Lower Thames Crossing

6.3 Environmental Statement Appendices
Appendix 12.8 – National Grid Electricity Transmission Network, Assessment for Audible Noise

APFP Regulation 5(2)(a)

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Lower Thames Crossing

Appendix 12.8 – National Grid Electricity Transmission Network, Assessment for Audible Noise

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1 Introduction

1.1.1 The construction of the A122 Lower Thames Crossing ('the Project') will require the permanent diversion of four National Grid Electricity Transmission (NGET) high voltage (HV) overhead transmission lines (OHLs). Whilst OHLs operate quietly most of the time, they can produce audible noise under certain conditions.

1.1.2 This technical note assesses the likely operational audible noise impacts on noise-sensitive receptors where the OHLs would move closer to them in compliance with the requirements of the Overarching National Policy Statement for Energy (NPS EN-1) and National Policy Statement for Electricity Networks Infrastructure (NPS EN-5), as described in Annex C. Construction noise impacts are assessed within Chapter 12 Noise and Vibration of this Environmental Statement (Application Document 6.1).

1.1.3 The assessment of noise from OHLs is carried out according to National Grid Policy Statement PS(T)134 (2021) "Operational Audible Noise Policy for Overhead Lines (New Build, Reconductoring, Diversions and Uprating".

1.1.4 The sections of OHL to be permanently diverted and considered in this technical appendix are as follows:

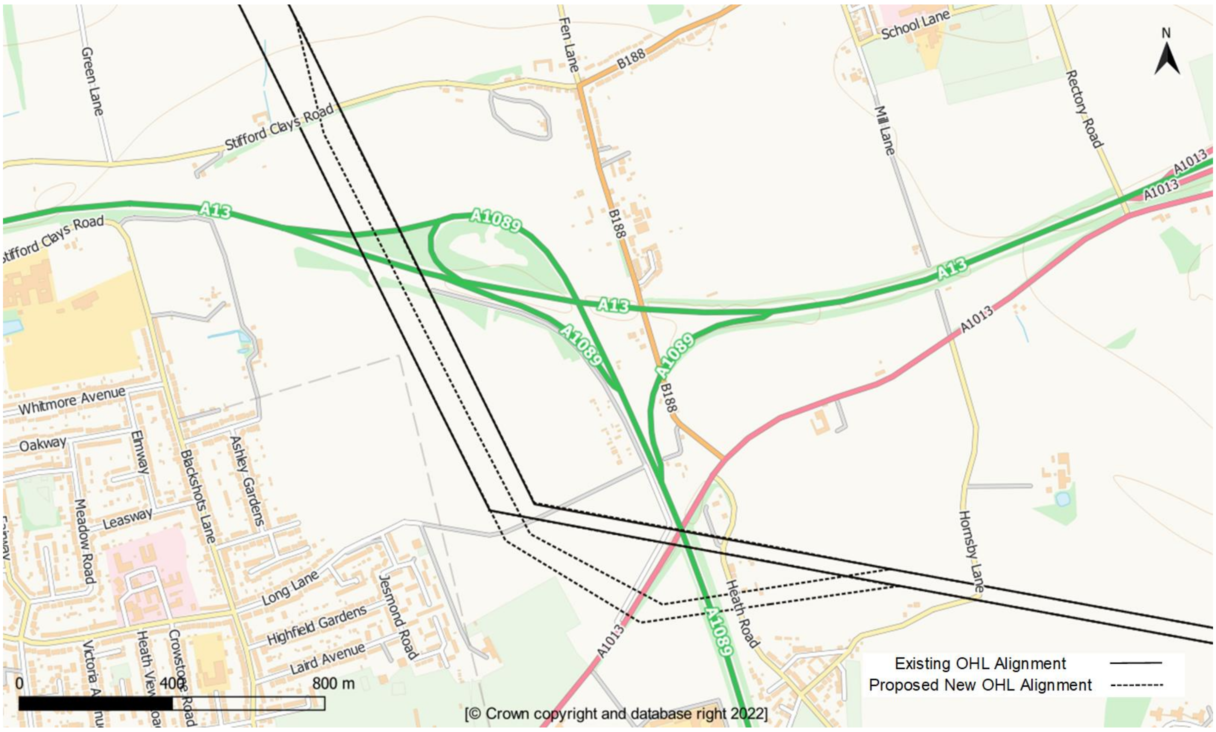
a. The ZB 275kV OHL between ZB026 west of Orsett to ZB019 north of Orsett Heath (Work No. OH7, herein referred to as Alignment 1) as presented in Plate 1.1.

b. The YYJ 400kV OHL between YYJ116 east of Chafford Hundred and YYJ119 north of Orsett Heath (Work No. OH6, herein referred to as Alignment 2) as presented in Plate 1.1.

c. The ZJ 400kV OHL between ZJ012 and ZJ010 near East Tilbury (Work No. OH4, herein referred to as Alignment 3) as presented in Plate 1.2.

d. The 4YN 400kV OHL between 4YN046 near Riverview Park and 4YN051 near the A2 dual carriageway (Work No OH1, herein referred to as Alignment 4) as presented in Plate 1.3.

Plate 1.1 Alignment 1 (Work No. OH7) and Alignment 2 (Work No. OH6) location



Alignment 1 (ZB) lies to the north and east, Alignment 2 (YYJ) to the south and west.

Plate 1.2 Alignment 3 (Work No. OH4) location

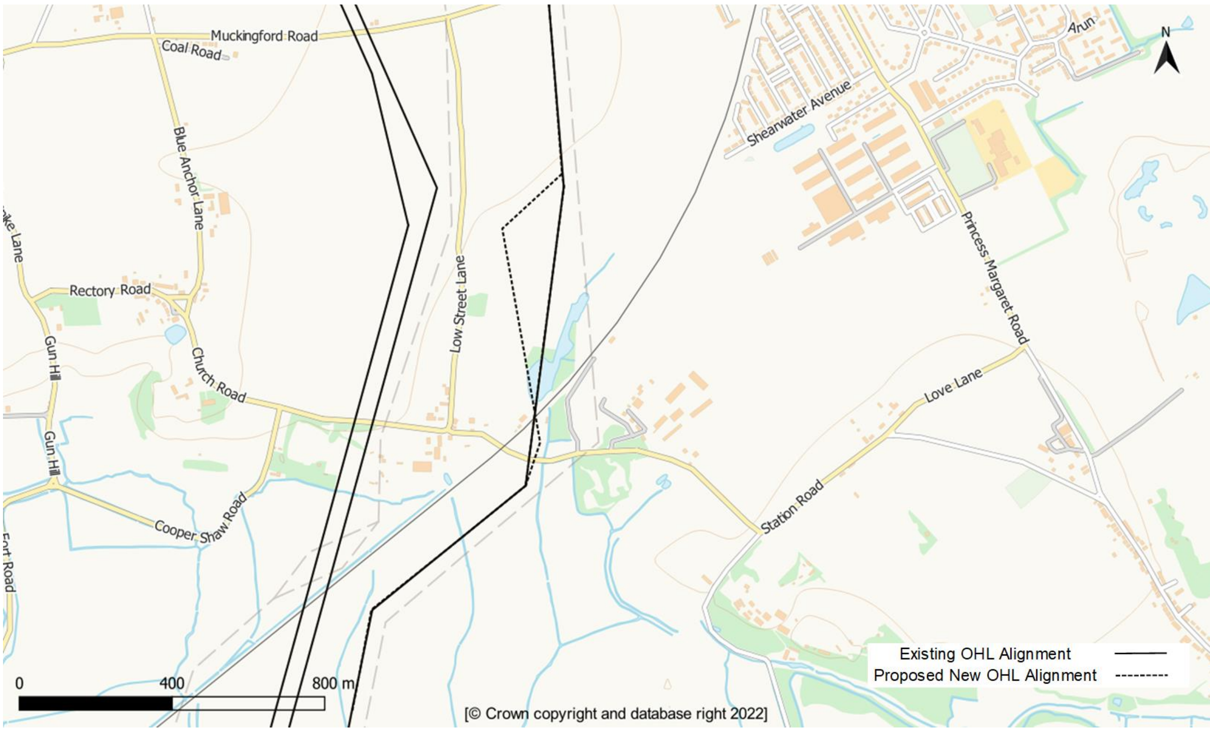
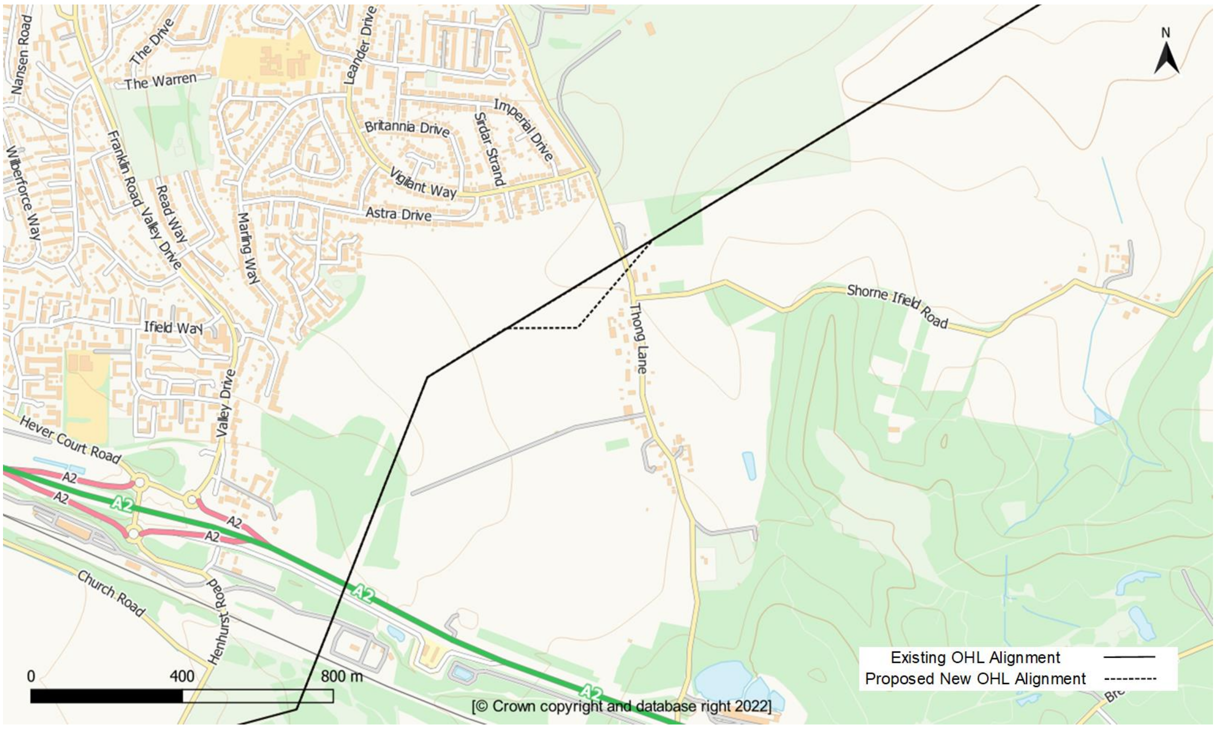


Plate 1.3 Alignment 4 (Work No. OH1) location



1.1.5 In addition to the sections to be diverted as described above, other sections of the YYJ, ZB, ZJ and 4YN (Work No. OH6, OH7, OH4 and OH1) would be refurbished, works which include the replacement of towers ZB033 (Work No. OH7) and ZJ014R (Work No. OH4). In these sections there would be no alignment change of the OHLs and no net change in audible noise; hence these sections are scoped out of further assessment.

1.1.6 It should be noted that these OHL diversions are taking place in the context of the A122 Lower Thames Crossing road scheme (The Project). While the Project has been developed to avoid or minimise significant effects on the environment by including appropriate noise mitigation measures, the Project is likely to have local impacts of a greater significance at the receptor locations assessed in this Appendix than the OHL diversions.

2 Audible noise from high voltage overhead lines (OHLs)

2.1.1 The OHLs are of lattice pylon construction but carry different conductor systems (wires and fittings). All equipment used on the National Grid transmission system must comply with the relevant National Grid technical specifications and Type Registration requirements which include specifications and test requirements for corona discharge, which is a potential source of audible noise, and wind-induced audible noise, where relevant. When it occurs, corona noise from an OHL is usually described as a 'crackle', 'fizz' or 'hum', while wind-induced noise, if it occurs, can sound like a 'whistle', a 'ring' or a 'howl'.

2.1.2 Conductor system noise is caused by corona discharge activity. Corona discharges occur when the electric field intensity or electric stress around a conductor exceeds a certain value. High levels of electric stress can cause a temporary breakdown in the insulating properties of the air surrounding the conductor, giving rise to ionization events that result in the formation of corona discharges.

2.1.3 Corona discharge occurs when the conductor surface electric stress exceeds the inception level for corona discharge, a level of around 17 to 20 kilovolts per centimetre (kV/cm). The proposed OHLs are designed to operate below this threshold, and so will usually operate quietly in dry weather conditions. Small areas of surface contamination on conductors spoiling the otherwise smooth conductor surface are likely to cause a local enhancement of electric stress which may be sufficiently high to initiate localised corona discharge activity. At each discharge site a limited electrical breakdown of the air occurs. A portion of the energy associated with the corona process is released as acoustic energy which radiates into the air as sound pressure waves.

2.1.4 After a prolonged spell of dry weather without heavy rain to wash the conductors, contamination may accumulate sufficiently to result in increased noise. Under these circumstances the noise is referred to as 'dry noise'. During the next occurrence of heavy rain, these discharge sources are washed away, and the line will resume its normal quieter operation.

2.1.5 The highest noise levels generated by OHLs generally occur during rainfall. Water droplets may accumulate on the surface of the conductor and initiate multiple corona discharges. The number of droplets, and hence the noise level, will depend primarily on the rate of rainfall. Fog may also give rise to increased noise levels, although these levels are less than those during rain. Noise generated under these circumstances is referred to as 'wet noise'. However, some of the effect of this increased noise is masked by increased ambient noise due to rainfall, either directly due to raindrops falling on hard surfaces or nearby foliage, or indirectly due to increased vehicle tyre/road interaction noise on local wet roads.

2.1.6 Audible noise from OHLs is therefore variable in nature, as it is principally due to the effect of weather on the energised conductors. Historic anecdotal evidence received by National Grid over the years suggests that levels of audible noise from new overhead lines can be higher in the first few months of operation as the conductors undergo a 'weathering-in' process. The operational noise assessment is based on the effect of noise from 'weathered-in' conductors, therefore for the first few months of operation the OHLs may be slightly noisier as the conductors weather in.

2.1.7 Calculations of corona noise are based on calculations carried out using the propriety software EFC-400. The calculations are based on operating voltage and geometrical factors for pylon design and conductor bundle configurations.

2.1.8 Good practice environmental and quality control processes to control audible noise generated by the operation of the new and refurbished sections of OHL would be implemented in accordance with REAC commitment NV016 (Application Document 6.3, Appendix 2.2 as part of the Code of Construction Practice) and is described below:

2.1.9 Noise from pylon fittings, such as dampers, spacers, clamps and insulators, will be controlled through technical specifications: TS2.04 'Generic Design Principles for Overhead Lines', (Issue 6 July 2021); TS 3.04.35 'Components for Overhead Lines', (Issue 5 April 2021); TS 3.04.36 'Insulators and Insulator Sets for Overhead Lines', (Issue 7 February 2022) and TS 3.04.37 'Conductors and Conductor Systems for Overhead Lines', (Issue 8 January 2022), which include requirements for wind tunnel testing and/or corona extinction tests to minimise the occurrence of both corona and wind induced noise, and PS(T)134 'Operational Audible Noise Policy of Overhead Lines (New Build, Reconductoring, Diversion and Uprating)' (Issue 2, June 2021) and TGN(E)322 'Operational Audible Noise Assessment Process for Overhead Lines (New Build, Reconductoring, Diversion and Uprating)', (Issue 2, June 2021).

In accordance with the technical specifications, policy and guidance document listed above, good practice environmental and quality control processes to control audible noise generated by the operation of the new and refurbished sections of OHL shall include:

a. Pylon fittings designed and procured in accordance with National Grid's functional and performance requirements.

b. Compliance with performance requirements for corona inception and audible noise on all fittings.

c. Wind tunnel testing of insulators for audible tones generated by Aeolian mechanisms.

d. Sample testing to ensure each fitting type conforms to the specification.

e. Care taken during installation to ensure conductors are kept clean and free of surface contaminants during stringing.

3 Proposed changes

3.1.1 Where the OHLs are diverted, the rebuilt sections would be similar in design and construction to the existing sections they replace.

3.1.2 Pylons: where the pylons do not move, they would be refurbished and reused. Where they are replaced, newer versions with slightly different geometrical dimensions would be used.

3.1.3 Conductors (wires): on the YYJ (Work No. OH6) and ZJ (Work No. OH4) routes the replacement conductors would be a more modern variant of the conductors already used on those routes; on the ZB (Work No. OH7) and 4YN (Work No. OH1) the replacement conductors would be close equivalents to the existing conductors capable of carrying the required route capacity.

3.1.4 Fittings: on all routes the fittings would be replaced with modern variants appropriate for the new conductor systems. Fittings include items such as insulators, vibration dampers, spacers, clamps and arcing horns. All fittings must meet National Grid technical specification standards which include corona inception and wind-induced noise tests.

3.1.5 The existing and proposed pylon and conductor bundle configurations, their calculated maximum electrical stress levels (Emax, kV/cm), along with a description of the effect on audible noise performance of each OHL, are given in Table 3.1 below.

3.1.6 There would not be a significant noise change due to the 275kV ZB OHL (Work No. OH7) as this parallels the 400kV YYJ OHL (Work No. OH6), the contribution from which dominates the noise calculation at all receivers.

Table 3.1 Summary of OHL designs and effect on audible noise performance

Route volts	Existing design	Replacement design	Effect on audible noise performance
YYJ 400kV (Work No. OH6)	L2 lattice pylon 2 x 31.5mm diameter conductors (Twin Matthew) Emax = 17.4kV/cm	L2 and L8* lattice pylons 2 x 31.5mm diameter conductors (Twin Matthew) Emax (L2) = 17.4kV/cm Emax (L8) = 17.1kV/cm	Use of L8 pylons reduces electrical stress, reducing the occurrence of corona noise. Newer variants of Matthew conductor exhibit favourable noise characteristics compared to older variants. Noise from fittings is minimised through technical specifications and type registration requirements.
ZJ 400kV (Work No. OH4)	L2 lattice pylon 2 x 31.5mm diameter conductors (Twin Matthew) Emax = 17.4kV/cm	L2 and L8* lattice pylons 2 x 31.5mm diameter conductors (Twin Matthew) Emax (L2) = 17.4kV/cm Emax (L8) = 17.1kV/cm	
ZB 275kV (Work No. OH7)	L2 lattice pylon 2 x 28.6mm diameter conductors (Twin Zebra) Emax = 13kV/cm	L2 and L8* lattice pylons 2 x 29mm diameter conductors (Twin Totara) Emax (L2) = 12.8kV/cm Emax (L8) = 12.6kV/cm	The use of L8 pylons and the Totara conductor reduces electrical stress, reducing the occurrence of corona noise. Noise from fittings is minimised through technical specifications and type registration requirements.
4YN 400kV (Work No. OH1)	L6 Lattice pylon 4 x 28.6mm diameter conductors (Quad Zebra) Emax = 12.4kV/cm	L6 and L12** lattice pylons 2 x 41.04mm diameter conductors (Twin Redwood) Emax (L6) = 13.6kV/cm Emax (L12) = 13.8KV/cm	The use of the slightly smaller L12 pylon and smaller twin Redwood conductor configuration would increase electrical stress, however this would remain significantly below corona inception level. The number of conductors per bundle (and hence noise sources) reduces from four to two. Noise from fittings is minimised through technical specifications and type registration requirements.

Notes to Table 3.1

** L8 pylons would be used where existing L2 pylons are removed and replaced. Where the routes are not diverted, they would be refurbished and the existing L2 pylons would remain.*

*** L12 pylons would be used where existing L6 pylons are removed and replaced. A standard L12 pylon is slightly smaller than a standard L6 pylon.*

4 Noise modelling basis of approach

4.1.1 Due to embedded mitigation identified in 2.1.9 in the OHL design and the selection of type-registered components, any changes in source noise level in the diverted sections of OHL would be negligible. Overall, the source noise levels, noise behaviours and noise characteristics of the 'new' and 'old' sections of OHL would not be significantly different after completion of the diversion works compared to the present day.

4.1.2 National Grid's Policy Statement PS(T)134 requires that noise impact of diverted OHLs are assessed using the same criteria as new build and reconductored overhead lines. Where the OHLs move towards a noise-sensitive receptor there is the potential for a predicted increase in noise received at the receptor, these receptors are scoped in for noise assessment.

4.1.3 For the YYJ, ZB and ZJ OHLs (Work No. OH6, OH7 and OH4) the replacement designs for the diverted sections would be less electrically stressed than the existing designs. Where these sections move further away from a noise sensitive receptor there would be a predicted reduction in impact due to the OHL at the receptor; at these locations there would be no adverse effect due to the OHL diversions and these are therefore scoped out of further assessment.

4.1.4 For the 4YN OHL (Work No. OH1), the replacement design for the diverted section would be slightly more electrically stressed than the existing OHL. Where this section moves further away from a noise sensitive receptor there is still the potential for an increase in impact due to noise from the OHL. Whilst this increase is likely to be very low due to the inherently low electrical stress of the L6/L12 design, it is considered prudent that these receptors remain scoped into the assessment.

4.1.5 There would not be a significant impact due to noise from the 275kV ZB OHL (Work No. OH7) as this OHL would be less electrically stressed and further away from receptors than the 400kV YYJ OHL (Work No. OH6) which would dominate the noise calculation at these receivers. With the exception of one location near Chadwell St. Mary, where it would move closer to a receptor, the ZB OHL (Work No. OH7) is scoped out of the assessment.

4.1.6 30 noise-sensitive receptors have been identified for noise assessment, as listed in Table 6.1, Table 6.2 and Table 6.3. These include 27 residential receptors and three educational facilities (Treetops School, Beacon Hill School and Willow Day Nursery.

5 OHL operational noise assessment methodology

5.1.1 Detailed operational noise predictions for the realigned sections of the 400kV overhead lines have been carried out using the EFC-400 software and are presented in the screening charts in Annex A. The noise is assessed using the noise prediction method described in National Grid Policy Statement PS(T)134 and its supporting technical guidance, TGN(E)322 and TR(E)564.

5.1.2 PS(T)134 describes methods for predicting the environmental impact due to audible noise caused by new, reconductored, diverted or uprated overhead transmission lines. The method uses internationally recognised line noise prediction methodology to calculate noise emission levels based on operating voltage, conductor design and pylon geometry. Noise propagation modelling according to ISO 9613-2:1996 has been carried out to predict noise levels at noise sensitive receivers along the route of the proposed diverted lines.

5.1.3 The highest noise levels generated by an overhead line generally occur during rainfall. Noise generated under these circumstances is referred to as 'wet noise' and can be described as a crackle, which is sometimes accompanied by a tonal ‘hum’. Noise which occurs during dry weather conditions is referred to as ‘dry noise’ and can be described as a crackle. The tonal hum which sometimes occurs during wet weather conditions is typically more annoying than crackle alone. Consequently, people tend to have a higher tolerance for dry noise than wet noise before finding it annoying, although this varies from person to person. It should be noted that neither wet noise nor dry noise would occur all the time.

5.1.4 According to the requirements of BS 4142:2014 + A1:2019, PS(T)134 applies a +3dB character correction to dry noise to account for the subjective ‘crackle’, while a +6dB character correction is applied to predicted wet noise levels to account for the additional ‘hum’ from the audible noise during worst case wet weather conditions. It should be noted that the majority of the identified noise sensitive receptors will experience some noise from the OHLs in their current alignments, hence the application of the character corrections to the diverted sections of OHL is considered worst case.

5.1.5 National Grid Technical Report TR(E)564 explains the reasoning behind the noise criteria set out in PS(T)134. Noise criteria have been set taking account of the UK policy context and evidence from multiple sources, including the World Health Organisation and BS 4142:2014 + A1:2019 for noise and associated health impacts. The criteria have been developed by National Grid based on health impact data associated with the night-time period. The night-time period is considered more sensitive than the daytime as background sound levels are normally lower and people are trying to sleep.

5.1.6 The overhead line noise assessment process follows a three-tier ‘screening’ approach based on worst-case source noise levels and source to receptor distance. If predicted noise levels fail the Tier 1 test, a Tier 2 assessment is undertaken and if predicted noise levels fail the Tier 2 test, a Tier 3 assessment is undertaken. The three-tier approach comprises the following steps designed to screen receptors out of further assessment where there would be no adverse impact:

5.1.7 Tier 1: A primary screening step based on 'worst-case' absolute wet noise effects and the pre-determined assessment criteria set out in PS(T)134;

5.1.8 Tier 2: A further screening step based on combined absolute wet noise and dry noise effects and recalculated assessment criteria which take account of the annual average rainfall rate in the assessment area. This step takes account of the fact that wet noise occurs during periods of wet weather and therefore does not occur all the time; and

5.1.9 Tier 3: If required, full assessment following the principles of BS 4142:2014 + A1:2019 for both wet noise and dry noise.

5.1.10 For the assessment of wet noise, knowledge of typical rainfall rates based on Meteorological Office data (Annex B) for the Project area is required. Miller curves are used to estimate the background noise level due to the effect of rainfall.

5.1.11 The Tier 1 (wet noise) assessment is carried out against the relevant criteria presented in PS(T)134 shown in Table 5.1. The Tier 2 (dry and wet noise combined) assessment is carried out against the criteria shown in Table 5.2.

5.1.12 The Tier 1 and Tier 2 screening approach concludes that the Tier 3 assessment following the principles of BS 4142:2014 + A1:2019 is not required for any of the identified noise sensitive receptors.

5.2 PS(T)134 assessment criteria

Tier 1

5.2.1 Predicted Wet Noise levels which fall into the 'No Adverse Impact' category in Table 5.1 are considered acceptable. Receptors falling into this category are screened out of further assessment and no further action or assessment is necessary.

5.2.2 A Tier 2 Assessment shall be carried out where predicted Wet Noise levels exceed the 'No Adverse Impact' Category in Table 5.1.

Table 5.1 PS(T)134 Tier 1 assessment criteria

Use	No Adverse Impact	Further Assessment Necessary
	Screened out	Tier 2 Assessment required
Vulnerable subgroups	< 29dBA	≥ 29dBA
Residential	< 34dBA	≥ 34dBA
Schools and Hotels	< 39dBA	≥ 39dBA

Tier 2

5.2.3 The impact of dry and wet noise is assessed in combination.

5.2.4 Tier 2 noise impact criteria are calculated as a combined figure for dry and wet noise using the data in Table 5.2 and taking account of the percentage duration of wet and dry noise based on UK wet weather data for the geographical area being assessed.

5.2.5 The duration of wet noise is based on Met Office historical rainfall data as shown in the annual average wet hours rainfall map in Annex B. The LTC project area is a relatively dry area with an annual average rainfall duration of less than 450 hours per year.

5.2.6 The predicted combined wet and dry noise levels are then assessed against the newly created noise impact criteria which take into account rainfall duration as shown in Table 5.3.

Table 5.2 PS(T)134 Tier 2 dry and wet noise levels for the determination of combined noise assessment criteria

Use	Weather condition	No Adverse Impact	Adverse Impact	Significant Adverse Impact
		Acceptable - No Action Necessary	Mitigate and Minimise[3]	Unacceptable - Avoid
Vulnerable subgroups	Wet	< 29dBA	29 to 39dBA	> 39dBA
	Dry	< 32dBA	32 to 42dBA	> 42dBA
Residential	Wet	< 34dBA	34 to 44dBA	> 44dBA
	Dry	< 37dBA	37 to 47dBA	> 47dBA
Schools & Hotels	Wet	< 39dBA	39 to 49dBA	> 49dBA
	Dry	< 42dBA	42 to 52dBA	> 52dBA

Table 5.3 PS(T)134 Tier 2 combined noise assessment criteria for rainfall duration <450 hours per year

Use	No Adverse Impact	Adverse Impact	Significant Adverse Impact
	Acceptable	Mitigate and Minimise	Unacceptable
	Screened out	Tier 3 Assessment required	Tier 3 Assessment required
Vulnerable subgroups	< 31.9dBA	31.9 to 41.9dBA	>41.9dBA
Residential	< 36.9dBA	36.9 to 46.9dBA	> 46.9dBA
Schools and Hotels	< 41.9dBA	41.9 to 51.9dBA	>51.9dBA

5.3 Identified noise sensitive receptors

5.3.1 Plate 5.1, Plate 5.2 and Plate 5.3 present the receptor locations where noise from OHLs has been predicted. Details of the receptor location and the results of the Tier 1 and Tier 2 assessments are presented in Table 6.1, Table 6.2, and Table 6.3.

Plate 5.1 Receptor locations assessed – Alignment 1 (Work No. OH7) and 2 (Work No. OH6)

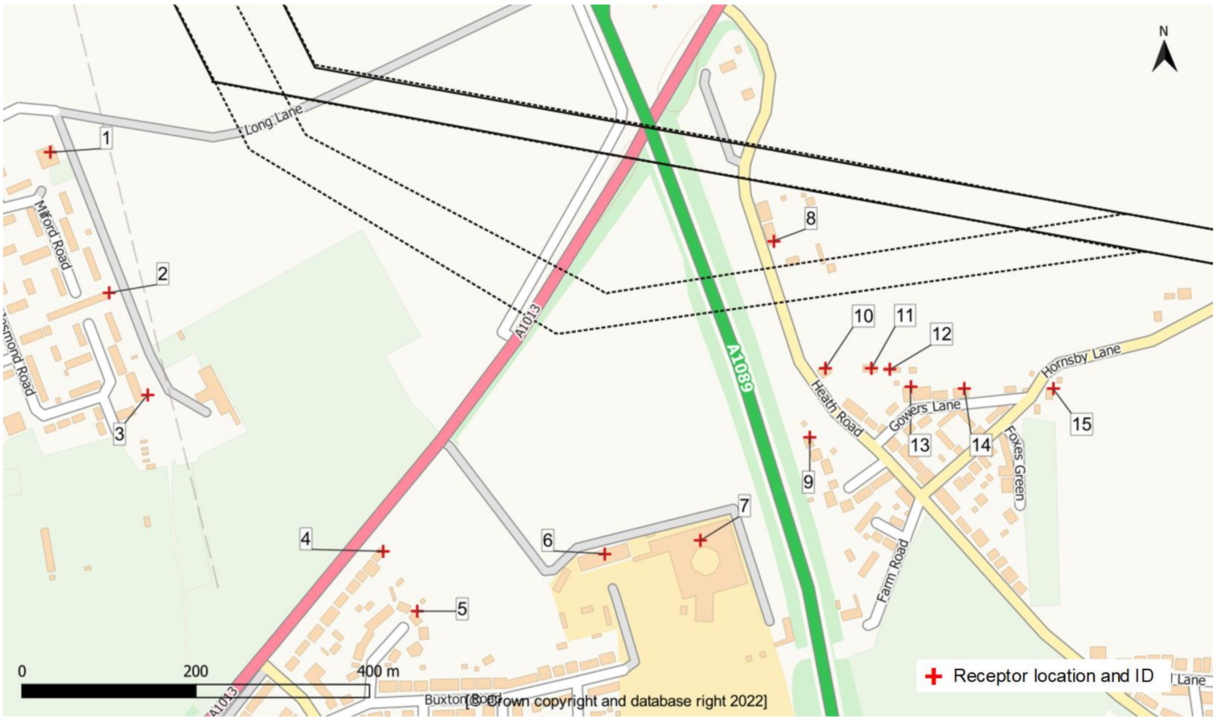


Plate 5.2 Receptor locations assessed – Alignment 3 (Work No. OH4)

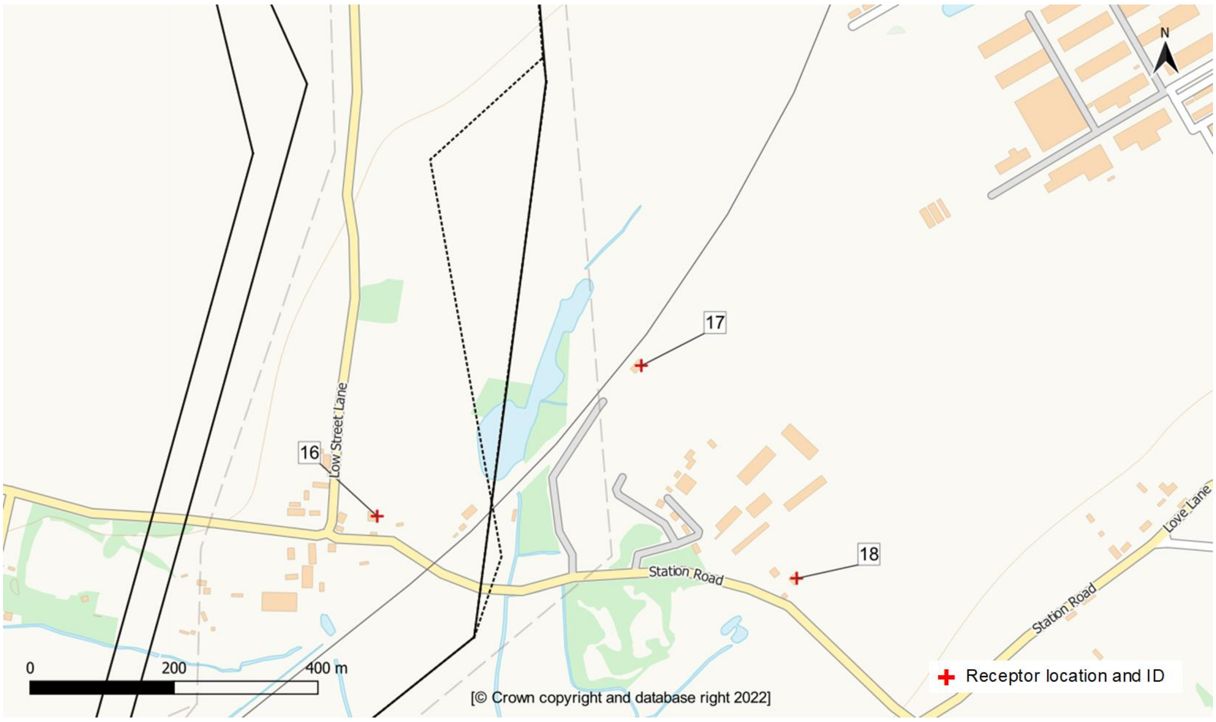


Plate 5.3 Receptor locations assessed – Alignment 4 (Work No. OH1)

6 Assessment of effects

6.1.1 In order to determine the potential for any significant environmental effects, the following factors have been considered:

Tier 1 screening

6.1.2 The Tier 1 assessment is a primary screening step which aims to screen out receptors from further assessment where there would not be an adverse impact even under the most onerous, worst-case, 'wet noise' conditions. The worst-case assumptions include rainfall of 1 mm/hr, considered the inception point for 'hum' to occur and therefore attracting a full +6dB character correction, and hard reflective ground which represents worst case for attenuation of noise over distance.

6.1.3 The Tier 1 screening criteria, as shown in Table 5.1, are 34dBA for residential receptors and 39dBA for receptors which include schools and hotels. The Tier 1 screening indicates that the criteria are exceeded for the identified receptors.

6.1.4 The Tier 1 assessment concludes that all the identified receptors remain **screened in** for the Tier 2 assessment.

Tier 2 screening

6.1.5 The Tier 2 assessment calculates a combined noise level at each receiver which considers the duration of wet noise effects based on historical Met Office rainfall data and assumes dry noise would occur for the remainder of the time. The calculated noise level is an annually averaged combined wet and dry noise level calculated at the nearest façade of each noise sensitive receiver. The combined noise levels are then compared to assessment criteria which are recalculated to take account of the relative durations of wet noise and dry noise.

6.1.6 The Tier 2 assessment also includes worst-case assumptions which, for wet noise, include rainfall of 1 mm/hr and a full +6dB character correction to account for 'hum', and, for dry noise, a character correction of +3dB to account for OHL crackle. In addition, it is assumed dry noise occurs for the remainder of the time, a situation that does not occur in reality. As for the Tier 1 assessment, the noise propagation model in EFC-400 assumes hard reflective ground which represents worst case for attenuation of noise over distance. These factors ensure the Tier 2 assessment is conservative to ensure the potential for an adverse effect is not underestimated.

6.1.7 The results of the Tier 2 assessment are shown in Table 6.1, Table 6.2 and Table 6.3 below. The EFC-400 screening charts are shown in Annex A for each OHL design.

6.1.8 The Tier 2 assessment concludes that all the identified receptors are **screened out** of the Tier 3 assessment. This means there would not be an adverse effect at any of the identified noise sensitive receptors. There is therefore no requirement under PS(T)134 to carry out a BS 4142:2014 + A1:2019 assessment of the diverted OHL sections.

6.1.9 It should be noted that the PS(T)134 method assumes that the diverted OHLs are entirely new infrastructure; the method does not take into account the existing OHL infrastructure, some of which would be removed.

Table 6.1 PS Alignment 1 and 2 receptors Tier 2 assessment

Receptor ID	Address	Tier 2 combined wet & dry noise level dBA	Tier 2 screening criteria dBA	Tier 2 screening outcome
1	1 Keir Hardie House	29.6	<36.9	Screened OUT
2	77 Springfield Road	28.5	<36.9	Screened OUT
3	48 Springfield Road	26.3	<36.9	Screened OUT
4	44 Stanford Road	25.8	<36.9	Screened OUT
5	16 Masefield Road	24.9	<36.9	Screened OUT
6	Beacon Hill School	27.9	<41.9	Screened OUT
7	Treetops School	28.2	<41.9	Screened OUT
8	202 Heath Road *	36.6 *	<36.9	Screened OUT
9	179 Heath Road	31.2	<36.9	Screened OUT
10	Accommodation at The Fox and Hounds	35.7	<36.9	Screened OUT
11	176 Heath Road	35.2	<36.9	Screened OUT
12	Willow Garden Day Nursery	34.8	<41.9	Screened OUT
13	Mimosa, Gowers Lane	33.2	<36.9	Screened OUT
14	Apple Grove, Gowers Lane	32.6	<36.9	Screened OUT
15	Myrtle Cottage, Hornsby Lane	31.9	<36.9	Screened OUT

**Includes a negligible contribution from the 275kV ZB OHL*

Table 6.2 PS Alignment 3 receptors and Tier 2 assessment

Receptor ID	Address	Tier 2 combined wet & dry noise level dBA	Tier 2 screening criteria dBA	Tier 2 screening outcome
16	Polwicks, Church Road	31.1	<36.9	Screened OUT
17	4 Railway Cottages	28.4	<36.9	Screened OUT
18	1 Gravel Pit Cottages Station Road	23.9	<36.9	Screened OUT

Table 6.3 PS Alignment 4 receptors and Tier 2 assessment

Receptor ID	Address	Tier 2 combined wet & dry noise level dBA	Tier 2 screening criteria dBA	Tier 2 screening outcome
19	10 Gazelle Glade	22.6	<36.9	Screened OUT
20	356 Thong Lane	23.0	<36.9	Screened OUT
21	37 Thong Lane	33.1	<36.9	Screened OUT
22	38 Thong Lane	31.4	<36.9	Screened OUT
23	Hartshill Bungalow	29.5	<36.9	Screened OUT
24	Little Westwood, Thong Lane	28.0	<36.9	Screened OUT
25	Westwood Farm, Thong Lane	27.4	<36.9	Screened OUT
26	43 Thong Lane	25.0	<36.9	Screened OUT
27	Greenacre Barn	26.5	<36.9	Screened OUT
28	Dreams, Thong Lane	24.7	<36.9	Screened OUT
29	41 Thong Lane	23.3	<36.9	Screened OUT
30	44 Thong Lane	23.0	<36.9	Screened OUT

6.2 Frequency of occurrence

6.2.1 It is important to note that OHL noise calculations are based on noise levels which assume a rainfall rate of 1mm/hr for wet noise and conductor surface contamination for dry noise. Neither of these conditions occur all the time.

6.2.2 The historical ten-year annual average wet hours (averaged over ten-year period 2001 to 2010) for the Project area are less than 450 hours (Annex B), indicating that wet noise may occur for approximately 5% of the time. It is more difficult to estimate the occurrence and duration of dry noise which usually relates to the build-up of surface contamination in the form of dust and pollens during spring and summer months following a long dry spell. This may typically occur a few times a year and may persist for a few days. Dry noise levels would return to normal following a period of rainfall.

6.2.3 The Tier 2 combined OHL noise level used in the assessment above assumes that worst-case wet noise occurs for 5% of the time and a level of surface contamination causing dry noise to occur for 95% of the time, this is a worst-case assumption as dry noise would not occur all the time.

7 Conclusions

7.1.1 This technical note has assessed the likely operational noise impacts due to the permanent diversion of National Grid's high voltage OHLs on noise-sensitive receptors close to the Project.

7.1.2 In all locations where OHLs would be diverted, the operational audible noise characteristics of the rebuilt OHL designs would not change significantly compared to removed OHL designs. Therefore, the principal factor that determines any change in predicted noise impact at noise-sensitive receptors is due to any change in the attenuation (reduction) of noise over distance.

7.1.3 Based on assumptions for 'worst case' OHL noise in wet weather and dry weather conditions, the maximum adverse effects are predicted to occur where the OHLs move closest to existing noise-sensitive receptors.

7.1.4 Table 7.1 presents a summary of the predicted OHL-generated noise assessment.

Table 7.1 Summary of OHL noise impacts

Assessment	**Conditions**	
	Wet	**Dry**
OHL-generated noise level	Of the 30 receptor locations assessed, none would experience an adverse impact due to noise from the realigned OHL sections. The predicted OHL noise levels would be below the Tier 2 'No Adverse Impact' criteria of 36.9dBA (residential receptors) and 41.9dBA (schools) at all identified noise sensitive receptors	
Frequency of occurrence	5% of the time based on historical Met Office ten-year average wet hours (2001 to 2010)	Typically occurs a few times a year and may persist for a few days

7.1.5 With consideration of the predicted change in OHL noise level, the context of the future noise climate with the A212 Lower Thames Crossing Project implemented and the frequency that wet noise conditions would occur, it is concluded that the temporary and permanent realignment of any OHL associated with the Project would not constitute a significant environmental effect.

References

British Standards Institution (2019). BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound.

Department of Energy and Climate Change (2011a). Overarching National Policy Statement for Energy (EN-1). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf.

Department of Energy and Climate Change (2011b). National Policy Statement for Electricity Networks Infrastructure (EN-5). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37050/1942-national-policy-statement-electricity-networks.pdf.

International Organisation for Standardisation (1996). ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors: Part 2: General method of calculation

Miller L N (1978) 'Sound Levels of Rain and Wind in the Trees', Noise Control Engineering, Volume 11, No 3, pp 101 – 109

Narda Safety Test Solutions (2021) EFC-400 (F9 EPRI method)

National Grid (2021) TGN(E)322 'Operational Audible Noise Assessment Process for Overhead Lines (New Build, Reconductoring, Diversion and Uprating)', Issue 2

National Grid (2021) PS(T)134 'Operational Audible Noise Policy for Overhead Lines (New Build, Reconductoring, Diversion and Uprating)' Issue 2

National Grid (2021) TR(E)564 'Development of Method for Assessing the Impact of Noise from Overhead Lines (New Build, Reconductoring, Diversion and Uprating), Issue 1

National Grid (2021) TS 2.04 'Generic Design Principles for Overhead Lines'

National Grid (2021) TS 3.04.35 'Components for Overhead Lines'

National Grid (2022) TS 3.04.36 'Insulators and Insulator Sets for Overhead Lines'

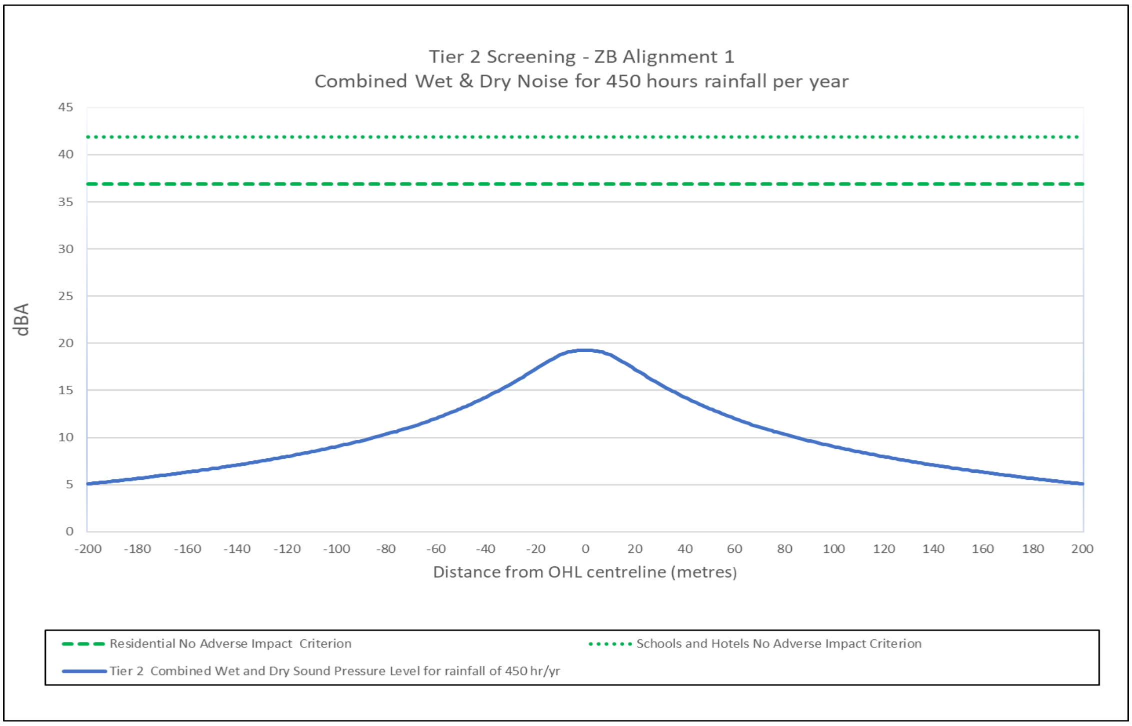
National Grid (2022) TS 3.04.37 'Conductors and Conductor Systems for Overhead Lines'

World Health Organisation (1999) Guidelines for Community Noise

Annexes

Annex A EFC-400 Tier 2 noise propagation modelling

Plate A.1 Tier 2 screening for 275kV OHL (Work No OH7)

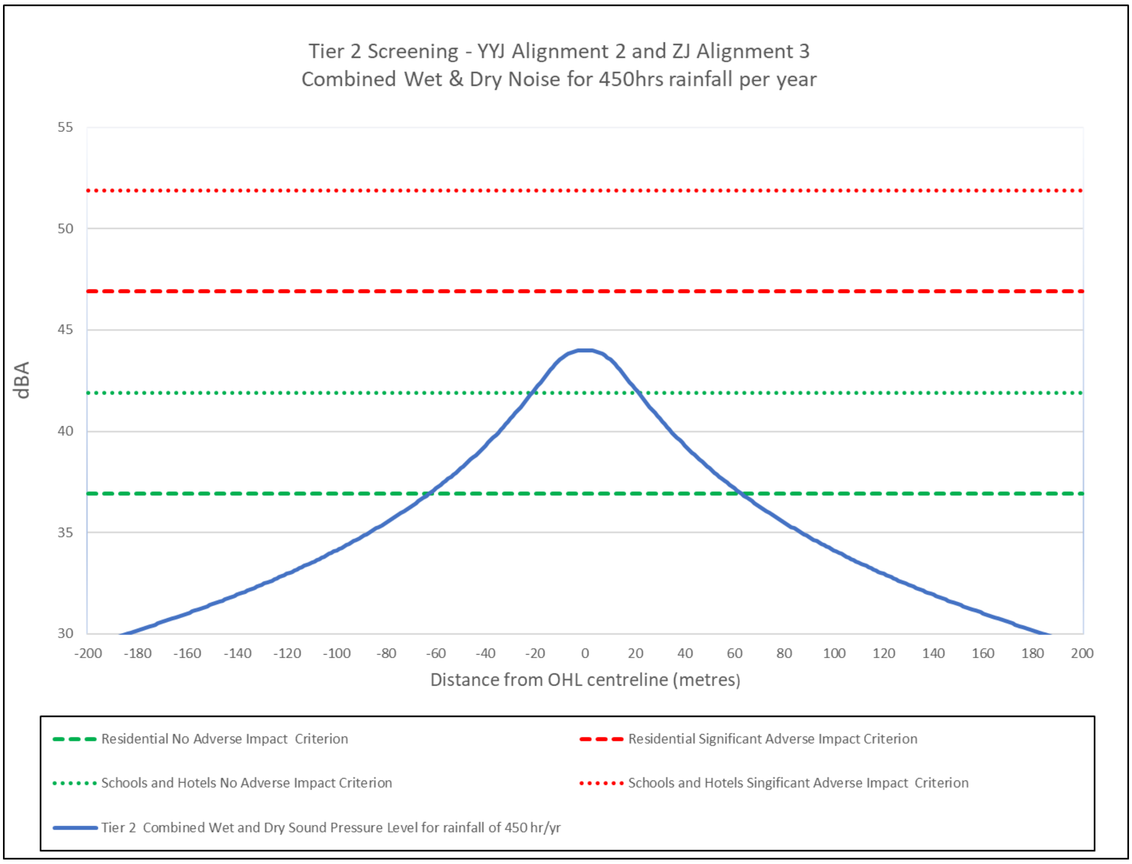


A.1.1 The chart above shows the EFC-400 Tier 2 screening curve for the 275kV ZB OHL. The horizontal axis shows the distance in metres either side of the OHL, with the OHL centreline (0m) in the centre of the chart. The vertical axis shows the predicted combined wet and dry noise value in dBA for this OHL design. The dashed lines show the Tier 2 'No Adverse Impact' screening criteria from Table 5.3 for Schools and Hotels (41.9 dBA) and residential (36.9 dB).

A.1.2 The curve does not exceed the screening criteria even at 0m distance, concluding that all Alignment 1 receptors are screened out of Tier 3 assessment.

A.1.3 No receptors have been identified that could be classified as vulnerable subgroups so the criteria for this group are not shown.

Plate A.2 Tier 2 screening for 400kV YYJ and ZJ OHLs (alignments 2 and 3) (Work Nos OH6 and OH4)



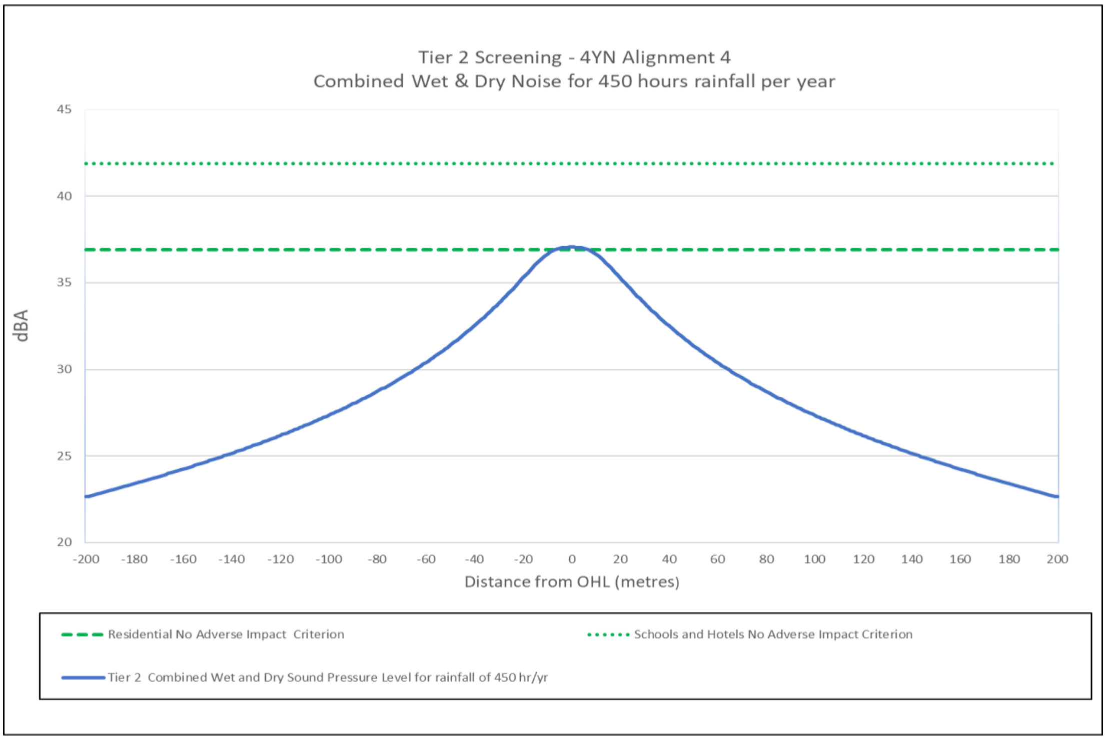
A.1.5 The chart above shows the EFC-400 Tier 2 screening curve for the 400kV YYJ and ZJ OHLs. The horizontal axis indicates the distance in metres either side of the OHL, with the OHL centreline (0m) in the centre of the chart. The vertical axis shows the predicted combined wet and dry noise value in dBA. The green dashed lines show the Tier 2 'No Adverse Impact' screening criteria from Table 5.3 for Schools and Hotels (41.9 dBA) and Residential (36.9 dB). The red dashed lines show the 'Significant Adverse Impact' screening criteria for the receptor groups which in each case are 10dB higher.

A.1.6 The curve passes through the 'No Adverse Impact' criteria lines at 63m for Residential receptors and 21m for Schools and Hotels. There are no Schools and Hotels within the 21m screening distance and therefore this receptor group is screened out.

A.1.7 The nearest residential receptor is Receptor 8 which would be approximately 66m from the realigned YYJ, giving a predicted Tier 2 assessment value of 36.4dBA. Even when taking into account the contribution from the 275kV ZB OHL, which would be approximately 25m from this receptor, the combined assessment value of 36.6dBA does not exceed the 36.9dB screening criterion. As all other identified residential receptors are further away from the YYJ and ZJ OHLs, all are screened out of Tier 3 assessment.

A.1.8 No receptors have been identified that could be classified as vulnerable subgroups so the criteria for this group are not shown.

Plate A.3 Tier 2 screening for 400kV 4YN OHL (alignment 4) (Work No OH1)



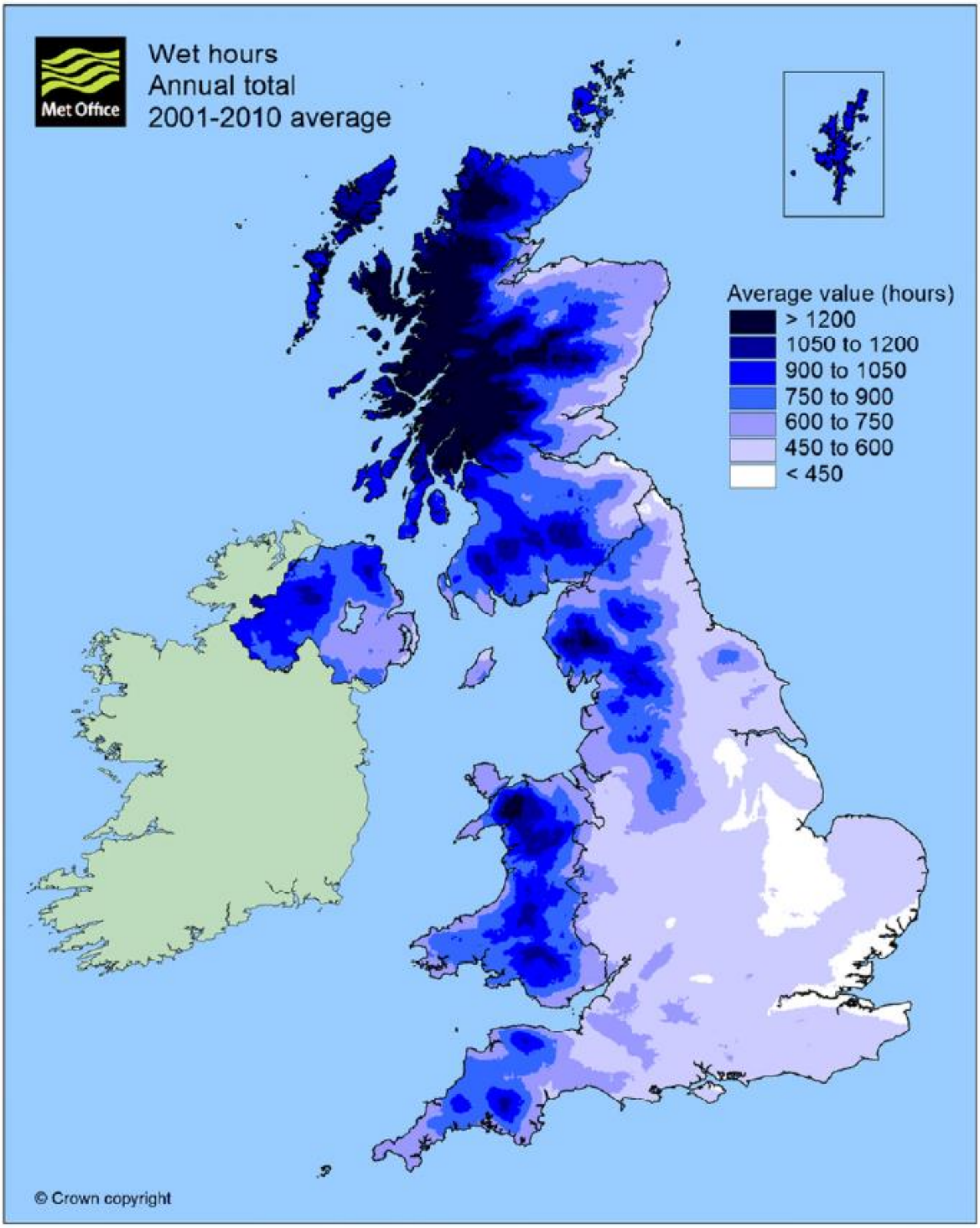
A.1.9 The chart above shows the EFC-400 Tier 2 screening curve for the 400kV 4YN OHL. The horizontal axis shows the distance in metres either side of the OHL, with the OHL centreline (0m) in the centre of the chart. The vertical axis shows the predicted combined wet and dry noise value in dBA for this OHL design. The dashed lines show the Tier 2 'No Adverse Impact' screening criteria from Table 5.3 for Schools and Hotels (41.9 dBA) and residential (36.9 dB).

A.1.10 The curve does not exceed the screening criteria for Schools and Hotels, and for Residential receptors beyond 10m from the OHL centreline. As the nearest residential receptor would be approximately 35m from the realigned 4YD OHL centreline, it is concluded that all Alignment 4 receptors are screened out of Tier 3 assessment.

A.1.11 No receptors have been identified that could be classified as vulnerable subgroups so the criteria for this group are not shown.

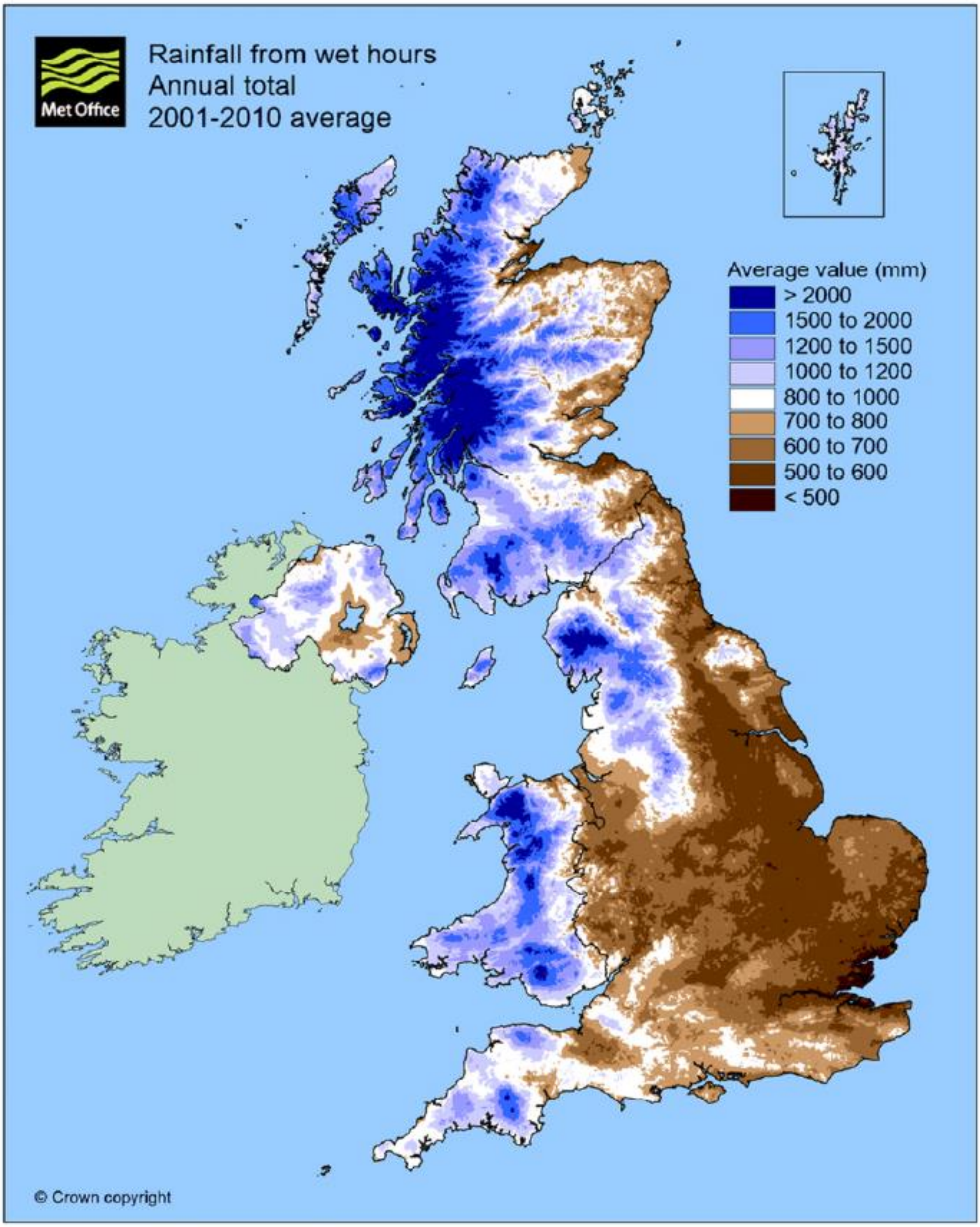
Annex B Historical weather maps

Plate B.1 Met Office rainfall duration averaged over ten-year period 2001-2010



Average value for the Project area is <450 hours of rain per year.

Plate B.2 Met Office annual total rainfall averaged for period 2001-2010



Annual average for the Project area is <500mm rain per year

Annex C Compliance with NPS EN-1 and NPS EN-5

C.1.1 NPS EN-1 sets out the overarching national policy for energy infrastructure. Part 4 of EN-1 set outs general assessment principles and Part 5.11 covers generic impacts of noise. NPS EN-5 specifically set outs instructions and guidance for applicants for new electricity networks infrastructure.

C.1.2 Appendix B of the Planning Statement sets out a full assessment of how The Project satisfies the requirements of the relevant NPSs. The table below sets out the relevant paragraphs of EN-1 and EN-5 and details how the assessment presented in this appendix satisfies their requirements.

Table C.1 Compliance with NPS EN-1

EN-1 paragraph	EN-1 policy issue	Compliance
Applicant's assessment		
5.11	Sets out how noise should be assessed where noise impacts are likely to arise from the Project. EN-1 refers to the relevant British Standards for the assessment of operational noise (where 'noise' is used as an umbrella term for noise and vibration) and refers to further information provided in the technology specific National Policy Statements e.g., EN-5	This Appendix provides an assessment of the likely operational noise impacts due to the realignment of high voltage overhead lines as part of the A122 (Lower Thames Crossing) Project.
5.11.4	*"Where noise effects are likely to arise, the applicant should include:* *A description of the noise generating aspects of the development proposal leading to noise impacts including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise".*	Provided in Section 2.0 of this Appendix.
5.11.4	*"Identification of noise sensitive premises and noise sensitive areas that may be affected."*	Potential noise sensitive receptors are identified in Plate 1.1, Plate 1.2 and Plate 1.3, and Table 6.1, Table 6.2, Table 6.3.
5.11.4	[a description of]: *"The characteristics of the existing noise environment"*	Provided in **Application Document 6.1**, Chapter 12 Noise and Vibration, Section 12.4, and Appendix 12.5, Baseline Noise Survey Information.

EN-1 paragraph	EN-1 policy issue	Compliance
5.11.4	*"A prediction of how the noise environment will change with the proposed development;* • *In the shorter term such as during the construction period*; • *In the longer term during the operating life of the infrastructure;* • *At particular times of the day, evening and night as appropriate;"*	Construction noise is covered in Appendix 12.4 Construction Noise and Vibration Assessment. Operational noise and temporal considerations are covered in Section 5.0 and Section 6.0 of this Appendix.
5.11.4	*"An assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive area"*	The assessment of effects due to operational noise is presented in Section 6.0 of this Appendix.
5.11.4	"*Measures to be employed in mitigating noise"*	Good practice and quality control measures are detailed in paragraph 2.1.9.
5.11.6	*"Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance …"*	The guidance provided in PS(T)134 and supporting documents is followed.
5.11.7	*"The applicant should consult EA and Natural England (NE), or the Countryside Council for Wales CCW), as necessary and in particular with regard to assessment of noise on protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account".*	Chapter 8: Terrestrial Biodiversity and Chapter 9: Marine Biodiversity of the Environmental Statement (ES) (**Application Document 6.1**) outline the consultation undertaken with Natural England throughout the EIA process. The desk-based and field survey requirements which have informed the Habitats Regulations Assessment were subject to consultation with Natural England via the EIA scoping process and reported within the Scoping Report for the Project. The diverted OHLs would be like-for-like replacements of the existing overhead lines and any noise from them would be of a low magnitude. The diverted OHLs do not encroach on or move toward any protected areas or protected species and therefore there would be negligible contribution compared to the contribution of the Project as a whole.
5.11.8	*"The project should demonstrate good design through selection of the quietest cost-effective plant available; containment of noise*	Table 3.1 sets out the replacement OHL designs and the potential effect on audible noise performance.

EN-1 paragraph	EN-1 policy issue	Compliance
	within buildings wherever possible; optimisation of plant layout to minimise noise emissions; and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission"	Good practice and quality control measures are detailed in paragraph 2.1.9. Appendix B of Planning Statement (**Application Document 7.2**), Table B1, para. 5.11.8 refers to the Project's measures to ensure good acoustic design.
5.11.9	*The IPC should not grant development consent unless it is satisfied that the proposals will meet the following aims:* • *avoid significant adverse impacts on health and quality of life from noise;* • *mitigate and minimise other adverse impacts on health and quality of life from noise; and* • *where possible, contribute to improvements to health and quality of life through the effective management and control of noise.*	Chapter 12: Noise and Vibration of the ES (**Application Document 6.1**) provides details of the Project's measures to avoid significant adverse impacts on health and quality of life and to minimise other adverse effects on life as discussed in Chapter 13 of the ES: Population and Human Health (**Application Document 6.1**). Section 6, Assessment of effects, of this Appendix assesses the impact of the OHL diversions using criteria based on health impact criteria for the night-time period, and Section 7 of this appendix concludes that the diversions would not result in a significant effect.

Table C.2 Compliance with NPS EN-5

EN-5 paragraph	EN-5 policy issue	Compliance
2.9.8	'*While standard methods of assessment and interpretation using the principles of the relevant British Standards are satisfactory for dry weather conditions, they are not appropriate for assessing noise during rain, which is when overhead line noise mostly occurs, and when the background noise itself will vary according to the intensity of the rain.*'	The assessment of effects, as detailed in Section 6 of Appendix 12.8 follows well established acoustic principles for human perception of noise and the context within which the noise occurs. Section 5 of Appendix 12.8 outlines an alternative methodology considered by National Grid and the Applicant to be appropriate for the permanent diversion of existing overhead lines (OHLs) in the context of the Project. The methodology considers the occurrence of OHL noise in both dry and wet conditions and follows the principles outlined in PS(T)134, 2021 to predict OHL source noise levels.
2.9.9	*Therefore, an alternative noise assessment method to deal with rain-induced noise is needed, such as the one developed by National Grid as described in report TR(T)94,1993. This follows recommendations broadly*	

EN-5 paragraph	EN-5 policy issue	Compliance
	outlined in ISO 1996 (BS 7445:1991) and in that respect is consistent with BS 4142:1997. The IPC is likely to be able to regard it as acceptable for the applicant to use this or another methodology that appropriately addresses these particular issues.’	
Mitigation		
2.9.10	*The IPC should ensure that relevant assessment methodologies have been used in the evidence presented to them, and that the appropriate mitigation options have been considered and adopted. Where the applicant can demonstrate that appropriate mitigation measures will be put in place, the residual noise impacts are unlikely to be significant.*	See response to paragraphs 2.9.8 and 2.9.9 above. Where possible, the re-alignment of the OHL has been undertaken with noise as a consideration, however due to the works being a re-alignment of the existing OHL network, these considerations were confined by the locations and positions of the existing OHL tower network. The proposed OHL designs and conductor arrangements are detailed in Table 3.1 of Appendix 12.8. Good practice environmental measures to reduce audible noise effects through quality assurance, are detailed in paragraph 2.1.9 of Appendix 12.8.
2.9.11	*Consequently, noise from overhead lines is unlikely to lead to the IPC refusing an application, but it may need to consider the use of appropriate requirements to ensure noise is minimised as far as possible.*	
2.9.12	*‘Applicants should have considered the following measures:* • *the positioning of lines […] to help* • *mitigate noise;* • *ensuring that the appropriately sized conductor arrangement is used to minimise potential noise;* • *quality assurance through manufacturing and transportation to avoid damage to overhead line conductors which can increase*	

EN-5 paragraph	EN-5 policy issue	Compliance
	potential noise effects; and • *ensuring that conductors are kept clean and free of surface contaminants during stringing/installation.'*	
2.9.13	'*The ES should include information on planned maintenance arrangements.* *Where this is not the case, the IPC should consider including these by way of requirements attached to any grant of development consent*.'	The maintenance arrangements for new and refurbished sections of OHL would be the same as for the existing OHL infrastructure. National Grid will continue undertake its statutory duty to maintain its Electricity Transmission infrastructure in accordance with the requirements of the Electricity Act 1989 (as amended).

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