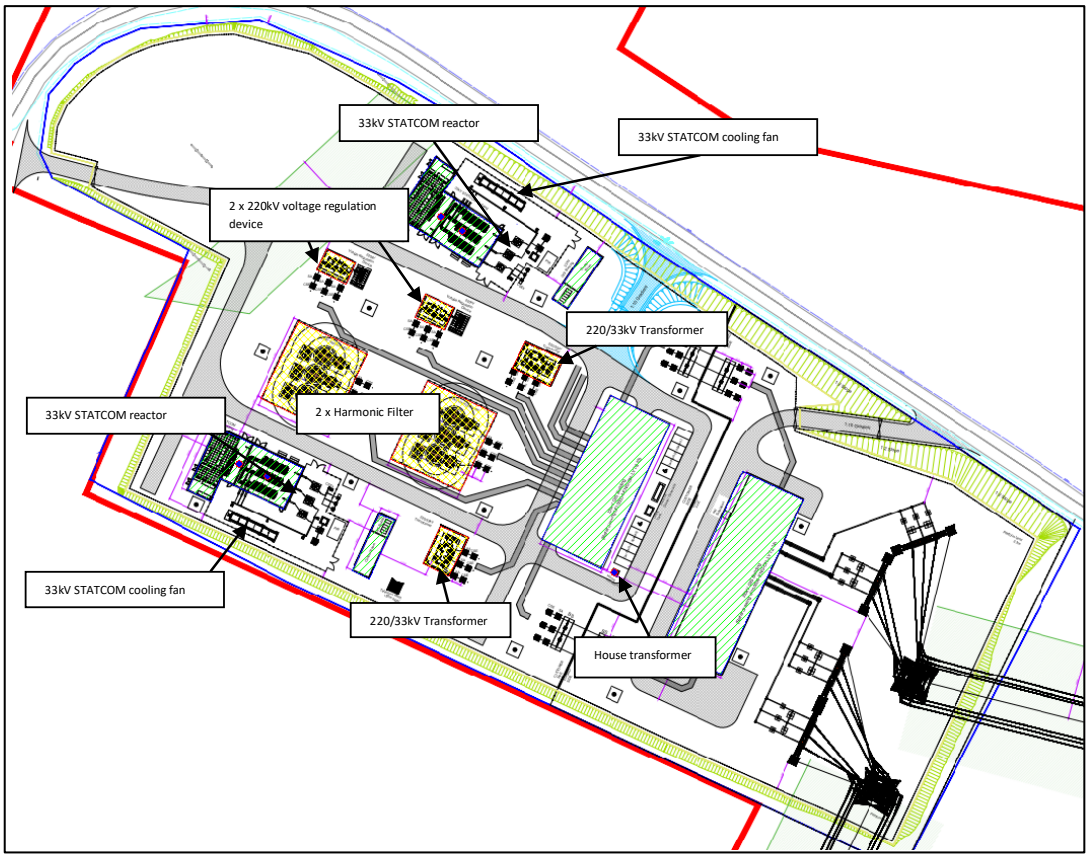

Figure 1: Substation noise model

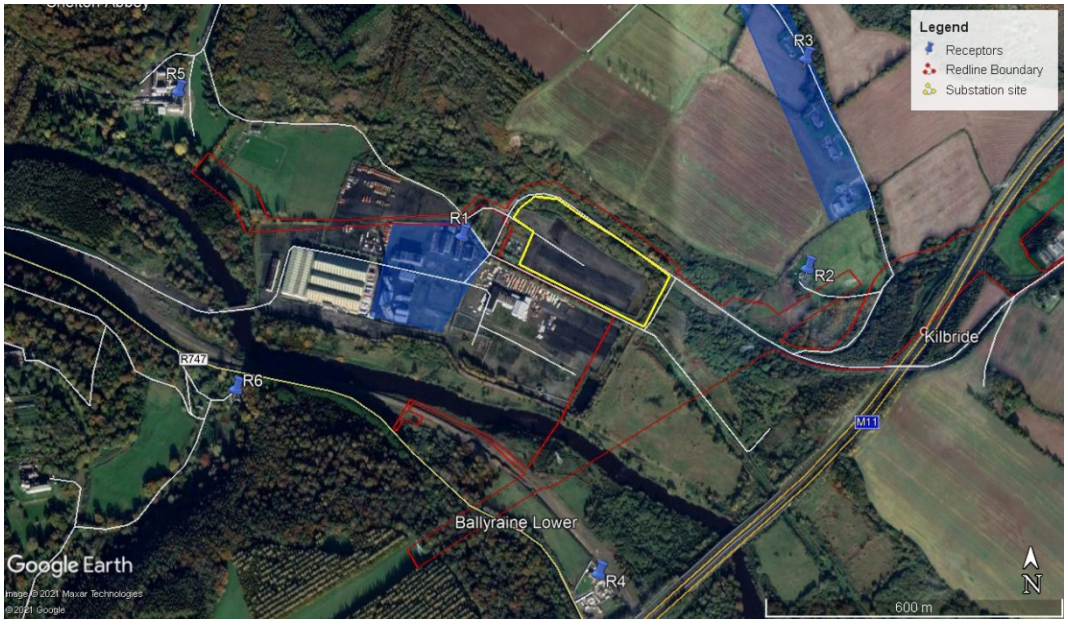

Figure 2: Substation Site and Receptor Locations

Table 2: Octave band sound power levels per plant item

Plant	Sound power level per octave band, L_w dB (linear)									Overall L_w, dB(A)
	31.5	63	125	250	500	1k	2k	4k	8k	
220kV Voltage regulation device	96	90	101	84	84	80	77	70	69	88
220kV Harmonic filter	39	64	100	65	97	95	38	34	34	98
House transformer	87	81	82	75	71	68	61	60	77	78
220/33 kV transformer	102	96	97	90	86	83	76	75	92	93
33kV STATCOM reactors	39	64	100	65	97	95	38	34	34	98
33kV STATCOM cooling fans	44	75	85	97	97	99	94	83	71	102

Crag Digital Avoca Ltd Data Centre Model Calibration Exercise

The noise model used for the planning application reference 18940 was not available therefore a new noise model was created in order to recreate the results. Publicly available data was used to form the base of the Crag Digital Avoca Ltd Data Centre (planning reference 18940) which was originally prepared within CadnaA noise modelling software.

CadnaA, like SoundPlan 8.2, implements the calculation procedures of ISO 9613 'Acoustics – Attenuation of Sound During Propagation Outdoors' to predict the propagation of noise away from the site in all directions and to quantify resultant noise levels at the identified noise sensitive receptor locations.

The noise model has included the same data inputs and assumptions as the OGI substation, with the inclusion of:

- Publicly available information regarding the Crag Digital Avoca Ltd Data Centre scheme was found via Wicklow County Council planning portal, using planning reference 18940. The EIAR Noise and Vibration chapter was used to obtain information about receptor locations, noise source data, noise modelling assumptions and results. Drawings of the Data Centre were used to model buildings and locations of stationary plant.
- Noise levels of the plant with the highest sound power levels (chillers, transformers and generators) were adjusted to recreate the contour plot, found in Figure 10-4 of the Crag Digital Avoca Ltd Data Centre Noise and Vibration chapter, as closely as possible. Results at selected receptors were then calculated;

- Where it was not possible to accurately reproduce the Crag Digital Avoca Ltd Data Centre Noise and Vibration chapter results, a correction was applied at individual receptors; and
- It was assumed that rec10/R10 listed in the Crag Digital Avoca Ltd Data Centre Noise and Vibration chapter is equivalent to R4 of the OGI Substation assessment. This is consistent with receptors listed in amended planning application ref. 201285.

The results from the Crag Digital Avoca Ltd Data Centre EIAR (planning reference 18940) are presented in Table 3, along with the results of the model designed to recreate these results, and the difference in noise level identified.

The northern data hall that is within the substation boundary of the proposed development was removed from the recreated date centre model. Results at selected receptors are presented in Table 4, with the difference from Table 3 applied as to calibrate the recreated model with the previous application model.

Table 3: Noise modelling results – recreated Crag Digital Avoca Ltd Data Centre model

Crag Digital Avoca Ltd Data Centre Receptor No.	OGI Substation Receptor No.	Height	$L_{Aeq,T}$ dB(A)		Difference, dB
			Crag Digital Avoca Ltd Data Centre	Recreated Model	
R01	R2	1.5 m	45	44	+1
R02	R3	1.5 m	43	41	+2
R03	R3	1.5 m	42	41	+1
R04	R3	1.5 m	42	41	+1
R05	R3	1.5 m	41	40	+1
R06	R3	1.5 m	41	40	+1
R07	R3	1.5 m	42	40	+2
R08	R5	1.5 m	44	41	+3
R09	R6	1.5 m	44	42	+2
R10	R4	1.5 m	42	43	-1

Table 4: Noise modelling results – recreated Crag Digital Avoca Ltd Data Centre model – north data hall removed

Crag Digital Avoca Ltd Data Centre Receptor No.	OGI Substation Receptor No.	Height	Results, $L_{Aeq,T}$ dB(A)	Correction, dB	Correction applied, $L_{Aeq,T}$ dB(A)
R01 – GF	R2 – GF	1.5 m	41	+1	42
R01 – F1	R2 – F1	4.0 m	42	+1	43
R02 – GF	R3 – GF	1.5 m	39	+2	41

Crag Digital Avoca Ltd Data Centre Receptor No.	OGI Substation Receptor No.	Height	Results, $L_{Aeq,T}$ dB(A)	Correction, dB	Correction applied, $L_{Aeq,T}$ dB(A)
R02 – F1	R3 – F1	4.0 m	40	+2	42
R08 – GF	R5 – GF	1.5 m	40	+3	43
R08 – F1	R5 – F1	4.0 m	42	+3	45
R09 – GF	R6 – GF	1.5 m	41	+2	43
R09 – F1	R6 – F1	4.0 m	42	+2	44
R10 – GF	R4 - GF	1.5 m	42	-1	41

Crag Digital Avoca Ltd Data Centre Model (amended application ref. 201285)

For planning application ref. 201285, the noise model for the 'Standard Operation' scenario was used directly with permission from the applicant. The mitigation assumptions within the 'Standard Operation with Mitigation' scenario have then also been applied, to reproduce this scenario. The data hall that is within the substation boundary of the proposed development was removed from the noise model. The noise modelling results at receptors have been used to assess cumulative operational noise impacts.

The noise model has included the same data inputs and assumptions as the previous models discussed above.

The results from the 'Standard Operation with Mitigation' scenario and with the north data hall removed are presented in Table 5.

Table 5: Crag Digital Avoca Ltd Data Centre (amended application) modelling results

Receptor	Floor	Height	$L_{Aeq,T}$ dB(A)	
			'Standard Operation with Mitigation'	'Standard Operation with Mitigation' and north data hall removed
R1	GF	1.5 m	51	51
R2	GF	1.5 m	41	41
R3	GF	1.5 m	39	38
R4	GF	1.5 m	41	40
R5	GF	1.5 m	37	37
R6	GF	1.5 m	40	39
R1	F 1	4.0 m	52	51
R2	F 1	4.0 m	42	42

Receptor	Floor	Height	$L_{Aeq,T}$ dB(A)	
			'Standard Operation with Mitigation'	'Standard Operation with Mitigation' and north data hall removed
R3	F 1	4.0 m	38	38
R4	F 1	4.0 m	42	41
R5	F 1	4.0 m	37	37
R6	F 1	4.0 m	41	40

Summary of Modelling results

Table 6 presents a summary of noise modelling results as used in the EIAR assessment. This includes the following scenarios

- Scenario 1: Proposed development substation
- Scenario 2: Proposed development substation with additional 5 dB mitigation to the harmonic filters and the 33kV STATCOM reactors, applicable for the cumulative assessment of the Crag Digital Avoca Ltd Data Centre (ref. 18940 – permitted) as discussed in the EIAR
- Scenario 3: Crag Digital Avoca Ltd Data Centre (ref. 18940 – permitted)
- Scenario 4: Crag Digital Avoca Ltd Data Centre amended application (ref. 201285 – permitted)

Table 6: Noise modelling results

Receptor	Floor	Height (above local ground level)	Predicted operational noise rating level $L_{Ar,Tr}$, dB			
			Scenario 1	Scenario 2	Scenario 3	Scenario 4
R1 day	GF	1.5 m	48	44	52	51
R2 day	GF	1.5 m	40	36	42	41
R2 evening	GF	1.5 m	40	36	42	41
R2 night	F1	4.0 m	42	38	43	42
R3 day	GF	1.5 m	40	36	41	38
R3 evening	GF	1.5 m	40	36	41	38
R3 night	F1	4.0 m	42	38	42	38
R4 day	GF	1.5 m	37	33	41	40
R4 evening	GF	1.5 m	37	33	41	40
R4 night	F1	4.0 m	37	33	41	41
R5 day	GF	1.5 m	37	33	43	37

Receptor	Floor	Height (above local ground level)	Predicted operational noise rating level $L_{Ar,Tr}$, dB			
			Scenario 1	Scenario 2	Scenario 3	Scenario 4
R5 evening	GF	1.5 m	37	33	43	37
R5 night	F1	4.0 m	39	35	45	37
R6 day	GF	1.5 m	38	34	43	39
R6 evening	GF	1.5 m	38	34	43	39
R6 night	F1	4.0 m	39	35	44	40

Receptor	Floor	Height (above local ground level)	Predicted operational noise rating level $L_{Ar,Tr}$, dB			
			Scenario 1	Scenario 2	Scenario 3	Scenario 4
R4 night	F1	4.0 m	37	33	41	41
R5 day	GF	1.5 m	37	33	43	37
R5 evening	GF	1.5 m	37	33	43	37
R5 night	F1	4.0 m	39	35	45	37
R6 day	GF	1.5 m	38	34	43	39
R6 evening	GF	1.5 m	38	34	43	39
R6 night	F1	4.0 m	39	35	44	40