A specialist energy consultancy

Environmental Noise Impact Assessment

Necton Greener Grid Park

Statkraft (UK) Ltd.

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COMMERCIAL IN CONFIDENCE

Statkraft

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1 Introduction

1.1 Overview

TNEI has been commissioned by Statkraft UK Ltd (Statkraft) to undertake an environmental Noise Impact Assessment (NIA) to support the planning application for the construction and operation of the Necton Greener Grid Park development (the Proposed Development).

The Proposed Development is to be located adjacent to the existing Necton Onshore Substation in Necton, Norfolk. The Proposed Development is located approximately 500 m to the east of the A47, at approximate Ordnance Survey coordinates 588856, 310441.

The Proposed Development site is on undeveloped agricultural land located to the south of the substation development. The local area around the site is semi-rural in nature, predominantly consisting of agricultural land, but with a small number of residential properties located to the west, north and east, with a larger number of residential properties to the south on the outskirts of Necton village.

The aims of the NIA are to;

- Identify potential noise sensitive receptors in the vicinity of the Proposed Development;
- Identify the dominant sound sources associated with the operation of the Proposed Development;
- Calculate the likely levels of operational noise at the nearest noise sensitive receptors to determine the noise impacts associated with the development;
- Consider any cumulative noise effects that may arise from the operation of the Proposed Development in conjunction with any relevant nearby developments; and,
- Indicate any requirements for mitigation measures, if required, in order to provide sufficient levels of protection for nearby noise sensitive receptors.

All work undertaken to produce this report has been carried out by members of the TNEI Environment and Engineering Team, all of whom are affiliated with the Institute of Acoustics (IOA). Specifically, the following members of staff have been involved in the project;

- Alex Dell, AMIOA, PhD: Baseline Sound Survey;
- Will Conway, Tech IOA, BSc (Hons): Reporting; and,
- Ewan Watson, AMIOA, BEng (Hons), IOA Postgraduate Diploma in Acoustics and Noise Control: Noise Propagation Modelling and Quality Assurance.

1.2 Nomenclature

Please note the following terms and definitions, which are used throughout this report;

- **Emission** refers to the noise level emitted from a noise source, expressed as either a sound power level or a sound pressure level;
- **Immission** refers to the sound pressure level received at a specific location from a noise source;
- **SWL** indicates the sound power level in decibels (dB);
- **SPL** indicates the sound pressure level in decibels (dB);

- **NML** (Noise Monitoring Location) refers to any location where baseline or specific noise levels have been measured;
- **NSRs** (Noise Sensitive Receptors) are all identified receptors which are sensitive to noise; and;
- **NAL** (Noise Assessment Location) refers to any location where the noise immission levels are calculated and assessed.

In the interests of clarity, a Glossary of Terms is also provided as Appendix A of this report.

All figures referenced within the report can be found in Appendix F.

Unless otherwise stated, all noise levels refer to free field levels i.e. noise levels without influence from any nearby reflective surfaces.

All grid coordinates refer to the Ordnance Survey grid using Eastings and Northings.

2 Project Description

2.1 Development Description

The Proposed Development site is located within an area of currently undeveloped agricultural land located to the south of the existing Necton Onshore Substation development.

The Proposed Development is to consist primarily of housed synchronous compensator units with associated cooling and electrical plant. A synchronous compensator is a rotating electrical machine that resembles a generator or motor in design. Unlike a generator or motor, a synchronous compensator is not coupled to a prime mover or load, hence the only real power flow is a small percentage of rated power imported to support its internal losses. The compensators will rotate continuously at a constant rpm to support the national grid transmission system voltage by supplying or absorbing reactive power and providing synchronous inertia. This would allow for increased renewable energy generation connecting onto the National Grid, thereby supporting the network and stabilising the grid.

An indicative site layout and location plans provide an overview of the proposed site and are included within Appendix B of this report.

The Proposed Development would introduce new sound sources to the local area in the form of synchronous compensators, each housed within a building, with additional externally located fixed plant. Specifically, the dominant sound sources considered within the assessment are:

- Synchronous Compensator Unit Housed within Building (2 of);
- External Cooling Equipment (2 of);
- Primary Transformer (2 of); and,
- Auxiliary Transformer (2 of).

The sound level output of the any auxiliary infrastructure that forms part of the Proposed Development, such as circuit breakers and the comms house, is considered to be insignificant in comparison to the primary sound sources detailed above. Accordingly, no other items of plant have not been considered within the assessment.

2.2 Study Area

Noise Sensitive Receptors (NSRs) are properties that are sensitive to noise and therefore, require protection from nearby noise sources. The study area for the assessment of environmental noise is usually defined through the identification of the closest NSRs to the development.

The assessment of noise attributable to the development considers the nearest NSRs only, on the assumption that if sound levels at the closest receptors are within appropriate noise level limits, then sound levels at NSRs at greater distances should also be within acceptable levels.

The nearest identified NSRs, which have a high level of sensitivity, are existing residential properties located at varying distances in all directions from the site. The curtilage of the closest residential receptors is approximately 580 m to the southwest of the nearest noise emitting plant.

Figure 1 included within Appendix F details the closest NSRs considered within the assessment.

3 Assessment Methodology

3.1 Legislation and Policy Context

3.1.1 National Planning Policy Framework, 2021

At a national level, the relevant policy is the National Planning Policy Framework (NPPF) [(1)]. The NPPF states in Paragraph 174 that the planning system should contribute to and enhance the natural and local environment by *"preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution…"*.

In addition, paragraph 185 of the NPPF states that all planning policies and decisions should *"mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life"* and *"identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*.

No specific guidance on the assessment or acceptability of noise is provided within the NPPF but further detail is provided in the Noise Policy Statement for England.

3.1.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England (NPSE) [(2)] sets out the long-term vision of Government noise policy and should apply to all forms of noise including environmental noise, neighbour and neighbourhood noise. The NPSE refers to 'environmental noise' with the key aims being to:

- *"Avoid significant adverse impacts on health and quality of life while taking into account the guiding principles of sustainable development;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."*

3.1.3 Breckland Council Local Development Plan

The Breckland Council Local Development Plan (LDP) [(3),] was adopted in 2019 and forms the local development strategy in the area. The LDP comprises 6 documents, with LP/D/1 *"Adopted Core Strategy and Development Control Policies"* relating to new developments. With regards to energy developments, Policy CP 12 – Energy, states:

"…Opportunities to deliver decentralised energy systems, particularly those which are powered by a renewable or low-carbon source, will be supported…".

With regards to noise specifically, Policy DC 15 – Renewable Energy, states:

"…Permission will be granted for these developments unless it, or any related infrastructure such as power lines or access roads etc, has a significant detrimental impact or a cumulative detrimental impact upon…local amenity as result of noise…".

3.2 Assessment Methods

A number of standards and guidelines are available for the assessment of environmental noise from proposed new developments or activities. Typically, assessments are based on a comparison of likely noise levels against either 'context' based limits or a set of fixed limits.

Context based limits are set relative to the existing noise environment and may also consider the characteristics of the noise source(s), whilst fixed limits are usually set regardless of the existing noise environment or type of noise source(s).

3.2.1 Fixed Noise Limits

With regards to fixed noise level limits, TNEI note the use of recent planning conditions (extant and proposed) for the control of operational noise from a number of electrical infrastructure developments in the local area; namely for the Norfolk Vanguard Offshore Wind Farm (Development Consent Order (DCO) Reference: EN010079), Norfolk Boreas Offshore Wind Farm (Development Consent Order (DCO) Reference: EN010087) and for National Grid's proposed Necton Substation Extension (Breckland Council Planning Reference: 3PL/2022/1003/F – application currently undetermined).

The conditions, although similar, are not identical for the respective schemes. The following condition has been issued for the operation of Work No. 8A (Onshore Converter/Substation Buildings) within both the Norfolk Vanguard Offshore Wind Farm Order 2022 and the Norfolk Boreas Offshore Wind Farm Order 2021:

- *The noise rating level for the use of Work No. 8A and during maintenance must not exceed 35 dB $L_{Aeq,\ (5\ minutes)}$ at any time at a free field location immediately adjacent to any noise sensitive location.*
- *The noise rating level for the use of Work No. 8A and during maintenance must not exceed 32 dB $L_{Leq\ (15\ minutes)}$ in the 100 Hz third octave band at any time at a free field location immediately adjacent to any noise sensitive location.*

In a publicly available correspondence document accessed via the council's planning portal, a similar condition was suggested by Environmental Health Officers at Breckland Council for operational noise levels from the National Grid Necton Substation Extension development. It states:

- *The noise rating level (defined as set out in BS4142) from the operation of the substation shall not exceed 35 dB $L_{Aeq\ (5\ minutes)}$ at any time at a free field location immediately adjacent to any noise sensitive location.*
- *Noise from the operation of the substation shall not exceed a limit value of 32dB $L_{Leq\ (15\ minutes)}$ in the 100Hz third octave band, at any time at a free field location immediately adjacent to any noise sensitive location.*

With consideration of the above, it is assumed that the Proposed Development would likely have to adhere to a similar set of fixed limits. However, TNEI would note the following with respect to the above conditions:

- In both instances, the 100 Hz element of the condition states that an $L_{Leq\ (15\text{-}minutes)}$ value of 32 dB must not be exceeded. It should be noted that the weighting indicated by L_L is *Linear* (or un-weighted). The equivalent A-weighted value (L_A) of 32 dB $L_{Leq\ (15\text{-}minutes)}$ is approximately equivalent to 13 dB $L_{Aeq\ (15\text{-}minutes)}$. This is extremely low and highly likely to be inaudible. Class 1 Sound Level Meters, which are typically recommended for use in professional surveys, have a lower measurement threshold limit of around 15 – 20 dBA.

- It is noted that the broadband element of both the Vanguard and Boreas DCO conditions does not specifically prescribe that the Rating Level is determined in accordance with BS 4142, as it does within the Necton Substation Extension condition i.e. *"The noise rating level (defined as set out in BS4142)".* TNEI have assumed that the Rating Level was intended to be defined in accordance with BS 4142 in both instances.

3.2.1 'Context' Based Limits (BS 4142:2014 +A1:2019)

BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' [4] is commonly used to assess the potential impacts of new sound sources on nearby receptors. In June 2019, the standard was amended and reissued as BS 4142:2014 + A1:2019. This assessment, therefore, refers to the newly revised version (hereafter referred to simply as BS 4142). It should be noted that no material changes have been made to the assessment process detailed within the Standard, rather the amendments are simply to provide clarifications to the existing text.

The BS 4142 form of assessment is based on the predicted or measured levels of an assessed sound source compared to the measured background sound levels without the specific sound source present and uses, *"outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident".*

Specifically, the assessment is made by subtracting the measured background sound level from a calculated or measured 'Rating Level'.

BS4142 uses the following definitions:

Ambient Sound: Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, both near and far. Described using the metric, $L_{Aeq\ (t)}$.

Specific Sound Level: Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, *Tr*. Described using the metric $L_{Aeq\ (t)}$. Also referred to in this report as the *Immission Level*.

Residual Sound Level: Equivalent continuous A-weighted sound pressure level of the residual sound without the specific sound source(s) present at the assessment location over a given time interval, *T*. Described using the metric $L_{Aeq\ (t)}$.

Background Sound Level: A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, *T*, measured using time weighting *F* and quoted to the nearest whole number of decibels. Described using the metric $L_{A90\ (t)}$.

Rating Level: The Specific Sound Level adjusted for the characteristics of the sound. The Rating Level is calculated by adding a penalty or penalties (if required) to the Specific Sound Level when the sound source contains audible characteristics such as tonal, impulsive or intermittent components. Described using the metric, $L_{Aeq\ (t)}$.

3.2.1 EPO Consultation

TNEI consulted with an Environmental Protection Officer (EPO) of Breckland Council, Angela Masterson, via email on the 17th of May 2023 to agree on the apporpaite assessment methodology to be used. TNEI proposed the use of BS 4142 but also noted the existing planning conditions, seeking clarification on condition wording (particularly regarding the 100 Hz weighting) and enquiring as to whether the conditioned noise limits would also likely apply to the Proposed Development. On the 15th August 2023, TNEI received a response confirming that if the Proposed Development was consented, it would likely be conditioned with the same fixed noise level limits as

detailed above. The EPO also confirmed that the 100 Hz limit is correctly worded as linear and not A-weighted. Copies of the EPO correspondence is included with Appendix C for reference.

3.3 Assessment Criteria

With due regard to the above, this noise assessment considers the following assessment criteria:

- An assessment of predicted operational Specific Noise Level from the Proposed Development in the 100 Hz frequency band against a fixed noise level limit of 32 dB $L_{Leq\ (15\ minutes)}$;
- An assessment of the operational noise Rating Level in accordance with BS4142:2014 +A1:2019 against both limits set relative to the existing background noise levels and against a fixed noise level limit of 35 dB $L_{Aeq\ (5\ minutes)}$; and,
- An assessment of cumulative operational noise levels against both sets of likely fixed noise limits.

3.4 Calculation Method

3.4.1 Noise Propagation Model (ISO 9613-2:2996)

In order to predict the noise immission levels attributable to the Proposed Development, a noise propagation model was created using the propriety noise modelling software CadnaA. Within the software, complex models can be produced in order to simulate the propagation of noise according to a range of international calculation standards.

For this assessment, noise propagation was calculated in accordance with ISO9613 '*Acoustics – Attenuation of sound during propagation outdoors* [5] using the following input parameters;

- Temperature is assumed to be 10°C and relative humidity as 70%;
- A ground attenuation factor of 1 (soft ground) has been used, with specific areas of developed ground (including the Proposed Development area and adjacent substation) modelled with a ground attenuation factor of 0 (hard ground); and
- Receiver heights are set to 4 m.

3.4.2 Uncertainties and Limitations

The noise propagation model is designed to give a good approximation of the specific sound level and the contribution of each individual sound source; however, it is expected that measured levels are unlikely to be matched exactly with modelled values and the following limitations in the model should be considered:

- In accordance with ISO 9613, all assessment locations are modelled as downwind of all sound sources and propagation calculations are based on a moderate ground-based temperature inversion, such as commonly occurs at night. These conditions are favourable to noise propagation;
- Table 5 of ISO 9613 estimates overall accuracy for broadband noise predictions of ± 3 dB, with average source to receiver heights <5 m, at distances of up to 1,000 m;

- The predicted barrier attenuation provided by local topography, embankments, walls, buildings and other structures in the intervening ground between source and receiver can only be approximated and not all barrier attenuation will have been accounted for;
- The model assumes all sound sources are operating continuously, simultaneously and at maximum noise output; and,
- Modelled sound sources represent candidate plant and a proposed site layout. Final plant specification and layout will be determined during the tendering stage.

4 Baseline Sound Level Monitoring

In order to inform the BS 4142 assessment, an unattended baseline sound level survey was undertaken at four locations between the 30th of May and 8th of June 2023. In addition to the four fixed locations, attended spot measurements were taken at a fifth location. The fixed noise monitoring equipment measured continually for the entire survey period, logging in 15-minute averaging intervals. Table 4-1 details the Noise Monitoring Locations (NMLs), which are also shown on Figure 1 (Appendix F). The NMLs were selected to be representative of the NSRs in the vicinity of the development. Figure 1 indicates which NSRs have been represented by each NML.

Table 4-1: Noise Monitoring Locations

NML	Coordinates		Comments
NML01	588477	310738	Representative of NSRs to the west of the Proposed Development
NML02	588621	309724	Representative of NSRs to the south of the Proposed Development
NML03	589547	309601	Representative of NSRs to the southeast of the Proposed Development
NML04	589733	310856	Representative of NSRs to the northeast of the Proposed Development
NML05 (Spot Measurements)	589718	311288	Undertaken to quantify soundscape at specific NSR and NML04's suitability to represent this location

All measurements were made with the sound level meters (SLM) mounted approximately 1.2 m above the ground and away from nearby reflective surfaces i.e. building façades, fences etc.

Meteorological data was collected with a Kestrel portable weather station and a tipping bucket rain gauge. All noise data obtained during periods in which precipitation events were recorded was removed from the dataset. This was done to reduce the potential influence of increased sound levels from rainfall and increased road traffic noise due to wet roads. The data was also filtered for periods of wind speeds above 5 m/s. Weather was very settled throughout the duration of the survey (no wind data was recorded over 5 m/s and no significant rain events) so no noise data was removed on this basis.

The noise monitoring equipment consisted of five Rion NL-52 SLMs fitted with appropriate environmental wind shields. All noise monitoring equipment (calibrator, SLM and microphones) used for the study are categorised as Class 1, as specified in IEC 61672-1 *'Electroacoustics - Sound level*

meters - Specifications' [6]. The equipment was calibrated onsite at the beginning and end of each measurement period with no significant deviations noted. Appendix D contains the equipment and laboratory calibration details for the SLMs and microphones.

Subjective observations made during the installation and collection of the fixed survey equipment noted the following:

- At NML01, the soundscape during installation and collection of equipment consisted predominantly of road traffic noise (clearly audible) and also birdsong.
- At NML02, the soundscape during installation and collection of equipment consisted of birdsong, wind in foliage, road traffic noise and construction style noise to northeast.
- At NML03, the soundscape during installation and collection of equipment consisted of birdsong, wind in foliage, road traffic noise (faintly audible) and noise from nearby warehouses.
- At NML04, the soundscape during installation and collection of equipment consisted of road traffic noise, birdsong, some wind in foliage and the occasional plane flying overhead from nearby RAF base.
- At NML05, the soundscape during the spot measurements consisted of wind in foliage, birdsong and road traffic noise.

Table 4-2 details the typical background sound levels $L_{A90\ (15\ minutes)}$, which have been determined after considering the distribution of data for each measurement period. Detailed measurement data including statistical analysis charts can be found in Appendix D.

Table 4-2: Representative Background Sound level, dB L_{A90}, Derived Through Statistical Analysis

NML ID	Daytime $L_{A90(15\ minutes)}$	Night-time $L_{A90(15\ minutes)}$
NML01	52	31
NML02	34	26
NML03	33	26
NML04	38	31

4.1 Short-term Measurements

As stated above, in addition to the fixed monitoring locations, additional attended short-term monitoring was undertaken at one location, NML05. Measurements were undertaken in order to ascertain the local noise environment at the nearby NSR (Top Farm) and to determine whether the nearest fixed monitoring location, NML04, was a suitably representative. Spot measurement values are detailed in Table 4-3 and compared to the measurements taken at NML04 during the same time period.

Table 4-3: Comparison of NML05 Spot Measurements to NML04 Measurements

Timestamp	NML04		NML05		Difference between NML04 and NML05	
	$L_{Aeq\ (15\ minutes)}$, dBA	$L_{A90\ (15\ minutes)}$, dBA	$L_{Aeq\ (15\ minutes)}$, dBA	$L_{A90\ (15\ minutes)}$, dBA	L_{Aeq}, dB	L_{A90}, dB
30/05/2023 18:15:00	42	40	49	44	7	4
30/05/2023 18:30:00	43	40	46	42	4	2
30/05/2023 18:45:00	43	40	46	42	3	3
30/05/2023 19:00:00	42	39	47	42	4	3
31/05/2023 09:00:00	47	41	49	44	2	3
31/05/2023 09:15:00	44	39	47	42	3	3
31/05/2023 09:30:00	43	40	47	43	4	3
31/05/2023 09:45:00	48	40	51	45	3	5
08/06/2023 15:00:00	40	38	47	43	7	5
08/06/2023 15:15:00	43	37	47	43	4	6
08/06/2023 15:30:00	40	37	48	43	9	6
08/06/2023 15:45:00	40	37	47	42	7	5

It can be seen from Table 4-3 above that during all spot-measurement periods, the measured background sound levels are higher at NML05 than at NML04. Despite the lack of comparable data during the night-time period, it is assumed that the comparison above demonstrates that the general soundscape at NML05 is louder than at NML04. However, as a conservative approach, the quieter background sound level data measured at NML04 will be used to represent the NSR proximate to NML05 for the purpose of the BS 4142 assessment.

4.2 100 Hz Measurements

As part of the baseline noise survey, it was deemed pertinent to undertake the baseline measurements in 1/3 Octave Bands in order to quantify the existing noise levels in the 100 Hz frequency band at each of the long-term monitoring locations. Quantification of existing levels is particularly important should an additional monitoring exercise be deemed necessary to demonstrate compliance with the limit once the Proposed Development is operational.

The measured 100 Hz noise levels were analysed for periods between 01:00 and 04:00 only to minimise the influence of any atypical or transient noise sources/events that may have been present, such as road traffic. Table 4-4 below shows the logarithmically averaged $L_{Leq\ (15\ minutes)}$ 100 Hz measured values for each analysed period of the survey at all of the long term NMLs.

Table 4-4: Logarithmically averaged $L_{Leq\ (15\ minutes)}$ 100 Hz measured values

Date	NML01 - 100 Hz $L_{Leq\ (15\text{-}minutes)}$, dB	NML02 - 100 Hz $L_{Leq\ (15\text{-}minutes)}$, dB	NML03 - 100 Hz $L_{Leq\ (15\text{-}minutes)}$, dB	NML04 - 100 Hz $L_{Leq\ (15\text{-}minutes)}$, dB
01/06/2023	47.1	29.3	24.8	23.0
02/06/2023	45.8	29.8	26.8	24.1
03/06/2023	47.1	30.4	27.9	26.2
04/06/2023	45.0	28.5	25.9	24.6
05/06/2023	45.5	23.0	22.5	19.7
06/06/2023	45.8	22.3	23.1	21.1
07/06/2023	46.3	25.2	24.1	21.9
08/06/2023	46.9	24.6	25.4	22.1

At NML01, the existing $L_{Leq\ (15\text{-}minutes)}$ measured level in the 100 Hz frequency band was found to already be above the 32 dB limit as stipulated by the EPO for every 01:00-04:00 period across the survey. At all other NMLs, the existing level was found to be below the fixed limit for the same time periods. The measured 1/3 octave band spectral breakdown at each NML is presented in a graph included within Appendix D.

5 Operational Noise Impacts

5.1 Modelling of Individual Sound Sources

The noise model considers all of the sound sources detailed within Section 2.1. The following sections describe how each sound source has been incorporated into the noise model. All items of plant have been modelled as area sources and are assumed to be operating continually and with a constant sound level output.

It should be noted that whilst all predictive noise modelling has been undertaken using data for plant that is typical for a development of this size and class, final plant specification, including the buildings' noise attenuation performance, will be undertaken at a later stage during the tendering process and may differ from that used within the model.

5.1.1 Synchronous Compensator Units

Synchronous compensator units typically consist of a generator and flywheel with additional components such as a lube oil skid, air compressor and pumps. The two Synchronous Compensator units that are proposed will be housed inside separate buildings (termed the 'SC building' and the 'HISC building'). Statkraft have provided TNEI with noise measurement data for a candidate ABB Synchronous Compensator unit, an extract of which is provided within Appendix E. The Octave-Band Sound Pressure Level (SPL) values measured at 1 m from the unit, which equates to 94 dBA, are shown in Table 5-1 below:

Table 5-1: ABB Synchronous Compensator Octave-Band Sound Pressure Level (SPL) at 1 m Data, dBA

Frequency (Hz)									Total, dBA
31.5	63	125	250	500	1000	2000	4000	8000	
-	84	90	82	81	81	80	78	73	94

The SPL data shown above has been used to calculate an internal reverberant Sound Pressure Level (L_i) value for both the SC and HISC buildings. This is done via an RT60 calculation process which takes account both the SPL of the source, the dimensions and volume of the internal space and the material of the building's facades and roof. For the purpose of these calculations, the building material is assumed to be of a standard panelling, such as Kingspan.

To calculate the breakout noise level (i.e the reverberant sound that passes through the building material) a Sound Reduction Index (SRI) value is applied to the calculated reverberant sound pressure level values. Table 5-2 shows the SRI values applied to the facades and roof of the buildings respectively, which have been obtained from Kingspan's Acoustic Performance Guide (an extract of which is included within Appendix E):

Table 5-2: Kingspan SRI Values used within Noise Propagation Model

Building Element	Material used in model	Frequency (Hz)								Rw
		63	125	250	500	1000	2000	4000	8000	
Roof	Kingspan KS1000 RW/80 + no lining	20	18	20	24	20	29	39	47	25
Façades	Kingspan AWP/60 + no lining	15	16	19	23	26	22	39	39	24

The resultant breakout noise levels have been applied as area sources to all facades and the roof of both the SC and HISC buildings within the noise model.

5.1.2 External Cooling Equipment

Both the SC and HISC buildings require cooling which is to be provided in the form of externally located ground mounted cooling fans, approximately 3 m in height. Statkraft have provided TNEI with data for a candidate 16-fan Modine unit (an extract of which is shown in Appendix E). The Sound Power Level (SWL) data provided within the datasheet, which has been used to represent the SC building's fan bank as an area source within the noise model, is shown in Table 5-3 below:

Table 5-3: Modine 16-Fan Cooling Unit Octave-Band Sound Power Level (SWL) Data, dBA

Frequency (Hz)									Total, dBA
31.5	63	125	250	500	1000	2000	4000	8000	
-	78	81	84	87	86	81	76	69	92

Statkraft have informed TNEI that a similar but larger cooling unit (approximately 40-fans) will be required to cool the HISC building. In the absence of the any additional candidate noise data, TNEI have used the original SWL data for the 16-fan unit and scaled it up logarithmically by a factor of 3 (essentially representing a 48-fan unit). This is likely an overestimation of the size of unit required and therefore provides a conservative approach. The resulting SWL data used to represent the HISC building's fan bank, again as an area source within the noise model, is shown in Table 5-4 below:

Table 5-4: Derived 48-Fan Cooling Unit Octave-Band Sound Power Level (SWL) Data, dBA

Frequency (Hz)									Total, dBA
31.5	63	125	250	500	1000	2000	4000	8000	
-	82	86	88	91	91	86	80	74	96

5.1.3 Primary Transformer

The Proposed Development will include two Primary Transformer units located within the HV yard. Statkraft have not been able to provide data for a candidate unit but have indicated that the total SWL level of each unit is likely to equate to 85 dBA. In the absence of any spectral data, TNEI have used the Octave-band SWL data from a candidate ABB transformer data sheet (an extract of which is shown in Appendix E) and have adjusted it until the total equates to 85 dBA, as per the client's instruction. The spectral data used to represent each Primary Transformer unit within the noise model can be found in Table 5-5 below:

Table 5-5: Primary Transformer Octave-Band Sound Power Level (SWL) Data, dBA

	Frequency (Hz)								
SWL, dBA	**25**	**50**	**100**	**200**	**400**	**800**	**1600**	**3150**	**6300**
	-	61	69	71	74	75	69	64	59
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
	-	45	65	73	74	74	67	64	57
	40	**80**	**160**	**315**	**630**	**1250**	**2500**	**5000**	**10000**
	-	52	75	77	76	71	65	62	55

5.1.4 Auxiliary Transformers

There are two Auxiliary Transformer units detailed as part of the Proposed Development; the SC Building Auxiliary Transformer and the HISC Building Auxiliary Transformer. As with the Primary Transformer units, Statkraft were unable to provide candidate data for these units but have indicated that the likely total SWL would be 70 dBA and 75 dBA for the SC Building Auxiliary Transformer and the HISC Building Auxiliary Transformer respectively. The same approach used for the Primary Transformers of adjusting the ABB spectral data to equate to the total SWL values has been adopted for both Auxiliary Transformers, and the resulting levels used within the noise model are shown in Table 5-6 and Table 5-7.

Table 5-6: HISC Building Auxiliary Transformer Octave-Band Sound Power Level (SWL) Data, dBA

	Frequency (Hz)								
SWL, dBA	**25**	**50**	**100**	**200**	**400**	**800**	**1600**	**3150**	**6300**
	-	51	59	61	64	65	59	54	49
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
	-	35	55	63	64	64	57	54	47
	40	**80**	**160**	**315**	**630**	**1250**	**2500**	**5000**	**10000**
	-	42	65	67	66	61	55	52	45

Table 5-7: SC Building Auxiliary Transformer Octave-Band Sound Power Level (SWL) Data, dBA

Frequency (Hz)									
SWL, dBA	25	50	100	200	400	800	1600	3150	6300
	-	46	54	56	59	60	54	49	44
	31.5	63	125	250	500	1000	2000	4000	8000
	-	30	50	58	59	59	52	49	42
	40	80	160	315	630	1250	2500	5000	10000
	-	37	60	62	61	56	50	47	40

5.2 Additional Mitigation Measures

Acoustic barriers have been included in the design to reduce noise immission levels at the nearest NSRs. The barriers have been modelled at a height of 4 m and would be positioned around both the SC and HISC coolers, as shown in Figure 2 of Appendix F. The barrier does not need to have any specific noise absorption coefficient value but does need to be of a minimum mass of 10 kg/m^2. The barrier should have no air gaps and be sufficiently robust so as not to develop any air gaps (holes) during the lifetime of the development. The inclusion of these mitigation measures responds to the national planning policy contained in NPPF paragraphs 174 and 185 in relation to mitigation and reduction to a minimum of potential adverse noise impacts.

5.3 Calculated Immission Levels

Noise immission levels have been calculated at seven Noise Assessment Locations (NALs), which have been selected to represent the closest NSRs to the Proposed Development site. The NALs are detailed in Table 5-8 and shown on Figure 2 in Appendix F.

Table 5-8: Noise Assessment Locations

Noise Assessment Location				
NAL ID	NAL Descriptor	Eastings	Northings	Representative NML
NAL01	The Grove	588475	310806	NML01
NAL02	Redgates	588764	311008	NML01
NAL03	Top Farm	589689	311251	NML04
NAL04	Lodge Farm	590024	310164	NML04
NAL05	Ivy Todd	589611	309650	NML03

Noise Assessment Location				
NAL ID	**NAL Descriptor**	**Eastings**	**Northings**	**Representative NML**
NAL06	St Andrews Lane	588532	309930	NML02
NAL07	Shell Field Farm	588029	310289	NML01

The immission levels (Specific Sound Level) are calculated assuming all plant is operating continuously and concurrently at maximum operating capacities. Both the broadband and 100 Hz immission levels are detailed in Table 5-9 as dB $L_{Aeq(t)}$. No time period is specified as the model assumes, as a worst case, that noise levels do not fluctuate and remain the same for both daytime and night-time periods. A noise contour plot is provided as Figure 2 in Appendix F.

Table 5-9: Predicted Immission Levels, dB $L_{Aeq(t)}$

Noise Assessment Location		Immission Level	
NAL ID	**NAL Descriptor**	**Broadband, dB $L_{Aeq(t)}$**	**100 Hz, dB $L_{Leq(t)}$**
NAL01	The Grove	26	30
NAL02	Redgates	25	30
NAL03	Top Farm	19	24
NAL04	Lodge Farm	23	25
NAL05	Ivy Todd	18	24
NAL06	St Andrews Lane	22	28
NAL07	Shell Field Farm	19	23

6 Noise Impact Assessment

6.1 100 Hz Noise Limit Assessment

As detailed in Section 3.3, an assessment is undertaken against the fixed 100 Hz noise level limit of 32 dB $L_{Leq\ (15\ minutes)}$. As can be seen in Table 5-9 above, the predicted immission levels from the Proposed Development in the 100 Hz frequency band are below the adopted target noise level limit at all NALs.

Accordingly, the Proposed Development is expected to be compliant with this adopted noise limit.

6.2 BS4142:2014 +A1:2019 Assessment

The qualitative assessment, which is undertaken following the guidance presented in BS 4142, considers the predicted immission levels, the character of the sound, the existing sound environment and the context of the development.

In order to assess the immission levels in accordance with BS 4142, the Specific Sound Level must be converted into a Rating Level. The Rating Level allows for character corrections to be added to account for particular characteristics of the sound that may be perceived as more annoying. In particular the Rating Level considers tonality, impulsivity and intermittency of the sound, as well other sound characteristics that are neither tonal, impulsive, or intermittent, but are otherwise readily distinctive against the residual acoustic environment.

6.2.1 Tonality

With regards to tonality, BS4142:2014 states:

"For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible."

Electrical plant such as power transformers are inherently tonal at source, typically in the 100 Hz frequency band. BS 4142 corrections, however, are only applied if the noise characteristics are present at the receptor location, not at the source location. Consideration of the predicted one third octave levels at the closest receptors indicate that tonality will not be noticeable from any plant and at most locations the 100 Hz component, as demonstrated in Table 5-9, is likely to be imperceptible. As such, no tonal character correction has been applied.

6.2.2 Impulsivity

With regards to impulsivity, BS4142:2014 states:

"A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible."

Impulsivity is not considered to be a relevant sound characteristic of synchronous compensators and their associated plant when operational. Once operational, the noise is likely to be predictable and consistent.

6.2.3 Intermittency

With regards to intermittency, BS4142:2014 states:

If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

As with impulsivity, intermittency is not considered to be a relevant sound characteristic in this case. Once operational, the development will be operational for extended durations. This is not considered to be a demonstration of intermittency. Once operational, the noise is likely to be predictable and consistent.

6.2.4 Other Sound Characteristics

With regards to other sound characteristics, BS4142:2014(+A1-2019) states:

"Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

No other noise characteristics that would be '*readily distinctive against the residual acoustic environment'* are anticipated, especially when considering the measured ambient sound levels.

6.2.5 Calculation of the Rating Level

With due regard to the above, no character corrections are required. Therefore, the Rating Level is equal to the Specific Sound Level.

6.2.6 Assessment of the Impacts

BS4142, Section 11, requires that the assessment considers the context in which the sound occurs, and as such there is no definitive pass/fail element to the standard. However, as a starting point the standard states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following…

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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 or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

Table 6-1 presents a comparison of the Rating Levels against the fixed 35 dBA adopted limit, with Table 6-2 showing the comparison of the Rating Levels against the daytime and night-time measured background sound levels.

Table 6-1: Margin Above / Below (+/-) Fixed Noise Level Limit, dB

Noise Assessment Location		Daytime and Night-time		
NAL ID	NAL Descriptor	Fixed Noise Level Limit, dBA	Rating Level, dBA	Margin, dB
NAL01	The Grove	35	26	-9
NAL02	Redgates	35	25	-10
NAL03	Top Farm	35	19	-16
NAL04	Lodge Farm	35	23	-12
NAL05	Ivy Todd	35	18	-17
NAL06	St Andrews Lane	35	22	-13
NAL07	Shell Field Farm	35	19	-16

Table 6-2: Margin Above / Below (+/-) Background Sound Level, dB

Noise Assessment Location		Daytime			Night-time		
NAL ID	NAL Descriptor	Representative Background Sound Level, dBA	Rating Level, dBA	Margin, dB	Representative Background Sound Level, dBA	Rating Level, dBA	Margin, dB
NAL01	The Grove	52	26	-26	31	26	-5
NAL02	Redgates	52	25	-27	31	25	-6
NAL03	Top Farm	38	19	-19	31	19	-12
NAL04	Lodge Farm	38	23	-15	31	23	-8
NAL05	Ivy Todd	33	18	-15	26	18	-8

Noise Assessment Location		Daytime			Night-time		
NAL ID	NAL Descriptor	Representative Background Sound Level, dBA	Rating Level, dBA	Margin, dB	Representative Background Sound Level, dBA	Rating Level, dBA	Margin, dB
NAL06	St Andrews Lane	34	22	-12	26	22	-4
NAL07	Shell Field Farm	52	19	-33	31	19	-12

At all locations and for both daytime and night-time the Rating Level is comfortably below both the fixed noise level limit and the background sound level, the latter of which is *'an indication of the specific sound source having a low impact, depending on the context.'* The context in which this assessment is made is as follows;

- The assessment has modelled all sound sources operating continuously, simultaneously and at maximum noise output;
- The assessment considers candidate plant and the maximum sound level output for this type of plant. It also considers typical noise attenuation measures for some elements, such as the synchronous compensator building materials, but does not consider further noise control measures that may be put into place as part of final design;
- Noise levels from the Site will be consistent and predictable i.e. little variation in noise level output will occur;
- Subjective observations on site noted that noise from the nearby operational substation was not audible in the vicinity of the NSRs; and
- Noise immission levels are expected to be below the fixed noise level limits that are likely to be applicable to the Proposed Development, as stipulated by Breckland Council.

Consideration of the context does not change the assessment outcome. Accordingly, the BS 4142 assessment concludes that the Proposed Development is expected to have a low impact in terms of noise.

7 Cumulative Impacts

7.1 Norfolk Vanguard and Boreas Offshore Wind Farm Developments

The Noise & Vibration chapters of the respective Environmental Statements for both the Norfolk Boreas[1] and Vanguard[2] Offshore Wind Farms consider the operational noise impacts of the onshore element of each development. The Noise & Vibration Chapter for the latter presents a cumulative assessment of the predicted operational noise immissions, including required mitigations measures, from both the Vanguard and Boreas developments against both the fixed Broadband and 100 Hz noise limits that have also been adopted for this NIA. The results of this cumulative assessment are shown on Page 88 and 89 in Table 25.43 (a copy of which has been included within Appendix G of this NIA) of the Norfolk Vanguard Offshore Wind Farm Noise & Vibration chapter.

7.2 Necton Substation Extension Development

A noise impact assessment was not submitted as part of National Grid's Necton Substation Extension application. However, a letter (a copy of which is included within Appendix G of this NIA) was submitted by National Grid explaining that *"operational noise has not been considered a concern"* and that the development will be *"compliant with agreed noise levels secured through DCO Requirement 27[3]"*. The letter goes on to state that both stakeholders and Breckland Council agreed that the operational limits were appropriate. Given no predicted noise immission levels have been provided, the substation extension development's specific cumulative contribution cannot be quantified within this NIA. In the absence of any further information, it is assumed that the substation extension development will give appropriate consideration to any potential cumulative effects that may arise from the operation of the development with due regard to both the operational noise limits and the surrounding developments for which the same limits apply.

7.3 Cumulative Assessment

With regard to the above, a cumulative assessment has been undertaken against both the fixed Broadband noise level limit of 35 dB $L_{Aeq\ (5\ minutes)}$ and the fixed 100 Hz specific limit of 32 dB $L_{Leq\ (15\ minutes)}$. Table 7-1 below shows the results of cumulative assessment, in which the Proposed Development's predicted noise immissions have been logarithmically added together with the worst-case (of the Ground Floor and First Floor) predicted noise immissions for the combined operation of the Vanguard and Boreas developments. Cumulative levels are presented at NALs which are common to all three assessments only, as determined with reference to Plate 25.3 (a copy of which is shown in Appendix G) of Appendix 25.3 – *Norfolk Vanguard Offshore Wind Farm – Operational Phase Assessment.*

[1] Link to the Norfolk Boreas Offshore Wind Farm Noise & Vibration ES Chapter: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000411-6.1.25%20Environmental%20Statement%20Chapter%2025%20Noise%20and%20Vibration.pdf

[2] Link to the Norfolk Vanguard Offshore Wind Farm Noise & Vibration ES Chapter: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-001513-Chapter%2025%20Noise%20and%20Vibration%20Norfolk%20Vanguard%20ES.pdf

[3] Reference to the Vanguard and Boreas work order requirement which defines the Broadband and 100 Hz fixed noise level limits.

Table 7-1: Cumulative Noise Impact Assessment Results

Noise Assessment Location		TNEI Predicted Immission Level		Worst-Case Vanguard and Boreas Cumulative Predicted Immission Level		Cumulative Immission Level		Margin between Cumulative Immission Level and Fixed Noise Limits, dB	
TNEI NAL ID	Equivalent Vanguard and Boreas Chapter NAL ID	Broadband, dB $L_{Aeq(t)}$	100 Hz, dB $L_{Leq(t)}$	Broadband, dB $L_{Aeq(t)}$	100 Hz, dB $L_{Leq(t)}$	Broadband, dB $L_{Aeq(t)}$	100 Hz, dB $L_{Leq(t)}$	Broadband, dB	100 Hz, dB
NAL01	SSR11	25.9	30.3	31.3	27.7	32.4	32.2	-2.6	0.2 †
NAL02	SSR5	24.7	29.5	29.9	27	31.0	31.4	-4.0	-0.6
NAL03	SSR7	18.8	24.1	39.4	31.3	39.4	32.1	4.4	0.1 †
NAL04	*N/A	23.3	24.7	-	-	23.3	24.7	-11.7	-7.3
NAL05	SSR2	17.8	23.5	28.4	31.5	28.8	32.1	-6.2	0.1 †
NAL06	SSR1	22.4	27.7	33.8	25.2	34.1	29.6	-0.9	-2.4
NAL07	*N/A	19.3	23.4	-	-	20.0	25.0	-15.0	-7.0

*Noise Immission Levels were not predicted at these locations within the Vanguard and Boreas Noise and Vibration Chapters, and therefore the cumulative immission level is equivalent to the TNEI predicted noise immission level only.

†Due to their marginal nature, these exceedances are considered negligible.

As can be seen above, cumulative operational noise immission levels remain below or equal to both fixed noise level limits at all NALs, with the exception of NAL03 when assessing against the Broadband limit of 35 dB $L_{Aeq\ (5\ minutes)}$. However, it should be noted that at this location, predicted noise levels from the Proposed Development are more than 10 dB below those of the combined operation of the Vanguard and Boreas developments, such that when they are logarithmically added together, the contribution of the Proposed Development to the overall cumulative level is negligible. In summary, the predicted cumulative noise level from the Vanguard and Boreas developments is already exceeding the fixed Broadband limit at this NAL, whilst the immissions from the Proposed Development are both compliant with the limit when assessed on an individual basis and do not contribute to any further cumulative exceedance at this location.

8 Summary

In order to predict the noise immission levels of the Proposed Development, TNEI has produced a noise propagation model in accordance with ISO 9613 based on candidate plant typical for this type of development. The model does not require the use of specific mitigation measures, such as the use of barriers or low noise equipment enclosures. The noise model assumes that all plant will be operational at full capacity continuously and concurrently, however, this is unlikely to occur for the majority of the Proposed Development's operation. Accordingly, the noise assessment is inherently conservative.

Assessments considering the nearest residential NSRs have been carried out as follows;

- A quantitative assessment was undertaken in which the operational Specific Sound Levels of the Proposed Development was found to not exceed the fixed noise level limit of 32 dB $L_{Leq\ (15\ minutes)}$ in the 100 Hz frequency band[4] (as used by Breckland Council) at all receptors.
- A quantitative assessment was undertaken in which the BS 4142 Rating Levels of operational noise from the Proposed Development was found to not exceed the fixed broadband noise level limit of 35 dB $L_{Aeq\ (5\ minutes)}$ (again as introduced by Breckland Council) at all receptors.
- A qualitative assessment was undertaken in accordance with BS 4142, which concluded that during both the daytime and night-time, the Rating Levels from the Proposed Development would be below the representative background noise level at all receptors. In accordance with BS 4142, this is *"an indication of the specific sound source(s) having a low impact, depending on the context."*
- A cumulative assessment (which considered the onshore operational noise immissions from both the Norfolk Vanguard Offshore Wind Farm and the Norfolk Boreas Offshore Wind Farm developments) was undertaken against both the broadband and 100 Hz noise limits. Negligibly small exceedances of the 100 Hz noise limit were found at a number of receptors, whilst an exceedance of the broadband limit was identified at a single Noise Assessment Location (NAL03). However, the exceedance at this location is entirely attributable to the combined immission level of the Vanguard and Boreas developments, as the immission level from the Proposed Development was found to be negligible at this location.

Accordingly, the NIA concludes that the Proposed Development will not have an adverse noise impact on the local area.

[4] It is TNEI's professional opinion that the fixed 100 Hz noise level limit of 32 dB $L_{Leq\ (15\ minutes)}$ is unduly low, especially when compared against the existing ambient noise levels presented in Table 4-4. It is TNEI's recommendation that the 100 Hz limit is revised by Breckland Council and TNEI are happy to provide advice on the selection of a more appropriate limit and drafting of a planning condition that will maintain appropriate levels of protection for all nearby residential receptors.

9 References

1. **Department for Communities and Local Government.** *National Planning Policy Framework.* UK : The Crown, 2021.

2. **Department for Environment, Food and Rural Affairs.** *Noise Policy Statement for England.* London : The Crown, 2010.

3. **Breckland Council.** *Breckland Council Local Development Plan.* 2019.

4. **British Standards Institute.** *Methods for Rating and Assessing Industrial and Commercial Sound.* UK : BSI, 2014. BS4142:2014 + A1:2019.

5. **(ISO), International Organization for Standardization.** *Acoustics – Attenuation of Sound During Propagation Outdoors: Part 2 – General Method of Calculation.* Geneva : (ISO), International Organization for Standardization, 1996. ISO 9613-2:1996.

6. **Commission Electrotechnique Internationale (IEC).** *Electroacoustics - Sound level meters - Part 1: Specifications.* Geneva : IEC, 2013. IEC 61672-1:2013.

Appendix A – Glossary of Terms

Attenuation: the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.

Background Sound Level: the sound level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or night-time periods. The LA90 indices (see below) are typically used to represent the background sound level.

Broadband Noise: noise with components over a wide range of frequencies.

Decibel (dB): the ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. A logarithmic scale is used in sound level measurements because of this wide range. The scale used is the decibel (dB) scale which extends from 0 to 140 decibels (dB) corresponding to the intensity of the sound level.

dB(A): the ear has the ability to recognise a particular sound depending on its pitch or frequency. Microphones cannot differentiate sound in the same way as the ear, and to counter this weakness the sound measuring instrument applies a correction to correspond more closely to the frequency response of the human ear. The correction factor is called 'A Weighting' and the resulting measurements are written as dB(A). The dB(A) weighting is internationally accepted and has been found to correspond well with people's subjective reaction to sound levels and noise. Some typical subjective changes in sound levels are:

- a change of 3dB(A) is just perceptible;
- a change of 5dB(A) is clearly perceptible; and
- a change of 10dB(A) is twice (or half) as loud.

Directivity: the property of a sound source that causes more sound to be radiated in one direction than another.

Emission: the sound energy emitted by a sound source (e.g. a wind turbine).

Frequency: the pitch of a sound in Hz or kHz. See Hertz.

Ground Effects: the modification of sound at a receiver location due to the interaction of the sound waves with the ground along its propagation path from source to receiver. Described using the term 'G', and ranges between 0 (hard ground), 0.5 (mixed ground) and 1 (soft ground).

Hertz (Hz): sound frequency refers to how quickly the air vibrates, or how close the sound waves are to each other (in cycles per second, or Hertz (Hz)).

Immission: the sound pressure level detected at a given location (e.g. the nearest dwelling).

Isopleth: a line on a map connecting points of equal value, for example air pressure, noise level etc.

Noise: unwanted sound.

Lw: is the sound power level. It is a measure of the total sound energy radiated by a sound source and is used to calculate sound levels at a distant location. The *LWA* is the A-weighted sound power level.

Leq: is the equivalent continuous sound level, and is the sound level of a steady sound with the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient noise encompassing all noise at a given time. The LAeq, T is the A-weighted equivalent continuous sound level over a given time period (T).

L90: index represents the sound level exceeded for 90 percent of the measurement period and is used to indicate quieter times during the measurement period. It is often used to measure the background sound level. The LA90,10min is the A-weighted background sound level over a ten-minute measurement sample.

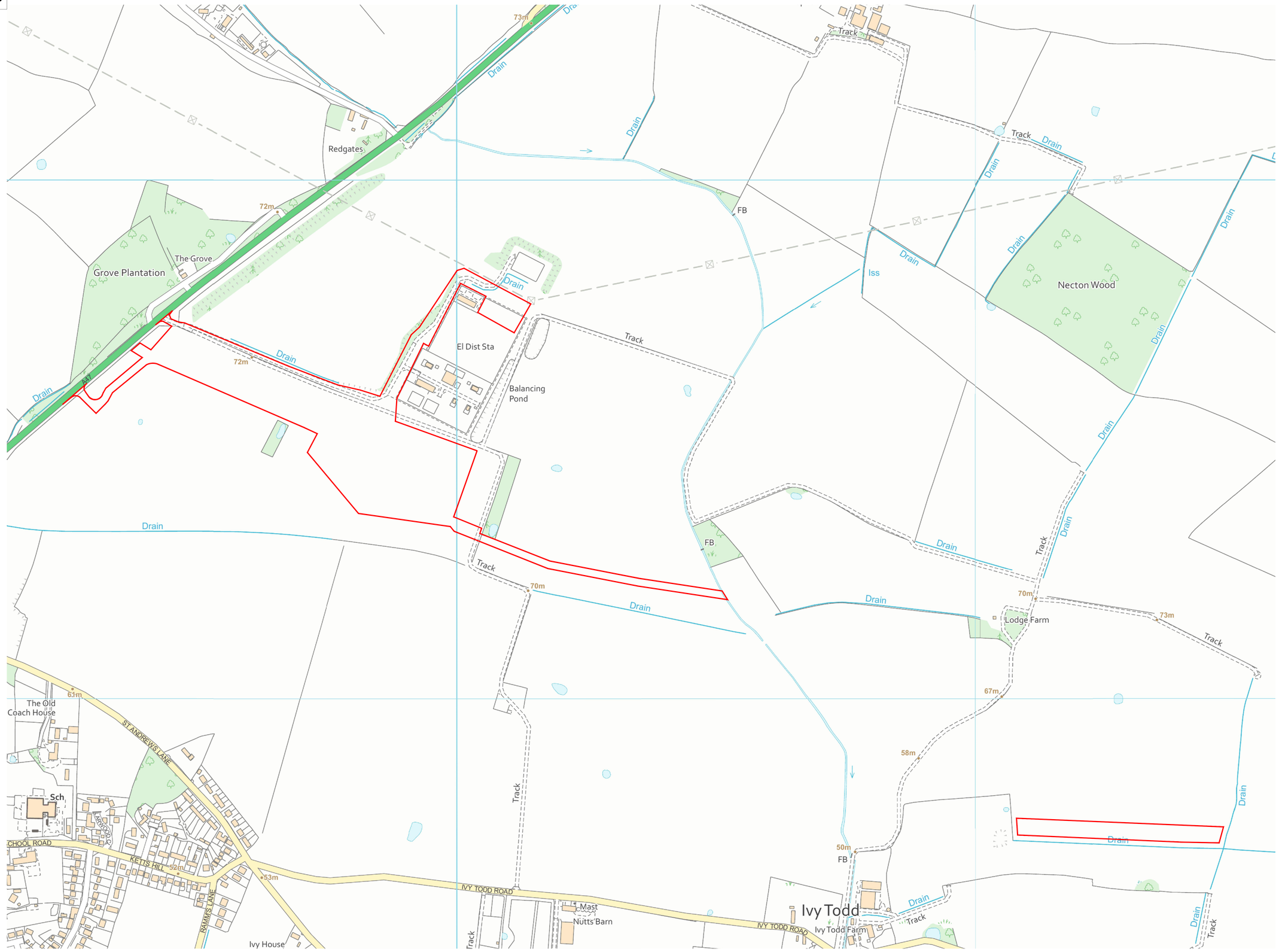
Sound Level Meter: an instrument for measuring sound pressure level.

Sound Pressure Level: a measure of the sound pressure at a point, in decibels.

Tonal Noise: noise which covers a very restricted range of frequencies (e.g. a range of ≤20 Hz). This noise is subjectively more annoying than broadband noise.

Appendix B – Proposed Site Layout

A0



1 NECTON SITE LOCATION PLAN

Scale: 1:2500@A0

0 50 100 150 200 250m
SCALE 1:2500

Revisions:

Revision	Date	Revision Notes	Drawn	Inspected
01	02.05.23	First Issue	GF	JM
02	24.05.23	Red Line Boundary Amended	MC	JM
03	06.06.23	Red Line Boundary Amended - BNG Area Added	GF	JM
04	03.07.23	RLB Amended and Addition of BLB	MC	JM
05	05.07.23	Revised	CS	JM

LEGEND:

PLANNING APPLICATION BOUNDARY

N

Project:

Necton Greener Grid Park

Client:

Statkraft UK Ltd.
10th Floor, 22 Bishopsgate
London, EC2N 4BQ
Tel: +44 (0) 20 7549 1000

Drawn by:

CADmando Design & Draughting Solutions Ltd
The Long Barn, The Courtyard, Severn Drive, Tewkesbury
Business Park, GL20 8GD
Tel: +44 (0) 1684 850019
Mob: +44 (0) 7514430910

Status:

PLANNING

Drawing Title:

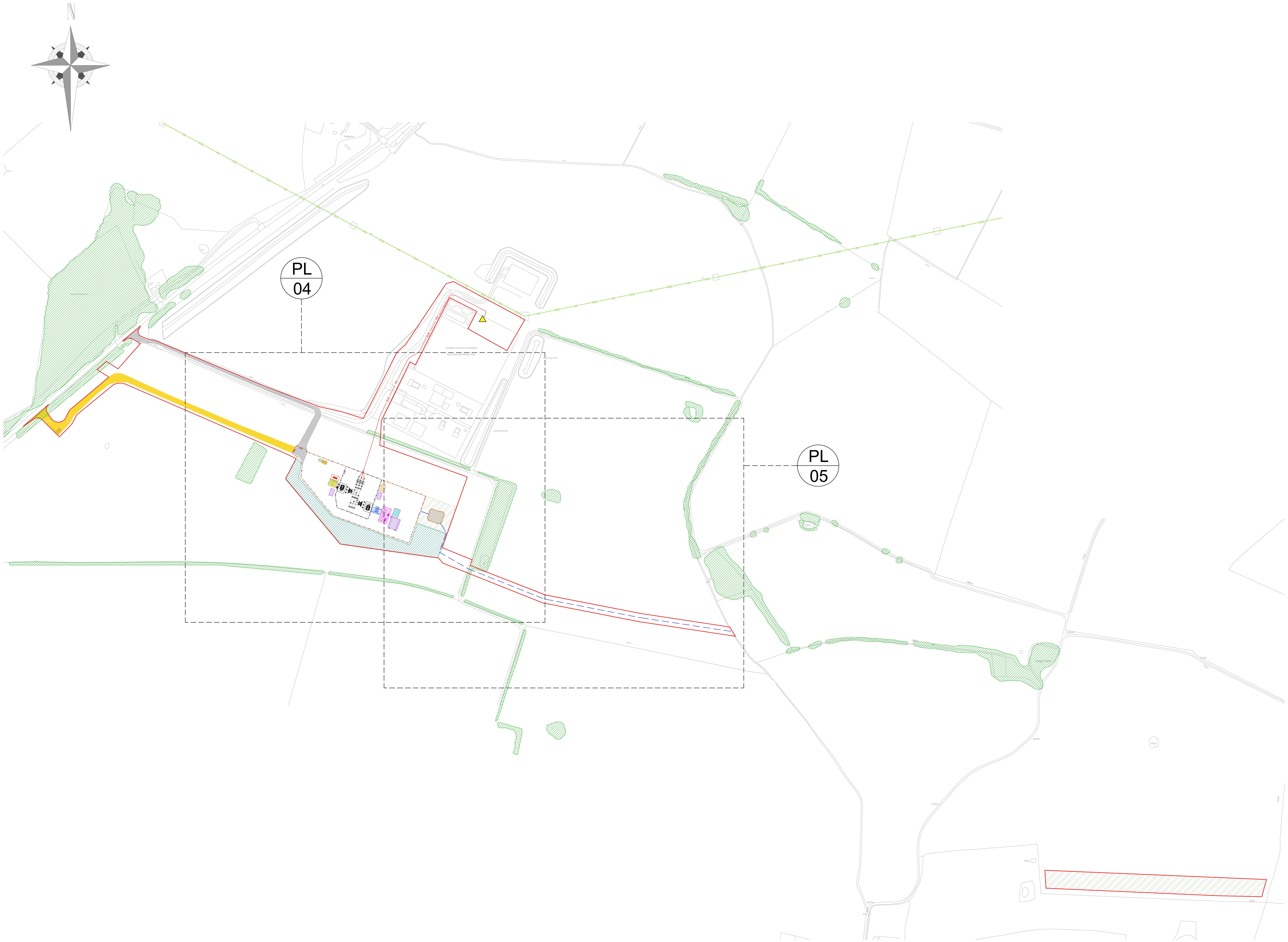
Necton Site Location Plan

Drawn:	Checked:	First Issued:
GF	JM	02.05.2023

Project Code: **STA002-** Drawing Number: **SP-01**

Sheet Size:	Scale:	Revision:
A0	1:2500	05

A0



1 NECTON SITE LAYOUT PLAN

 Scale: 1:2500@A0

0 50 100 150 200 250m
SCALE 1:2500

Scaled dimensions must not be taken from this drawing. All dimensions are to be confirmed on site prior to commencement of work

Revisions:

Revision	Date	Revision Notes	Drawn	Inspected
01	02.05.23	First Issue	GF	JM
02	24.05.23	Amendments to Site Layout	MC	JM
03	06.06.23	BNG Added	GF	JM
04	03.07.23	Revised	MC	JM
05	05.07.23	POC and SUDs Basin Amended	CS	JM

LEGEND:

- PLANNING APPLICATION BOUNDARY
- TEMPORARY CONSTRUCTION ACCESS
- PERMANENT SITE ACCESS OPTION
- ELE — HV — ELE — EXISTING O/H ELEC CABLE
- WELDMESH FENCE 3.4m High
- PALISADE FENCE 3.4m High
- ELE — HV — ELE — PROPOSED CABLE ROUTE (INDICATIVE)

SITE INFRASTRUCTURE:

- SECURITY GATE (3.4m High)
- CCTV & LIGHT COLUMN 6m High
- AUX TX 3m (W) x 2m (L) x 3.6m (H)
- COOLER WITH NOISE ATTENUATING WALL 4m (H) 8.2m (W) x 2.8m (L) x 2.5m (H)
- COMMS HOUSE 7m (W) x 13m (L) x 3.5m (H)
- OFFICES 3.1m (W) x 9.8m (L) x 3.5m (H)
- STORES 2.4m (W) x 6.1m (L) x 2.60m (H)
- EMERGENCY GENERATOR 3.5m (W) x 12.95m (L) x 3.5m (H)
- SC BUILDING 15m (W) x 12.5m (L) x 7m (H)
- COOLERS 2 WITH NOISE ATTENUATING WALL 4m (H) 9.7m (W) x 12.9m (L) x 2.63m (H)
- HISC BUILDING 18m (W) x 28m (L) x 11m (H)
- CONTROL CONTAINERS 16m (W) x 21m (L) x 5.2m (H)
- HV YARD (42.2m (W) x 78.60m (L) x 11.87m (H)
- CIRCUIT BREAKER & AUXILIARY TRANSFORMER 12.5m (W) x 18.4m (L) x 10m (H)

VEGETATION:

- PROPOSED VEGETATION
- EXISTING VEGETATION
- BIODIVERSITY NET GAIN
- SUDs BASIN
- DRAINAGE PIPELINE CORRIDOR (INDICATIVE)

Project:

Necton Greener Grid Park

Client:

Statkraft

Statkraft UK Ltd.
19th Floor, 22 Bishopsgate
London, EC2N 4BQ
Tel: +44 (0) 20 7549 1000

Drawn by:

CADmando
2D, 3D CAD & BIM SERVICES

CADmando Design & Draughting Solutions Ltd
The Long Barn, The Courtyard, Severn Drive, Tewkesbury Business Park, GL20 8GD
Tel: +44 (0) 1684 850019
Mob: +44 (0) 7814436910

Status:

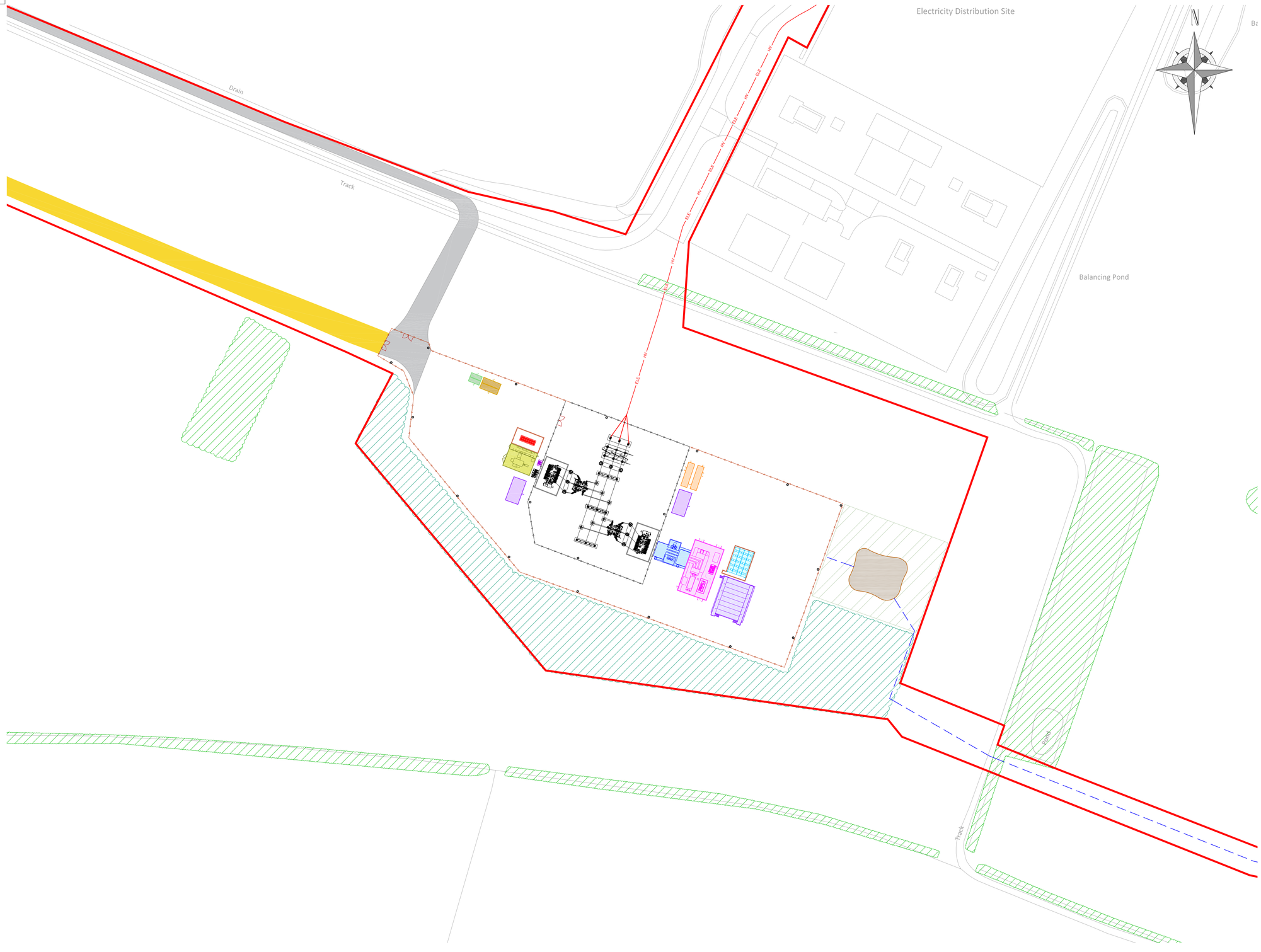
PLANNING

Drawing Title:

Site Layout Plan

Drawn: GF	Checked: JM	First Issued: 02.05.2023
Project Code: STA002-	Drawing Number: PL-03	
Sheet Size: A0	Scale: 1:2500	Revision: 05

A1



Revisions:

Revision	Date	Revision Notes	Drawn	Inspected
01	02.05.23	First Issue	GF	JM
02	24.05.23	Amendments to Layout	MC	JM
03	06.06.23	Revised	GF	JM
04	03.07.23	Revised	MC	JM
05	05.07.23	Amendments to Red Line Boundary POC and SUDs Basin Amended	CS	JM

LEGEND:

- PLANNING APPLICATION BOUNDARY
- TEMPORARY CONSTRUCTION ACCESS
- PERMANENT SITE ACCESS OPTION
- EXISTING O/H ELEC CABLE (ELE — HV — ELE)
- WELDMESH FENCE 3.4m High
- PALISADE FENCE 3.4m High
- PROPOSED CABLE ROUTE (INDICATIVE) (ELE — HV — ELE)

SITE INFRASTRUCTURE:

- SECURITY GATE (3.4m High)
- CCTV & LIGHT COLUMN 6m High
- AUX TX 3m (W) x 2m (L) x 3.6m (H)
- COOLER WITH NOISE ATTENUATING WALL 4m (H) 8.2m (W) x 2.8m (L) x 2.2m (H)
- COMMS HOUSE 7m (W) x 13m (L) x 3.5m (H)
- OFFICES 3.1m (W) x 9.8m (L) x 3.5m (H)
- STORES 2.4m (W) x 6.1m (L) x 2.60m (H)
- EMERGENCY GENERATOR 3.5m (W) x 12.35m (L) x 3.5m (H)
- SC BUILDING 15m (W) x 12.5m (L) x 7m (H)
- COOLERS 2 WITH NOISE ATTENUATING WALL 4m (H) 9.7m (W) x 12.0m (L) x 2.83m (H)
- HISC BUILDING 18m (W) x 28m (L) x 11m (H)
- CONTROL CONTAINERS 16m (W) x 21m (L) x 5.2m (H)
- HV YARD (42.2m (W) x 78.60m (L) x 11.87m (H)
- CIRCUIT BREAKER & AUXILIARY TRANSFORMER 12.5m (W) x 18.4m (L) x 10m (H)

VEGETATION:

- PROPOSED VEGETATION
- EXISTING VEGETATION
- BIODIVERSITY NET GAIN
- SUDs BASIN
- DRAINAGE PIPELINE CORRIDOR (INDICATIVE)

Project:

Necton Greener Grid Park

Client:

Statkraft

Statkraft UK Ltd.
19th Floor, 22 Bishopsgate
London, EC2N 4BQ
Tel: +44 (0) 20 7549 1000

Drawn by:

CADmando
2D , 3D CAD & BIM SERVICES

CADmando Design & Draughting Solutions Ltd
The Long Barn, The Courtyard, Severn Drive, Tewkesbury Business Park, GL20 8GD
Tel: +44 (0) 1684 850019
Mob: +44 (0) 7814436910

Status:

PLANNING

Drawing Title:

Site Layout Plan (Detail)

Drawn:	Checked:	First Issued:
GF	JM	02.05.2023

Project Code:	Drawing Number:
STA002-	**PL-04**

Sheet Size:	Scale:	Revision:
A1	**1:1000**	**05**

1

NECTON SITE LAYOUT PLAN (DETAIL)

Scale: 1:1000@A1

0 10 20 30 40 50 60 70 80 90 100m

SCALE 1:1000

Appendix C – EPO Consultation

Ewan Watson

From: Masterson, Angela <Angela.Masterson@breckland.gov.uk>
Sent: 23 May 2023 09:42
To: Ewan Watson
Subject: RE: Necton Greener Grid Park (GGP) - Noise Impact Assessment

Morning Ewan

I have been advised by the Director of Planning Simon Wood that Statkraft have agreed to enter into a PPA (Planning Performance Agreement) with Breckland. With this in mind I would prefer to wait until this has been agreed before I enter into any discussions.
While it is likely that the planning applications and the DCO for proposed Vattenfall development and the associated National Grid substation upgrade will have some bearing on this new application without reviewing all the relevant documentation I am not currently in a position to discuss the matter.

Apologies for not replying to your email of last week

Kind Regards

Angela

Angela Masterson

Environmental Protection Officer
Breckland Council

T: 01842 765892
M: 07979 505619

Elizabeth House, Walpole Loke, Dereham, Norfolk, NR19 1EE

From: Ewan Watson <ewan.watson@tneigroup.com>
Sent: Tuesday, May 23, 2023 9:33 AM
To: Masterson, Angela <Angela.Masterson@breckland.gov.uk>
Cc: Jim Singleton <jim.singleton@tneigroup.com>
Subject: RE: Necton Greener Grid Park (GGP) - Noise Impact Assessment

Hi Angela,

Would you be available for a call regarding the below at some point today? Please let me know.

Kind regards,

Ewan Watson
Senior Consultant

Manchester | Newcastle | Glasgow | Cape Town | Dublin

Tel: +44(0)141 4283182

From: Ewan Watson
Sent: Wednesday, May 17, 2023 11:26 AM
To: Angela.masterson@breckland.gov.uk
Cc: Jim Singleton <jim.singleton@tneigroup.com>
Subject: Necton Greener Grid Park (GGP) - Noise Impact Assessment

Good afternoon Angela,

I hope you are well.

I have been given your contact details by our client, Statkraft. TNEI are a specialist energy consultancy and are currently in the process of undertaking a noise assessment in support of a planning application for the proposed Necton GGP development to be located adjacent to the existing Necton Onshore Substation, in Necton, Swaffham, PE37 8EG. The development will introduce new sound sources to the area, primarily in the form of electrical infrastructure such as transformers, cooling equipment such as fans and also break-out noise from buildings used to house synchronous condenser equipment (which is used to provide inertia and maintain system voltage on the grid).

For these types of developments, we would typically undertake a noise assessment in accordance with British Standard 4142, where an operational "noise rating level" for the proposed development is calculated and then compared against the existing background sound levels measured at (or near to) the nearest noise sensitive receptors. An assessment of this kind would typically look to achieve a rating level of no higher than 5 dB above the existing background sound level, as per BS 4142's definition of "likely adverse impact".

From reviewing the planning conditions for the proposed Vattenfall DCO and National Grid substation upgrade applications adjacent to the Necton Onshore Substation, we note that rather than a BS 4142 related condition, fixed operational noise level limits of 35 dB $L_{Aeq\ (5\ minutes)}$ and 32 dB $L_{Leq\ (15\ minutes)}$ in the 100 Hz frequency band specifically (which is stated as a Linear (L_{Leq}) limit as opposed to A-weighted (L_{Aeq})) have been issued.

In order to progress our assessment, would it be possible to indicate to us whether you would also require the proposed Necton GGP development to be assessed in accordance with these same fixed limits shown above or would you consider a BS 4142 assessment an appropriate approach? If the former, please can you confirm that the 100 Hz limit is in fact Linear and not A-weighted?

This is a matter of urgency for our client, so if you could endeavour to respond to this email as quickly as possible, it would very much be appreciated. If it is easier to discuss over the phone, please let me know and we can look to arrange a call.

Kind regards,

Ewan Watson
Senior Consultant

Manchester | Newcastle | Glasgow | Cape Town | Dublin

Tel: +44(0)141 4283182

Address: TNEI, 7th Floor, 80 St Vincent Street, Glasgow, G2 5UB

Registered in England & Wales No. 03891836
Registered Address: TNEI Services Ltd, Bainbridge House, 86-90 London Road, Manchester M1 2PW

Ewan Watson

From: Masterson, Angela <Angela.Masterson@breckland.gov.uk>
Sent: 15 August 2023 14:13
To: Ewan Watson
Subject: RE: URGENT - Clarification on 100 Hz Noise Limit - Necton GGP

Follow Up Flag: Follow up
Flag Status: Flagged

Afternoon Ewan

Thank you for your email, fortunately I am working today so have been able to respond quickly.

The 100Hz condition is meant to be linear (unweighted), the intention is to have a measurable condition for the 100Hz band and although the condition is primarily aimed at the transformers and the low frequency "hum" at 100Hz it should ultimately provide a condition to control low frequency noise generated by all plant.
It is my experience that control measures to limit the level of the 100Hz band are likely to result in the control of other low frequency octave bands.

Kind regards

Angela

Angela Masterson

Environmental Protection Officer
Breckland Council

T: 01842 765892
M: 07979 505619

Elizabeth House, Walpole Loke, Dereham, Norfolk, NR19 1EE

From: Ewan Watson <ewan.watson@tneigroup.com>
Sent: Tuesday, August 15, 2023 12:36 PM
To: Masterson, Angela <Angela.Masterson@breckland.gov.uk>
Subject: URGENT - Clarification on 100 Hz Noise Limit - Necton GGP
Importance: High

Good afternoon Angela,

I hope you are well.

We spoke previously regarding the noise assessment for the proposed Necton Greener Grid Park development. I am informed by our client that the PPA fees have now been paid and that correspondence is now possible. Since we last spoke, we have received correspondence from Gemma Manthorpe, who has informed us that you would expect the

proposed development to be assessed in accordance with the same fixed noise level limits as issued for both the Norfolk Boreas DCO and the Necton substation upgrade, as per below:

In summary, we both acknowledge the noise limits of 35dB LAeq (5mins) / 32 dB LLeq (15mins) imposed on the Vattenfall Norfolk Boreas DCO as per the extract below:

Control of noise during operational phase and during maintenance

27.—(1) The noise rating level for the use of Work No. 8A and during maintenance must not exceed 35dB $L_{Aeq, (5\ minutes)}$ at any time at a free field location immediately adjacent to any noise sensitive location.

(2) The noise rating level for the use of Work No. 8A and during maintenance must not exceed 32 dB $L_{Leq\ (15\ minutes)}$ in the 100Hz third octave band at any time at a free field location immediately adjacent to any noise sensitive location.

(3) Work No. 8A must not commence operation until a scheme for monitoring compliance with the noise rating levels set out in paragraphs (1) and (2) above has been submitted to and approved by the relevant planning authority. The scheme must include identification of suitable monitoring locations (and alternative surrogate locations if appropriate) and times when the monitoring is to take place to demonstrate that the noise levels have been achieved after both initial commencement of operations and six months after Work No. 8A is at full operational capacity. Such measurements must be submitted to the relevant planning authority no later than 28 days following completion to confirm the rating level of operational noise emissions do not exceed the levels specified in sub-paragraphs (1) and (2), including details of any remedial works and a programme of implementation should the emissions exceed the stated levels.

(4) The monitoring scheme must be implemented as approved.

I am equally aware of the condition request from the EPO (see attached) relating to the National Grid Necton substation extension planning application (LPA Ref. 3PL/2022/1003/F) – see extract below – that also wants to apply the same 35dB LAeq (5mins) / 32dB LLeq (15mins) noise limit conditions as per the Vattenfall development:

The noise rating level (defined as set out in BS4142) from the operation of the substation shall not exceed 35 dB LAeq (5 minutes) at any time at a free field location immediately adjacent to any noise sensitive location.

Reason for condition
In the interest of the amenity of nearby residents

Noise from the operation of the substation shall not exceed a limit value of 32dB LLeq (15 minutes) in the 100Hz third octave band, at any time at a free field location immediately adjacent to any noise sensitive location

Reason for condition
In the interest of the amenity of nearby residents

Angela's initial thoughts are that Statkraft's Greener Grid Park proposal will also likely be imposed with the same noise limit conditions to ensure easier noise monitoring and enforcement…

We are happy with this and accordingly, our assessment will also adopt the above noise limits.

However, there is a further matter that we would seek clarification on – we note that the 32 dB $L_{Leq\ (15\ minutes)}$ limit in the 100 Hz frequency band specifically is stated as a **Linear** (L_{Leq}) weighted (or "unweighted") limit as opposed to an **A-weighted** (L_{Aeq}) limit. For context, A-weighting is applied to instrument-measured sound levels in an effort to account for the relative loudness perceived by the human ear and is considered the standard for general purpose measurement.

We would note that the A-weighted equivalent level of 32 dB(L) (or dB(Z) as it is sometimes written) in the 100 Hz frequency band is approximately equal to **13 dB(A)**. The reason we are querying this level is that an A-weighted level of 13 dB(A) would be effectively imperceptible against any sort of existing ambient noise level and would in practice, given Class 1 Sound Level Meters typically have a lower measurement threshold of around 15-20 dBA, not be measurable as part of any sort of compliance survey/assessment that may be enforced if, for example, complaints were received.

Before we submit the assessment, we just wanted confirmation that the 100 Hz limit is intended to be Linear and not in fact A-weighted?

This is a matter of urgency for our client as they are looking to submit the assessment by Thursday of this week, so if you could endeavour to respond to this email as quickly as possible, it would very much be appreciated.

Kind regards,

Ewan Watson
Senior Consultant

tnei

Tel: +44(0)141 4283182
Email: ewan.watson@tneigroup.com
Address: TNEI, 7th Floor, 80 St Vincent Street, Glasgow, G2 5UB

Appendix D – Baseline Survey Information

Project Nb.& Name	15997 – Necton GGP Noise
Client	Statkraft

MONITORING LOCATION DETAILS

NML Nb. and Name	NML01
NML Contact Details (Name, address, phone nb..)	
Description/Reason for exact location and Grid Coordinates	Monitoring location representative of the houses to the west of substation. Easting – 588477, Northing - 310738

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM52	NL52	00410234	12/08/21
Pre Amplifier				
Microphone				
Calibrator	002	NC74	34973250	19/01/23

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	Leq, L90	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15mins	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20-110	
Audio (No ,Yes 16Khz/16bit ...)	Yes	
Other (GMT/BST)	BST	
Resident Comments Sheet		
Resident consent to use photographs		

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90…)	Time Interval (10min,10s..)	Time Weighting (Fast …)	Range (20-110 …)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible…	Snow/River Present?
1	TS	0101	17:30 30/05/23	16:23 08/06/23	94.0	94.0									
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	Cloudy (oktas 8), 13°C, light rain, light breeze. Road nearby which is very audible, some birdsong.
2	Sunny (oktas 1), 17°C, road noise, birdsong, wind in foliage.
3	
4	

Project Nb.& Name	15997 – Necton GGP Noise
Client	Statkraft

MONITORING LOCATION DETAILS

NML Nb. and Name	NML02
NML Contact Details (Name, address, phone nb..)	
Description/Reason for exact location and Grid Coordinates	Monitoring location representative of closest houses to south of substation Easting – 588621, Northing - 309724

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM56	NL52	00520922	26/07/22
Pre Amplifier				
Microphone				
Calibrator	002	NC74	34973250	19/01/23

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	Leq, L90	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15min	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20-110	
Audio (No ,Yes 16Khz/16bit ...)	Yes 16kHz	
Other (GMT/BST)	BST	
Resident Comments Sheet		
Resident consent to use photographs		

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90…)	Time Interval (10min,10s..)	Time Weighting (Fast …)	Range (20-110 …)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible…	Snow/River Present?
1	TS	0201	10:45 31/05/23	14:25 08/06/23	94.0	93.9									
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	Cloudy (oktas 8), breezy, birdsong, wind in foliage, road noise audible, frequent loud bang from construction to north east, 11°C
2	Clear skies (oktas 1), breezy, wind in foliage, dog noise, residents talking, aeroplane noise, some birdsong, road noise in distance, 17°C
3	
4	

Project Nb.& Name	15997 Necton GGP Noise
Client	Statkraft

MONITORING LOCATION DETAILS

NML Nb. and Name	NML03
NML Contact Details (Name, address, phone nb..)	
Description/Reason for exact location and Grid Coordinates	Location representative of the nearest receptors to the southeast of substation Easting – 589547, Northing - 309601

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM047	NL52	00386760	23/02/22
Pre Amplifier				
Microphone				
Calibrator	002	NC74	34973250	19/01/23

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	Leq, L90	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15min	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20-110	
Audio (No ,Yes 16Khz/16bit ...)	Yes 16kHz	
Other (GMT/BST)	BST	
Resident Comments Sheet		
Resident consent to use photographs		

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90…)	Time Interval (10min,10s..)	Time Weighting (Fast …)	Range (20-110 …)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible…	Snow/River Present?
1	TS	0301	16:00 30/05/23	17:30 08/06/23	94.0	93.9									
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	13°C, cloudy (oktas 8), breezy, no rain, birdsong, wind in foliage audible, road to north west just audible, some noise nearby warehouses.
2	16°C, clear skies (oktas 1), breezy, birdsong, wind in foliage, road noise audible. Field around kit has been raked/ploughed within close proximity to SLM. Aeroplane noise audible.
3	
4	

Project Nb.& Name	15997 Necton GGP Noise
Client	Statkraft

MONITORING LOCATION DETAILS

NML Nb. and Name	NML04
NML Contact Details (Name, address, phone nb..)	
Description/Reason for exact location and Grid Coordinates	Monitoring location to the northeast of substation. Representative of the receptors to the northeast of substation. Easting – 589733, Northing - 310856

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM62	NL52	00721063	12/10/22
Pre Amplifier				
Kestral	RG01			
Calibrator	002	NC74	34973250	19/01/23

MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

	Setting	Comment
Index (Leq,L90..)	Leq, L90	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15min	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20-110	
Audio (No ,Yes 16Khz/16bit ...)	Yes 16kHz	
Other (GMT/BST)	BST	
Resident Comments Sheet		
Resident consent to use photographs		

SITE VISIT HISTORY (VISITS 1 TO 4)

Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90…)	Time Interval (10min,10s..)	Time Weighting (Fast …)	Range (20-110 …)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible…	Snow/River Present?
1	TS	0401	14:45 30/05/23	17:00 08/06/23	94.0	94.0									
2															
3															
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	Cloudy (oktas 8), no rain, road noise from northwest is audible, birdsong, some wind in foliage, light breeze, 14°C. Occasional aeroplane flyby from nearby RAF base.
2	Sunny (oktas 1), road noise from northwest, birdsong, some wind in foliage, 17°C
3	
4	

Project Nb.& Name	15997 Necton GGP Noise
Client	Statkraft

MONITORING LOCATION DETAILS

NML Nb. and Name	NML5 Spot measurements
NML Contact Details (Name, address, phone nb..)	
Description/Reason for exact location and Grid Coordinates	Monitoring location representative of closest houses to north of substation. Spot measurements. Easting – 589718, Northing - 311288

MONITORING EQUIPMENT DETAILS

	TNEI Id Nb.	Model	Serial Number	Last Cal.
Sound Level Meter	SLM56	NL52	00520922	26/07/22
Pre Amplifier				
Microphone				
Calibrator	002	NC74	24973250	19/01/23

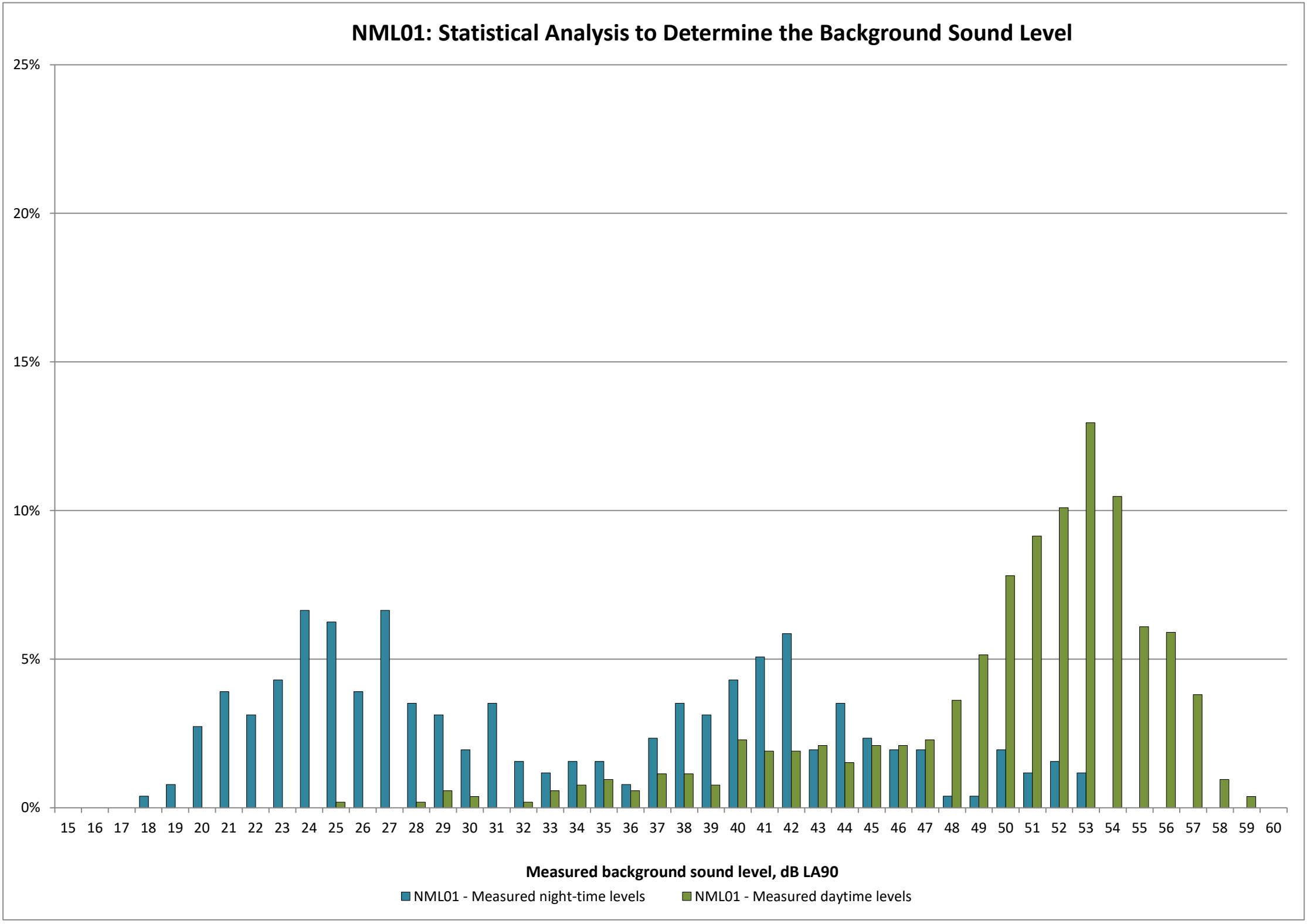
MONITORING EQUIPMENT SETTINGS AT START **(TO BE CHECKED AT EACH SITE VISITS)**

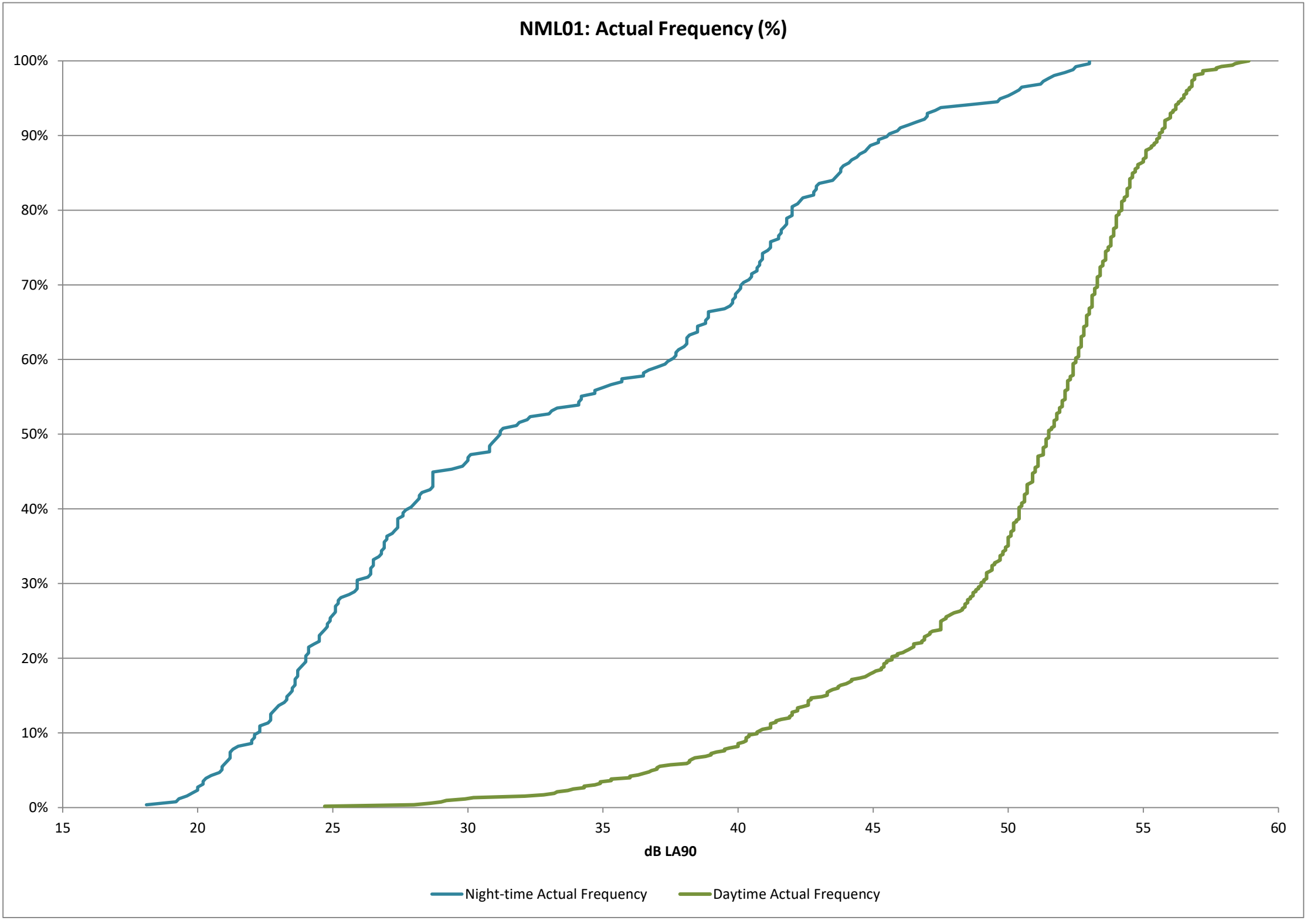
	Setting	Comment
Index (Leq,L90..)	Leq, L90	
Network (A,B,Z)	A	
Time Interval (10min,10s..)	15min	
Time Weighting (Fast/Slow)	Fast	
Measurement Range (20-110 ..)	20-110	
Audio (No ,Yes 16Khz/16bit ...)	Yes 16kHz	
Other (GMT/BST)	BST	
Resident Comments Sheet		
Resident consent to use photographs		

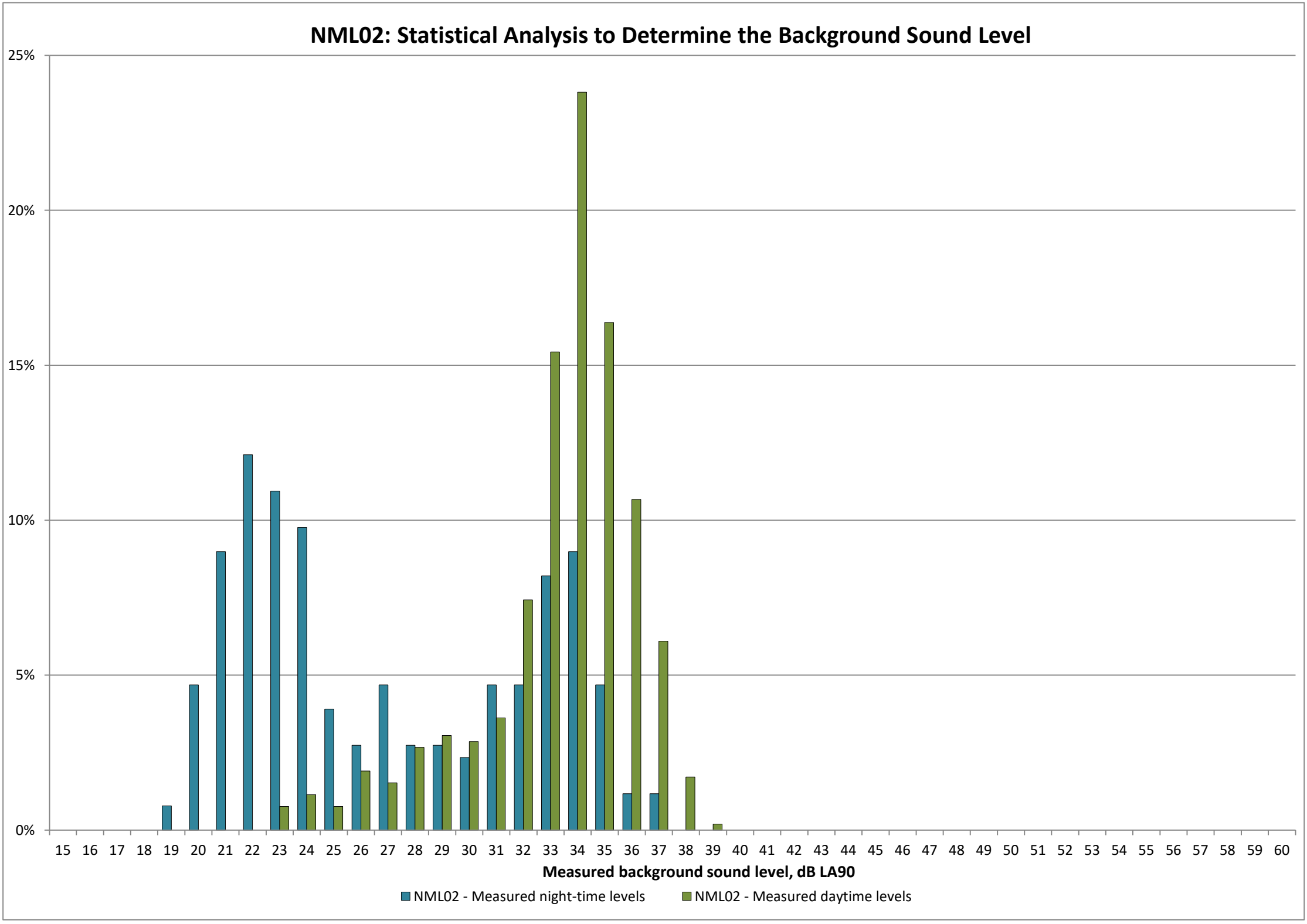
SITE VISIT HISTORY (VISITS 1 TO 4)

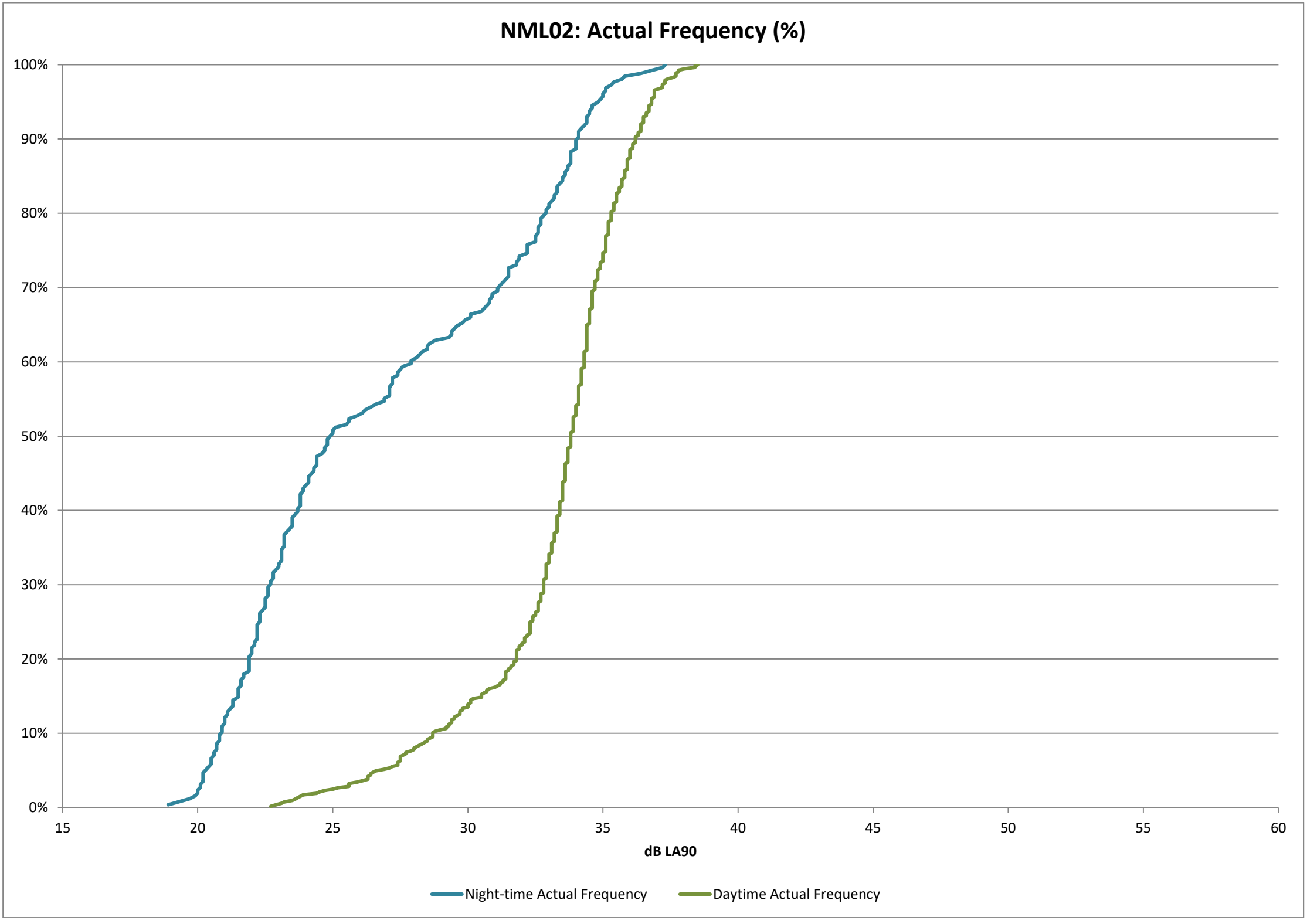
Visit Nb	Surveyor Initials	File Name (on SLM)	Start Date&Time (on watch)	End Date&Time (on watch)	Calibration at Start	Calibration at End	File Name	Index & Network (LAeq,LA90…)	Time Interval (10min,10s..)	Time Weighting (Fast …)	Range (20-110 …)	Batteries	Photographs (Kit+ SLM)	Write Notes on sound audible…	Snow/River Present?
1	TS	0501	18:15 30/05/23	19:15 30/05/23	94.0	94.0									
2	TS	0502	09:00 31/05/23	10:00 31/05/23	94.0	94.0									
3	MR	0503	15:00 08/06/23	16:00 08/06/23	94.0	94.0									
4															

Visit Nb	NOTES / SITE OBSERVATIONS / Sounds Audible During Each Visits
1	0501 – Cloudy, 13°C, wind in foliage, birdsong, road noise, breezy, dry
2	0502 – Cloudy, 11°C, wind in foliage, birdsong, road noise, breezy, dry, intermittent construction noise at substation (bolting/riveting)
3	0503 – Clear skies (oktas 1), wind in foliage, birdsong, road noise, 17°C
4	

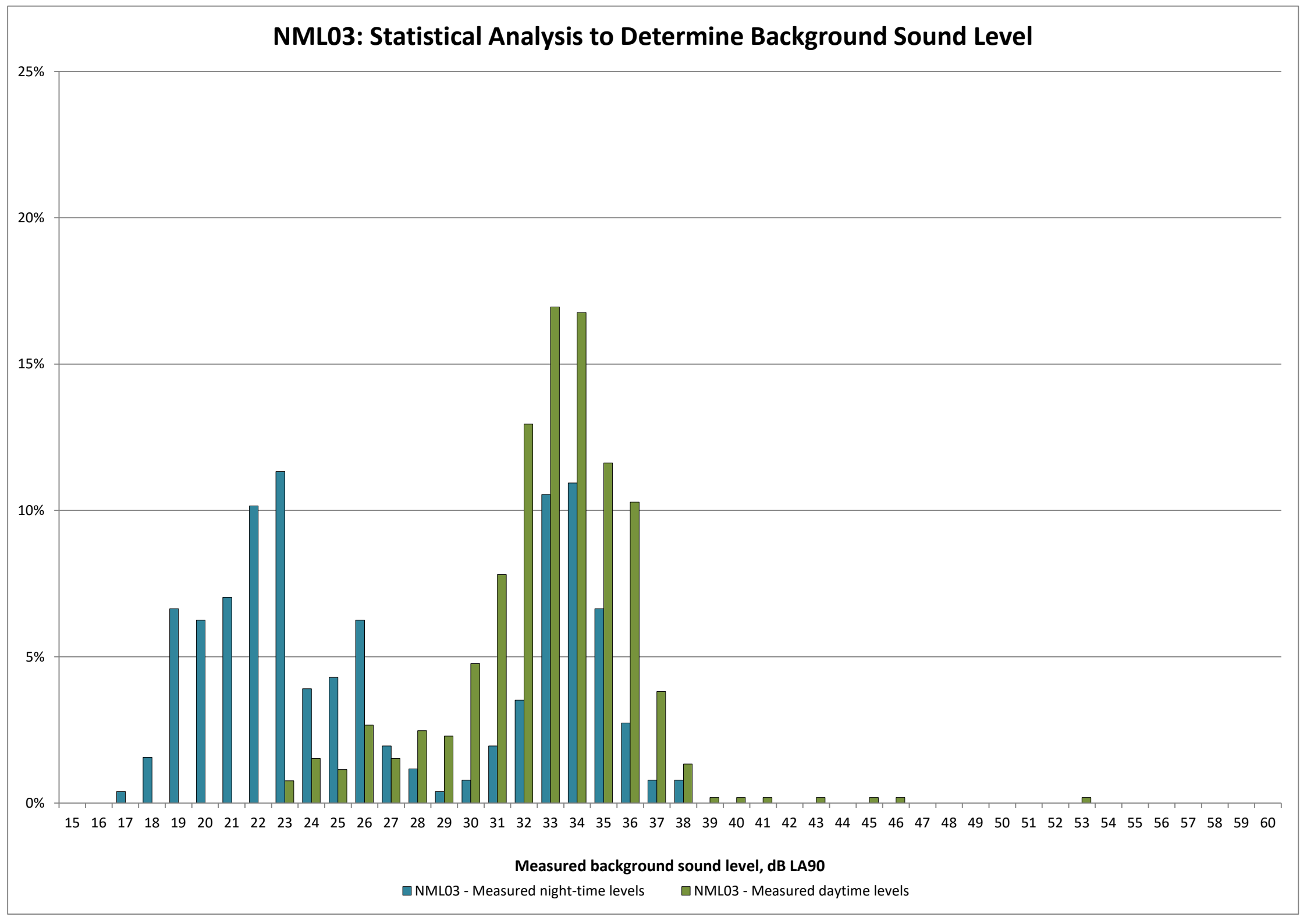

NML01: Statistical Analysis to Determine the Background Sound Level
25%
20%
15%
10%
5%
0%
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
Measured background sound level, dB LA90
NML01 - Measured night-time levels
NML01 - Measured daytime levels

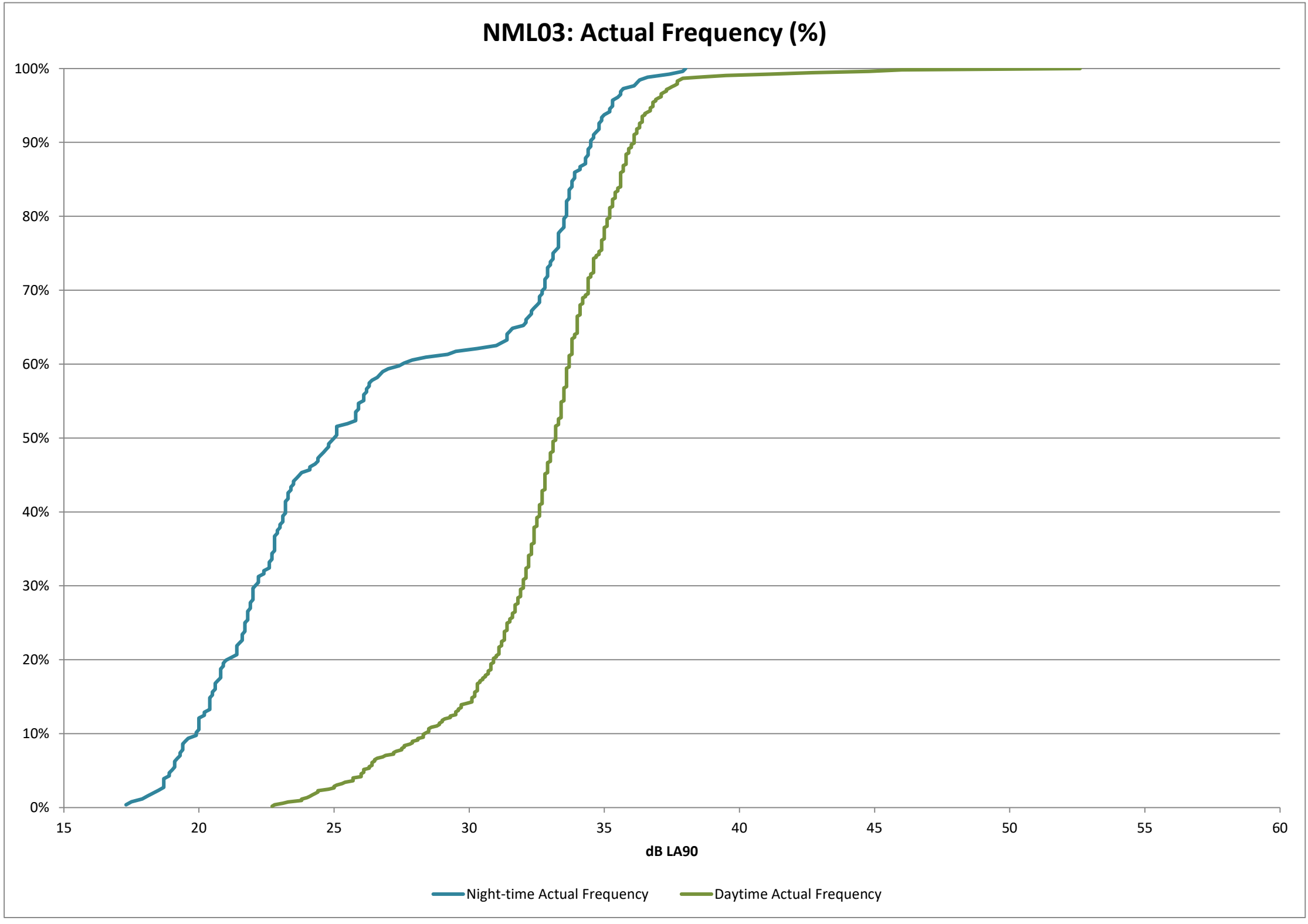

NML01: Actual Frequency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
15
20
25
30
35
40
45
50
55
60
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency

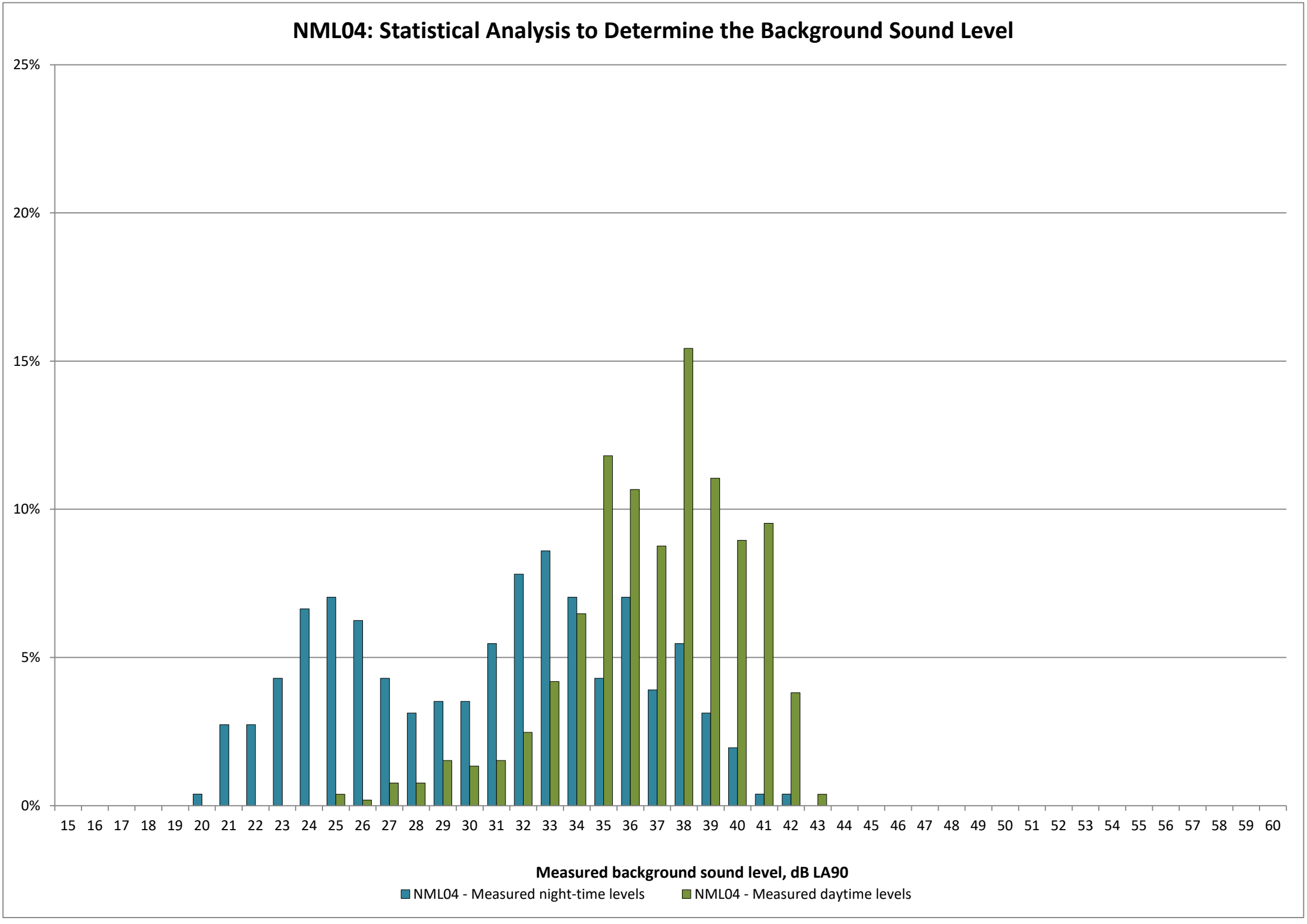

NML02: Statistical Analysis to Determine the Background Sound Level
25%
20%
15%
10%
5%
0%
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
Measured background sound level, dB LA90
NML02 - Measured night-time levels
NML02 - Measured daytime levels

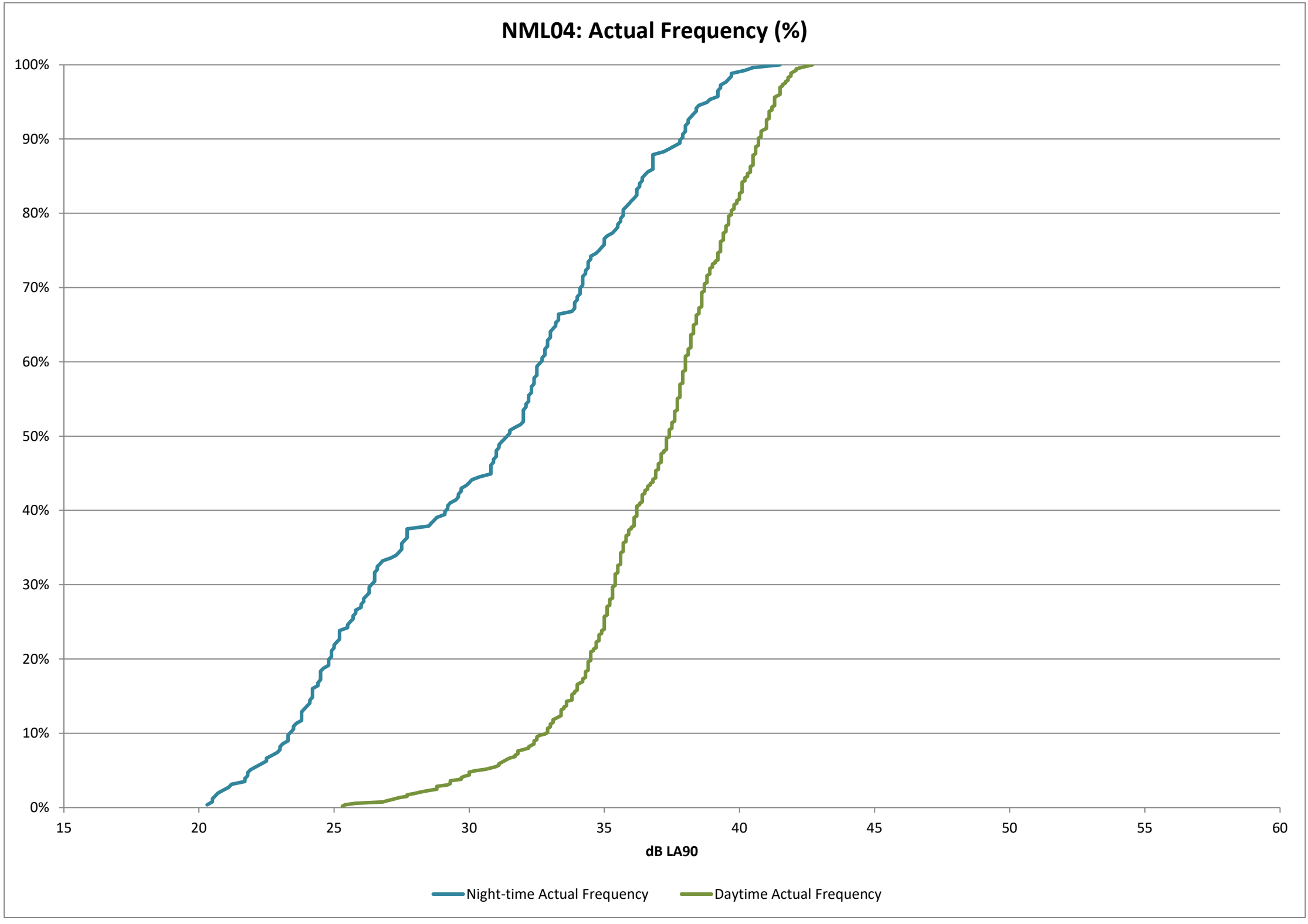

NML02: Actual Frequency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
15
20
25
30
35
40
45
50
55
60
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency

NML03: Statistical Analysis to Determine Background Sound Level




NML03: Actual Frequency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
15
20
25
30
35
40
45
50
55
60
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency


NML04: Statistical Analysis to Determine the Background Sound Level
25%
20%
15%
10%
5%
0%
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
Measured background sound level, dB LA90
NML04 - Measured night-time levels
NML04 - Measured daytime levels


NML04: Actual Frequency (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
15
20
25
30
35
40
45
50
55
60
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**26 July 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF072210**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00520922
Preamplifier	Rion	NH-25	11769
Microphone	Rion	UC-59	21319

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 26 July 2022

B. Bogdan

BEAUFORT COURT, 17 ROEBUCK WAY, MILTON KEYNES, MK5 8HL
☎ 01908 642846 🖹 01908 642814
✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**12 October 2022**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF102206**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00721063
Preamplifier	Rion	NH-25	22169
Microphone	Rion	UC-59	22051

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 12 October 2022

B. Bogdan

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CERTIFICATE OF CALIBRATION

Date of Issue: 23 February 2022 **Certificate Number: TCRT22/1161**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	TNEI Floor 7 80 St Vincent Street Glasgow G2 5UB
Order No.	5001
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00386760
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76910
	Rion	Microphone	UC-59	12778
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class	1
Test Procedure	TP 10. SLM 61672-3:2013 *Procedures from IEC 61672-3:2013 were used to perform the periodic tests.*
Type Approved to IEC 61672-1:2013	Yes *If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013*
Date Received	22 February 2022 ANV Job No. TRAC22/02079
Date Calibrated	23 February 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	10 September 2020	TCRT20/1515	ANV Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number
TCRT22/1161

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	NL-52/NL-42 Description for IEC 61672-1		
SLM instruction manual ref / issue	No. 56034 21-03	Source	Rion
Date provided or internet download date	19 March 2021		

	Case Corrections	Wind Shield Corrections	Mic Pressure to Free Field Corrections
Uncertainties provided	Yes	Yes	Yes

Total expanded uncertainties within the requirements of IEC 61672-1:2013	YES

Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	NC-74-002		
Calibrator cal. date	17 February 2022		
Calibrator cert. number	UCRT22/1246		
Calibrator cal cert issued by Lab	ANV Measurement Systems		
Calibrator SPL @ STP	94.03	dB	Calibration reference sound pressure level
Calibrator frequency	1002.04	Hz	Calibration check frequency
Reference level range	Single	dB	

Accessories used or corrected for during calibration - None

Environmental conditions during tests	Start	End	
Temperature	23.80	23.81	± 0.30 °C
Humidity	38.1	38.2	± 3.00 %RH
Ambient Pressure	101.02	100.97	± 0.03 kPa

Indication at the Calibration Check Frequency			
Initial indicated level	94.0 dB	Adjusted indicated level	94.0 dB
Uncertainty of calibrator used for Indication at the Calibration Check Frequency ±			0.10 dB

Self Generated Noise					
Microphone installed -	Less Than	18.5	dB	A Weighting	
Microphone replaced with electrical input device -				UR = Under Range indicated	

Weighting	A			C			Z		
	10.9	dB	UR	15.5	dB	UR	22.3	dB	UR

Self Generated Noise reported for information only and not used to assess conformance to a requirement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

Additional Comments

None

…… END ……

Calibrated by: B. Bogdan

R 2

MEASUREMENT SYSTEMS

CERTIFICATE OF CONFORMANCE

Date of Issue	**12 August 2021**
Customer	**TNEI Services Ltd**
Certificate Number	**CONF082105**

	Manufacturer	**Type**	**Serial Number**
Sound Level Meter	Rion	NL-52	00410234
Preamplifier	Rion	NH-25	10676
Microphone	Rion	UC-59	18979

This is to certify that the instrument was tested and calibrated at the Manufacturer's factory according to their specification and that the product satisfied all the relevant requirements of the following Standards:

IEC 61672-1:2013 Class 1.

The instrument also received a functional check by ANV Measurement Systems prior to despatch in the UK, in accordance with our standard procedures.

Signed..... Position. Calibration Technician Date. 12 August 2021

B. Bogdan

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✉ info@noise-and-vibration.co.uk 💻 www.noise-and-vibration.co.uk

Appendix E – Noise Modelling Data

Noise measurement result for Lister Drive string No.2 at ABB Machines

Table of Contents

1. *Noise measurement procedure*

Due to space restrictions in the test room, a complete noise measurement of the complete string including the pony motor could not be performed. To determine the average noise pressure value for the complete string, a measurement around the synchronous condenser (SC) and flywheel (FW) enclosure was performed, and the total string noise level were then calculated by a formula with the separate noise value for the pony motor.

The noise test was performed acc. to ISO 3744 on a combined measurement surface with 1m distance to the reference box just enclosing the SC and FW enclosure. Measurement was performed on height levels 1,4 / 2,8 / 4,2 / 5,6m, with point distribution and instrumentation acc. to the test record with a total of 58 measurement points. The test was conducted on warmed up machines at 1500 rpm.

Due to accessibility restrictions for safety reasons 12 point values on the left side of SC seen from the non-drive end were mirrored from measurement data from the symmetrical position on the other side of the machine. Symmetry check from the noise test on separate SC show good symmetry with an average difference of -0,4 dB from comparison with 8 points on the fully measured side. For the points around the FW enclosure 6 point values out of 31 were mirrored due to problems with accessibility. Symmetry check from the noise test on FW show good symmetry with an average difference of less than -0,2 dB from comparison with 4 points on the fully measured side. The symmetry check show that the noise level in average was a little lower on the left side of the string seen from SC non-drive end due to more free space on that side. Thus, using the mirrored values from the side with louder noise mean that the method is conservative regarding the total noise level.

A K2 correction factor calculated according to ISO 3744, annex A clause A.3.5 is applied on the measured average value for the FW+SC before calculation of combined string noise level together with the Pony motor noise value. The correction factor compensates for the reflected noise from adjacent walls and test equipment. The method for determining K2 has been verified in previous test with comparison to the reverberation method in ISO 3744, annex A clause A.3.2. The report “Sound Power Assessments in P0 - HRM - 11175-19121602” describes the methodology used to determine the correction factor. A conservative K2 value of 3,0 dB is applied considering the uncertainty associated with the analytical method for determination of the K2 correction factor.

The criteria for background noise acc. to ISO 3744 clause 4.2 is met which mean that no correction for background noise is made. Testing was made during nighttime which mean low background noise level (below 63 dB) that has not affected the measurement.

2. *Test result with comments*

Average noise pressure level for the combined SC + FW test from 58 points acc. to test record:

Lp = 86,9 dB(A).

After correction with K2=-3,0 dB

Lp = 83,9 dB(A).

This value should be considered conservative since it includes some noise from the pony motor without noise damper, and increased noise from the couplings due to absence of coupling covers.

The combined string level together with the 80,0 dB(A) declared noise pressure level from the pony motor is calculated acc. to formula below for adding of multiple noise sources:

$$L_\Sigma = 10\log_{10}\left(10^{\frac{L_1}{10\ \mathrm{dB}}} + 10^{\frac{L_2}{10\ \mathrm{dB}}}\right)\ \mathrm{dB}.$$

Lp_Σ = 85,4 dB(A).

When comparing with the 90 dB(A) limit value, a measurement tolerance of 3,0 dB is added to the combined string noise level:

Total value for string 2 incl. tolerance: Lp_Σ = 85,4 + 3,0 = 88,4 dB(A).

For the string test on site we expect lower measurement values than at ABB Machines due to assembly with coupling covers, less reverberant condition with the sound enclosure compared to our test environment, and due to increased measurement distance from the machines due to larger flywheel enclosure and the MTB beside the condenser.

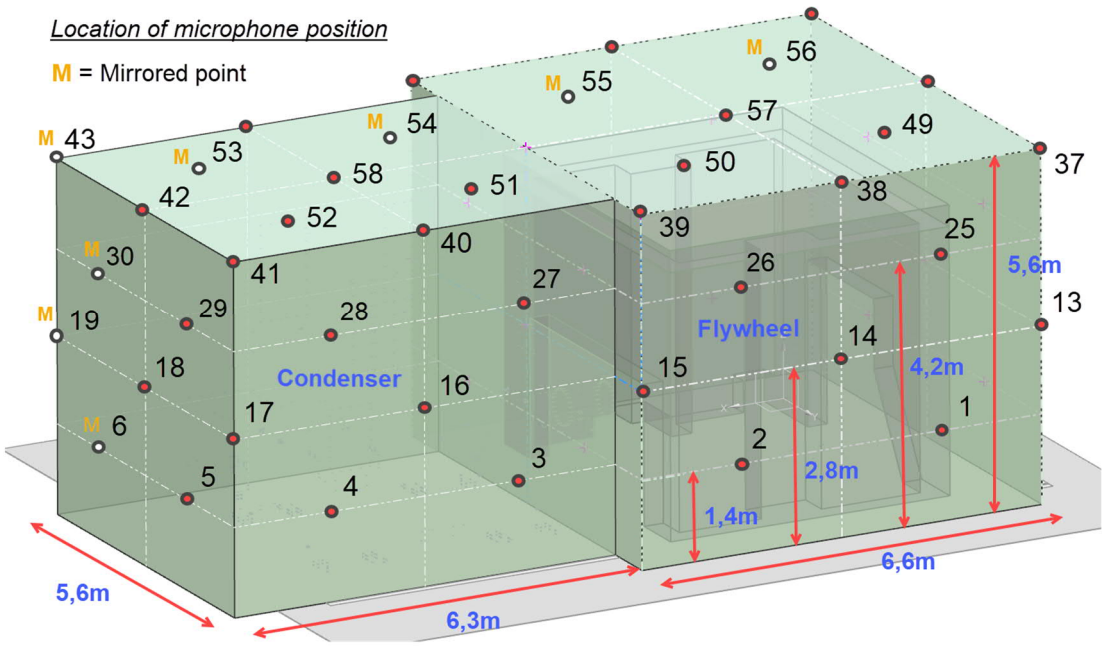


Fig. 1 Noise measurement layout for FW+SC test of Lister Drive No. 2 at ABB Machines

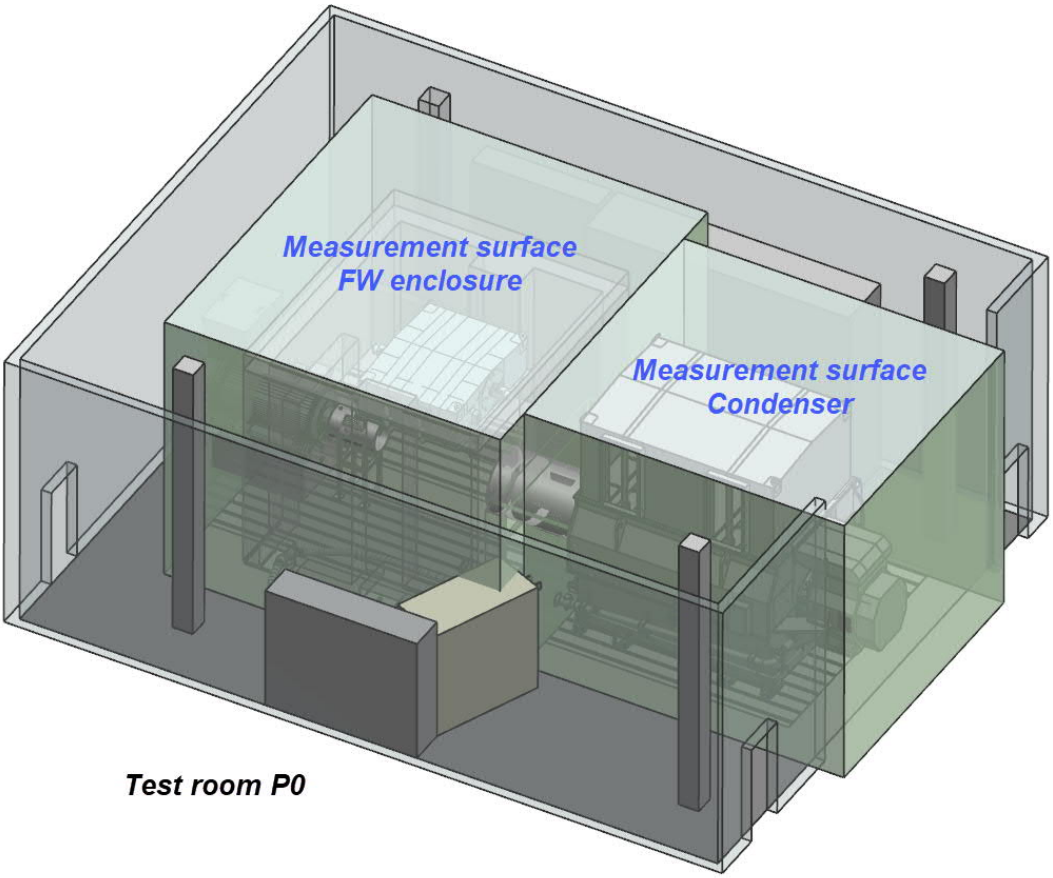


Fig. 2 Test room set-up with measurement surface around FW enclosure and SC

Appendix A: Average noise level from 58 points measurement in string test

INSPECTION AND TEST RECORD XYK 215 360- KLMb2

Page 1
Cont 2

ABB AB, Machines Noise measurement

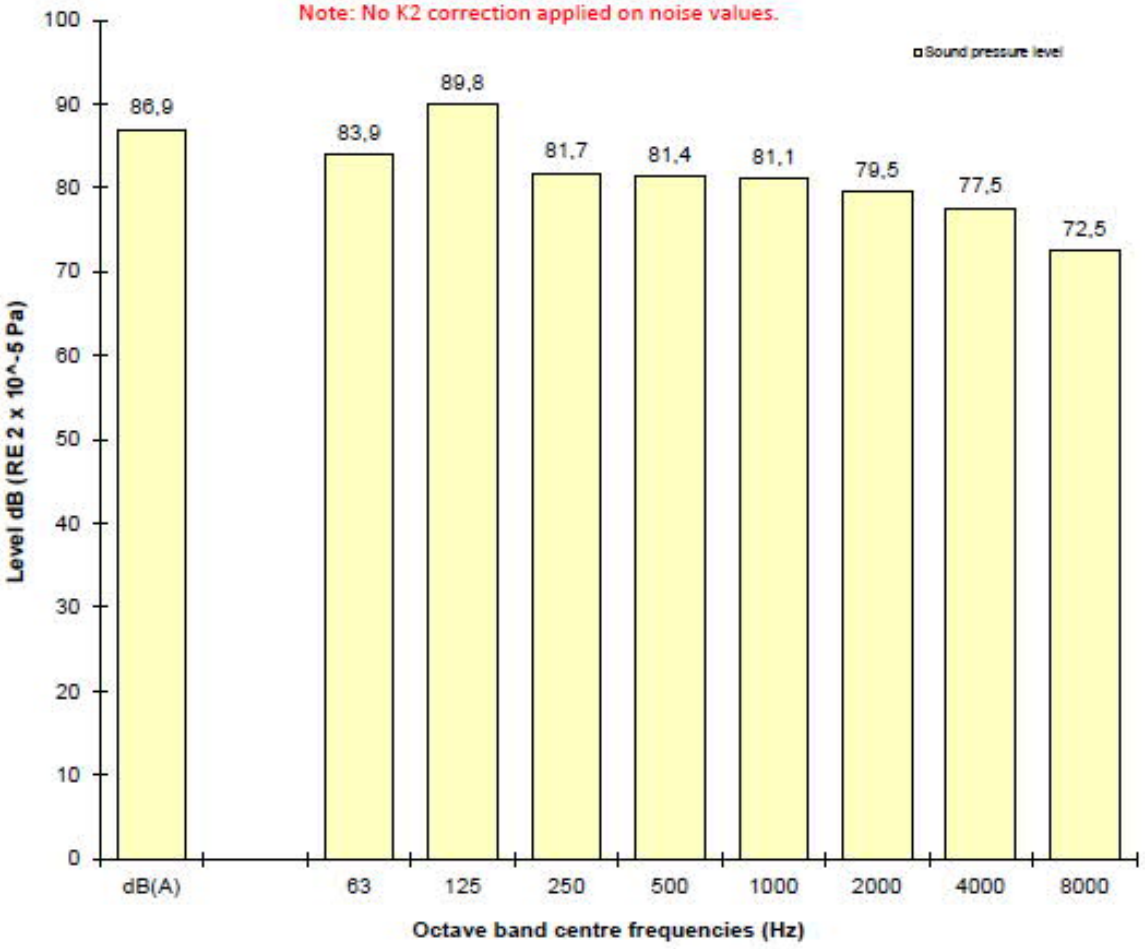
Customer:	**ABBUK/Statkraft**	Flywheel + Synchronous condenser
Type:	Combined AFW 1400 + AMS 1400LM	
Order no :	L007721-B2	
Serial no:	8269 906	1500 rpm
Exciter :		IEC 60034-1

Sound pressure measurement at 1 m distance from machine surface, acc to ISO 3744

Test condition:	No load running at	1500 rpm
Location:	Test dept. Machines/MP7.	
Instruments:	Brüel & Kjær Analyzer type 2250	
	Brüel & Kjær microphone type 4189.	
	Brüel & Kjær calibration pistophone type 4231.	

Sound pressure level (logaritmic mean values)

Note: No K2 correction applied on noise values.



Note: No correction for background noise is made. The criteria for background noise acc. to ISO 3744 clause 4.2 is met. Background noise mean level is below 63 dB and will not affect the measurement.

Carried out : Gabor Sztojka
ABB ATAP/MP 7 Västerås Sweden Date:2021-11-03

Witnessed by : .....
Date :

Form no 2000 733E - 562 Page 1, Cont 2 Dept: DRI/MPS 5 Year: 92 Wk: 15

ABB

ABB AB, Machines Noise measurement

Customer: **ABBUK/Statkraft** Flywheel + Synchronous condenser
Type : Combined AFW 1400 + AMS 1400LM
Order no : L007721-B2
Serial no : 8269 906 1500 rpm
IEC 60034-1

Sound pressure measurement at 1 m distance from machine surface, acc to ISO 3744

Measure point	dB(A)	Mirrored point	Sound pressure level (dB RE 2 x 10^-5 Pa) Octave band centre frequencies (Hz) 63	125	250	500	1000	2000	4000	8000
1	83,3		81,7	82,7	77,6	76,4	76,4	75,3	75,0	70,3
2	89,4		82,7	82,7	79,8	81,7	82,6	81,8	81,2	77,6
3	91,9		85,8	88,9	83,5	84,4	85,7	85,1	82,4	78,2
4	87,8		82,6	88,5	83,5	83,5	81,6	79,7	77,0	71,8
5	85,4		84,3	90,5	82,9	80,4	79,2	76,3	74,7	69,7
6	85,4	X	84,3	90,5	82,9	80,4	79,2	76,3	74,7	69,7
7	87,8	X	82,6	88,5	83,5	83,5	81,6	79,7	77,0	71,8
8	91,9	X	85,8	88,9	83,5	84,4	85,7	85,1	82,4	78,2
9	89,7		84,3	87,4	81,4	82,8	83,4	83,0	79,7	74,0
10	86,3		83,3	83,0	78,9	80,9	80,0	79,1	75,8	69,9
11	85,6	X	84,1	84,9	85,1	79,4	79,8	77,3	74,4	68,5
12	85,6		84,1	84,9	85,1	79,4	79,8	77,3	74,4	68,5
13	83,3		78,5	83,8	80,4	77,4	77,2	74,7	73,4	68,7
14	84,7		79,5	78,8	79,7	76,5	77,7	76,5	77,3	73,6
15	92,6		82,8	89,4	82,7	84,8	86,1	85,6	83,5	79,4
16	89,2		88,0	95,9	82,5	83,1	83,0	80,9	79,1	74,0
17	85,7		82,8	88,9	81,5	81,8	79,1	76,8	75,0	70,2
18	84,3		81,2	85,8	80,1	80,3	77,8	75,2	74,5	67,9
19	85,7	X	82,8	88,9	81,5	81,8	79,1	76,8	75,0	70,2
20	89,2	X	88,0	95,9	82,5	83,1	83,0	80,9	79,1	74,0
21	92,6	X	82,8	89,4	82,7	84,8	86,1	85,6	83,5	79,4
22	85,3		80,8	84,1	78,3	79,3	79,4	78,0	74,7	68,9
23	84,5		82,2	85,6	78,1	78,8	77,7	77,3	74,4	69,8
24	86,7		84,1	86,5	84,6	81,3	80,6	79,0	75,3	69,1
25	82,1		80,1	79,1	79,5	76,6	76,8	74,9	74,1	69,3
26	86,4		81,9	84,0	80,8	81,0	81,3	79,3	78,5	72,9
27	90,4		90,8	98,8	84,6	83,8	84,8	83,8	81,5	76,3
28	85,2		83,1	88,4	82,9	81,3	80,0	77,6	75,7	70,3
29	83,7		84,4	91,1	81,6	80,6	78,2	75,4	74,0	68,4
30	83,7	X	84,4	91,1	81,6	80,6	78,2	75,4	74,0	68,4
31	85,2	X	83,1	88,4	82,9	81,3	80,0	77,6	75,7	70,3
32	90,4	X	90,8	98,8	84,6	83,8	84,8	83,8	81,5	76,3
33	86,3		83,1	88,3	81,9	81,1	81,0	79,8	77,2	71,6
34	84,2		81,1	80,4	79,4	79,2	79,0	78,0	74,9	68,4
35	81,6	X	81,7	83,4	79,4	77,8	76,6	74,3	71,4	64,7
36	81,6		81,7	83,4	79,4	77,8	76,6	74,3	71,4	64,7
37	81,9		77,4	78,0	78,4	76,4	76,2	74,7	74,2	70,2
38	83,7		78,2	80,0	79,8	78,0	79,2	76,5	74,9	70,0
39	89,4		85,2	93,2	80,4	84,4	84,2	82,8	80,7	75,2
40	87,3		85,7	93,8	81,9	82,2	81,9	80,6	78,5	72,4
41	84,0		80,0	81,0	80,9	80,6	79,0	76,6	74,6	68,9
42	82,8		84,7	91,4	81,4	79,3	77,0	74,6	72,4	66,1
43	84,0	X	80,0	81,0	80,9	80,6	79,0	76,6	74,6	68,9
44	87,3	X	85,7	93,8	81,9	82,2	81,9	80,6	78,5	72,4
45	89,4	X	85,2	93,2	80,4	84,4	84,2	82,8	80,7	75,2
46	82,5		78,6	78,7	78,1	78,3	78,1	75,7	72,0	64,9
47	82,5		79,4	83,4	77,9	78,2	77,9	75,5	72,4	65,7
48	81,3		80,7	82,0	78,7	78,3	76,1	74,1	70,3	63,1
49	80,3		80,7	82,6	78,0	76,8	75,2	72,8	70,3	63,3
50	86,9		81,3	80,7	80,7	81,5	81,1	80,9	78,5	71,9
51	87,2		84,0	85,7	84,0	83,0	82,0	80,1	78,0	72,8
52	83,2		83,3	89,9	82,2	80,7	77,6	74,4	72,5	66,8
53	83,2	X	83,3	89,9	82,2	80,7	77,6	74,4	72,5	66,8
54	87,2	X	84,0	85,7	84,0	83,0	82,0	80,1	78,0	72,8
55	86,9	X	81,3	80,7	80,7	81,5	81,1	80,9	78,5	71,9
56	80,3	X	80,7	82,6	78,0	76,8	75,2	72,8	70,3	63,3
57	83,6		81,0	81,6	79,3	79,2	78,2	76,9	74,4	67,6
58	85,2		83,6	87,8	83,1	81,8	79,8	77,2	75,2	69,8
Logaritmic mean.	**86,9**		**83,9**	**89,8**	**81,7**	**81,4**	**81,1**	**79,5**	**77,5**	**72,5**

Note ! The noise measurement is not carried out under free-field condition

Carried out : Gabor Szlojka
ABB ATAP/MP 7 Västerås Sweden Date:2021-11-03

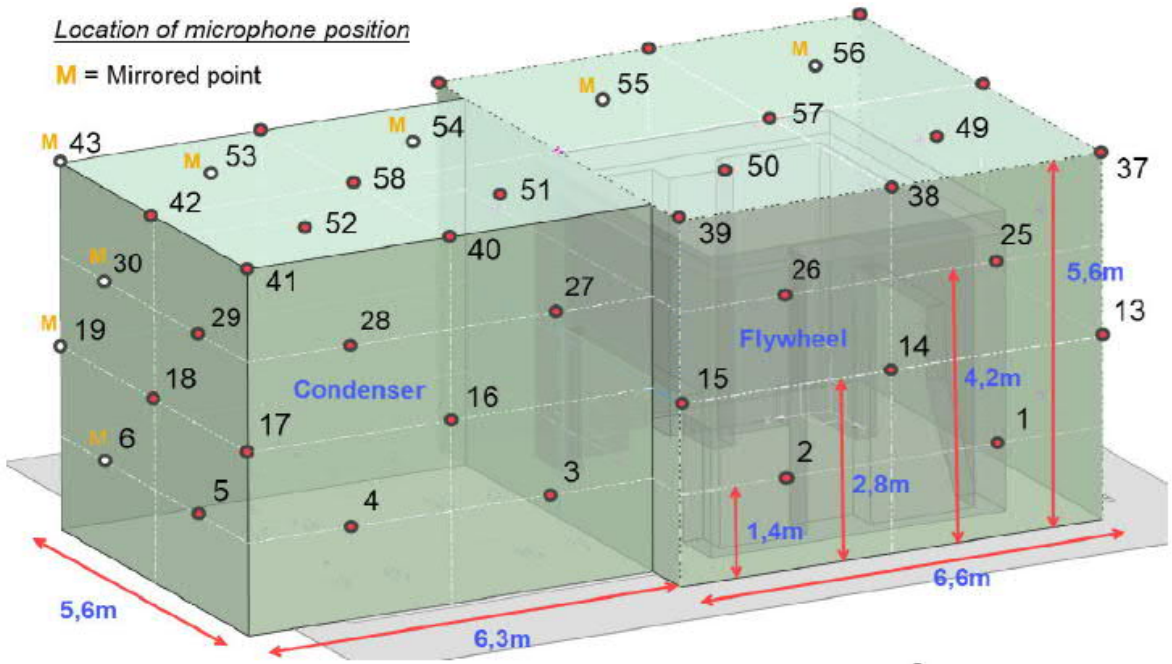
Witnessed by : .....
Date :

ABB AB, Machines Noise measurement

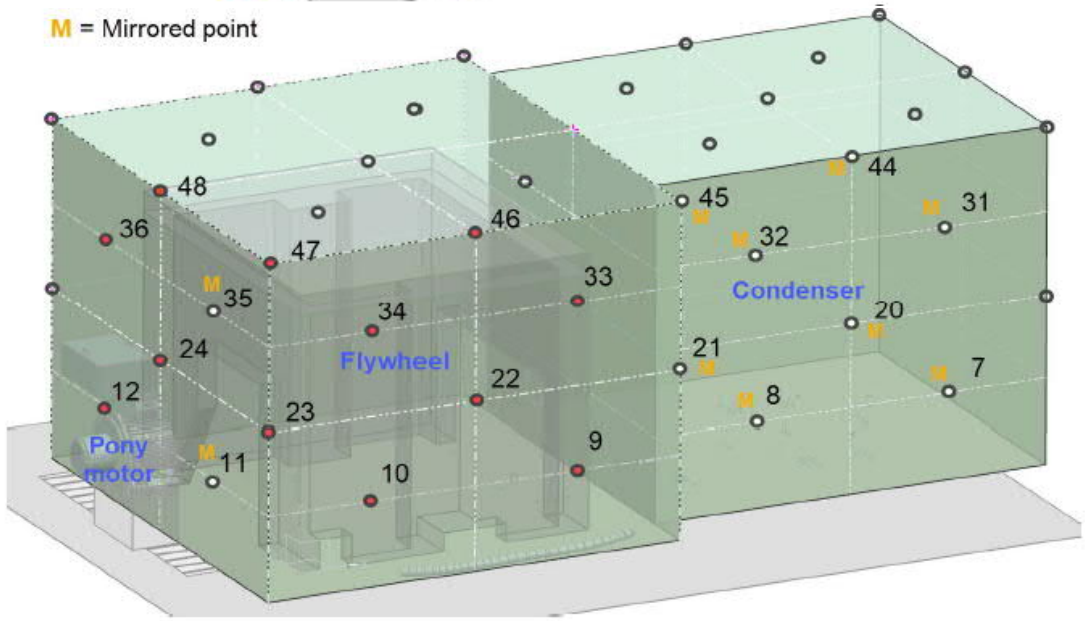
Customer: **ABBUK/Statkraft** Flywheel + Synchronous condenser
Type : Combined AFW 1400 + AMS 1400LM
Order no : L007721-B2
Serial no : 8269 906 1500 rpm
IEC 60034-1

Location of microphone position

M = Mirrored point



M = Mirrored point



Carried out : Gábor Sztojka
ABB ATAP/MP 7 Västerås Sweden Date:2021-11-03

Witnessed by : .....
Date :

CI/SfB (37) Hh2
UK June 2005

Acoustic Performance Guide

Insulated Roof, Wall & Facade Systems

Insulated Panels to the Power of

Kingspan®

Insurer Approved FIRESAFE Systems

Acoustic Test Results Appendix A - Wall/Facade Panel Construction

Octave Band Sound Reduction Index (R) and Weighted Sound Reduction Index (R_w)

Wall	Panel and Lining	Octave Band Sound Reduction Index R								R_w	C_{tr}	Surface Weight Kg/m²
		63	125	250	500	1k	2k	4k	8k			
1W	AWP/60 + no lining	15	16	19	23	26	22	39	–	25	-3	18
2W	AWP/60 + F	12	19	32	42	50	52	60	–	43	-10	30
3W	AWP/60 + W15	14	17	31	40	48	46	56	–	41	-10	28
4W	AWP/60 + W15 + F	17	24	37	45	52	54	64	–	47	-9	40
5W	AWP/60 + P + W12	16	22	37	45	51	50	63	–	46	-10	41
6W	AWP/60 + P + W12	18	23	35	44	49	50	61	–	45	-8	41
7W	AWP/60 + I + P + W	18	24	37	48	53	55	63	–	48	-10	4
8W	KS1000 RW/40 + I + L	13	14	29	38	40	45	55	–	38	-9	20
9W	KS1000 RW/40 + I + L	12	16	30	40	44	51	64	–	40	-9	20
10W	AWP/70 + no lining	20	15	17	23	18	25	40	46	24	-4	12.5

Key

AWP = Architectural Wall Panel with various profiles (Optimo, MR, EB, FL, MM, CX, WV, Longspan)
F = 10mm dense particle board (11.7kg/m²)
W15 = 15mm plasterboard (10kg/m²)
W12 = 12.5mm wallboard (7.9kg/m²)
P = 19mm dense plasterboard plank (15.2kg/m²)
I = Insulation (see construction description for details)
L = 0.7mm profiled steel liner sheet
The figures after the forward slash refers to the panel thickness in mm (ie AWP/60 = panel thickness of 60mm)

Acoustic Test Results Appendix B - Roof Panel Construction

Octave Band Sound Reduction Index (R) and Weighted Sound Reduction Index (R_w)

Roof	Panel and Lining	Octave Band Sound Reduction Index R								R_w	C_{tr}	Surface Weight Kg/m²
		63	125	250	500	1k	2k	4k	8k			
1R	KS1000 LP/45 + I + 2 x SB	27	32	47	61	69	69	75	–	58	-11	–
2R	KS1000 RW/40 + I + L	8	17	32	43	48	54	60	–	43	–	2
3R	KS1000 RW/40 + I + L	11	19	36	48	54	61	73	–	46	–	19
4R	KS1000 RW/40 + I + Py	17	27	39	44	49	57	67	–	48	–	31
5R	KS1000 RW/30 + no lining	–	17	20	23	23	23	41	–	25	-3	–
6R	KS1000 RW/30 + I + L	–	18	35	50	55	59	60	–	44	-11	–
7R	KS1000 RW/50 + I + L	–	19	34	48	52	56	63	–	44	-10	–
8R	KS1000 RW/80 + I + L	–	20	36	48	50	66	70	–	46	-11	–
9R	KS1000 RW/80 + no lining	–	18	21	23	20	38	42	–	26	-4	–
10R	KS1000 RW/80 + no lining	20	18	20	24	20	29	39	47	25	-3	–
11R	KS1000 RW/80 + I + PL	18	19	22	29	31	40	58	49	32	-4	–
12R	KS1000 ZIP/90 + no lining	19	18	19	20	17	35	38	44	23	-4	–
13R	KS1000 LP/80 + no lining	19	19	19	22	19	35	39	46	24	-4	–
14R	KS1000 RT + no lining	20	19	21	22	22	32	38	44	25	-2	–
15R	KS1000 TS + no lining	20	16	15	23	29	39	45	53	27	-4	27

Key

I = Insulation (see construction description for details)

2 x SB = 2 x 12.5mm dense plasterboard (15.2kg/m²)

L = Profiled Steel Liner Sheet

Py = 10mm thick dense particle board (11.7kg/m²)

PL = Profiled Perforated Steel Liner Sheet

The figures after the forward slash refers to the panel thickness in mm (ie LP/45 = panel thickness of 45mm)

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Name of manufacturer:	Modine Söderköping AB
Order number:	
Date of test:	2019-12-17
Responsible person for testing:	Peter Holmberg
Persons present during test:	Peter Holmberg

Description of noise source

Type:	ABCS-282204-42502-22-152-3-0635-1155-213-13-Z
Fan type:	Ziehl-Abegg, ZN080-ZIL.GG.V7P3
Rated motor power, [kW]:	1.86
Rated motor current, [A]:	3.0
Rated motor voltage, [V]:	400
Rated motor frequency, [Hz]:	50
Rated fan speed, [rpm]:	950
Number of fans:	16

Equipment used for the measurements

Sound level meter:	Brüel & Kjær 2250 Light, No. 3002801
Acoustical calibrator:	Brüel & KjærType 4231, No. 3016025
Microphone:	Brüel & Kjær 4950, No: 2827245
Preamplifier:	Brüel & Kjær Type ZC-0032, No. 14369
Tachometer:	Shimpo DT 205-B, Serial No. 45129012
Voltmeter:	Fluke T5-600, Serial No. 79030166
Clamp meter:	Fluke T5-600, Serial No. 79030166
Anemometer:	Testo 400 dp, Serial No. 20602196
Barometer:	Kimo MP55, Serial No. 1P 150624912
Temperature sensor:	Testo 400 dp, Serial No. 20602196

Conditions during measurements

Measured fan current, [A]:	1.59
Measured fan voltage, [V]:	396
Measured fan frequency, [Hz]:	50
Measured fan speed, [rpm]:	636
Atmospheric pressure, [mm Hg]:	757
Air temperature, [°C]:	0
Wind speed, [m/s]:	0,3

Dimensions of the reference box, measurement distance, measurement surface

Reference box width l1, [m]:	11,2
Reference box lenght l2, [m]:	2,3
Reference box height l3, [m]:	1,30
Measurement distance d, [m]:	1
Measuring surface S_{tot}, [m^2]:	137

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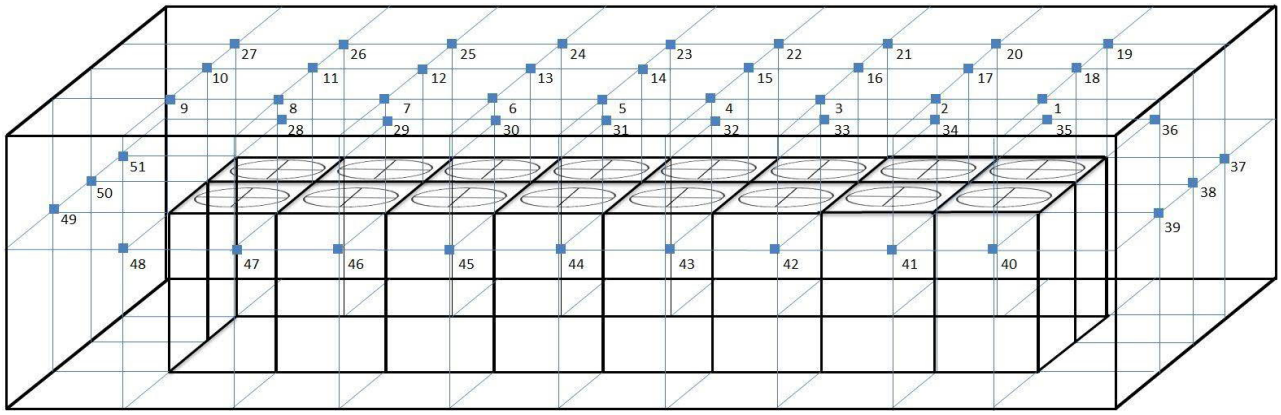
Test environment

The measurements were made outdoors on a bottom pallet made of wood.

Microphone positions

Sketch of the reference box and the microphone positions.



Partial measuring area	Measuring points
a	1-27
b	28-36
c	37-39
d	40-48
e	49-51

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Results

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000	TOT
Sound power level L_W , [dB (A)]	77,5	81,4	83,5	86,5	86,2	81,3	75,6	68,9	91,6
Average sound pressure level on partial measuring area "a" L_{pa} , [dB (A)]	58,2	61,7	64,4	67,9	68,0	63,3	57,7	51,2	73,1
Average sound pressure level on partial measuring area "b" L_{pb} , [dB (A)]	55,2	59,5	61,2	62,8	61,1	54,5	47,6	37,2	67,8
Average sound pressure level on partial measuring area "c" L_{pc} , [dB (A)]	53,2	58,0	58,5	60,5	58,0	51,0	45,4	36,2	65,4
Average sound pressure level on partial measuring area "d" L_{pd} , [dB (A)]	55,3	59,4	61,4	63,4	61,8	55,1	48,4	38,1	68,3
Average sound pressure level on partial measuring area "e" L_{pe} , [dB (A)]	53,0	57,9	57,9	59,2	58,2	52,0	45,3	35,6	64,9
Background noise correction on partial measuring area "a" K_{1a} , [dB (A)]	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
Background noise correction on partial measuring area "b" K_{1b} , [dB (A)]	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
Background noise correction on partial measuring area "c" K_{1c} , [dB (A)]	0,0	0,0	0,0	0,0	0,2	0,2	0,0	0,0	-
Background noise correction on partial measuring area "d" K_{1d} , [dB (A)]	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
Background noise correction on partial measuring area "e" K_{1e} , [dB (A)]	0,0	0,0	0,0	0,0	0,2	0,2	0,0	0,0	-
Environmental correction K_2, [dB (A)]	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-

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Extra information

Max measured sound pressure level for noise source, $L_{pk,MAX}$

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000	TOT
Microphone position	[dB (A)]	[dB (A)]	[dB (A)]	[dB (A)]	[dB (A)]	[dB (A)]	[dB (A)]	[dB (A)]	[dB (A)]
15	60,9	63,1	66,6	70,1	70,1	65,4	59,7	52,8	75,2

Directivity number for partial area "a", DI_a

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000
[dB (A)]	2,1	1,6	2,3	2,8	3,1	3,4	3,4	3,7

Directivity number for partial area "b", DI_b

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000
[dB (A)]	-1,0	-0,5	-1,0	-2,4	-3,7	-5,4	-6,7	-10,4

Directivity number for partial area "c", DI_c

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000
[dB (A)]	-2,9	-2,0	-3,7	-4,6	-6,9	-8,9	-8,9	-11,3

Directivity number for partial area "d", DI_d

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000
[dB (A)]	-0,8	-0,6	-0,7	-1,7	-3,1	-4,8	-5,8	-9,5

Directivity number for partial area "e", DI_e

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000
[dB (A)]	-3,1	-2,2	-4,2	-6,0	-6,7	-7,9	-9,0	-12,0

Sound power level for the test subject under reference meteorological conditions, $L_{Wref,atm}$

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000	TOT
[dB(A)]	76,7	80,6	82,7	85,7	85,4	80,5	74,8	68,1	90,9

Standard sound pressure level at 1 m from the apparatus, $L_{p@1m}$

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000	TOT
[dB(A)]	56,1	60,0	62,1	65,2	64,9	59,9	54,3	47,6	70,3

Mean time-average sound pressure level for background noise, $\overline{L_{p(B)}}$

Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000	TOT
[dB(A)]	25,2	30,1	36,4	42,6	44,4	38,3	26,4	13,7	47,7

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Extra information

Sound pressure level for noise source (corrected for background & environmental influences)									
Frequency-band, [Hz]	63	125	250	500	1 000	2 000	4 000	8 000	TOT
Microphone position	[dB A]	[dB A]	[dB A]	[dB A]	[dB A]	[dB A]	[dB A]	[dB A]	[dB A]
1	54,0	58,5	60,6	64,1	64,9	60,9	56,2	50,9	69,8
2	56,2	59,9	63,0	66,6	66,7	62,3	57,4	51,7	71,8
3	57,3	61,5	64,6	67,9	67,7	63,0	57,8	51,3	72,9
4	58,0	62,2	64,7	68,1	67,8	63,2	57,8	51,2	73,1
5	59,0	62,6	64,7	68,1	67,9	63,3	57,9	51,4	73,2
6	58,9	62,9	65,1	68,4	68,2	63,4	58,1	51,3	73,5
7	58,3	63,2	65,1	68,4	68,2	63,3	57,9	51,1	73,5
8	56,9	61,9	63,8	67,4	67,3	62,5	57,5	51,7	72,5
9	54,3	58,3	59,9	63,7	63,9	59,4	54,9	49,3	69,0
10	55,2	59,1	61,1	65,2	65,3	60,6	56,2	50,7	70,3
11	58,6	61,9	65,4	68,9	69,0	64,2	59,3	53,3	74,0
12	59,7	63,5	66,3	69,8	69,9	65,1	59,5	52,5	74,9
13	61,1	63,0	66,5	70,0	70,1	65,4	60,0	53,4	75,1
14	60,3	63,1	66,5	70,0	70,1	65,5	59,9	53,0	75,1
15	60,9	63,1	66,6	70,1	70,1	65,4	59,7	52,8	75,2
16	60,1	62,2	66,4	69,8	69,9	65,2	59,3	52,4	74,9
17	57,8	60,9	65,0	68,6	69,2	64,7	60,1	54,7	74,0
18	55,1	59,8	61,6	65,7	66,9	62,6	57,6	52,1	71,4
19	54,3	58,6	60,2	63,4	64,5	60,4	55,2	49,0	69,3
20	57,0	61,0	63,7	67,3	67,2	62,2	55,8	48,5	72,2
21	57,6	61,6	64,0	67,6	67,4	62,5	55,7	47,9	72,6
22	59,8	62,3	64,7	68,1	68,0	63,1	56,7	49,1	73,2
23	58,3	62,4	64,7	68,0	67,9	63,2	56,8	49,9	73,1
24	58,8	62,5	64,7	68,2	68,1	63,2	56,7	49,2	73,3
25	58,4	62,1	64,9	68,3	68,2	63,2	56,6	48,9	73,3
26	57,4	61,1	64,4	67,7	67,7	62,6	56,1	48,4	72,7
27	55,4	58,7	61,2	64,1	64,3	59,3	52,4	44,5	69,4
28	53,4	57,6	59,2	61,2	59,3	52,7	45,9	35,8	66,0
29	54,2	59,3	60,6	62,4	60,8	54,4	47,3	37,2	67,5
30	56,0	60,0	61,6	63,3	61,6	55,0	48,2	37,7	68,3
31	55,6	60,5	62,2	63,5	62,0	55,3	48,2	37,7	68,7
32	57,2	60,3	62,1	63,7	62,1	55,5	48,5	37,8	68,8
33	55,9	60,4	62,1	63,5	61,9	55,1	48,0	37,3	68,6
34	55,4	59,8	61,5	63,0	61,4	54,7	47,8	37,2	68,1
35	54,5	59,4	60,9	62,8	61,0	54,3	47,6	37,7	67,7
36	52,3	57,4	59,1	60,8	59,0	52,0	45,8	35,7	65,7
37	52,9	57,9	58,5	61,1	57,8	50,6	44,4	34,6	65,5
38	53,6	58,7	58,4	60,1	57,5	50,9	45,5	36,3	65,3
39	53,0	57,4	58,5	60,3	58,6	51,5	46,2	37,3	65,4
40	52,8	57,4	59,3	61,2	59,5	53,4	46,8	37,7	66,1
41	55,5	58,9	60,8	62,7	61,2	54,8	48,2	38,9	67,7

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42	55,4	59,8	61,9	64,0	62,2	55,6	48,8	38,3	68,7
43	55,9	60,3	62,5	64,4	62,8	56,0	49,1	38,5	69,2
44	56,9	60,5	62,6	64,6	62,9	56,1	49,6	38,7	69,4
45	56,0	60,3	62,4	64,5	62,8	56,0	49,4	38,6	69,2
46	55,6	59,9	62,0	64,0	62,5	55,6	49,1	38,3	68,8
47	54,9	59,2	60,7	62,9	61,2	54,5	47,8	37,5	67,7
48	53,2	57,4	58,7	60,8	59,4	52,4	45,8	35,5	65,8
49	53,1	57,4	58,0	58,6	57,9	51,6	44,8	35,4	64,6
50	53,7	58,4	57,6	59,7	58,4	52,5	45,8	36,3	65,3
51	52,1	57,7	58,1	59,1	58,2	51,9	45,2	34,9	64,9

TEST REPORT

Sound Level

Serial No. : 1ZPL001134582

Combination of sound level measurements

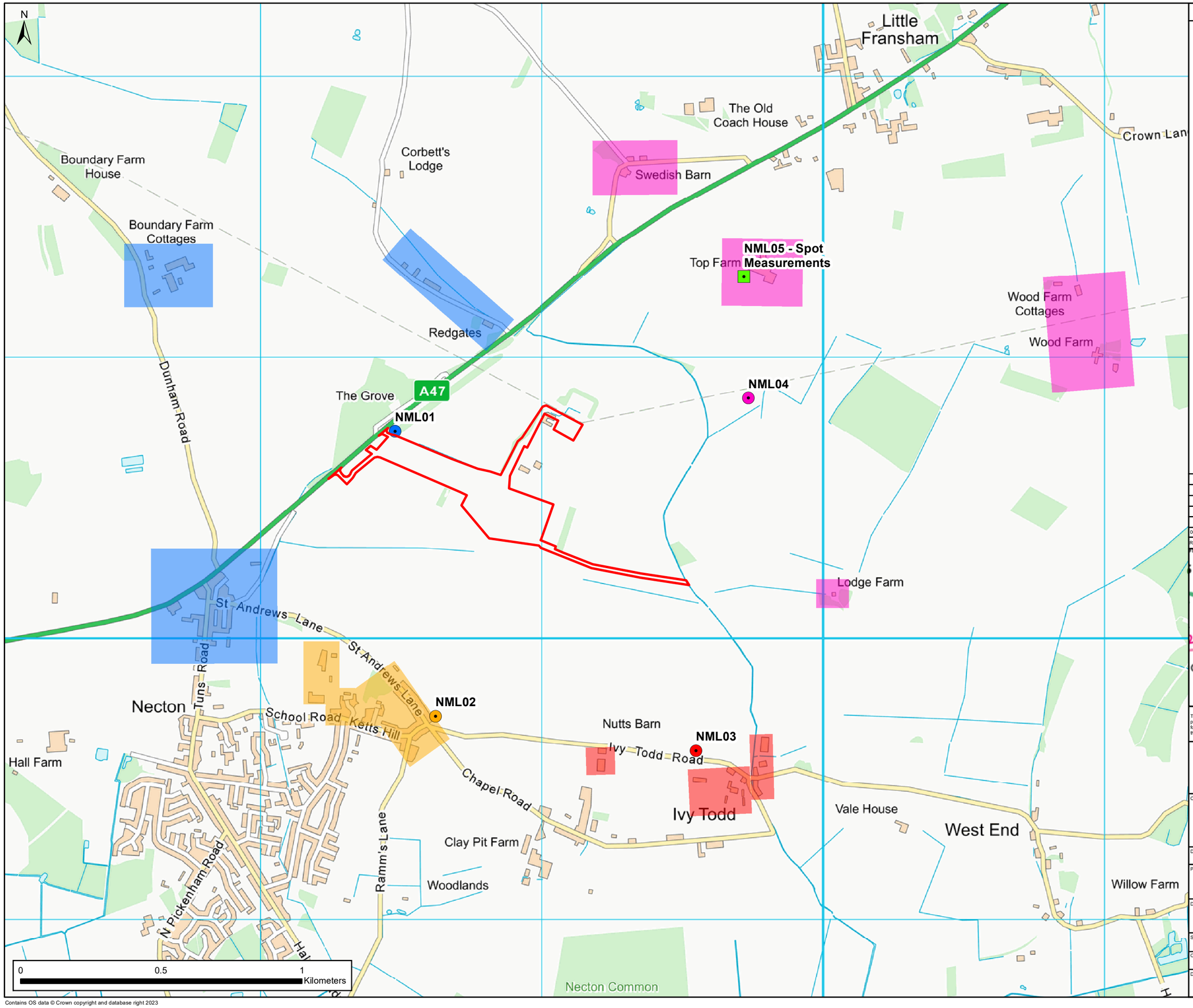
Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation
[%]	[kV]	[%]	[A]			
100	33	100	262.43		8	

Frequency	Measurement 1 Sound Power Level	Measurement 4 Sound Power Level		Combined Sound Power Level
[Hz]	[dB(A)]	[dB(A)]		[dB(A)]
Total Sound Level	76.9	87.8		**88.2**
Octave Band 63	39.6	64.4		**64.4**
125	59.5	79.6		**79.6**
250	76.1	81.2		**82.3**
500	67.3	82.6		**82.7**
1000	56.3	81.7		**81.7**
2000	51.6	75.4		**75.4**
4000	54.1	71.3		**71.4**
8000	57.4	64.2		**65.0**
⅓ Octave Band 50	36.1	63.8		**63.8**
63	37.0	47.4		**47.8**
80	0.0	55.1		**55.1**
100	58.4	71.9		**72.1**
125	47.5	68.5		**68.6**
160	51.3	78.4		**78.4**
200	63.1	73.7		**74.1**
250	60.9	76.4		**76.5**
315	75.8	78.0		**80.1**
400	61.2	77.0		**77.1**
500	63.7	76.9		**77.1**
630	62.5	79.2		**79.3**
800	53.7	78.6		**78.6**
1000	51.4	76.7		**76.7**
1250	47.1	74.5		**74.5**
1600	47.0	72.4		**72.4**
2000	46.7	70.2		**70.2**
2500	46.9	68.5		**68.5**
3150	48.4	67.5		**67.6**
4000	49.6	66.9		**67.0**
5000	49.9	64.8		**64.9**
6300	51.2	61.5		**61.9**
8000	52.9	58.8		**59.8**
10000	53.6	56.4		**58.2**

Rated voltage	Applied voltage	Rated current	Applied current	Tap position	Fans in operation	Pumps in operation
[%]	[kV]	[%]	[A]			

Frequency				Combined Sound Power Level
[Hz]				[dB(A)]
Total Sound Level				
Octave Band 63				
125				
250				
500				
1000				
2000				
4000				
8000				
⅓ Octave Band 50				
63				
80				
100				
125				
160				
200				
250				
315				
400				
500				
630				
800				
1000				
1250				
1600				
2000				
2500				
3150				
4000				
5000				
6300				
8000				
10000				

Appendix F – Figures



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NOTES

Red Line Boundary

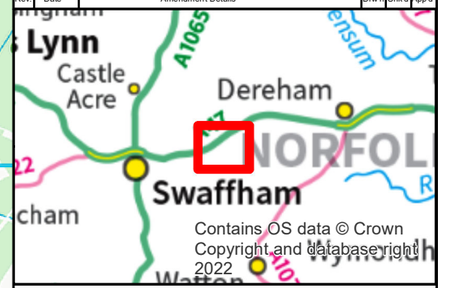
Noise Monitoring Locations (NMLs)

- NML01
- NML02
- NML03
- NML04
- NML05 - Spot Measurements

Nearest Noise Sensitive Receptors (NSRs)

- NSRs Represented by NML01
- NSRs Represented by NML02
- NSRs Represented by NML03
- NSRs Represented by NML04

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
00	11/07/23	First Issue	JCM	EW	JS



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tnei

Client: Statkraft

Drawing Status: FOR PLANNING

Project Title: Necton Greener Grid Park Noise Assessment

Drawing Title: Figure 1: Noise Study Area

Scale	Designed	Drawn	Checked	Approved
1:12,500	JCM	JCM	EW	JS
Original Size	**Date**	**Date**	**Date**	**Date**
A3	11/07/2023	11/07/2023	11/07/2023	11/07/2023

Drawing Number: 15997-002

Revision: 0

Scale 1:2000

N

Top Farm

NAL03 - Top Farm

NAL02 - Redgates

Redgates

A47

The Grove

NAL01 - The Grove

NAL07 - Shell Field Farm

NAL06 - St Andrews Lane

NAL04 - Lodge Farm

NAL05 - Ivy Todd

45

40

35

30

25

20

St Andrews Lane

School Road

Nutts Barn

Ivy Todd

0 0.5 1 Kilometres

NOTES

- Red Line Boundary
- Noise Assessment Locations (NALs)
- Site Layout
- Modelled Noise Sources
- Modelled Barriers
- Modelled Buildings

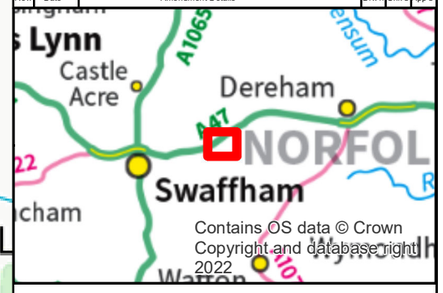
Predicted Noise Levels (dBA)

- 20-25
- 25-30
- 30-35
- 35-40
- 40-45
- >45

Noise contours modelled in accordance with ISO 9613 Part 2:1996 at a height of 4 m and displayed on a 10 m by 10 m grid.

All noise sources assumed to be operating concurrently. All levels shown as dB LAeq(t).

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
0	25/07/23	First Issue	JCM	EW	JS



tnei

Client: Statkraft

Drawing Status: FOR PLANNING

Project Title: Necton Greener Grid Park Noise Assessment

Drawing Title: Figure 2: Noise Conour Plot

Scale	Designed	Drawn	Checked	Approved
1:7,000	JCM	JCM	EW	JS
Original Size	**Date**	**Date**	**Date**	**Date**
A3	25/07/2023	25/07/2023	25/07/2023	25/07/2023

Drawing Number: 15997-003

Revision: 0

Appendix G – Cumulative Assessment Information

Table 25.43 Mitigated cumulative operational noise impacts – Norfolk Vanguard and Norfolk Boreas

NSR	Floor	Onshore Project Substation Noise Level Contribution at Receptor		Background Noise Level at Receptor L_{A90} [dB(A)]		BS4142 derived Impact Magnitude	100Hz [dB(Z)] Condition Compliance (Yes/No)
		Broadband [dB(A)]	100Hz [dB(Z)]	Daytime	Night Time		
SSR1	GF (Ground Floor)	33.8	25.2	37.7	33.8	No Impact	Yes
	FF (First Floor)	33.8	25.0	37.7	33.8	No Impact	Yes
SSR2	GF	28.4	31.1	32.2	28.4	No Impact	Yes
	FF	28.4	31.5	32.2	28.4	No Impact	Yes
SSR3	GF	28.4	25.4	32.2	28.4	No Impact	Yes
	FF	28.4	25.7	32.2	28.4	No Impact	Yes
SSR4	GF	22.9	30.8	31.0	22.9	No Impact	Yes
	FF	22.9	31.0	31.0	22.9	No Impact	Yes
SSR5	GF	29.9	26.5	50.5	29.9	No Impact	Yes
	FF	29.9	27.0	50.5	29.9	No Impact	Yes
SSR6	GF	28.6	24.0	36.0	28.6	No Impact	Yes
	FF	28.6	24.1	36.0	28.6	No Impact	Yes
SSR7	GF	39.4	31.1	46.3	39.4	No Impact	Yes
	FF	39.4	31.3	46.3	39.4	No Impact	Yes
SSR8	GF	36.8	27.5	58.4	36.8	No Impact	Yes

NSR	Floor	Onshore Project Substation Noise Level Contribution at Receptor		Background Noise Level at Receptor L_{A90} [dB(A)]		BS4142 derived Impact Magnitude	100Hz [dB(Z)] Condition Compliance (Yes/No)
		Broadband [dB(A)]	100Hz [dB(Z)]	Daytime	Night Time		
	FF	36.8	27.7	58.4	36.8	No Impact	Yes
SSR9	GF	32.2	25.1	36.5	32.2	No Impact	Yes
	FF	32.2	25.4	36.5	32.2	No Impact	Yes
SSR10	GF	21.8	29.9	34.0	21.8	No Impact	Yes
	FF	21.8	30.0	34.0	21.8	No Impact	Yes
SSR11	GF	31.3	27.1	56.5	31.3	No Impact	Yes
	FF	31.3	27.7	56.5	31.3	No Impact	Yes
		BS4142 Criteria Met or 32dBZ 100Hz Requirement Met					
		BS4142 Criteria Exceeded or 32dBZ 100Hz Requirement Exceeded					

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Michael Doyle
Principal Development Management Planner
Breckland Council

Nina Garner
Consents Officer
National Grid Electricity Transmission

27th October 2022

SENT VIA EMAIL

Your Ref: 3PL/2022/1003/F

Dear Michael,

Full Planning Application: Proposed Works at Existing National Grid Necton 400kV Substation, off A47, Necton.

The purpose of this letter is to address your request for further information to assist your consideration of the above planning application in relation to the approved Vanguard and Boreas Development Consent Orders (DCOs).

An Environmental Statement (ES) was produced by Royal HaskoningDHV in June 2019, to describe the potential environmental impacts of the development approved under the Vanguard and Boreas DCOs. It is important to note that, whilst the National Grid works under this application and the DCO works will be undertaken at the same time, it is a standalone project required to provide for a different electrical transmission system need, as described in the submitted Planning Statement.

The Vanguard and Boreas DCOs ES provided necessary information on environmental impacts, as required by the Environmental Impact Assessment Regulations 2017, to inform appropriate mitigation and was deemed satisfactory by the Secretary of State (SoS) when determining the DCO applications.

It is important to note that the Vanguard and Boreas DCOs ES related to the entire Vanguard and Boreas DCO projects including the offshore windfarm elements, the cable route from the offshore elements to the onshore Vanguard and Boreas Substation. The extensions to Necton Substation, which were consented as part of the DCOs, were only a very small part of the wider Vanguard and Boreas projects.

In terms of the environmental topics relevant to the above planning application, the Vanguard and Boreas DCOs ES Chapter 25 Noise and Vibration, provided an overview of the potential noise and vibration effects and the associated mitigation for the construction, operation and decommissioning of the onshore elements of the DCO projects. A link to the relevant ES chapter is provided at the bottom of this letter.

Operational noise has not been considered a concern for the proposed National Grid extension as it will be compliant with agreed noise levels secured through DCO Requirement 27. This conclusion was agreed with stakeholders and no concerns have been raised in the SoS decision letter (section 4.94). Breckland Council also agreed, through the Statement of Common Ground, that the operational limits were appropriate. The Examining Authority (ExA) was content that any

residual effects would be dealt with satisfactorily through DCO Requirement 27 and the Code of Construction Practice (CoCP) Requirement 20(2)(e).

ES Chapter 25 identifies Noise Sensitive Receptors (NSRs) for the wider project, with those nearest the substation site being relevant to the proposed extension, the subject of this application. The ES (table 25.34) demonstrates that impacts are of negligible significance to NSRs around the substations with standard mitigation implemented. Section 5.5.15 of the ExA Report outlines that standard mitigation for adverse construction noise effects would comprise of the Construction Noise Management Plan (CNMP) which forms part of the CoCP. The ExA is content that the measures set out in DCO Requirement 20 (CoCP), and 27 (operational noise) would provide an effective way to minimise adverse onshore noise and vibration effects.

The impacts of road traffic noise at NSRs were predicted to have a minor adverse impact for Norfolk Boreas through the implementation of a Traffic Management Plan (TMP). An Outline TMP has been approved through the DCO process and outlines standard mitigation measures. A detailed TMP is required to be approved for various phases of the approved DCO works in order to discharge DCO Requirement 21(1). In order for construction disruption to minimised, the National Grid substation extension works, the subject of the above application, are intended to take place at the same time as the substation extensions approved under the DCO. National Grid will work with Vattenfall when the relevant detailed TMP for the DCO approved works is being produced to ensure that National Grid can fully comply with the traffic management measures proposed, taking account of construction traffic relating to both the DCO approved works and the works the subject of the above application. National Grid is also content to accept a condition on any planning permission for the works of the subject of this application requiring a specific detailed TMP to be submitted to and approved by the Council.

As stated in the submitted Planning Statement, the proposed extension, the subject of the above application, will utilise the existing access track to the 400kV substation site which will be upgraded and a temporary access track constructed for access to the eastern end of the site. This is the same as approved under the DCO. Section 24.7.2.2 of Chapter 24 Traffic and Transport of the ES identifies a worst-case scenario in terms of construction traffic numbers. As National Grid propose to undertake the works (the subject of the above application) at the same time as the works approved under the DCOs, National Grid will work with Vattenfall to ensure that construction traffic will be managed to remain within the parameters assessed by the DCO ES and approved under the DCOs, as well as with any measures included in subsequent detailed TMPs.

We can confirm the Link 1b (A47) will be the main access to the extension, the subject of the above application, and there were no concerns raised in the SoS decision letter relating to this particular transport link. A link to the decision letter and relevant ES chapter is provided at the bottom of this letter.

A full assessment of the potential impacts and assumptions, identified with relation to air quality has been provided as part of the approved DCO application in Chapter 26 of the ES. It was anticipated that there will be no significant cumulative impacts during the operational phase, therefore, as agreed with the SoS, this was scoped out of the ES assessment. It was also concluded in Chaper 26 that impacts on air quality associated with construction phase dust and road traffic emissions would not be significant at both human and ecological receptors.

The ExA concluded emissions would be in line with the respective Air Quality objectives, and construction dust and fine particulate matter would be controlled by the mitigation within the Air Quality Management Plan in the CoCP (section 7.3.17). The SoS's main concerns for effects of construction on air quality, were focused on Cawston and Oulton, however the SoS decision letter

states these were satisfactorily resolved (4.91). As the construction of the the proposed extension will involve the same construction activities, and take place at the same time as the construction of the extensions approved under the DCOs, there will be no additional adverse impacts. A link to the ExA's report is provided at the bottom of this letter.

Air quality mitigation for the approved DCO works will be addressed through the CoCP that will be approved in order to comply with DCO Requirement 20(2)(i)- the principles of which have been identified and approved in the Outline CoCP. National Grid will ensure the extension works, the subject of this application, will be similarly compliant and, if considered necessary, would accept a suitably worded condition on any planning permission granted requiring the approval of a separate CoCP for the extension works the subject of this application.

In addition to the above environmental topics we can confirm that an addendum LVIA has been submitted with the above application that assesses the additional effect of the proposed extension over and above the extensions approved under the DCOs. Comments were provided by National Grid to Breckland Council via email on 26th October 2022 to address the Council's Landscape Architect's response.

In terms of ecology, there are no direct ecological effects relating to the proposed substation extension works. However, an offsite Biodiversity Net Gain (BNG) contribution has been proposed in line with National Grid's internal BNG policy to address the small loss of agricultural land. This has been detailed in the BNG reported submitted as part of this application.

Finally, in relation to drainage, the information submitted with the application confirms that the drainage solution approved under the DCOs provides adequate drainage infrastructure to accommodate the additional drainage requirements of the extension, the subject of the above application. In addition to the Drainage Technical Note submitted as part of this application, National Grid have provided further information sent to the Lead Local Flood Authority via email on 21st October 2022 to support the application.

We trust that this letter and the links to the relevant DCO documentation provide you with sufficient information in order to conclude that there is no reason to refuse the proposed substation extension.

Yours Sincerely,

Nina Garner

Consents Officer

Links to Relevant DCO Documents

SoS Decision Letter

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002917-NORB-Boreas-Decision-Letter.pdf

ExA Report

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002914-NORB-Recommendation-Report-FINAL.pdf

Development Consent Order

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002918-NORB-Development-Consent-Order.pdf

ES Chapter 24 Traffic and Transport

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000410-6.1.24%20Environmental%20Statement%20Chapter%2024%20Traffic%20and%20Transport.pdf

Outline Traffic Management Plan

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002562-8.8%20Outline%20Traffic%20Management%20Plan%20(Version%207)%20(Clean).pdf

ES Chapter 25 Noise and Vibration

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000411-6.1.25%20Environmental%20Statement%20Chapter%2025%20Noise%20and%20Vibration.pdf

Chapter 26 Air Quality

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000412-6.1.26%20Environmental%20Statement%20Chapter%2026%20Air%20Quality.pdf

Outline Code of Construction Practice

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002594-8.1%20Outline%20Code%20of%20Construction%20Practice%20(Version%207)%20(Clean).pdf

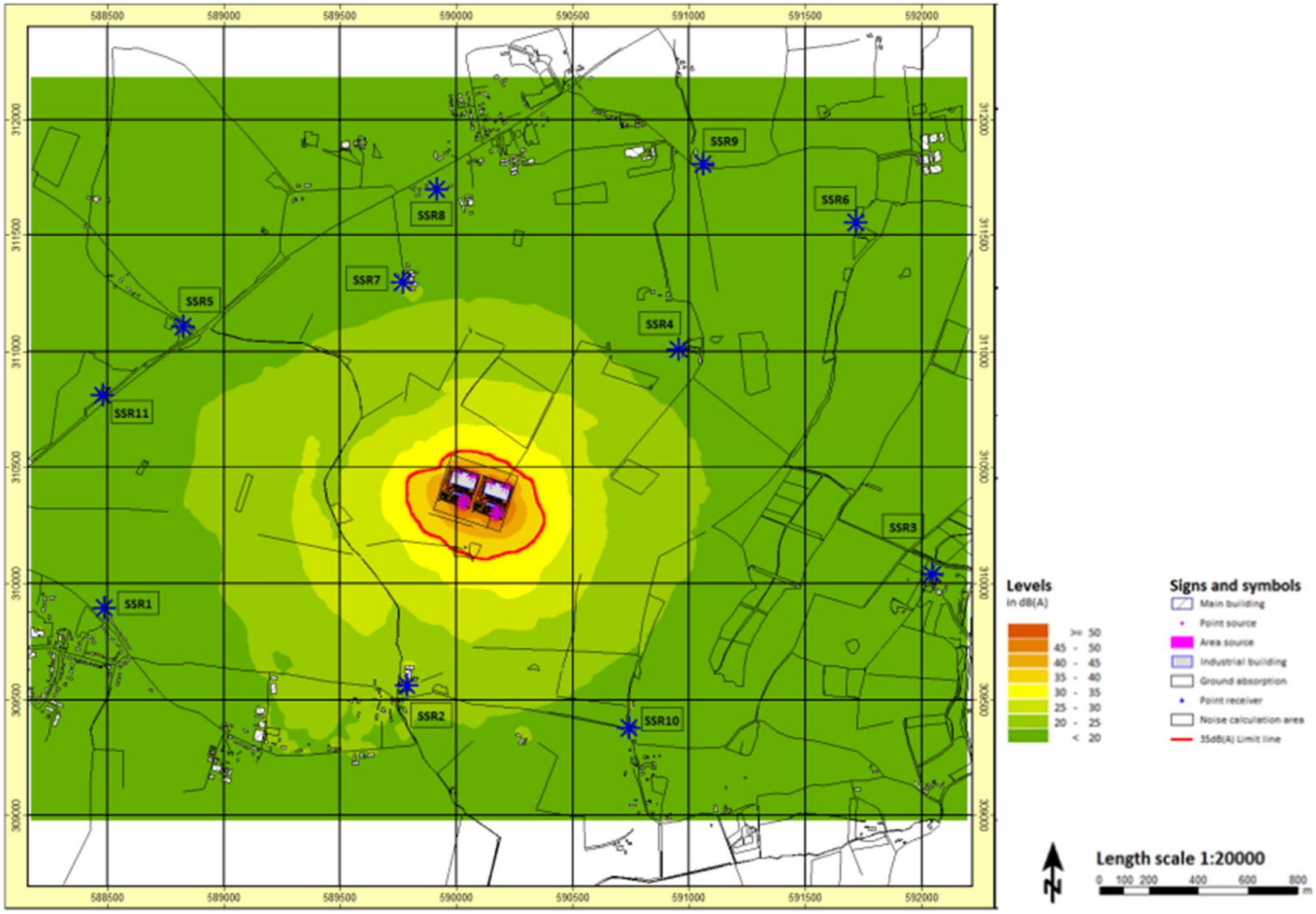

Plate 25.3 Norfolk Vanguard onshore project substation with mitigation (calculation in 1.5m above ground)