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Energy Project Management

Noise assessment, Bolfornought Energy Storage

A report to

Stirling Council

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Director

1 INTRODUCTION

1.1 The application

This document supports an application to Stirling Council by Intelligent Land Investments Group plc for consent under the Town and Country Planning (Scotland) Act 1997 for construction of a battery energy storage system at Bolfornought Farm, by Springkerse, Stirling FK7 7LL. The proposal is described as Bolfornought Energy Storage.

The application seeks consent for the installation of an energy storage system with a generating capacity of up to 49.99 megawatts. The development would consist of containers containing batteries, associated equipment, an access track, electricity meter building, fencing and new planting. Figures show the site location, and layout.

1.2 Site description

The proposed development site lies in farmland, part of Bolfornought Farm, a working farm. The site is agricultural land. The field in which the proposed development is sited is accessed from the A91 Distributor Road at the Muirton roundabout from where the existing private access serves the farm and 6 houses. This is in the vicinity of Forthbank Stadium and St Modans High School.

The site lies on the flat carse farmland around 2 kilometres east of the town of Stirling on the edge of the large Springkerse industrial area.

The site is around 300 metres from the nearest house at Upper Taylorton Farm to the north.

2 METHOD

2.1 Assessment method

A noise assessment has been prepared for the proposed development following the standard calculations in ISO 9613-2:1996 and BS4142:2014. Noise limits are proposed for the development to ensure no disturbance at neighbouring properties.

A noise model was created for the site and noise predictions made using the latest version of iNoise 2021, quality assured software for noise calculations.

Air absorption was based on a temperature of 20C, pressure of 101 kPa and 60% humidity. A ground factor of 0.7 was used except for areas of hard ground.

The report considers both external noise levels in the vicinity of dwellings, and levels within rooms, assuming windows open for ventilation. Inside levels were assessed by calculating facade noise levels adding 3 dB to free-field levels, and subtracting 10 dB for attenuation through a window open for ventilation.

3 EXISTING NOISE ENVIRONMENT

The proposed facility is located on agricultural land near a busy road east of Stirling. Road traffic dominates the noise environment. The key noise receptor was considered as Upper Taylorton.

The site was visited on 28 October 2020 10h – 16h when the weather was overcast but bright and damp with light wind, and 16 December 2020 14h - 16h when the weather was dull, overcast with light wind.

Dwelling	Sounds heard 28 October	Sounds heard 16 December
Upper Taylorton	Traffic, individual vehicles heard over more general noise; honking of a flight of geese, distant construction hammering.	Traffic, a crow, wingbeats of a group of pigeons passing over.

Table 3.1 Noise environment

3.1 Existing A91 road

Noise mapping for the Scottish Government for the Environmental Noise (Scotland) Regulations 2006 predicts noise levels in the area and levels for Upper Taylorton from that work suggest existing adverse noise impacts. Nighttime noise levels in the region of over 45 dB LAeq outside are predicted for these properties.

4 PROPOSED CHANGE IN NOISE ENVIRONMENT

4.1 Proposed equipment

The development will comprise batteries in metal containers, external inverters and switchgear in metal housings, and external transformers. Containers will have air conditioning units mounted at low level on their outsides. Equipment may operate at any time of day or night. Cooling will be designed for the most onerous case, being

hot summer conditions, however the greatest use of the facility is expected to be in winter during the day and early evening, from breakfast time to dinner time, so worst case combination of warm weather and high load are expected to be rare.

Measured data from an operational grid battery storage site with equipment functioning was used to derive source sound power data for the battery unit. Overall noise data for the inverter was available and octave band data was taken from a fan unit considered a suitable comparator. Measured data from a comparable transformer was used to model the transformers.

Equipment	Number of units	Sound power levels, dB, at octave band frequencies in hertz								dB A weighted total for one unit
		63	125	250	500	1k	2k	4k	8k	
Battery unit	52	74	74	78	79	77	75	70	66	82
Inverter	65	53	70	79	79	77	78	75	72	84
Transformer	13	72	74	70	69	58	51	46	40	68

Table 4.1: Sound Power Data

The battery and inverter equipment would not be tonal or intermittent in a away that would be perceptible at the distance of the nearby dwellings. The battery units incorporate mitigation within their design – noise attenuation cowls fitted to vents and low-noise multi-bladed fans on the air conditioning units which are sited at low level to minimise noise emissions.

The transformer noise has a tone that is clearly perceptible and therefore a rating penalty of 4dB has been applied, in line with standard methods.

For procurement and engineering reasons, it may be necessary to vary slightly the proposed equipment during or after the planning application process. In the event that alternative equipment is proposed that would give greater noise impacts at the receptors, then a full noise assessment would be undertaken in consultation with Stirling Council Environmental Health for approval prior to proceeding with that alternative equipment.

4.2 Noise mitigation

The ESU units incorporate mitigation within their design – noise attenuation cowls fitted to vents and low-noise multi-bladed fans on the air conditioning units which are sited at low level to minimise noise emissions.

A continuous acoustic absorptive fence of height of 3 metres is proposed around the proposed development.

5 RESULTS

5.1 Receptors & results

The closest dwelling to the proposed facility is at Upper Taylorton Farm situated at the courtyard around 300 metres north of the site. Other dwellings are Taylorton House, east of the farm, Mallard Cottage being the first cottage east of Upper Taylorton, Steuarthall Farm south east of the proposed facility, Stuarthall Cottages by the Bannock Burn, and Wallace View (residential caravan park) and Crook, off the A905.

A noise model was constructed using standard software to predict noise levels for each nearby dwelling due to the equipment. The results are presented in Table 4.2 below.

Nearby dwelling	Existing road noise, night, outside L_{night} dB L_{Aeq}	Existing road noise, all times, outside L_{den} dB L_{Aeq}	Predicted noise rating level due to energy storage facility, outside dB L_{Aeq}
Upper Taylorton Farm	49	56	35
Taylorton House	46	53	34
Mallard Cottage	36	42	30
Steuarthall Farm	36	43	31
Stuarthall Cottages	35	42	30
Wallaceview	38	45	29
Crook	36	40	23

Table 4.2

As can be seen in the table above, the predicted noise levels would be below acceptable levels for all properties, and well below existing noise levels, and unlikely to cause complaint.

Daytime noise levels of 35dB LAeq would be achieved outside all dwellings. This equates to standard levels that are considered not to cause disturbance. A noise limit for the facility at dwellings of 35dB LAeq at all times is proposed.

5.2 Noise conclusions

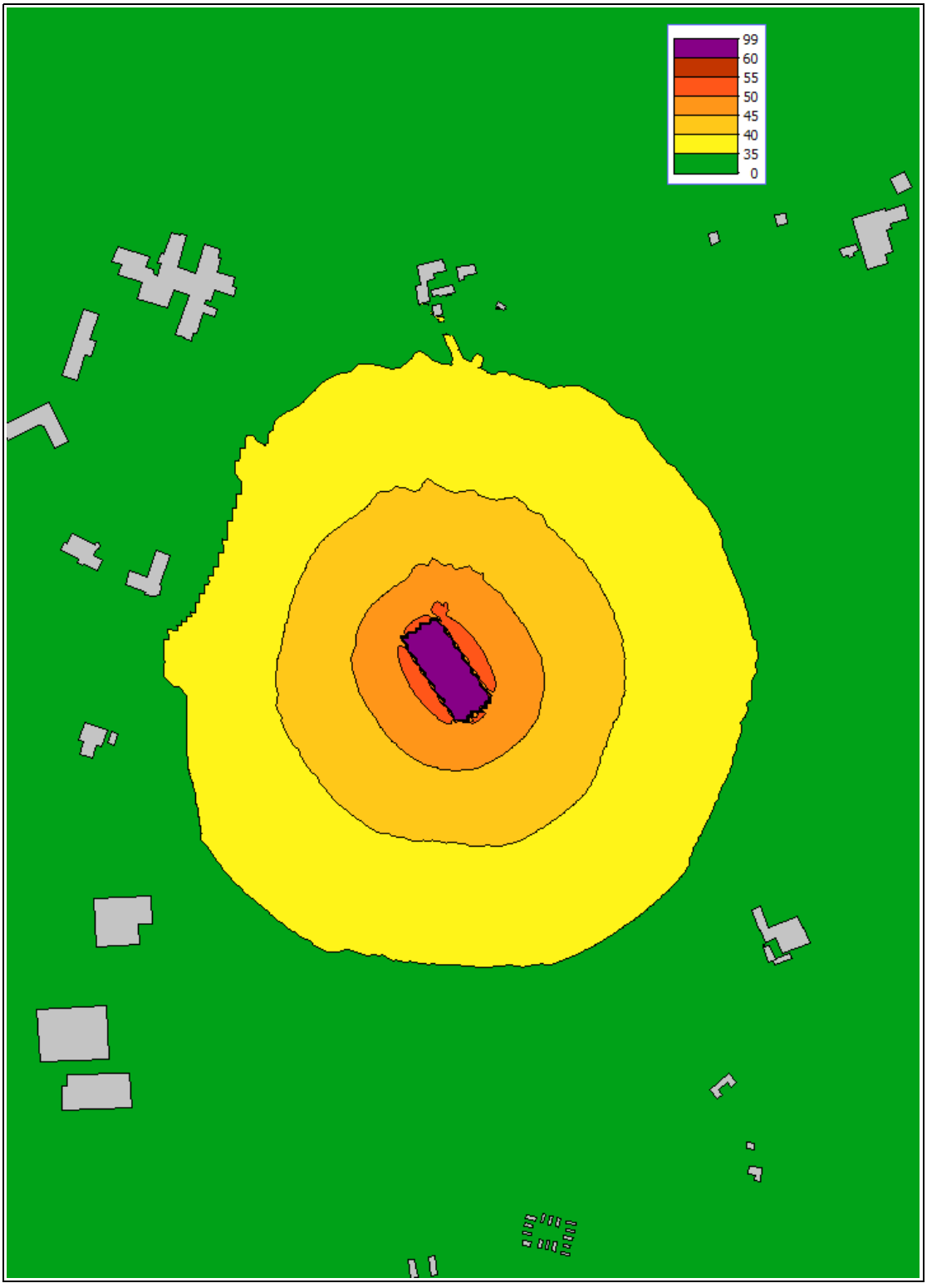
The noise levels from the development will be sufficiently low not to cause disturbance at neighbouring properties. A noise limit for the facility at dwellings of 35dB LAeq at all times is proposed.

Equipment suppliers should confirm noise data before orders are placed.

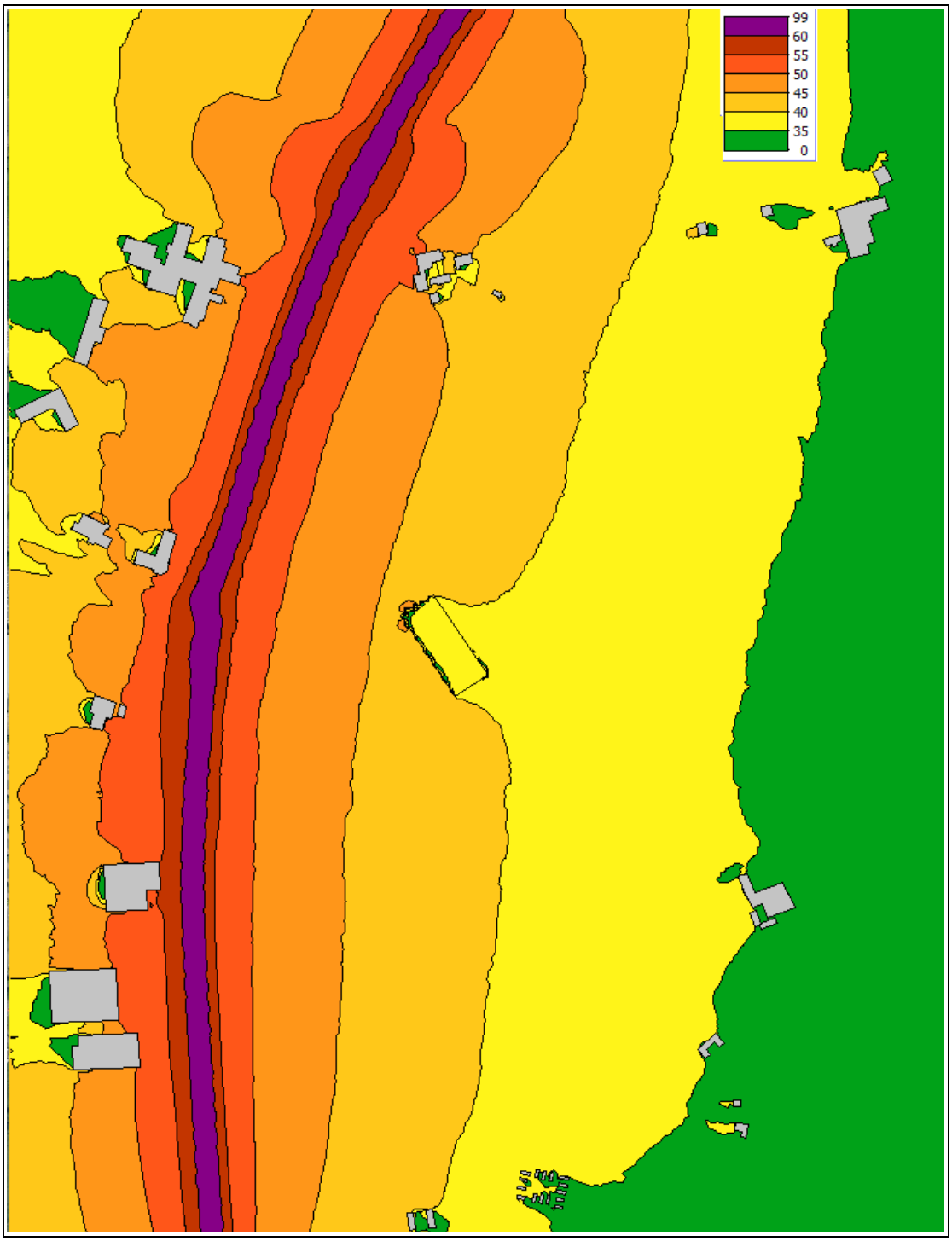
APPENDIX A. NOISE PLOTS

The graphics below show the predicted external noise contours for the site.

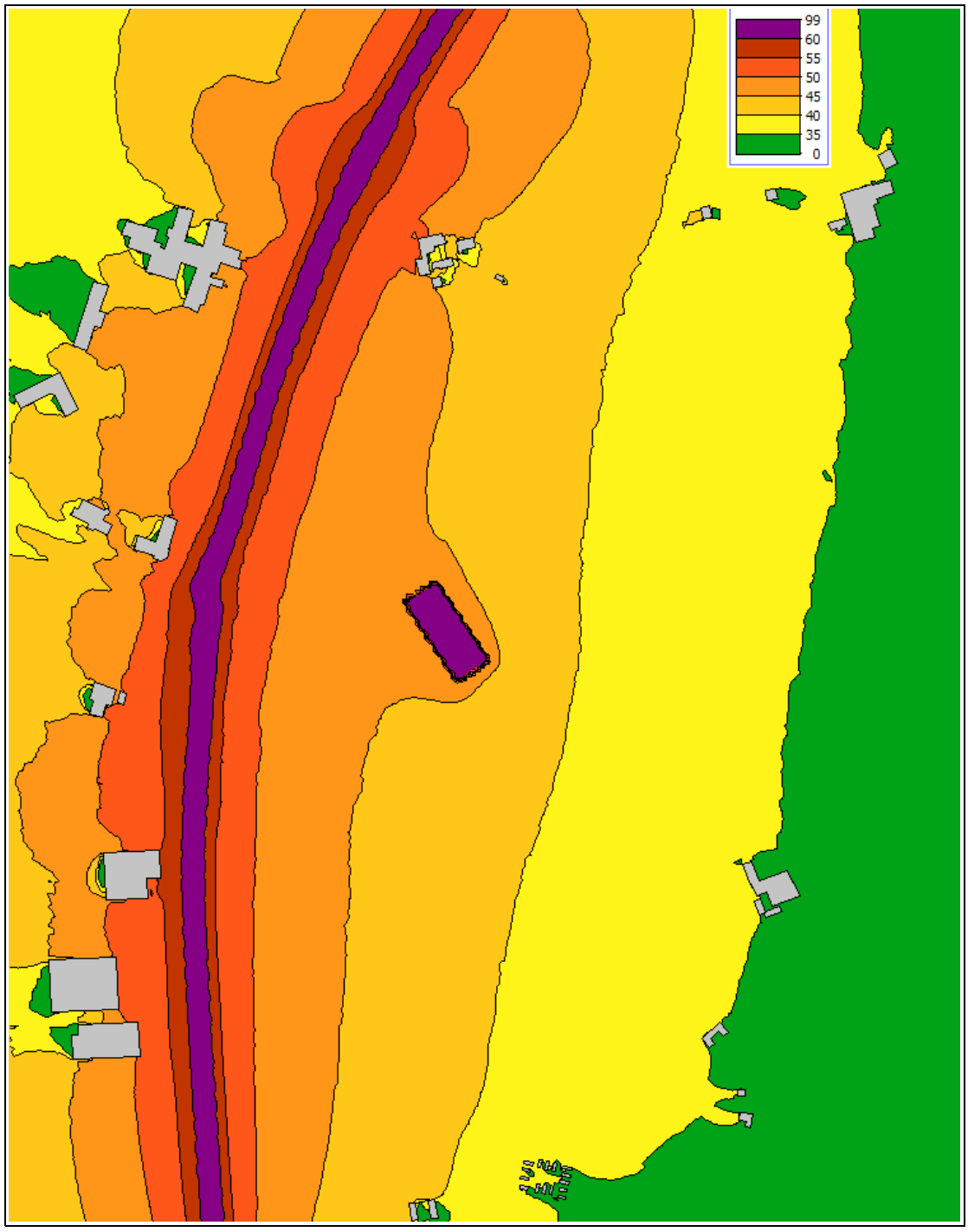
Battery project only, dB L_{Aeq}



Existing road, dB L_{Aeq}



Cumulative existing road plus energy storage facility, dB L_{Aeq}



APPENDIX B. ENERGY STORAGE EQUIPMENT NOISE MEASUREMENTS

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NOISE ASSESSMENT REPORT

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Appendix B
Hungerford Farm
Source Noise Measurements Report

Re: ESS Operational Battery at Hungerford Farm – Source Noise Measurements

Following our recent site visit to Hungerford Farm ESS (Energy Storage System), please find below results from source noise measurements undertaken of the operational containerised ESS.

Site Description and Noise Measurements

The operational battery at Hungerford farm comprises electrical storage technology and associated inverters within a steel container. The system is connected to the national grid via a separate electrical transformer and operates to provide electrical energy on an on-demand basis.

The container includes four external condensing units mounted to the sides of the container to provide cooling to the battery compartment. In addition, air extract louvres are located above the inverter compartment doors. Condensing units and air extract fans operate depending on internal temperatures of the containerised plant and are the primary noise sources associated with the plant system. The ESS site installation identifying relevant noise sources is shown in Figure 1.

A series of noise measurements were undertaken around the operational battery unit on 5th May 2017 to determine the level of noise generated during typical operation. The ESS container is installed on a concrete base adjacent to an associated solar farm located on arable farmland. No buildings or other structures are located nearby to the ESS container.

Background noise sources at the site primarily included aircraft and nearby livestock. Transient events (e.g. aircraft) were removed from the measurements.

Noise Measurements were undertaken in short samples (typically 30 seconds to attain a steady level) at 1 m from the plant at a height of 1.5 m above local grade level at multiple locations around the container. Measurement locations are identified in Figure 2. Measurements were undertaken using fast time weightings in terms of L_{Aeq}, L_{Amax} and L_{A90} sound pressure levels and unweighted single octave band centre frequency sound pressure levels using the following equipment:

- Rion NA-28 Class 1 accuracy precision real time analyser;
- Brüel & Kjær 4231 Class 1 accuracy acoustic calibrator.

The instrumentation was calibrated before and after measurements. No drift in calibration was recorded. Weather conditions were fine and dry during the measurements. Wind conditions varied during the survey period, however, measurements were paused during gusts in wind. Care was taken to ensure that the noise measurements were not affected by weather conditions.

The ESS plant was operating under normal conditions during noise measurements. Measurements were undertaken during periods when extract fans and condensing units were active. Measurements are therefore considered to be representative of operating conditions.

Calculations and Measurement Results

Measurement results have been analysed and calculations undertaken in accordance with guidance provided by EN ISO 3744: 2010 and standard acoustic theory to determine the sound power level of the operational battery system. Measurements have been corrected for background noise.

Measurement results identified the inverter air extract louvres to be the primary source of noise from the system. Noise measurement results from Locations 1 and 13 (1 m from louvres on each side of the container) are shown in Table 1.

Measurement Location	Sound Pressure Level at 1 m (dB) per Octave Band Frequency, Hz								dBA
	63	125	250	500	1k	2k	4k	8k	
1	56	59	59	59	58	58	54	50	64
13	53	57	59	60	58	57	53	49	64

Table 1: Air extract louvres – Noise Measurement Results at 1 m

Calculations have been undertaken to determine the ESS plant sound power level considering the ESS dimensions and range of noise measurement results. Calculation results are shown in Table 2.

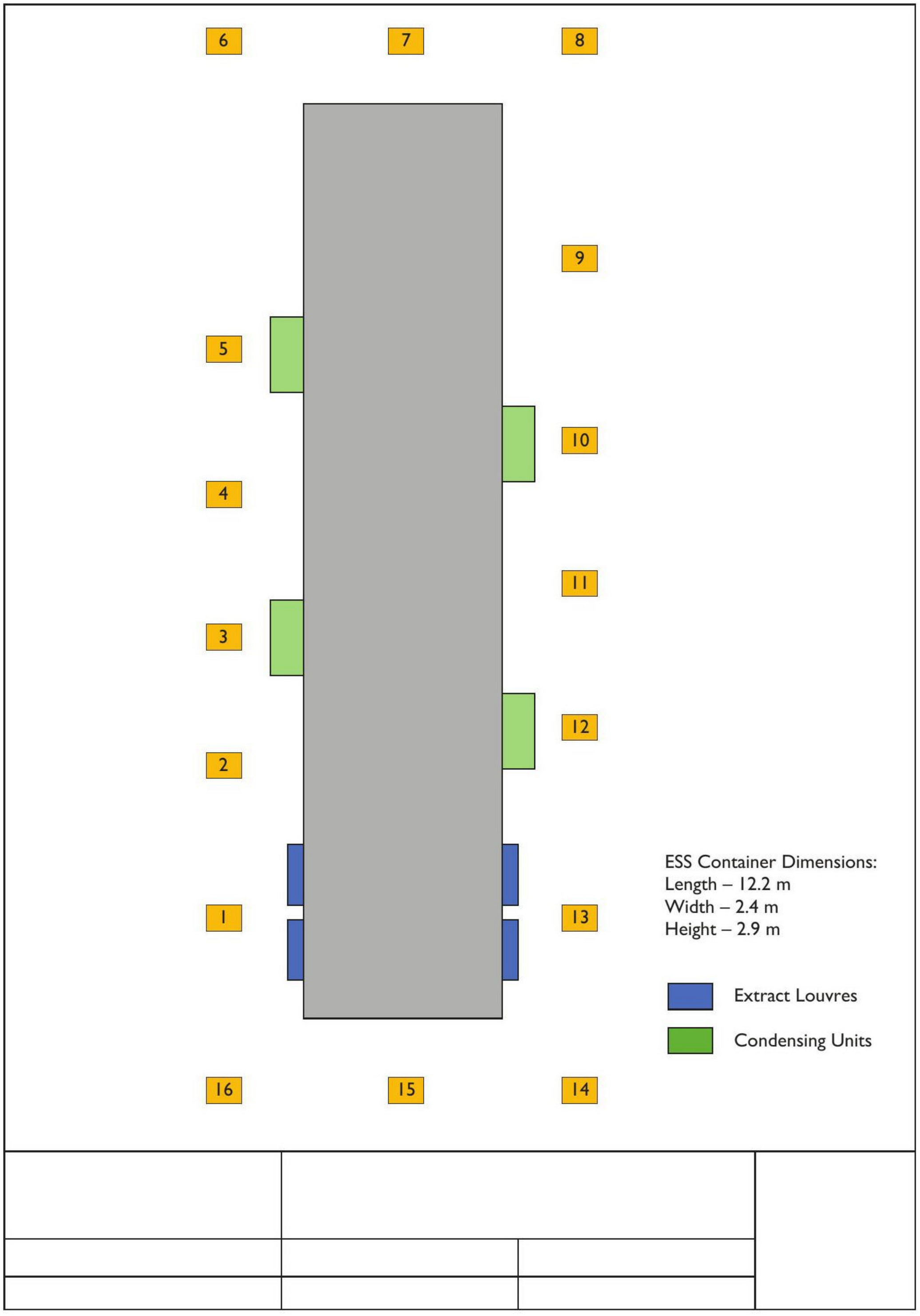
Noise Source	Sound Power Level (dB) per Octave Band Frequency, Hz								dBA
	63	125	250	500	1k	2k	4k	8k	
ESS - Operational Battery	74	74	78	79	77	75	70	66	82

Table 2: Operational Battery - Calculated Sound Power Level

Based on the sound power level stated in Table 2, the noise level at a distance of 50 m would be in the region of 40 dBA (based on hemi-spherical spreading alone).

Given the broadband nature of the noise from the air extract louvres and condenser units, it is considered that the noise emission would not attract any characteristic noise penalties when assessed under BS 4142.


Air extract louvres
External condensing units


6
7
8
9
5
10
4
11
3
12
2
1
13
16
15
14
ESS Container Dimensions:
Length – 12.2 m
Width – 2.4 m
Height – 2.9 m
Extract Louvres
Condensing Units