Offshore Wind Power Limited

West of Orkney Windfarm Onshore EIA Report

Volume 2, Supporting Study 13: Noise Modelling Report

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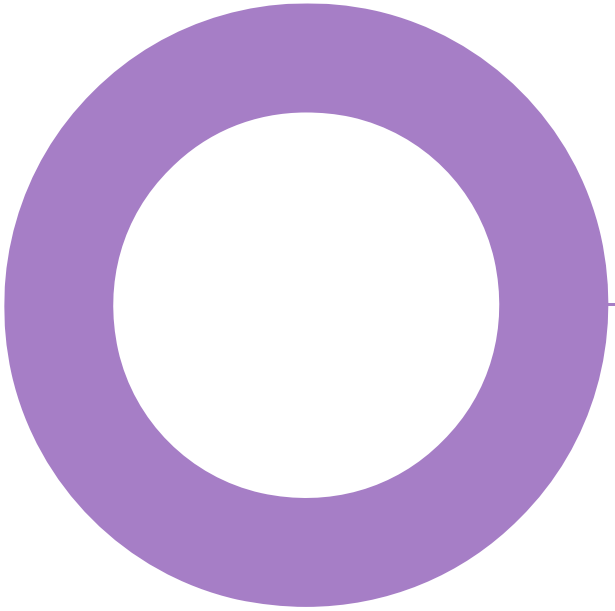
XODUS

West of Orkney Windfarm

West of Orkney Windfarm Onshore Substation. Spittal, Caithness.

Noise Modelling Report.

ACOUSTICS
NOISE MODELLING REPORT
HOARE LEA
REVISION 3 – 09 JUNE 2023



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
1	17/04/2023	First version	SG	MMC	MMC
2	12/05/2023	Updated version following comments	SG	MMC	MMC
3	09/06/2023	Updated version following comments	SG	MMC	MMC

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Contents.

Abbreviations.

Acronym	Definition
AOD	Above Ordnance Datum
NSR	Noise Sensitive Receptor
OEM	Original Equipment Manufacturer
SHET-L	Scottish Hydro Electric Transmission plc.
SVC	Static Var Compensator
THC	The Highland Council

Glossary.

Term	Definition
'A' weighting	The A-weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise.
Ambient sound level (L_{Aeq})	'A' weighted average sound pressure level.
Background sound level (L_{A90})	'A' weighted statistical sound pressure level exceeded for 90% of a time period. Used to represent the background sound level.
Decibel or dB	The decibel is the unit used to quantify sound pressure levels as well as sound intensity and power levels. In accordance with the logarithmic scale, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pa). Subjectively, this increase would correspond to a doubling of perceived loudness of the sound. dBA refers to A-weighted decibels.
Frequency	The rate at which the pressure fluctuations occur determines the pitch or frequency of the sound. The frequency is expressed in Hertz (Hz) or cycles per second.
Octave band frequency analysis	A frequency analysis using a filter that is an octave wide (the upper limit of the filter's frequency band is exactly twice that of its lower frequency limit).
One-third octave band frequency analysis	Similar to Octave Band analysis but with each octave further split into three providing a more detailed analysis of frequency content.
Rating Level or rating level (L_{Ar})	A sound pressure level measured in decibels inclusive of character, tonality and impulsivity / intermittency corrections.
Sound Pressure Level (SPL)	The human ear has an approximately logarithmic response to sound pressure over a very large dynamic range. The lowest audible sound pressure approximately 2 x 10-5 Pa (2 ten billionths of an atmosphere) and the highest is approximately 100 Pa. It is therefore convenient to express the sound pressure as a logarithmic decibel scale related to this lowest human audible sound.
Sound Power Level (SWL)	The sound energy emitted by an object measured in Watts (W) (decibel referenced to 10-12 W).
Weighted sound reduction index (R_w)	A single number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.

1. Introduction.

Hoare Lea LLP have been appointed to undertake noise modelling in relation to the development of an offshore wind farm to the West of Orkney, and associated onshore infrastructure, which will have an onshore grid connection near Spittal in Caithness.

This report sets out the predictions of the noise modelling undertaken for the proposed onshore Project substation site (the onshore substation).

The methodology within BS 4142: 2014+A1:2019 (BS 4142) has been considered, to assist with determining impact at the closest noise sensitive receptors (NSRs), based on measurements from the baseline noise survey undertaken by Hoare Lea in December 2022. Levels have also been assessed in the 100 Hz one-third octave frequency band following consultation with THC (as detailed in Section 2).

2. Consultation.

2.1 Consultation and scoping response.

Consultation was made with the Environmental Health Team at The Highland Council (THC) on 10th November 2022, outlining the proposed assessment methodology for carrying out the baseline noise survey and operational noise assessment. A response was received via email on 18th November 2022 from the Case Officer showing agreement with the proposed assessment methodology, providing that the proposals and noise assessment demonstrated compliance with their requirements in relation to electrical substations, which were the requirements as detailed in the scoping response.

The scoping response for the onshore Project (reference (22/00972/SCOP on 9th May 2022) does not include any requirements in relation to operational noise. The scoping response for the offshore Project (reference 22/01589/SCOP on 19th May 2022), requested that with regard to operational noise from the onshore substation, that "*the assessment should demonstrate that the following standards are achieved:*

1. *Noise arising from within the operational land of the sub-station, hereby permitted, when measured and / or calculated as an $L_{eq, 5min}$, in the 100 Hz one third octave frequency band must not exceed 30 dB, at noise sensitive premises; and*
2. *The Rating Level of noise arising from the use of plant, machinery or equipment installed or operated within the operational land of the sub-station, hereby permitted, must not exceed the current background noise levels at noise sensitive premises. The Rating Level should be calculated in accordance with BS 4142: 2014+A1:2019 Methods for rating and assessing industrial and commercial sound*."

The 100 Hz frequency band has been requested as it is the predominant emission frequency for transformers. As such noise predictions will also be considered at the 100 Hz one-third octave frequency band, in addition to assessing the Rating Level in terms of overall A-weighted levels in accordance with BS 4142.

It was further clarified in subsequent consultation via email with THC on 17th April 2023 (see Appendix A) that, in cases where background noise levels reduced below 25dB L_{A90}, at night-time, that the second requirement above could be interpreted in line with BS 4142 for rated levels to be limited to 25dB (but not any lower), as this represents a low absolute level and provide sufficient protection of amenity.

3. Identified NSRs.

A list of the nearest receptor locations, which was determined as representative of dwellings around the onshore substation search area, within which the onshore substation will be located, is set out in Table 3.1, and a map showing the location of each NSR is presented in Figure 3.1 below.

Receptor	NSR	Easting	Northing
Milton Farm	NSR 1	314993	956735
Hayfold Cottage	NSR 2	314717	956786
Maldon, Achalone	NSR 3	314991	956948
Cruachan, Achalone	NSR 4	315006	956908
Just Home, Achalone	NSR 5	315084	956859
Achalone View	NSR 6	315164	956910
Achalone Gill	NSR 7	315225	956930
Achalone Cottage	NSR 8	315533	956539
Mossgiel	NSR 9	315566	956434
Achomhairle Farm	NSR 10	315458	956216
The Cottage, Achalone	NSR 11	315671	956190
Spittal Mains Farm	NSR 12	316096	954650
Spittal Mains Cottage	NSR 13	316115	954519
Achanarras Farm	NSR 14	315134	955115

Table 3.1 – The nearest NSRs to the proposed onshore substation search area

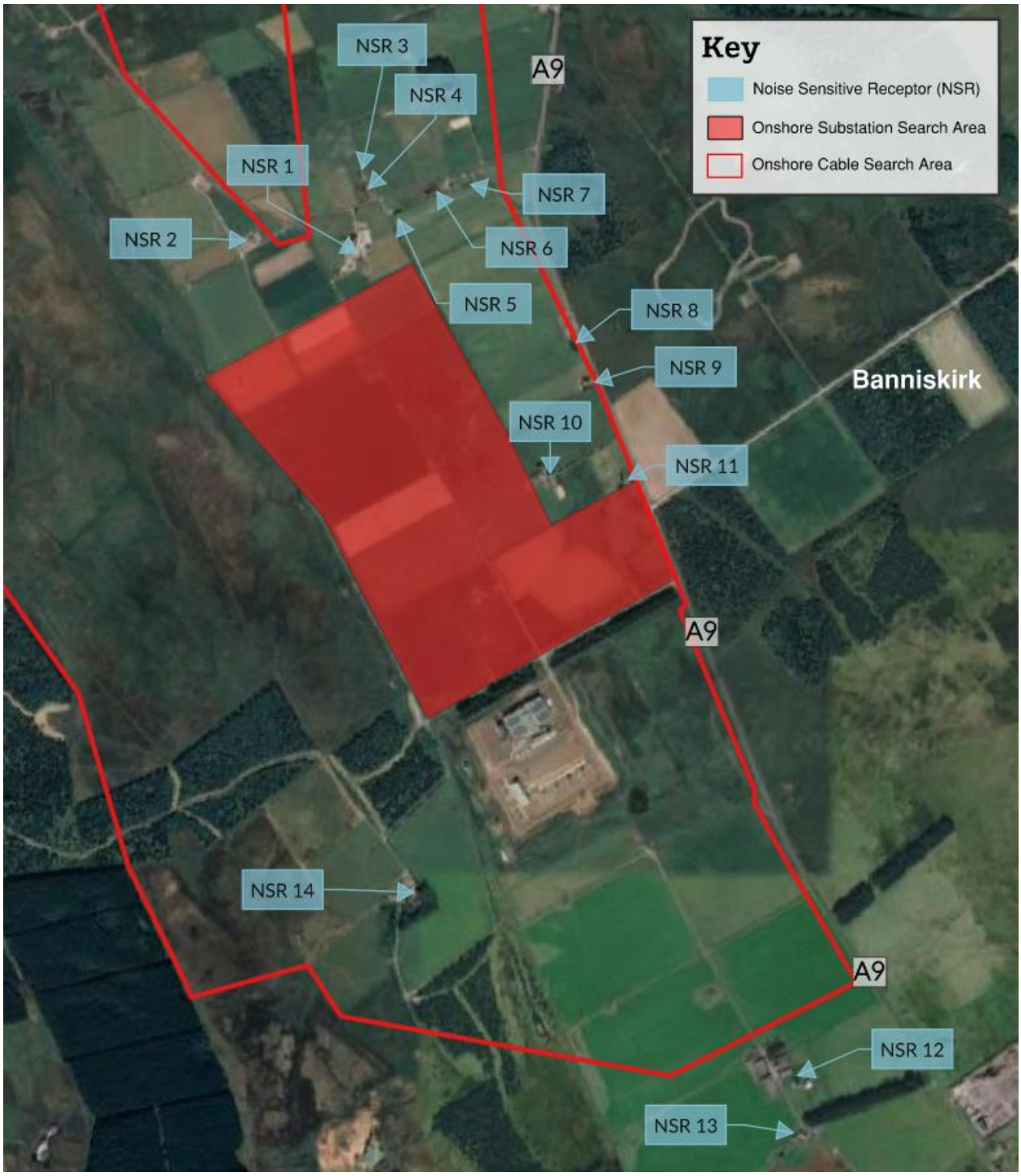


Figure 3.1: A map showing the location of each NSR and the onshore substation search area.

4. Operational noise.

Prediction of sound propagation from the proposed noise sources in the onshore substation to the nearest NSRs, has been undertaken in accordance with ISO 9613-2 'Acoustics – attenuation of sound during propagation outdoors – Part 2: General method of Calculation (International Organisation for Standardisation (ISO), 1996). This was implemented in the CadnaA® prediction software.

Ordnance Survey base mapping contours for existing and future ground levels have been supplied by Xodus Group Ltd. The proposed platform level for the onshore substation footprint has been set at 70 m Above Ordnance Datum (AOD), and indicative ground contours for future bunding which is proposed around the extents of the onshore substation site have been provided by the West of Orkney Windfarm Project team and included in the noise model. The indicative design of the earth bunding assumed can be seen in Appendix B.

Propagation over hard ground was assumed for the onshore substation platform area. Propagation over soft ground was assumed outside of the platform level area, typical of cultivated land in rural conditions.

The receiver locations NSR 1 – 11 are all single-storey dwellings and have been modelled at 1.5 m above ground floor level to represent ground floor windows. The receivers NSR 12 – 14 are two-storey dwellings and have been modelled at 4 m above ground floor level to represent first-floor windows. All buildings have been modelled as reflective surfaces.

The SVC and Control buildings have been included in the model as buildings, however the model did not consider any screening from the plant items themselves which were not included in the noise model as solid elements, but as point and area sources. This represents a worst-case scenario and is a precautionary approach.

In addition to modelling predicted levels and determining rating levels to carry out a BS4142 assessment, noise in the 100 Hz one-third octave frequency band has also been considered. Octave band data is typically used for modelling purposes, and the corresponding octave band which encompasses 100 Hz is the 125 Hz octave band. The majority of sound energy from transformers and similar electrical plant will be from 100 Hz in that octave band, so the level at 125 Hz is a good approximation of energy in the 100 Hz one-third octave frequency band and this has been used in the assessment.

4.1 Noise sources assumed.

The exact design of the onshore substation will be the result of a future tender process driven by electrical studies that assess the onshore equipment required to ensure grid compliance is achieved. Therefore representative equipment has been assumed for this noise assessment, based on indicative manufacturer selections from the same OEM. An indicative onshore substation layout, which has been input to the model, can be seen in Appendix C. It is understood that the final onshore substation design may include less plant and equipment. There are a total of five circuits proposed for the substation. The indicative layout includes three Static Var Compensator (SVC) buildings (serving five circuits) and three Control buildings across the whole site. Representative sound power levels for the equipment have been provided by the West of Orkney Windfarm Project team. The emission levels are based on plant running at full duty, and plant is assumed to run continuously. The sources of noise have been modelled at various heights, representative of the middle or upper half of each source. This represents a worst-case assumption for the model.

The modelled source heights, source types and assumed noise emission levels are detailed in Table 4.1.1 below.

Unit	Quantity	Sound power level (SWL) specified, per unit	Modelled Height above platform level (m)	Modelled Source Type
A/C unit (Control building)	24 (8 per control building)	80 dBA	2.8	Point
A/C unit (SVC building)	24 (8 per SVC block)	80 dBA	2.8	Point
Super Grid Transformer Tank & cooler	5 (1 per circuit)	100 dBA	3.8	Point
Auxiliary Transformer	5 (1 per circuit)	70 dBA	1.3	Point
275kV Shunt Reactor Tank & cooler *	5 (1 per circuit)	90 dBA	3.8	Point
275kV Air-Core Shunt Reactor *	15 (3 per circuit)	90 dBA	3	Point
33kV Mechanically Switched Reactor *	15 (3 per circuit)	90 dBA	3	Point
33kV SVC+ Ph. Reactor *	15 (3 per circuit)	90 dBA	2.5	Point
275kV (Harmonic) Filter Reactor *	15 (3 per circuit)	90 dBA	3	Point
275kV (Harmonic) Filter Cap. Banks (C1+C2) **	15 (3 per circuit)	80 dBA	4.7	Point
400kV (Harmonic) Filter Reactor *	15 (3 per circuit)	90 dBA	3	Point
400kV (Harmonic) Filter Cap. Banks (C1+C2) **	15 (3 per circuit)	80 dBA	4.7	Point
SVC+ Outdoor cooler	5 (1 per circuit)	78 dBA	1.8	Horizontal area

Table 4.1.1: Noise source data for all relevant equipment (* and ** refer to the spectral levels (see Table 4.1.2) applied in the model)

Unweighted manufacturer octave band spectral data for the plant as realised in similar projects and from experience of representative units and similar developments, has been used, as shown in Table 4.1.2. The corresponding A-weighted overall broadband SWL for each type of plant is listed in the column 'A'.

Plant Type	Sound Power Level SWL dB – Octave Band Spectrum (Hz)									
	31.5	63	125	250	500	1000	2000	4000	8000	A
A/C units	63	71	74	75	78	76	72	71	61	80
Super Grid Transformer Tank & cooler	96	96	107	102	101	86	71	60	53	100
Auxiliary Transformer	85	73	70	74	61	61	64	59	51	70
Reactors *	70	73	90	97	86	74	58	53	46	90
Harmonic Filters **	77	79	90	77	81	61	54	48	45	80
Outdoor Coolers	61	69	72	73	76	74	70	69	59	78

Table 4.1.2: Sound power level octave band spectral data for plant items (see * or ** for references to Table 4.1.1).

The grid transformers, reactors and harmonic filters in particular have noise emissions which are strongly dominated by the 100 Hz one-third octave frequency band and this is apparent from Table 4.1.2 in the 125 Hz octave band.

In addition to the plant outlined in Table 4.1.1, the assumption made for the SVC building is that it would house indoor plant which includes a Pump Skid. A sound power level of 75 dBA was provided for the internal SVC plant. Correcting the sound power level to a sound pressure level in a reverberant field, with an assumed reverberation time of between 1.5 – 2.5 secs for both the large (2,622 m^3) and smaller (1,311 m^3) SVC buildings, the resultant sound pressure level inside is predicted to be up to 48 dBA. Assuming a basic façade construction with a sound reduction of 25 R_w dB for the SVC building results in an outdoor sound pressure level of up to 17 dB, which at the nearest receptor would not be perceptible. As such, this noise source has not been considered further.

Any other plant and ancillary equipment, e.g. small ventilation plant associated with the SVC and Control buildings, and circuit breakers or switches, are not expected to generate substantial levels of noise and are therefore not considered further.

4.2 Prediction results – pre-mitigation.

Table 4.2.1 presents the results of the noise predictions across the wider area and at the NSRs identified in the absence of further mitigation.

Receptor Name	NSR	Predicted LAeq noise level (unrated), dB	Predicted Leq,5mins noise level, at 100 Hz (unweighted), dB
Milton Farm	1	38	44
Hayfold Cottage	2	36	42
Maldon, Achalone	3	36	41
Cruachan, Achalone	4	36	42
Just Home, Achalone	5	37	43
Achalone View	6	37	42
Achalone Gill	7	37	42
Achalone Cottage	8	40	45
Mossgiel	9	39	45
Achomhairle Farm	10	41	47
The Cottage, Achalone	11	41	45
Spittal Mains Farm	12	28	34
Spittal Mains Cottage	13	27	34
Achanarras Farm	14	36	40

Table 4.2.1: Noise model prediction results at the nearest dwellings for the onshore substation, without mitigation.

Figure 4.2.1 shows a noise map of the modelling predictions of L_{Aeq} (dB) for the onshore substation.

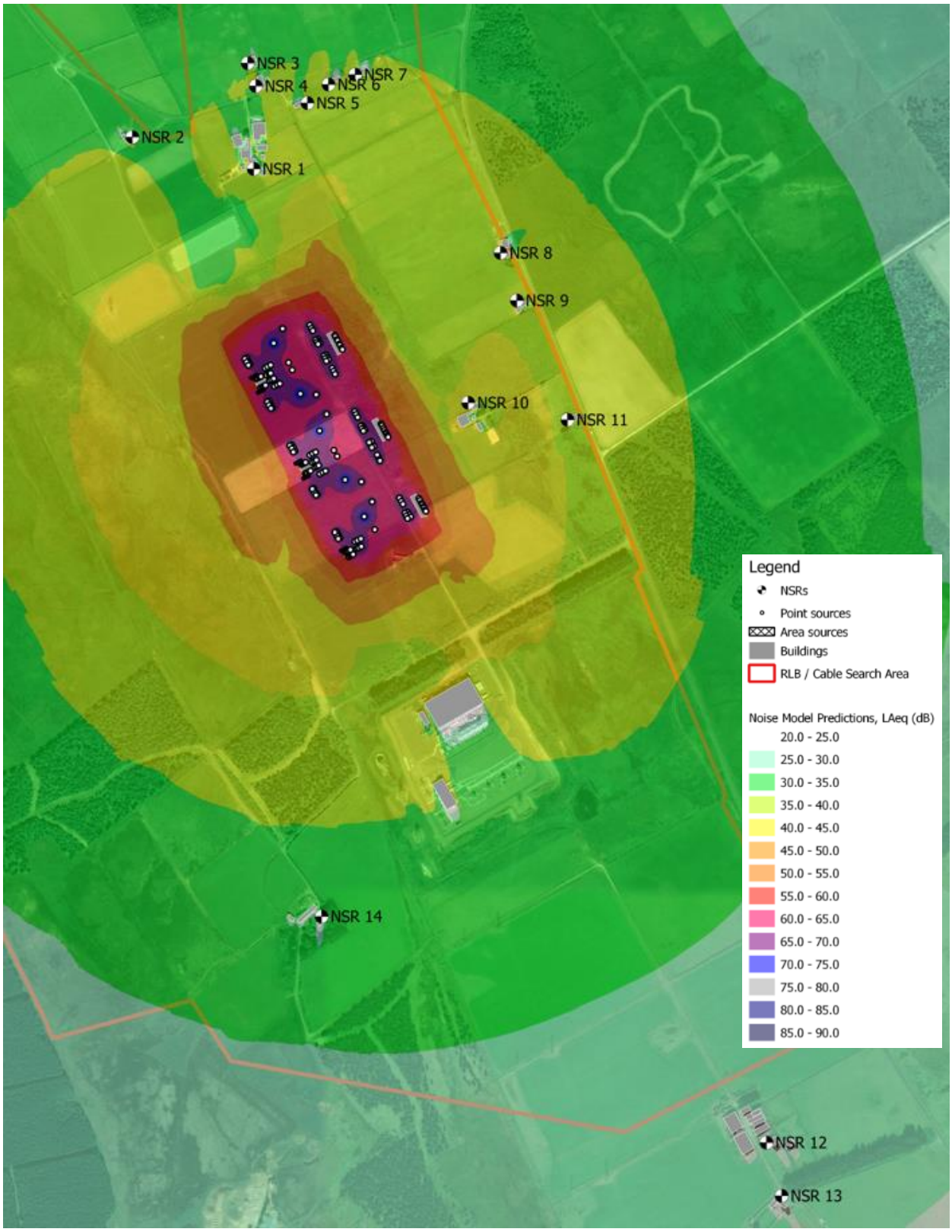


Figure 4.2.1: Noise model prediction results at the nearest NSRs to the onshore substation, without mitigation.

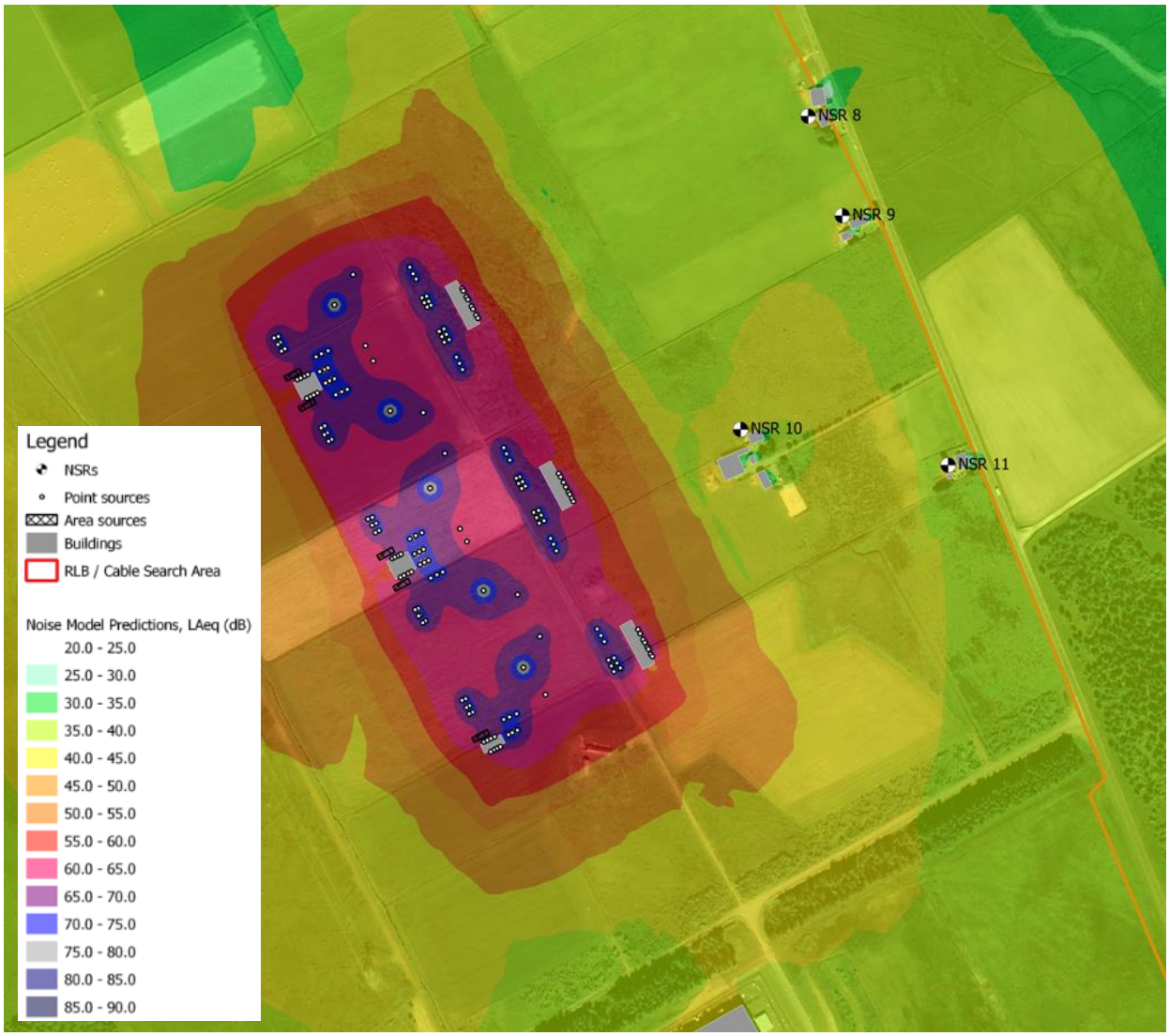


Figure 4.2.2: Noise model predictions showing a closer view of the onshore substation and nearest NSRs, without mitigation.

4.3 BS 4142 Assessment.

Electrical units such as transformers and reactors / filters can often produce a "humming" or tonal sound attributed to magnetostriction. An audible tonal noise character has been assumed for all plant, with the exception of fans, at the onshore substation, and a penalty of either +6 dB or +4 dB has been added to the predicted levels when determining the rated noise levels (L_{Ar}) at each receptor. A penalty correction of 6 dB has been applied at NSRs 1 -11 and 14 for tonal noise that is predicted to be highly perceptible, and a penalty of 4 dB has been applied at NSRs 12 and 13 for tonal noise that is predicted to be clearly perceptible. A lower penalty has been applied at NSRs 12 and 13 due to the greater distance from the onshore substation.

The representative (typical lowest) background noise levels as presented in the noise survey report and detailed below in Table 4.3.1 have been used in the following BS 4142 assessment. The representative ambient levels have also been included for context, shown as a range of values from the lowest $L_{Aeq,\ 16hr/8hr}$ to the highest $L_{Aeq,\ 16hr/8hr}$ period measured over the 14-day noise survey as detailed in the baseline noise survey report (see Supporting Study 12: Noise survey report).

Noise Metric	Daytime (07:00 – 23:00)	Night-time (23:00 -07:00)
Background Levels, L_{A90}	27 dB L_{A90} day	22 dB L_{A90} night
Ambient Levels, L_{Aeq}	36 – 46 dB $L_{Aeq, 16hr}$	25 – 41 dB $L_{Aeq, 8hr}$

Table 4.3.1: Background (L_{A90}) and ambient (L_{Aeq}) noise levels measured during the noise survey.

The predicted rating noise levels (L_{Ar}) have been assessed against the daytime and night-time background levels, in accordance with BS 4142 and presented in Table 4.3.2 below.

Receptor Name	NSR	Rating Level (L_{Ar}), dB	Background Level (L_{A90}) Daytime, dB	Excess of Rating over Background Level (L_{Ar} – L_{A90}) Day, dB	Background Level (L_{A90}) Night, dB	Excess of Rating over Background Level (L_{Ar} – L_{A90}) Night-time, dB
Milton Farm	1	44	27	+17	22	+22
Hayfold Cottage	2	42	27	+15	22	+20
Maldon, Achalone	3	42	27	+15	22	+20
Cruachan, Achalone	4	42	27	+15	22	+20
Just Home, Achalone	5	43	27	+16	22	+21
Achalone View	6	43	27	+16	22	+21
Achalone Gill	7	43	27	+16	22	+21
Achalone Cottage	8	46	27	+19	22	+24
Mossgiel	9	45	27	+18	22	+23
Achomhairle Farm	10	47	27	+20	22	+25
The Cottage, Achalone	11	47	27	+20	22	+25
Spittal Mains Farm	12	32	27	+5	22	+10
Spittal Mains Cottage	13	31	27	+4	22	+9
Achanarras Farm	14	42	27	+15	22	+20

Table 4.3.2: Predicted rating noise levels and BS 4142 assessment at key receptors – daytime and night-time periods.

It is concluded that the proposed onshore substation site, based on an indicative plant selection and in the absence of additional mitigation, is predicted to create rated noise levels which would clearly exceed the derived background noise levels during daytime and night-time periods by more than 10 dB at the majority of the NSRs. Predicted rated noise levels would also exceed the criteria of 25 dB for night-time agreed in consultation with THC by more than 10 dB.

For the majority of NSRs, the margin by which the rating level exceeds the background sound level is likely to be an indication of a significant adverse impact (a difference of around +10 dB or more) at the receptors according to BS 4142.

Mitigation measures are proposed in order to reduce the potential impact (see Section 5).

4.4 Low frequency noise at 100 Hz.

The predicted levels as an $L_{eq, 5mins}$ in the 100 Hz one-third octave frequency band (unweighted) have been compared to the noise criteria of 30 dB proposed by THC as shown in Table 4.4.1 below.

Receptor Name	NSR	Predicted L_{eq}, 100 Hz, dB	L_{eq} criteria at 100 Hz, dB	Excess of predicted L_{eq}, 100 Hz over the L_{eq} criteria, dB
Milton Farm	1	44	30	+14
Hayfold Cottage	2	42	30	+12
Maldon, Achalone	3	42	30	+11
Cruachan, Achalone	4	42	30	+12
Just Home, Achalone	5	43	30	+13
Achalone View	6	43	30	+12
Achalone Gill	7	42	30	+12
Achalone Cottage	8	45	30	+15
Mossgiel	9	45	30	+15
Achomhairle Farm	10	48	30	+17
The Cottage, Achalone	11	45	30	+15
Spittal Mains Farm	12	34	30	+4
Spittal Mains Cottage	13	34	30	+4
Achanarras Farm	14	40	30	+10

Table 4.4.1: Predicted Leq noise levels (dB) at 100 Hz at key receptors – in comparison with the stated limit.

It is therefore concluded that the proposed onshore substation site, based on an indicative plant selection, is predicted to exceed the THC noise criteria of 30 dB in the 100 Hz one-third octave frequency band at the nearest NSRs by 4 to 17dB at different receptors, in the absence of additional mitigation.

Based on the above, additional mitigation measures have been considered (see Section 5).

5. Mitigation.

5.1 Mitigation measures.

Embedded mitigation has already been included in the model in the form of earth bunding which provides some screening from the site for NSRs. Further mitigation measures have been explored for the noise sources, in order to reduce the predicted rating levels and noise levels at 100 Hz at the NSRs to acceptable levels. It is proposed that the following measures be applied to the relevant plant, with the reductions stated below being the minimum mitigation level to be applied, across all items of the same plant type, as described in Table 5.1.1. For grid transformers, harmonic filters and reactors, in addition to achieving the A-weighted sound reduction, there is a reduction that would need to be achieved at the frequency of 100 Hz: reductions of 20 dB are achievable in practice using specialist noise enclosures specifically designed for this type of application[1].

Plant item	A-weighted overall sound reduction (dB)	Reduction at 100 Hz (dB)	Mitigation measure(s)
A/C unit (Control building)	-10	-	Low noise fans / silencers
A/C unit (SVC building)	-10	-	Low noise fans / silencers
Super Grid Transformer Tank & cooler	-20	-20	Specialist noise enclosure
Auxiliary Transformer	0	-	n/a
275kV Shunt Reactor Tank & cooler	-17	-10	Enclosure / low noise plant
275kV Air-Core Shunt Reactor	-18	-15	Specialist noise enclosure
33kV Mechanically Switched Reactor	-18	-15	Specialist noise enclosure
33kV SVC+ Ph. Reactor	-18	-15	Specialist noise enclosure
275kV (Harmonic) Filter Reactor	-17	-15	Specialist noise enclosure
275kV (Harmonic) Filter Cap. Banks (C1+C2)	-15	-14	Specialist noise enclosure
400kV (Harmonic) Filter Reactor	-17	-15	Specialist noise enclosure
400kV (Harmonic) Filter Cap. Banks (C1+C2)	-15	-14	Specialist noise enclosure
SVC+ Outdoor cooler	-5	-	Low noise fans / silencers

Table 5.1.1: Proposed mitigation measures to be implemented with minimum mitigation levels per plant type.

The above mitigation has been based on the indicative worst-case assumptions of Section 4.1 above. The final mitigation measures and schedules would be determined based on the final onshore substation and earth bunding layout, using finalised plant selections and data.

5.2 Predictions with mitigation measures implemented.

By implementing the noise reducing measures described above in Table 5.1.1, reduced noise levels can be achieved at the NSRs, as detailed in Table 5.2.1 below.

[1] See https://www.kimptonacoustics.co.uk/ or https://www.iacacoustics.global/news/acoustic-enclosures-for-industrial-equipment/

Receptor Name	NSR	Predicted L_{Aeq} noise level, dB	Predicted L_{eq} noise level, at 100 Hz (unweighted), dB
Milton Farm	1	21	27
Hayfold Cottage	2	18	25
Maldon, Achalone	3	18	25
Cruachan, Achalone	4	19	25
Just Home, Achalone	5	20	26
Achalone View	6	19	26
Achalone Gill	7	19	25
Achalone Cottage	8	23	28
Mossgiel	9	22	28
Achomhairle Farm	10	23	30
The Cottage, Achalone	11	23	28
Spittal Mains Farm	12	10	17
Spittal Mains Cottage	13	10	17
Achanarras Farm	14	18	23

Table 5.2.1: Noise model prediction results at the nearest dwellings for the onshore substation following mitigation measures.

Figure 5.2.1 shows the L_{Aeq} (dB) noise map for the onshore substation following implementation of the mitigation measures as described above.

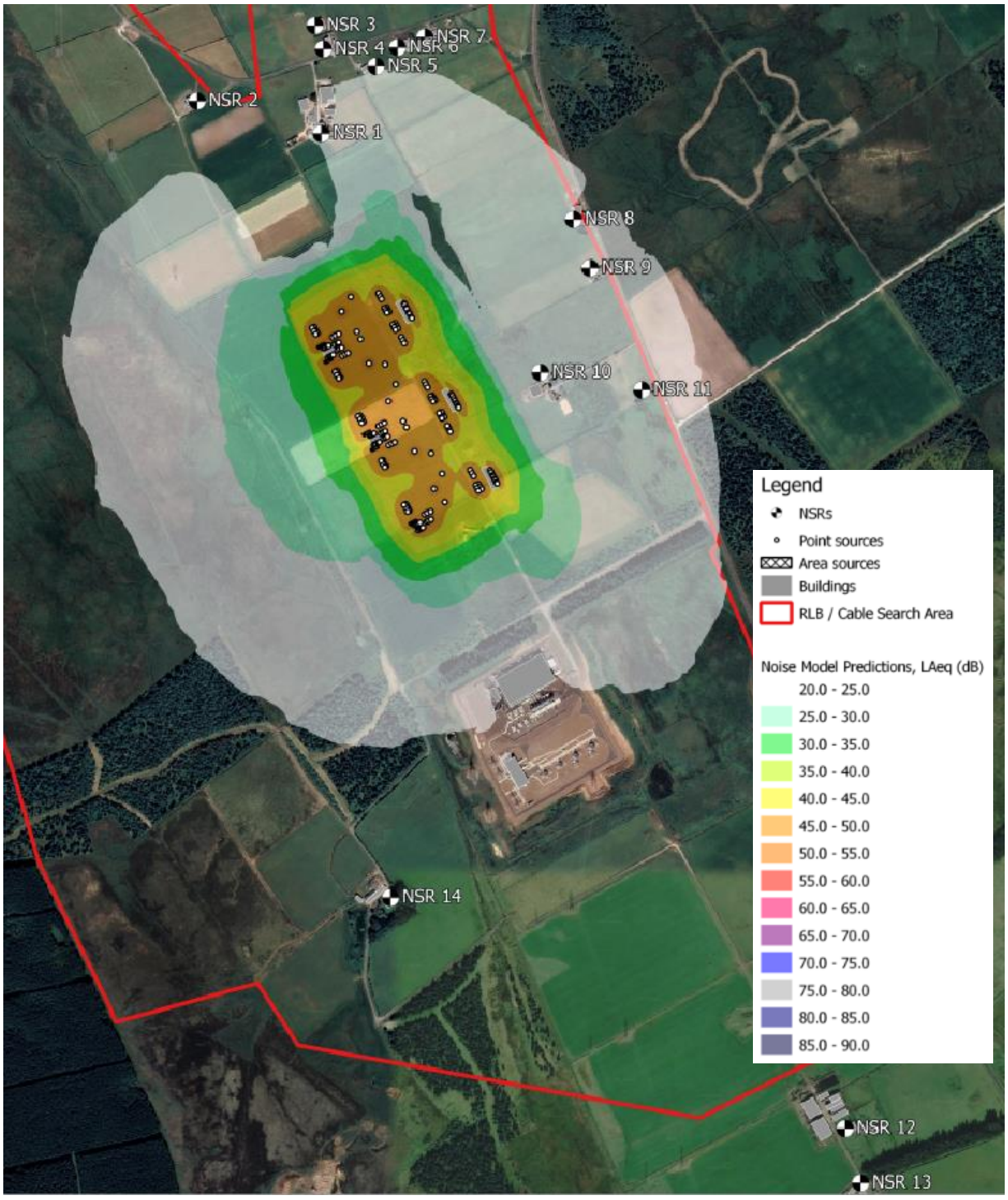


Figure 5.2.1: Noise model prediction results at the nearest dwellings for the onshore substation with mitigation

5.3 BS 4142 Assessment following mitigation.

The baseline noise survey (see Supporting Study 12: Noise survey report) has determined that, at some of the nearest properties, background noise levels can reduce in some cases below 25 dB L_{A90} at night-time. The BS 4142 standard explains the importance of considering contextual factors including the absolute level of the noise, which can be more relevant than the difference with the background particularly at night.

With this in mind, it is proposed to limit the rating level from the onshore substation plant to levels of 25 dB at night, which already represents a stringent requirement in terms of absolute levels of the noise, and with context considered, is in line with the lowest measured night-time ambient level of 25 dB $L_{Aeq, 8hr}$. As such, the rating level will be assessed against a proposed night-time background level criteria of 25 dB. This approach was agreed with THC as set out in Section 2.1 above.

The predicted rating noise levels, with mitigation measures implemented have been assessed in accordance with BS 4142 for the day and night-time periods and presented in Table 5.3.1 below. With mitigation measures implemented, it is predicted that the tonal element of the equipment will be at worst just perceptible, therefore a character penalty of +2 dB has been applied at each receptor as a conservative approach.

Receptor Name	NSR	Rating Level (L_{Ar}), dB	Background Level (L_{A90}) Daytime, dB	Excess of Rating over Background Level (L_{Ar} – L_{A90}) Day, dB	Proposed Night-time criterion (L_{A90}), dB	L_{Ar} –Night-time criterion, dB
Milton Farm	1	23	27	-4	25	-2
Hayfold Cottage	2	20	27	-7	25	-5
Maldon, Achalone	3	20	27	-7	25	-5
Cruachan, Achalone	4	21	27	-6	25	-4
Just Home, Achalone	5	22	27	-5	25	-3
Achalone View	6	21	27	-6	25	-4
Achalone Gill	7	21	27	-6	25	-4
Achalone Cottage	8	25	27	-2	25	0
Mossgiel	9	24	27	-3	25	-1
Achomhairle Farm	10	25	27	-2	25	0
The Cottage, Achalone	11	25	27	-2	25	0
Spittal Mains Farm	12	12	27	-15	25	-13
Spittal Mains Cottage	13	12	27	-15	25	-13
Achanarras Farm	14	20	27	-7	25	-5

Table 5.3.1: Predicted rated noise levels and BS 4142 Assessment with mitigation implemented - daytime and night-time periods.

The BS 4142 assessment with mitigation measures implemented shows that rated levels are 2 dB or more below daytime background levels, and either below background or below the agreed lower criterion of 25 dB at night. In both cases this indicates a low impact. Furthermore, this complies with the requirements of THC.

It is therefore concluded that the proposed onshore substation site, based on an indicative plant selection with suitable mitigation measures implemented, as detailed in Table 5.1.1, and with a noise level limit of 25 dB L_{A90} at night, when considering context of the area and ambient levels measured, can result in suitable levels being achieved at the nearest noise-sensitive receivers.

5.4 Low frequency noise at 100 Hz.

The predicted levels at 100 Hz, as shown in Table 5.2.1, show that with the mitigation measures implemented as described, that predicted noise from the operation of the onshore substation site does not exceed 30 dB in the 100 Hz one-third octave frequency band at any NSR.

6. Summary and conclusion.

Hoare Lea LLP have been appointed to undertake noise modelling in relation to the West of Orkney Windfarm proposed onshore substation site for the onshore grid connection for an offshore wind farm, on land near Spittal, Caithness, in line with the methodology of BS 4142: 2014.

The methodology within BS 4142 has been applied to assist with determining impact at the closest noise-sensitive receptors. This was based on baseline noise measurements undertaken by Hoare Lea at the surrounding NSRs to characterise the existing noise environment. In addition to this, levels have been assessed in the 100 Hz one-third octave frequency band as requested by THC in the Scoping Response.

It has been proposed to limit the rating level from the onshore substation plant to levels of 25 dB at night, which was agreed with THC, in addition to achieving the 30 dB limit at 100 Hz.

Predictions of noise from the main potential sources of noise were made at the nearest noise-sensitive locations according to the ISO 9613-2 standard, based on manufacturer information for indicative plant selection and experience of similar developments. With adequate selection of plant items, and suitable specialist noise reduction measures applied, a low impact is predicted in accordance with BS 4142, and noise in the 100 Hz one-third octave frequency band can be controlled so as not exceed 30 dB at the nearest existing noise-sensitive receivers. The final mitigation measures and schedules would be determined based on the final onshore substation and earth bunding layout, using finalised plant selections and data.

Appendix A: Consultation with THC.

Email from Matthew Cand (Hoare Lea) to THC on 13th April 2023:

Dear Robin, Philip,

We are assessing noise from the West of Orkney Wind Farm proposal which is an offshore project but includes onshore infrastructure, including cabling and a substation in Caithness. In your scoping response (reference 22/01589/SCOP on 19 May 2022), you mentioned in particular substation noise and that the assessment should demonstrate that the following standards are achieved:

1. Noise arising from within the operational land of the sub-station, hereby permitted, when measured and/or calculated as an $L_{eq, 5min}$, in the 100Hz one third octave frequency band must not exceed 30 dB, at noise sensitive premises; and
2. The Rating Level of noise arising from the use of plant, machinery or equipment installed or operated within the operational land of the sub-station, hereby permitted, must not exceed the current background noise levels at noise sensitive premises. The Rating Level should be calculated in accordance with BS 4142: 2014+A1:2019 Methods for rating and assessing industrial and commercial sound.

Regarding the second requirement in particular, our survey has determined that, at some of the nearest properties, background noise levels can reduce in some cases below 25dB L_{A90} at night-time. The BS 4142 standard explains the importance of considering contextual factors including the absolute level of the noise, which can be more relevant than the difference with the background particularly at night. With this in mind, we would propose to limit the rating level from the substation plant to levels of 25 dB at night, but not any lower noise limit, as this already represents a very stringent requirement in terms of absolute levels of the noise. Please note that this would be in addition to the (unweighted) L_{eq} level at 100Hz also not exceeding 30dB.

We consider that this is feasible using mitigation which we will set out in the planning submission but wondered if you could comment on this proposed approach?

Kind regards,

Matthew Cand
Associate Director

Response of Philip Dent (THC) on 17th April 2023:

Good Morning,

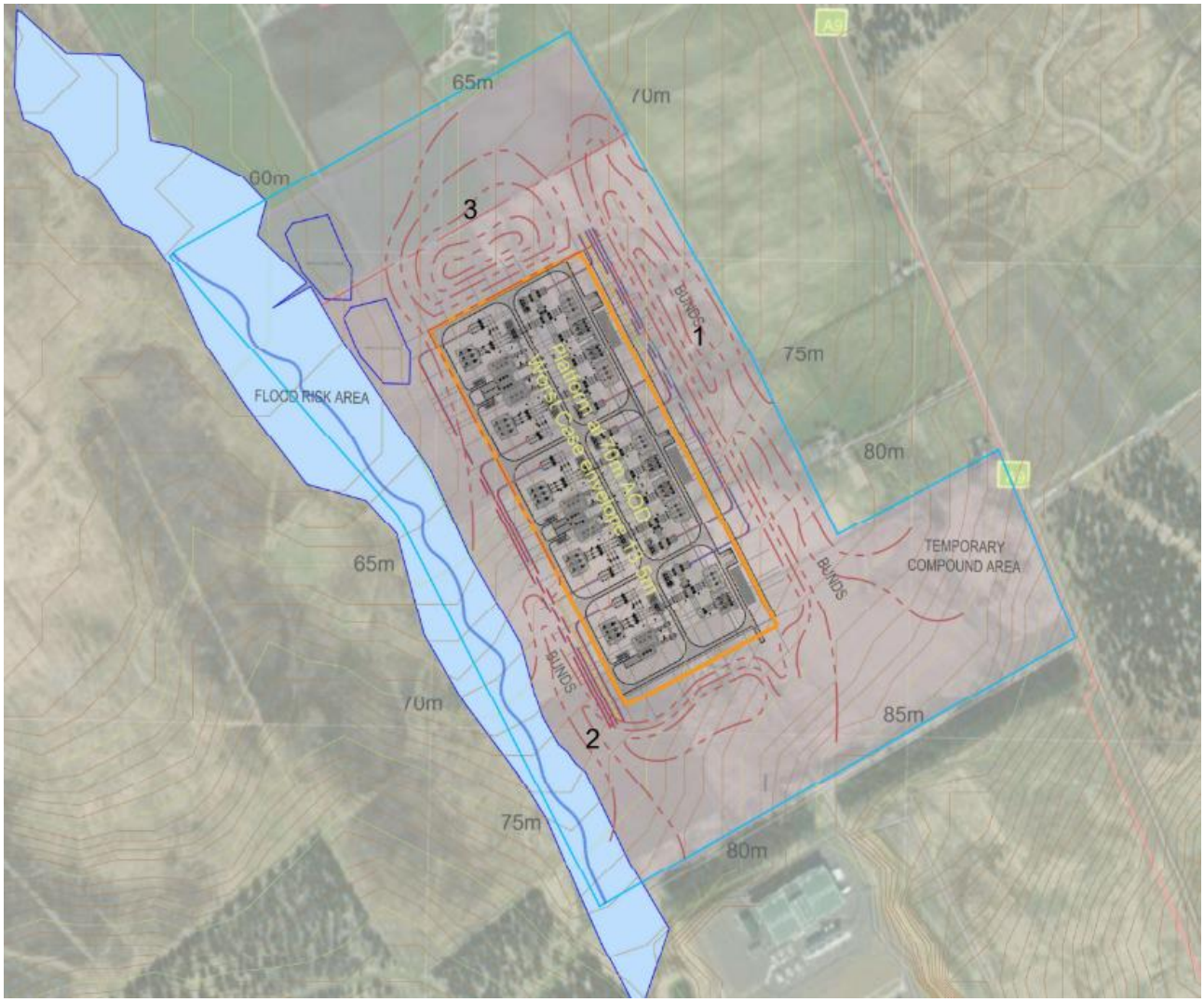
Further to your email below.

The proposal for external rating of 25dB(A) at night and in addition to 30dB at 100HZ is reasonable and the Department is satisfied with this approach. You state that it will be feasible with the mitigation that you will submit in the planning submission and so there are no further comments at the moment.

Regards

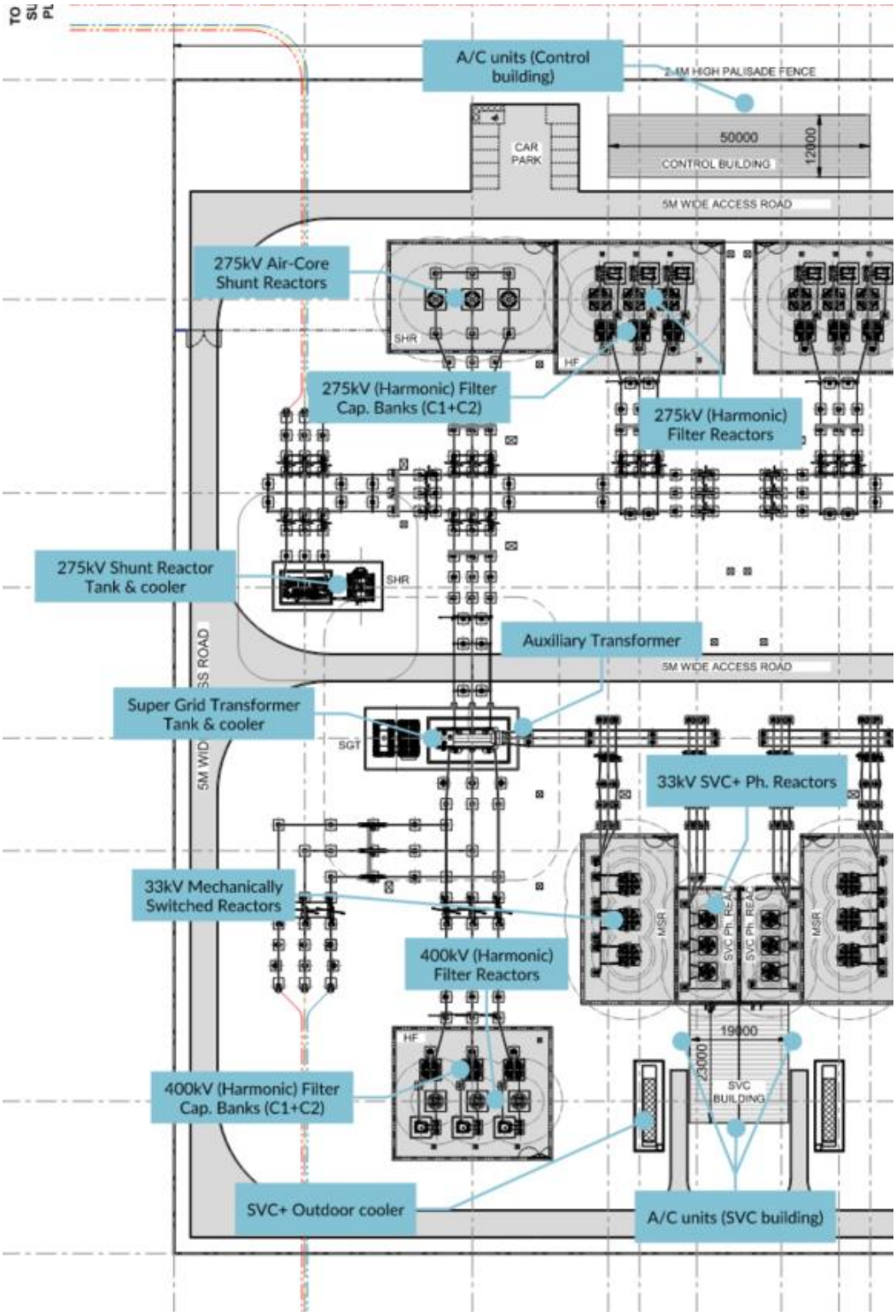
Philip Dent

Appendix B: Indicative earth bunding design.



Appendix C: Indicative onshore substation layout.

The plan below shows the layout of one circuit. There are a total of five circuits proposed within the onshore substation.



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