Heckington Fen Solar Park

EN010123

Environmental Statement | Volume 3: Technical Appendices

Appendix 12.2: Noise Modelling

Applicant: Ecotricity (Heck Fen Solar) Limited

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Pursuant to: APFP Regulation 5(2)(a)

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Planning Act 2008

APPENDIX 12.2: NOISE MODELLING

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Heckington Fen Energy Park. Appendix 12.2: Noise modelling.

Contents.

1. Identified noise-sensitive receptors

1.1.1 A selection of receptor locations, which was determined as representative of dwellings around the Energy Park Site (rather than an exhaustive list of all dwellings), is shown in Figure 12.2- Noise assessment locations (sheet 1, document reference 6.2.12). A detailed list of these representative receptors is set out in Table 12.2.1. Figure 12.2 (sheet 2) also shows additional representative residential properties identified around the Cable Route Corridor.

Table 12.2.1 – Representative noise sensitive assessment locations identified around the Energy Park

Receptor Name	Easting	Northing
Five Willow Farm	518599	346878
Mill Green Farm	519930	347330
The Old Church	521876	347321
Maryland Bank	522068	347082
Spinney Farm House	522924	346018
College Farm	521874	344471
Caitlins Farm	521795	344284
College Cottage	521839	344148
Cattleholme Farm	521832	343977
Swineshead House	521150	343583
Rakes Farm (The Rakes)	520807	343779
Six Hundred Drove/Farm	520605	343705
The Old Church (East Heckington)	520408	343858

Receptor Name	Easting	Northing
Ashleigh House	520352	343958
2 Council House	520174	343986
1-2 Rectory Cottages	519943	344054
Rectory Farmhouse	519660	344208
The Oat Sheaf	519612	344229
Beech House	519461	344339
Home Farm	519365	344541
Elm Grange Farm	519064	344483
First Cottage	518680	344800
Derwent Cottage	518657	344941
1-4 New Cottage	518617	345147
The Bungalow	518486	345459
Chapel House	518387	345879
Glebe Farm	518486	346134

2. Construction Noise and vibration

2.1 Construction Noise

2.1.1 Full details of the exact construction method, plant and duration are not available at this stage of the Proposed Development. The construction noise impact assessment considers the typical activity based on the type and scale of development. Table 12.2.2 below shows the assumed construction stages that would take place on-site across the Proposed Development and the associated sound power levels during these stages.

2.1.2 These sound power levels are based on likely worst-case scenarios. The typical emission levels of Table 12.2.2 have been based on assumptions in terms of what plant items will be in operation and the percentage of time the relevant plant will be in use during a 10-hour period ("on-time"): these are detailed in Table 12.2.2. Reference data for the emissions of typical construction plant and activities set out in BS 5228-1 (BSI, 2014) was used.

Table 12.2.2 Construction plant and equipment assumptions (based on BS 5228-1 guidance)

Work Stage	Plant / Equipment Description	Maximum Power (sound power, L_{wA} (dB))	On-Time (%)	Assumed Overall Sound Power L_{wA} (dB)
Earthworks	Tracked Excavator	106	70	111
	Dozer	108	70	
	Wheeled backhoe loader	96	50	
	Articulated dump truck	109	50	
Solar array mounts	Tubular steel piling - hydraulic jacking - 240mm diameter	117	90	117
	Mobile Cranes	105	50	
	Wheeled backhoe loader	96	50	
Access Road works	Tracked Excavator (16t)	104	60	108
	Dumper (5t)	106	70	
	Tamper	91	50	
	Vibratory roller (3t)	101	50	
	Asphalt paver + tipper lorry	105	50	
Horizontal Directional Drilling (HDD)	HDD power unit and drill / HDD generator / Bentonite pump / Bentonite mixer / Generator for Site Offices	115	100	115
Construct temporary Site compounds	360 deg Excavators (Large)	105	100	115
	20tonne Excavator	102	90	
	Wheeled backhoe loader	96	90	
	Vibratory roller	102	80	
	Dozer	108	80	
	Wheeled backhoe loader	96	80	105

Work Stage	Plant / Equipment Description	Maximum Power (sound power, L_{wA} (dB))	On-Time (%)	Assumed Overall Sound Power L_{wA} (dB)
Cable trench works	Lorry	106	20	
	Tracked Excavator (16t)	104	80	
Breaking concrete foundations	Concrete Crusher	112	80	115
	Power Tools	108	80	
	Lorries	106	50	
	Fork Lifts	104	50	

2.1.3 The resulting likely construction noise level estimates at different distances from the work has been undertaken in accordance with British Standard (BS) 5228-1 *'Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise'* (British Standards Institution (BSI), 2014) which provides methods for undertaking such predictions. It has been conservatively assumed that there are no screening effects, and that the ground cover is characterised as 50% hard / 50% soft.

Table 12.2.3 Predicted L_{Aeq} noise levels (dB) over the working day based at different distances for each of the working stages

Distance (m)	Earthworks	Solar array mounts	Access Road works	HDD	Construct temporary site compounds or Substation / breaking concrete foundations	Cable Trench
50	68	74	65	-	-	-
60	67	73	64	-	-	-
70	65	71	62	-	-	-
80	64	70	61	68	-	59
90	63	69	60	67	-	58
100	62	68	59	66	67	57
150	58	64	55	62	64	54
200	55	61	52	59	61	51
250	53	59	50	57	59	49
300	51	57	48	55	58	48
350	50	56	47	54	56	46
400	48	54	45	52	55	45
450	47	53	44	51	54	44
500	46	52	43	50	53	43

Distance (m)	Earthworks	Solar array mounts	Access Road works	HDD	Construct temporary site compounds or Substation / breaking concrete foundations	Cable Trench
550	45	51	42	49	52	42
600	44	50	41	48	51	41
700	43	49	40	47	50	40
800	42	48	39	46	49	39
900	40	46	37	44	48	38
1000	39	45	36	43	47	37

2.2 Construction vibration

2.2.1 Vibration predictions have been undertaken using reference information from BS 5228-2 *'Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 2: Vibration'* (BSI, 2014) for vibratory plant at varying distances, based on worst-case assumptions likely to over-estimate actual vibration levels in practice. Although HDD plant may also generate vibration locally, given this work is relatively distant from the nearest sensitive receptors, it does not require further consideration.

2.2.2 For vibratory ground compaction, predictions were made assuming a 0.8mm drum vibration amplitude and a 1.5m drum width, both for steady state and at start-up/run-down. For the percussive piling, predictions are based on toe at refusal with an 85 Joule hammer energy. These assumptions represent a worst-case based on the BS 5228-2 guidance. Table 12.2.4 sets out the resulting predictions for different separation distances.

Table 12.2.4 Predicted worst-case vibration levels (PPV, mm/s) for key activities

Distance (m)	Vibratory compaction, steady-state	Vibratory compaction, start-up/run-down	Percussive piling	Auger boring / HDD drilling
20	1.0	1.4	<1 mm/s	<1 mm/s
65	0.3	0.5	0.2	0.2
150	0.2	0.3	0.1	0.1
200	0.1	0.1	0.0	0.0

3. Operational Noise

3.1.1 Prediction of sound propagation from noise sources to representative noise sensitive receptors, closest to the Energy Park Site boundary, has been undertaken in accordance with ISO 9613-2 'Acoustics – attenuation of sound during propagation outdoors – Part 2: General method of Calculation (International Organisation for Standardisation (ISO), 1996). This was implemented in the CadnaA®[1] prediction software. Propagation over soft ground was assumed, typical of cultivated land in rural conditions, with receptor locations modelled at a height of 4 m to represent a first floor window. Please note that the model did not consider any screening from the solar PV panels themselves which were not included in the noise model as solid elements.

3.2 Noise sources assumed

3.2.1 The exact design of the solar installation will be the result of a future tendering process and therefore representative equipment has been assumed for this noise assessment, based on indicative manufacturer selection, The assumed noise emission levels are set out below in Table 12.2.5. Spectral data (where relevant) was based on manufacturer data when available or from experience of representative units

Table 12.2.5 - Solar energy electrical/mechanical plant – assumed sound power levels (dB)

Noise Source	Model	Octave Band Centre Frequency (Hz)						
	assumed	63	125	250	500	1000	2000	dB(A)
Energy Storage - inverter	Freesun PCS/HEMK	68	77	86	85	86	86	92
Energy Storage – cooling	Vertiv Liebetert HPS 14kW	-	-	-	-	-	-	70
Solar panel – central inverters	SMA SC4600UP	65	74	82	82	83	83	91
Solar panel – transformers	Generic data	-	-	-	-	-	-	80
Auxiliary transformer	Generic data	80	87	86	74	71	66	80
Power regulation unit	Generic data	85	92	91	79	76	71	85
Main 400/33 kV transformer	Generic data	100	107	106	94	91	86	100

3.2.2 The solar panels are associated with up to 127 Inverters and Transformer Stations distributed around the Energy Park. Table 12.2.5 however demonstrates that the noise emissions from these transformers are also negligible relative to the inverters and so only the latter were included in the model for each station.

3.2.3 The Energy Storage Compound area was assumed as including 200 Energy Storage Containers (ESS) units including a cooling unit, 100 inverters/power converters and 100 transformers. As the contribution from the transformers and cooling units was negligible[2] compared to the inverters (based on the available data as set out Table 12.2.5), only the emissions from the inverters were included in the noise model for the ESS area.

1 DataKustik GmbH, Computer Aided Noise Abatement (CadnaA®) software package, (Link https://www.datakustik.com/products/cadnaa/cadnaa/)

2 Adding one noise source to another which is 10 dB quieter or more results in negligible changes of less than 0.5dB.

3.2.4 The proposed Main Substation area will include several sources of noise associated with electricity conversion and regulation, located centrally between the Energy Storage Compound areas. Two 400/33 kV transformers were modelled using a representative sound power of 100 dB(A) as a worst case assumption, following a review of manufacturer data. Additional plant likely to be used at the Main Substation would also include four auxiliary transformers and power regulation units. In the absence of specific design information for this plant at this stage of the Proposed Development, the sound power levels assumed for the auxiliary transformers was 80 dB(A) for each of the four units, and two power regulation units were modelled with a sound power of 85 dB(A) each: see Table 12.2.5, representing a worse-case scenario.

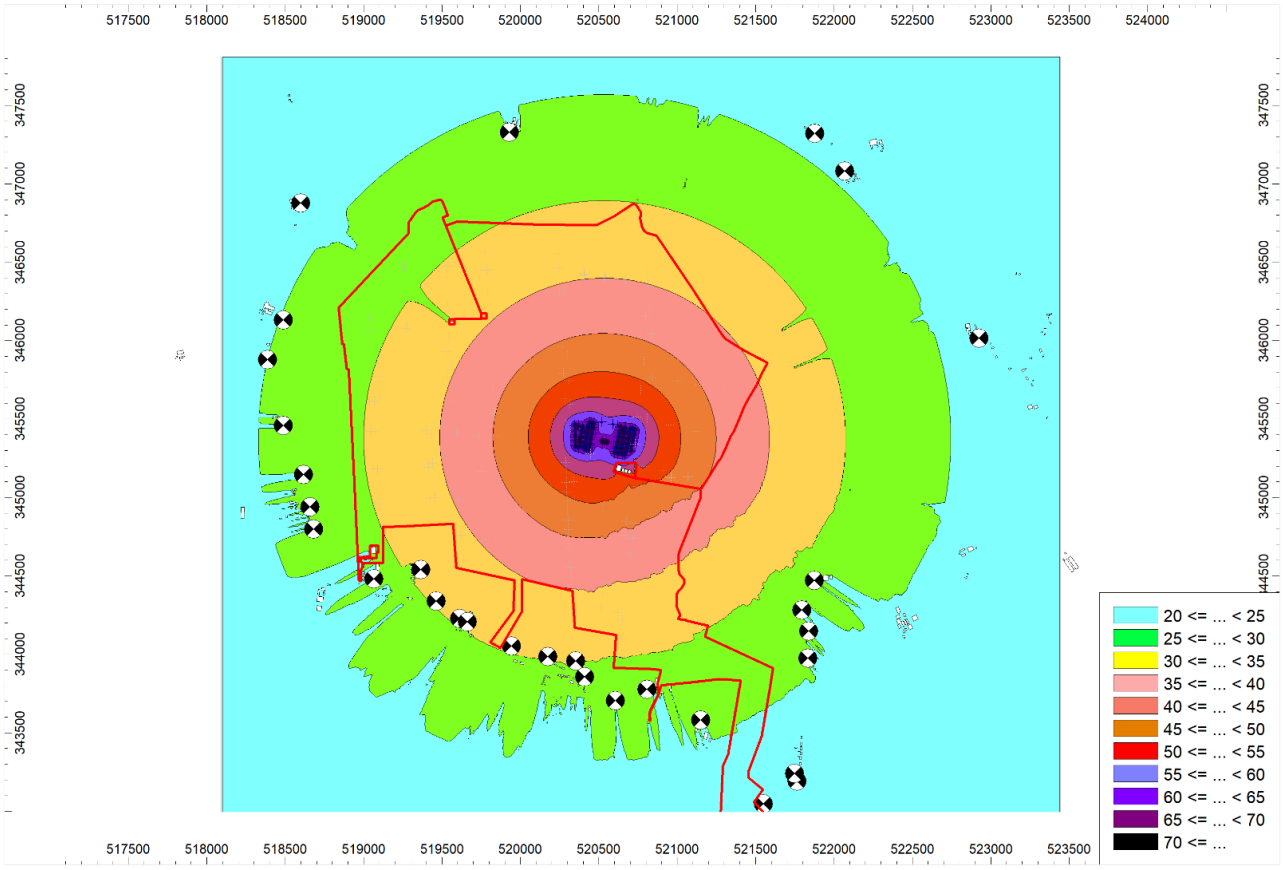

Figure 12.2.1 - L_{Aeq} (dB) noise map for the Energy Storage Compound and Main Substation area only.

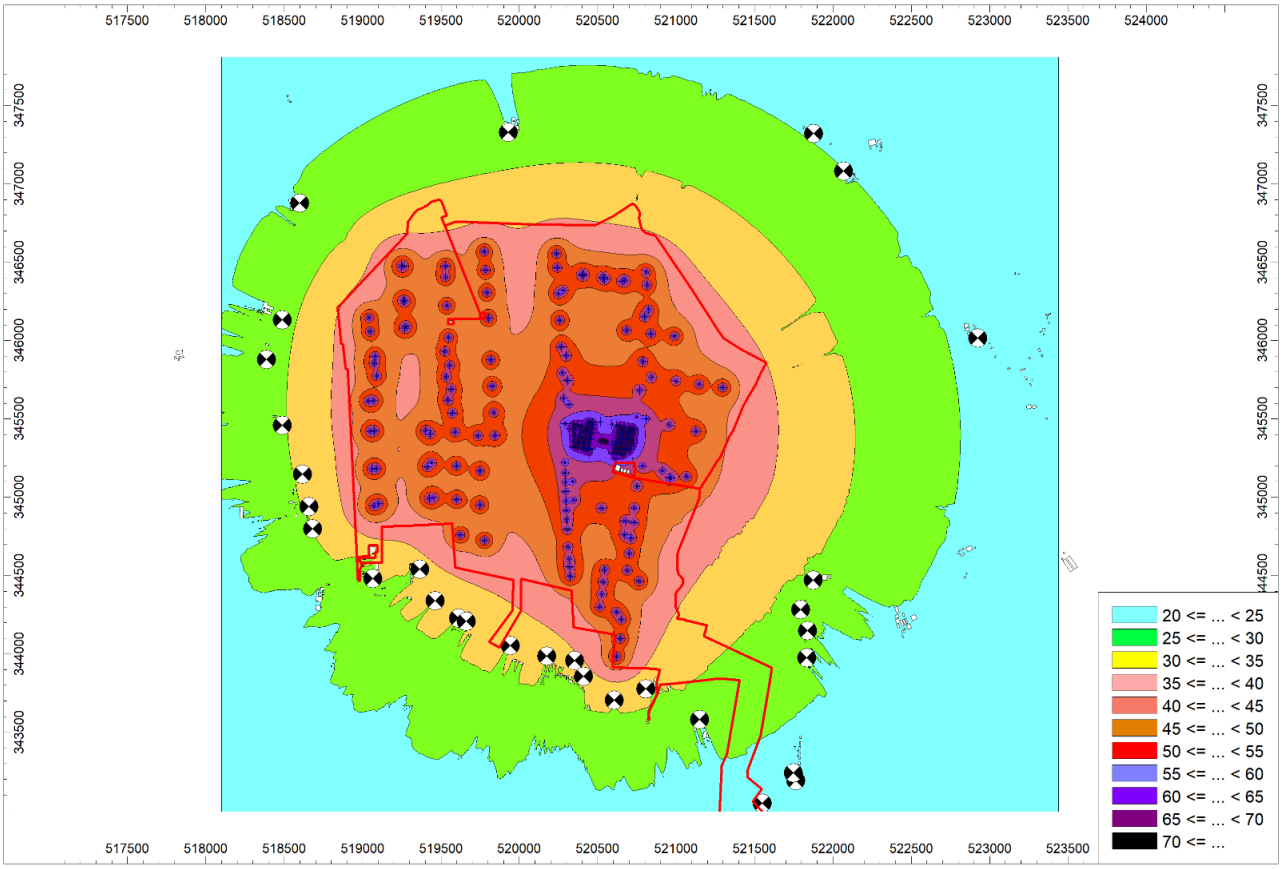

Figure 12.2.2 - L_{Aeq} (dB) noise map for all plant noise sources within the Energy Park.

3.3 Prediction results.

3.3.1 The resulting predictions are detailed below in Table 12.2.6 and illustrated in Figures 12.2.2-12.2.3, with separate results provided for the contribution of the plant in the BESS area and other plant modelled across the Site. The resulting detailed BS 4142 assessment is set out for day- and night-time periods in Table 12.2.8. and 12.2.9.

Receptor name	All plant (L_{Aeq}, dB)	Energy Storage Compound and Main Substation only (L_{Aeq}, dB)
Five Willow Farm	26	22
Mill Green Farm	28	26
The Old Church	25	24
Maryland Bank	25	24
Spinney Farm House	24	23
College Farm	27	25
Caitlins Farm	27	26
College Cottage	28	27
Cattleholme Farm	27	26
Swineshead House	27	26
Rakes Farm (The Rakes)	32	28
Six Hundred Drove/Farm	28	25
The Old Church (East Heckington)	33	29
Ashleigh House	34	30
2 Council House	33	30
1-2 Rectory Cottages	32	30
Rectory Farmhouse	30	27
The Oat Sheaf	32	30
Beech House	32	30
Home Farm	33	31
Elm Grange Farm	30	28
First Cottage	30	27
Derwent Cottage	31	27
1-4 New Cottage	31	27
The Bungalow	30	26
Chapel House	28	25
Glebe Farm	29	25

Table 12.2.7 – Energy Park operational noise prediction model results (L_{Aeq}, dB).

Property	Typical background (L_{A90})	Predicted plant noise level (L_{Aeq})	Predicted rated plant noise (L_{Ar})	Difference with background	Magnitude of Change	Noise limit
Five Willow Farm	30	26	30	-1	Low	35
Mill Green Farm	30	28	32	+2	Low	35
The Old Church	30	25	29	-1	Low	35
Maryland Bank	30	25	29	-1	Low	35
Spinney Farm House	30	24	28	-2	Low	35
College Farm	30	27	31	+1	Low	35
Caitlins Farm	30	27	31	+1	Low	35
College Cottage	30	28	32	+2	Low	35
Cattleholme Farm	30	27	31	+1	Low	35
Swineshead House	40	27	31	-9	Negligible	44
Rakes Farm (The Rakes)	40	32	36	-4	Low	44
Six Hundred Drove/Farm	40	28	32	-8	Negligible	44
The Old Church (East Heckington)	40	33	37	-3	Low	44
Ashleigh House	40	34	38	-2	Low	44
2 Council House	40	33	37	-3	Low	44
1-2 Rectory Cottages	40	32	36	-4	Low	44
Rectory Farmhouse	40	30	34	-6	Negligible	44
The Oat Sheaf	40	32	36	-4	Low	44
Beech House	40	32	36	-4	Low	44
Home Farm	40	33	37	-3	Low	44
Elm Grange Farm	40	30	34	-6	Negligible	44
First Cottage	35	30	34	-1	Low	39
Derwent Cottage	35	31	35	+0	Low	39
1-4 New Cottage	35	31	35	+0	Low	39
The Bungalow	30	30	34	+4	Low	35
Chapel House	30	28	32	+2	Low	35
Glebe Farm	30	29	33	+3	Low	35

Table 12.2.8 - Derived background, predicted rated noise levels (dB) and BS 4142 assessment at key receptors – day-time

Property	Typical background (L_{A90})	Predicted plant noise level (L_{Aeq})	Predicted rated plant noise (L_{Ar})	Difference with background	Magnitude of Change	Noise limit
Five Willow Farm	23	26	30	+7	Low	35
Mill Green Farm	23	28	32	+9	Low	35
The Old Church	23	25	29	+6	Low	35
Maryland Bank	23	25	29	+6	Low	35
Spinney Farm House	23	24	28	+5	Low	35
College Farm	23	27	31	+8	Low	35
Caitlins Farm	23	27	31	+8	Low	35
College Cottage	23	28	32	+9	Low	35
Cattleholme Farm	23	27	31	+8	Low	35
Swineshead House	35	27	31	-4	Low	39
Rakes Farm (The Rakes)	35	32	36	+1	Low	39
Six Hundred Drove/Farm	35	28	32	-3	Low	39
The Old Church (East Heckington)	35	33	37	+2	Low	39
Ashleigh House	35	34	38	+3	Low	39
2 Council House	35	33	37	+2	Low	39
1-2 Rectory Cottages	35	32	36	+1	Low	39
Rectory Farmhouse	35	30	34	-1	Low	39
The Oat Sheaf	35	32	36	+1	Low	39
Beech House	35	32	36	+1	Low	39
Home Farm	35	33	37	+2	Low	39
Elm Grange Farm	35	30	34	-1	Low	39
First Cottage	28	30	34	+6	Low	35
Derwent Cottage	28	31	35	+7	Low	35
1-4 New Cottage	28	31	35	+7	Low	35
The Bungalow	23	30	34	+11	Low	35
Chapel House	23	28	32	+9	Low	35
Glebe Farm	23	29	33	+10	Low	35

Table 12.2.9 - Derived background, predicted rated noise levels (dB) and BS 4142 assessment at key receptors – night-time