

Contract No 1MC08

# Noise Demonstration Report for Stoneleigh, Glasshouse Wood, Canley

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STAKEHOLDER REVIEW REQUIRED (SRR)	PURPOSE OF SRR
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Review Required

Team	Yes/No	Name	Position	Date
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Revision Summary

Paragraph Modified	Details of Modification

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## GLOSSARY OF TERMS

Term	Description
AFARP	As far as is reasonably practicable
ARFC	All reasonably foreseeable circumstances
BS	British Standard
CBA	Cost Benefit Analysis
CRTN	Calculation of Road Traffic Noise
dB	Decibel
dB(A)	'A' weighted Decibel.
Downside	In the direction away from London and towards Birmingham
EIA	Environmental impact assessment
EMRs	Environmental Minimum Requirements
ES	Environmental Statement
LOAEL	Lowest observed adverse effect level
LPA	Local planning authority
L <sub>pAeq</sub>	'A' weighted equivalent continuous sound level
L <sub>pAFmax</sub>	maximum 'A' weighted sound pressure level
NDR	Noise Demonstration Report
Nominated Undertaker	The body or bodies appointed to implement the powers of the hybrid Bill to construct and maintain the railway.
SOAEL	Significant observed adverse effect level
the Act	The High-Speed Rail (London – West Midlands) Act 2017
TNPM	Train Noise Prediction Model
U&As	Undertakings and Assurances
Upside	In the direction towards London and away from Birmingham

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## Executive Summary

This report describes the options considered for the additional airborne noise mitigation in the Stoneleigh, Glasshouse Wood, Canley area and discusses the final mitigation design solution and resultant noise impact at receptors. It sets out a justification for the mitigation design in compliance with planning forum notes 10 and 14.

In addition to standard parapets and earthworks embedded in the design, the report proposes the following noise mitigation measures:

- Noise barrier at 138+150 to 139+375 (downside) @5m (1225 m long);
- Noise barrier at 139+375 to 139+795 (downside) @4m (420 m long);
- Noise barrier at 139+875 to 140+090 (downside) @2m (215 m long);
- Noise barrier at 141+150 to 141+360 (downside) @2m (210 m long);
- Noise barrier at 141+360 to 141+420 (downside) @2.1m (acoustic parapet) (80 m long);
- Noise barrier at 141+420 to 141+650 (downside) @2m (230 m long);
- Noise barrier at 142+475 to 142+630 (downside) @4m (155 m long);
- Noise barrier at 142+630 to 142+675 (downside) @4.1m (acoustic parapet) (45 m long);
- Noise barrier at 142+675 to 142+775 (downside) @4m (100 m long); and
- Trackside earthwork at 142+750 to 143+000 crest height increase (downside) @+2 m (250 m long).

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# 1. INTRODUCTION

## Background and Aim

This Noise Demonstration Report is compiled in accordance with the High Speed Two (HS2) Phase 1 Planning Memorandum (paragraph 7.5.2) and Planning Forum Note 14<sup>1</sup>: Operational Noise from the Railway and Altered Roads.

The information in this Noise Demonstration Report (NDR) shows how noise mitigation is designed to perform as far as is reasonably practicable, and the expected conditions. While not material to approvals under paragraph 2 or 3, this information will provide reassurance in advance of the request for approval under paragraph 9 that the mitigation is appropriate and will present an opportunity to raise concerns.

This NDR is for the Schedule 17 Paragraph 3 application and future reports will be provided for later stages including Schedule 17 Paragraph 9 application.

In addition to the requirements to control airborne noise set out in Information Paper E20<sup>2</sup>, mitigation is also required to meet any undertakings and assurances that are relevant to the Stoneleigh, Glasshouse Wood, Canley area.

## Structure of Report

- Site Location
- Policy, Requirements and Standards
- Description of the Works
- Methodology
- Assumptions
- Results
- Conclusions

# 2. SITE LOCATION

This report considers noise levels and mitigation in the Stoneleigh, Glasshouse Wood, Canley area.

1

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/833184/PFN\\_14\\_Operational\\_Noise.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/833184/PFN_14_Operational_Noise.pdf)

<sup>2</sup> Information paper E20: Control of airborne noise from altered roads and the operational railway

The relevant section of track is 5658 m long (chainage 137+822 to 143+480) between Stoneleigh Park retaining wall and Crackley Road cutting, and includes the following assets:

- Stoneleigh Park retaining wall;
- B4113 Stoneleigh Road Green overbridge;
- Stoneleigh Park south accommodation overbridge;
- Stoneleigh Park north accommodation overbridge;
- Stonehouse Cutting;
- Agricultural Centre embankment;
- River Avon viaduct;
- Glasshouse Wood embankment;
- Glasshouse Wood cutting;
- B4115 Ashow Road overbridge;
- A46 Kenilworth bypass overbridge;
- Footpath K29 overbridge;
- Finham Brook embankment;
- Dalehouse Lane overbridge;
- Finham Brook viaduct;
- Dalehouse embankment;
- Kenilworth cutting;
- Millburn Grange farm accommodation overbridge;
- Coventry-Leamington Spar rail overbridge;
- A429 Kenilworth Road overbridge;
- Canley Brook embankment;
- Canley Brook viaduct;
- Crackley Road cutting; and
- Bridleway W164 overbridge.

The assessment areas comprise communities located downside (in the direction away from London) and upside (in the direction towards London) of the track consisting of a mix of residential and non-residential receptors, the latter comprising in general commercial and industrial buildings. These communities form nine broad areas (with

additional isolated receptors located throughout the 'Stoneleigh, Glasshouse Wood, Canley' area):

- Stareton area with 15 dwellings;
- Stoneleigh Park area with 58 dwellings;
- Birmingham Road area with 87 dwellings;
- Dalehouse Lane area with 14 dwellings;
- The Meadows area with 306 dwellings;
- Common Lane area with 124 dwellings;
- Coventry Road area with 310 dwellings;
- Stoneleigh Road area with 45 dwellings; and
- Cryfield Grange Road area with 51 dwellings.

The non-residential receptors are located on the downside and upside comprising 94 classified as G5 (offices and general commercial), 2 as G4 (schools, hotels, hospitals and libraries) and 3 as G3 (places of meeting for religious worship, courts, cinemas, lecture theatres, museums and small auditoria or halls).

Figure 1 presents the alignment of the track showing chainages and the main features in different colours. The relevant assessment locations are shown in Figure 2 and are as reported in the ES (as amended). Greyed out points represent assessment locations that are outside the Stoneleigh, Glasshouse Wood, Canley area and are therefore considered in other noise demonstration reports.

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Figure 1. Stoneleigh, Glasshouse Wood, Canley and surrounding area with main design features



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Figure 2. Stoneleigh, Glasshouse Wood, Canley and surrounding area with relevant receptor locations



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Baseline noise levels and the ES operational noise levels were obtained from the Community Forum Area report Stoneleigh, Kenilworth and Burton Green: CFA 18, Operational assessment Sound, noise and vibration<sup>3</sup> as updated by SES/AP2<sup>4</sup>.

**Description of significant adverse effects due to operational noise identified at the time of the ES**

Residential receptors - individual buildings

The ES identified significant adverse effect due to operational noise, see Table 1.

Residential receptors – communities

The ES identified significant adverse effect due to operational noise, see Table 1.

Non-residential receptors

The ES identified significant adverse effect due to operational noise, see Table 1.

Table 1. Significant adverse effects due to operational noise identified at the time of the ES

Description of significant adverse effects due to operational noise identified at the time of the ES
<p><u>Significant effects – individual buildings:</u></p> <p>OSV18-D01 (rec 229088): Forecast increases in sound from the railway are likely to cause a moderate adverse effect on two properties in the vicinity of Dalehouse Lane, Kenilworth.</p> <p>OSV18-D02 (rec 226073): A major operational noise impact has been identified based upon the change in the airborne noise level outside this receptor.</p> <p><u>Significant effects – communities:</u></p> <p>OSV18-C01 (rec 217994, 711043): Forecast increases in sound from the railway are likely to cause a moderate adverse effect on approximately five properties in the vicinity of Eastgate closest to the Proposed Scheme.</p> <p><u>Significant effects – non-residential receptors:</u></p> <p>OSV18-N01 (rec 218885, 219122, 219394): National Agriculture Centre. Potential noise disturbance of activities within the centre due to the operation of train services.</p>

<sup>3</sup> CFA18 | Stoneleigh, Kenilworth and Burton Green, Operational assessment (SV-004-018)

<sup>4</sup> Supplementary Environmental Statement and Additional Provision 2 Environmental Statement Volume 5 | CFA18 Stoneleigh, Kenilworth and Burton Green

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## Amendments and changes to the design within the SES and APs

Supplementary Environmental Statement 3 and Additional Provision 4 Environmental Statement Volume 2 | Community forum area reports CFA18 Stoneleigh, Kenilworth and Burton Green<sup>4</sup>, introduced an amendment to the design that may have affected operational noise as set out in Table 2.

Table 2. AP4 amendment to the design that may affect operational noise

Description of the AP4 revised scheme
(AP4-018-002) Amendments include provision of additional landscape mitigation earthworks to the east and west of the route adjacent to the southern approach to the River Avon viaduct. The amendment to the landscape earthworks reduces the operational airborne noise slightly, but not to the extent that the operational airborne noise impacts categories identified in the main ES are altered.
(AP4-018-003) Reduction of the extent of the western accommodation overbridge access track at Millburn Grange Farm in order to maintain access to a barn, which would be blocked by the track proposed in the original scheme. The height of landscape mitigation earthworks will be maintained, and noise fence barriers locally readjusted, to provide an equivalent level of acoustic screening to the original scheme.

Source: 'Supplementary Environmental Statement 3 and Additional Provision 4 Environmental Statement Volume 2 | Community forum area report CFA18 Stoneleigh, Kenilworth and Burton Green, Operational assessment (SV-004-018)'

The SES3/AP4 reported that an assessment was undertaken to determine whether operational noise levels from the AP4 revised scheme would result in a likely significant effect.

No new or different significant operational effects were identified for sound, noise and vibration as a result of the proposed SES3 changes, in comparison with the ES and SES.

### 3. POLICY, REQUIREMENTS AND STANDARDS

High Speed Two (HS2) is the Government's proposal for a new, high speed north-south railway. The proposal is being taken forward in two phases: Phase One will connect London with Birmingham and the West Midlands and Phase Two will extend the route to Manchester, Leeds and beyond.

The High-Speed Rail (London – West Midlands) Act 2017, referred to from this point forward as "the Act", provides powers for the construction and operation of Phase 1 of High Speed Two for the works, for which HS2 Ltd is the nominated undertaker. The Secretary of State has also published Environmental Minimum Requirements (EMRs),



which set out the environmental and sustainability commitments that will be observed in the construction of the Proposed Scheme.

Section 20 to the Act grants deemed planning permission for the works authorised by it, subject to the conditions set out in Schedule 17. Schedule 17 includes conditions requiring various matters to be approved by the relevant Local Planning Authority (LPA).

Schedule 17 of the Act sets out the specific grounds on which the LPA may impose conditions on approvals or refuse requests for approval. With respect to noise one of the specific grounds the LPA may refuse to approve plans or specifications is if “the design or external appearance of the building works ought to be modified to preserve the local environment or local amenity and is reasonably capable of being so modified”. This ties in with HS2 Ltd commitment to reduce airborne noise as far as is reasonably practicable (AFARP).

The following section provides a summary of the Environmental Minimum Requirements (EMRs) and relevant information papers that have been produced to explain the commitments made in the Act and the Undertakings and Assurances (U&As) given by the Secretary of State and how they will be applied to the design and construction of HS2 Phase 1.

### **Environmental Minimum Requirements (EMRs)**

The EMRs set out environmental and sustainability commitments that will be observed during the construction and operation of the Proposed Scheme. The EMRs include the Code of Construction Practice (CoCP) and a series of other supporting documents.

The EMR general principles<sup>5</sup> state:

The controls contained in the EMRs, along with powers contained in the Act and the Undertakings given by the Secretary of State, will ensure that impacts which have been assessed in the ES will not be exceeded, unless any new impact or impacts in excess of those assessed in the ES:

- results from a change in circumstances which was not likely at the time of the ES<sup>6</sup>; or

<sup>5</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/618074/General\\_principles.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/618074/General_principles.pdf)

<sup>6</sup> In addition, Supplementary Environmental Statements and Additional Provision Environmental Statements were published and tabled by the Promoter in July 2015, September 2015, October 2015 and December 2015.



- would not be likely to be environmentally significant<sup>7</sup>; or
- results from a change or extension to the project, where that change or extension does not itself require environmental impact assessment (EIA) under either (i) article 4(1) of and paragraph 24 of Annex 1 to the EIA Directive<sup>8</sup>; or (ii) article 4(2) of and paragraph 13 of Annex 2 to the EIA Directive<sup>9</sup>; or
- would be considered as part of a separate consent process (and therefore further EIA if required).

In the circumstances described in the first bullet point above, if the significant adverse impacts identified in the ES are likely to be exceeded, HS2 and their contractors will take all reasonable steps to minimise or eliminate those additional impacts. If despite these reasonable steps, significant adverse impacts remain HS2 and their contractors will report them.

### **Information Paper E20: Control of Airborne Noise from Altered Roads and the Operational Railway**

Information Paper E20 outlines the measures that are required to be put in place to control operational airborne noise. It sets out various objectives to minimise operational noise effects as summarised below.

HS2 and their contractors will take all reasonable steps to design and construct the scheme so that the combined airborne noise predicted, in all reasonably foreseeable circumstances (ARFC), does not exceed the lowest observed adverse effect level (LOAEL) at residential receptors.

Where it is not reasonably practicable to achieve this objective, HS2 and their contractors will reduce airborne noise as far as is reasonably practicable (AFARP).

HS2 and their contractors are required to consider the following measures to control operational noise, ranked in order of desirability:

- reduce noise generation at source;
- reduce noise propagation through noise barriers and/or landscape earthworks; and
- reduce the amount of noise entering eligible properties through the offer of noise insulation.

<sup>7</sup> i.e. a situation that could not reasonably have been anticipated at the time of the Environmental Statement. This covers all effects (both positive and adverse) where those effects are simply of no environmental significance.

<sup>8</sup> 2011 consolidated EIA Directive (2011/92/EU).

<sup>9</sup> Broadly, this would not allow those changes or extensions to the project (once it has received Royal Assent) which would give rise to adverse environmental effects within the EIA.

Noise insulation will be offered with the aim that operational airborne noise from the scheme does not give rise to significant adverse effects on health and quality of life that would otherwise be expected when airborne noise exceeds the significant observed adverse effect levels (SOAEL) at residential receptors.

The LOAEL and SOAEL values applicable to residential receptors are presented in Appendix A.

### Undertakings and assurances

There is one Undertaking and Assurance (U&A) specifically applicable to the Stoneleigh, Glasshouse Wood, Canley area:

#### U&A 2837\_19

The text of U&A 2837\_19 is as follows:

*12.1 The Nominated Undertaker will seek to secure that noise and vibration levels experienced at the Stoneleigh Park Estate arising from the operation of the Railway during the Operational Period shall not exceed the levels set out in the Environmental Statement deposited with the Act, such levels to be achieved by the implementation of the Environmental Minimum Requirements in relation to the design and construction of the Proposed Scheme and the provision of suitable noise and vibration mitigation.*

*12.2 The Nominated Undertaker will provide the Stoneleigh Park Estate Petitioners with information as predicted by the Nominated Undertaker of the levels of noise and vibration which are anticipated to arise from the Works during the Construction Period and the Operational Period at the Stoneleigh Park Estate and the levels of noise and vibration which do occur until completion of the Proposed Scheme.*

*12.3 The Nominated Undertaker will, in addition to the requirements of the Environmental Statement and the Environmental Minimum Requirements and in the absence of any other form of noise attenuation to at least 'equivalent acoustic performance' as agreed with the Stoneleigh Park Estate Petitioners, provide the Additional Bunding as soon as reasonably practicable following commencement of the Relevant Works and shall thereafter leave that Additional Bunding in place throughout the Construction and Operational Period.*

### Mitigation Appraisal Requirements

HS2 and their contractors are required to consider a list of potential mitigation measures and undertake a proportionate Cost Benefit Analysis (CBA) and consider all relevant acoustic and non-acoustic costs and benefits including:

- monetary benefit of noise reduction compared to cost;
- engineering practicability;
- impacts on other environmental disciplines, including landscape and visual; and
- consultation and stakeholder engagement responses.

## 4. DESCRIPTION OF THE WORKS

The Stoneleigh, Glasshouse Wood, Canley area encompasses an area between the Stoneleigh Park retaining wall and Crackley Road cutting. From its southern boundary, the proposed scheme will initially be retained on both directions as the track gradually reaches its lowest elevation in the Stoneleigh area, past the adjacent Stoneleigh Business Park on the downside before starting to rise again, going through the B4113 Stoneleigh Road Green overbridge and Stoneleigh Park south accommodation overbridge. The route transitions into Stonehouse cutting which incorporates Stoneleigh Park north accommodation overbridge and then continues towards the Agricultural Centre embankment, River Avon viaduct, and Glasshouse Wood embankment. Glasshouse Wood cutting then follows, intersecting B4115 Ashow road overbridge and A46 Kenilworth bypass overbridge. Finham Brook embankment encompassing Dalehouse Lane overbridge, Finham Brook viaduct, Dalehouse embankment, and Kenilworth cutting which encompasses the A429 Kenilworth Road overbridge follow at a fairly constant track elevation. From the northern side of Kenilworth cutting the track starts to rise again as it transitions through the Canley Brook embankments, Canley Brook viaduct, and Crackley Road cutting where it reaches its highest point in the Canley area.

### Design changes since the Hybrid Bill

The following changes are introduced as part of the design process since the Hybrid Bill:

- Stoneleigh Park - Track alignment has been raised throughout the retaining wall asset. Elevation increase is approximately 0.5 m for the majority of its length, while at the southernmost end this ranges from 0.5 m up to a maximum 2 m for approximately 300 m, resulting in the retaining wall length being reduced by approximately 140 m at the northern end and 260 m at the southern end;
- B4113 Stoneleigh Road Green overbridge, Stoneleigh Park south and north accommodation overbridges - Green overbridge deck width has decreased from 26.96 m to 24.64 m; Green overbridge span has increased from 22.8 m to 26.15 m with wing wall lengths increased 1.9 m at the north end and 0.8 m at the south end of the bridge, and outer parapet height no longer reduced at the bridge abutments; North overbridge span increased from 22.8 m to 24.1 m with the outer parapet height no longer reduced at the bridge abutments; South

overbridge span has increased from 22.8 m to 25.1 m with wing wall lengths increased 2.8 m at the north end and 3.1 m at the south end of the bridge, and outer parapet height no longer reduced at the bridge abutments;

- Stonehouse cutting – Negligible change in vertical rail alignment;
- Agricultural Centre embankment – Negligible change in vertical rail alignment;
- River Avon viaduct – Negligible change in vertical rail alignment;
- Glasshouse Wood embankment - Reduction in corridor width (crest to crest); slope angle changed from 1v:2.5h (vertical:horizontal) to 1v:2h; no change in vertical alignment;
- Glasshouse Wood cutting - Reduction in corridor width (toe to toe); slope angle changed from 1v:3h to 1v:2.5h and 1v:2h compound slopes; raise in vertical rail alignment (<1m);
- Dalehouse Lane overbridge - Bridge made integral and abutment redesigned; change from a 1 span solution to a three-span solution; the total width of the Overbridge is 12.357 m over a length of 50.6 m; the width of the approach embankments has increased from FPD to include the Highways drainage and is now 14.32 m; the vertical clearance has been increased by approximately 0.5 m because of OCS requirements;
- Finham Brook embankment - Reduction in corridor width (crest to crest); steepening of slope angle; negligible change in vertical rail alignment;
- Finham Brook viaduct - 2 span viaduct (optimised from 3 span scheme design);
- Kenilworth cutting – Track elevation increased by up to approximately 3 m; Canley Brook retaining wall is replaced by an extended Kenilworth Cutting as it is no longer required given the increase in the vertical alignment/decrease in cutting depths; cutting depth now ranges from >5 m to <10 m with a slope angle of 1v:2.5h; the balancing pond and pumping station have moved and are now situated immediately adjacent to Millburn Grange Farm; and
- Canley Brook viaduct/embankments - Canley Brook viaduct has replaced Canley Brook culvert due to the track elevation change, reducing the length of the water diversion and associated impacts; Crackley ATS is moved to the west side of the tracks and is no longer a discrete asset, with design tasks being shared between Canley Brook Embankment and Crackley Road Cutting; viaduct length has been reduced from 50 m to 28 m, changing from a three-span structure to a four span structure; Canley Brook embankment is a new asset created due to the increase in vertical alignment (embankment no.1 is on the south side of the viaduct, embankment no.2 is on the north side); maximum embankment height ranges from >1 m to <6 m with a 1v:2h slope.

### Scheme Design Updates

Scheduled works that are specifically part of this application are set out above. Scheme design updates that have been considered in the noise modelling are set out below:

- The track alignment incorporates a reduction of the spacing distance between track axes from 5.0 m to 4.7 m for high-speed sections of the Phase 1 scheme;
- The face of noise barriers (other than parapets) has been reduced to an offset of 4.4 m from the track alignment;
- Standard viaduct parapets are non-absorbent and 1.2 m above railhead compared with absorbent and 1.4 m above railhead at the time of the ES but where additional noise mitigation is needed, the height is increased and absorption introduced; and
- Concrete robust kerbs of height 0.35 m above railhead and 2 m from the nearest track centreline have now been incorporated into in the scheme design.

The reduction of the distance between track alignments, combined with the closer alignment of noise barriers has the capacity to provide a greater noise shielding effect.

Two further changes impact modelled noise levels routewide. These are:

- the track support system has been revised to concrete slabs in lieu of ballasted track envisaged in the ES; and
- the just-TSI compliant trains which were the noisiest have been removed, the revised source terms are provided in Table 51.

### ES mitigation

At the time of the ES parapet structures were incorporated along the length of the viaducts at a height of 1.4 m above top of rail. Additional barrier mitigation comprised:

- Noise barrier at 138+300 to 139+800 (downside) @3m (1500 m long);
- Noise barrier at 138+150 to 139+790 (downside) @3m (1640 m long);
- Standard parapet at 139+790 to 139+885 (downside) @1.4m (95 m long);
- Standard parapet at 139+800 to 139+895 (upside) @1.4m (95 m long);
- Noise barrier at 139+875 to 140+090 (downside) @3m (215 m long);
- Noise barrier at 139+885 to 140+095 (upside) @3m (210 m long);
- Noise barrier at 141+275 to 141+375 (upside) @2m (100 m long);
- Noise barrier at 141+150 to 141+360 (downside) @4m (210 m long);
- Standard parapet at 141+360 to 141+425 (downside) @1.4m (65 m long);
- Standard parapet at 141+375 to 141+445 (upside) @1.4m (70 m long);
- Noise barrier at 141+435 to 141+665 (upside) @4m (230 m long);
- Noise barrier at 141+425 to 141+650 (downside) @4m (225 m long);
- Noise barrier at 142+090 to 142+345 (downside) @2m (255 m long);
- Noise barrier at 143+050 to 143+315 (downside) @3m (265 m long); and
- Standard parapet at 143+220 to 143+280 (downside) @1.4m (60 m long).

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### Candidate mitigation options

The primary objective of this report is to provide evidence that all reasonable steps are taken into the Proposed Design so that the cumulative airborne noise from the railways and altered roads, predicted in all reasonably foreseeable circumstances (ARFC), does not exceed the lowest observed adverse effect level (LOAEL) at residential receptors.

Where it is not reasonably practicable to achieve this objective, various noise mitigation scenarios are proposed and evaluated against the noise criteria and the non-acoustic criteria i.e. visual and landscape effects, engineering practicability and value for money.

The Proposed Design corresponds to the option that reduces airborne noise as far as is reasonably practicable (AFARP).

In the following sections, the main outcome of the impact assessment is presented in turn for each of nine assessment areas. Maps are provided that show which assessment locations are included within each of the assessed areas, with the convention that black dots are used for assessment locations that fall within the area and grey dots are used otherwise. First, a comparison of a 'no additional noise mitigation' option with the Phase 1 ES (and supplementary environmental statements, SESs, and additional provisions (APs) design is made in terms of noise effects. Then, each noise mitigation design option is analysed and compared to determine the "as far as reasonably practicable" (AFARP) scenario, considering both the resulting noise impact classification and the as previously mentioned non-acoustic criteria. Where there is a noise material change with respect to the ES, this is stated within the summary results for each option.

A classification has been used to rank the noise assessment outcomes, benefit in comparison with cost, and environmental implication which is primarily the landscape and visual outcome in each case. These classifications are set out in Table 3.

Table 3 Impact classifications for noise and landscape/visual when comparing options

Classification	Noise assessment	Benefit in comparison with cost	Environmental Implication
✓✓	Materially beneficial reduction in noise levels; removal of one or more significant adverse effects on a community basis	Substantial benefits and/or relatively low mitigation cost	Significantly better or materially better effects than the ES mitigation
✓	Reduction in the number of major, minor or moderate	Some benefits and/or relatively high mitigation cost	Better effects than the ES but not materially better effects

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Classification	Noise assessment	Benefit in comparison with cost	Environmental Implication
	impacts for receptors above LOAEL but no material change		
~	Similar number of major, minor or moderate impacts for receptors above LOAEL and no material change	Comparable benefits and mitigation costs with the ES design	About the same effects as the ES mitigation
*	Increase in the number of major, minor or moderate impacts for receptors above LOAEL but no material change	Reduced benefits or increased costs in comparison with the ES design	Worse effects than the ES but not materially worse effects
**	Materially adverse increase in noise levels, number of major, minor or moderate impacts for receptors above LOAEL	Substantially reduced benefits of increased costs in comparison with the ES design	Significantly worse or materially worse effects than the ES mitigation

Assessment locations/community areas may be considered within more than one assessment area to ensure the influence of design interventions is included within adjacent areas. Prediction results for each receptor are nonetheless reported only once, in the context of the assessment area they each belong to.

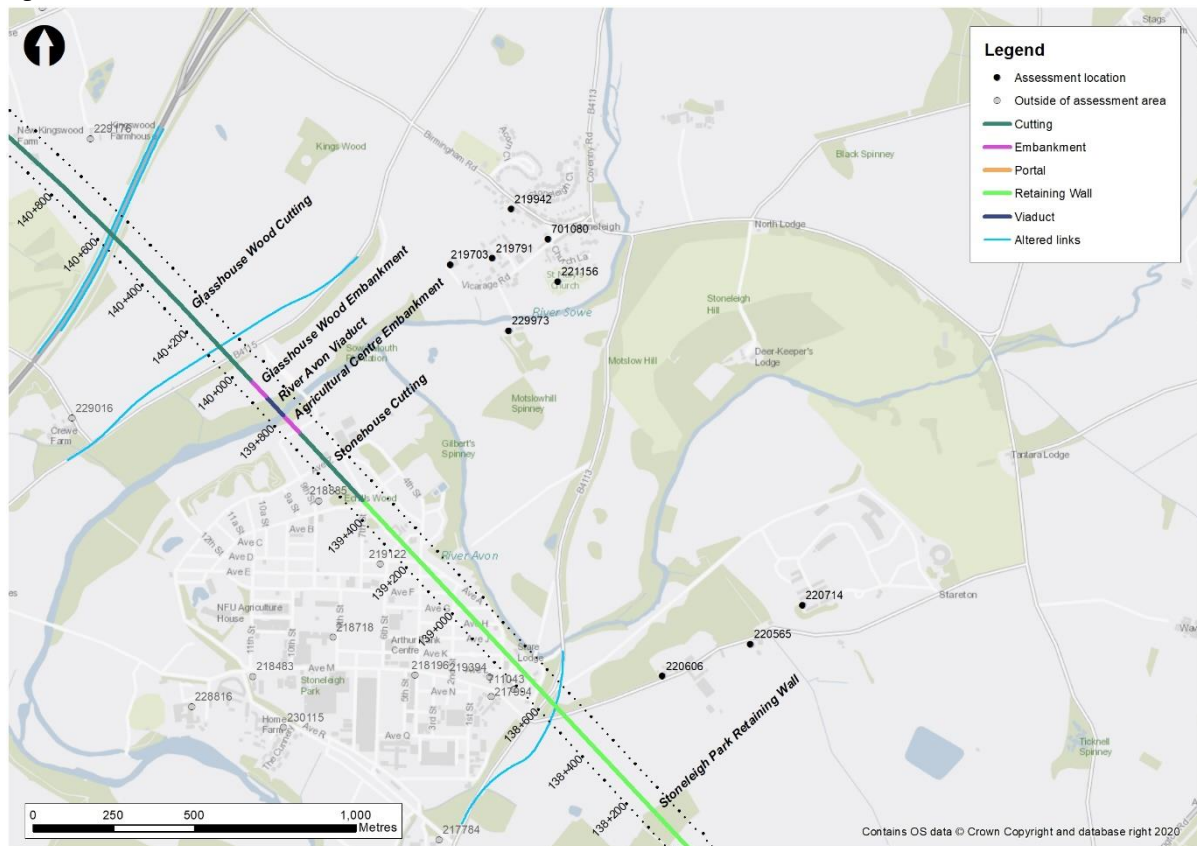
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### Assessment Area 1 candidate mitigation options

A total of two options were considered and studied to assess noise mitigation for communities in the vicinity of Stoneleigh Road on the upside of the HS2 alignment before reaching The Design (Option 1.0) for which consent is sought. Assessment Area 1 is shown in Figure 3.

Figure 3. Assessment Area 1 extents



Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were 8 negligible daytime impacts and 31 negligible night-time impacts at residential receptors above  $L_{pAeq}$  LOAEL. There were also 78 receptors

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where the  $L_{pAFMax}$  was at or greater than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, and changes in the alignment and earthworks in the current design. Notably, design changes in the area include an elevation increase up to 2 m of the HS2 track, and marginal height increases for earthworks on the upside.

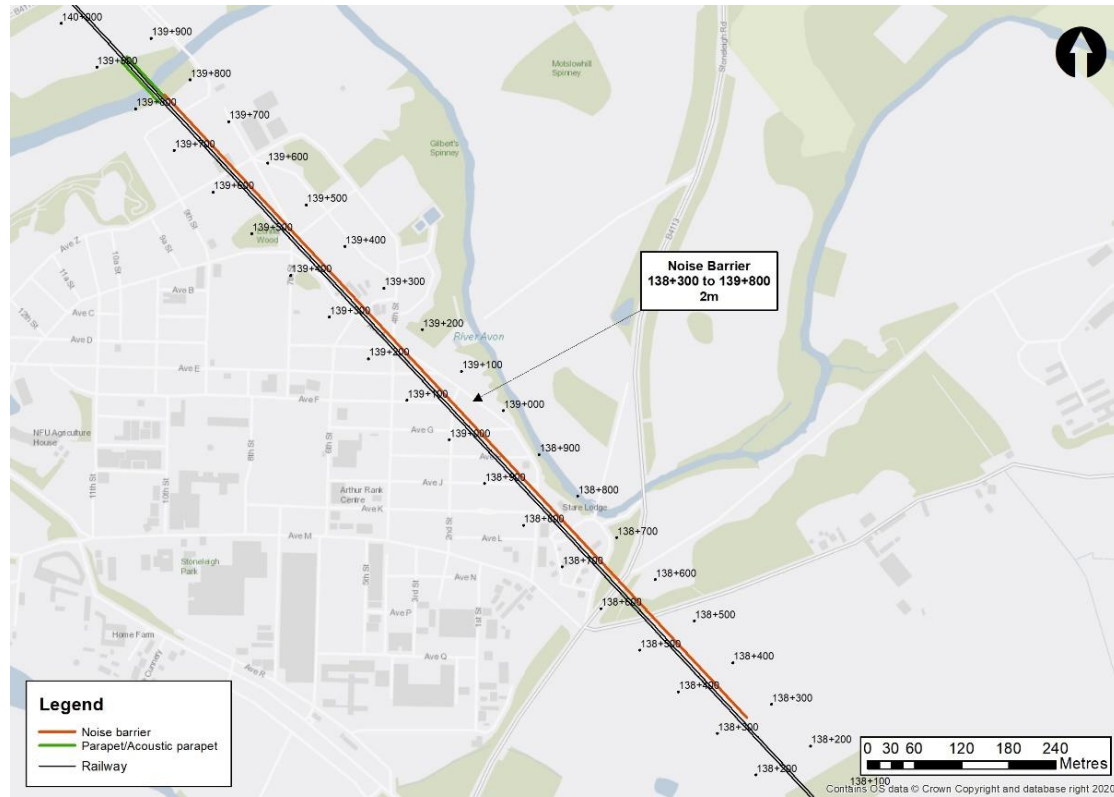
In the absence of additional mitigation (Option 1.0) the change in number of receptors above  $L_{pAeq}$  LOAEL compared to the ES is an increase of 12 during the daytime. Eight negligible and 12 minor impacts during daytime, and 11 negligible and 20 minor impacts during night-time are observed at residential receptors above  $L_{pAeq}$  LOAEL. No impacts at non-residential receptors are observed.

Other candidate mitigation options that were considered included:

- Option 1.1 was a 2 m high, 1.5 km long trackside barrier which was proposed in the ES at a height of 3 m, see Figure 4. This barrier would extend north from Stoneleigh Park retaining wall up to River Avon viaduct. Analysis showed that this option would produce little additional benefit in comparison to the ES, having comparable visual impact. Option 1.1 would have a low benefit in comparison to cost, therefore it is not recommended.

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Figure 4. Candidate mitigation Option 1.1



A summary analysis for the mitigation scenarios that were considered within Assessment Area 1 are presented in Table 4. Option 1.0 in the highlighted grey cells is the recommended final design solution as other candidate mitigation options had a low benefit in comparison to cost.

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Table 4. Option appraisal summary table (Assessment Area 1)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 1.0	Only mitigation embedded within the design	No cost/benefit	~ Impacts are comparable to the ES	No additional constraints	~	Further stakeholder engagement req'd.
Option 1.1	Noise barrier (2 m) at 138+300 to 139+800	x	✓ Reduced impacts compared to the ES but not materially improved	No additional constraints	~	Further stakeholder engagement req'd.

Note:

1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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## Assessment Area 2 candidate mitigation options

A total of seven options were considered and studied to assess noise mitigation for communities in the vicinity of Stoneleigh Park on the downside of the HS2 alignment before reaching The Design (Option 2.8) for which consent is sought. Assessment Area 2 is shown in Figure 5.

U&A 2837\_19 is applicable to Assessment Area 2 and has been considered in identifying suitable mitigation measures for the area.

Figure 5. Assessment Area 2 extents

Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option;
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit and/or
- U&A requirements have not been met.

At the time of the ES there were seven negligible, three minor and two moderate daytime impacts, and nine negligible and five moderate night-time impacts above  $L_{pAeq}$  LOAEL at residential receptors (a significant effect on a community basis, OSV18-C01, owing to the moderate impacts has been identified in relation to assessment location IDs 217994 and 711043). There were also 16 receptors where the  $L_{pAFmax}$  was at or greater than LOAEL. Six significant impacts at non-residential receptors (OSV18-N01, assessment location IDs 218885, 219122 and 219394) have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, and changes in the alignment design and surrounding earthworks, notably an elevation increase up to 2 m of the HS2 track, and earthwork height reductions in the approximate chainage range 138+800 to 139+300 on the downside. Trackside noise barriers have been moved closer to the track for all candidate options to maximise screening efficiency. The design approach has considered the balance between noise mitigation requirements and visual impact from relevant assets.

In the absence of additional mitigation (Option 2.0) resultant impacts at residential above  $L_{pAeq}$  LOAEL are increasing for both daytime and night-time receptors compared to the ES. Two new  $L_{pAFmax}$  SOAEL exceedances are also introduced compared to the ES. Option 2.0 results in a material change, while U&A requirements are not met, therefore this option is not recommended.

Other candidate mitigation options that were considered included:

- Option 2.1 was a 2 m high, 1.645 km long trackside noise barrier at 138+150 to 139+795 consisting of sections located on Stoneleigh Park retaining wall, Stonehouse cutting and Agricultural Centre embankment, see Figure 6. Impacts at residential receptors above  $L_{pAeq}$  LOAEL result in a material change owing to reaching a total of 5 moderate impacts during the day. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES. Option 2.1 would have a low benefit

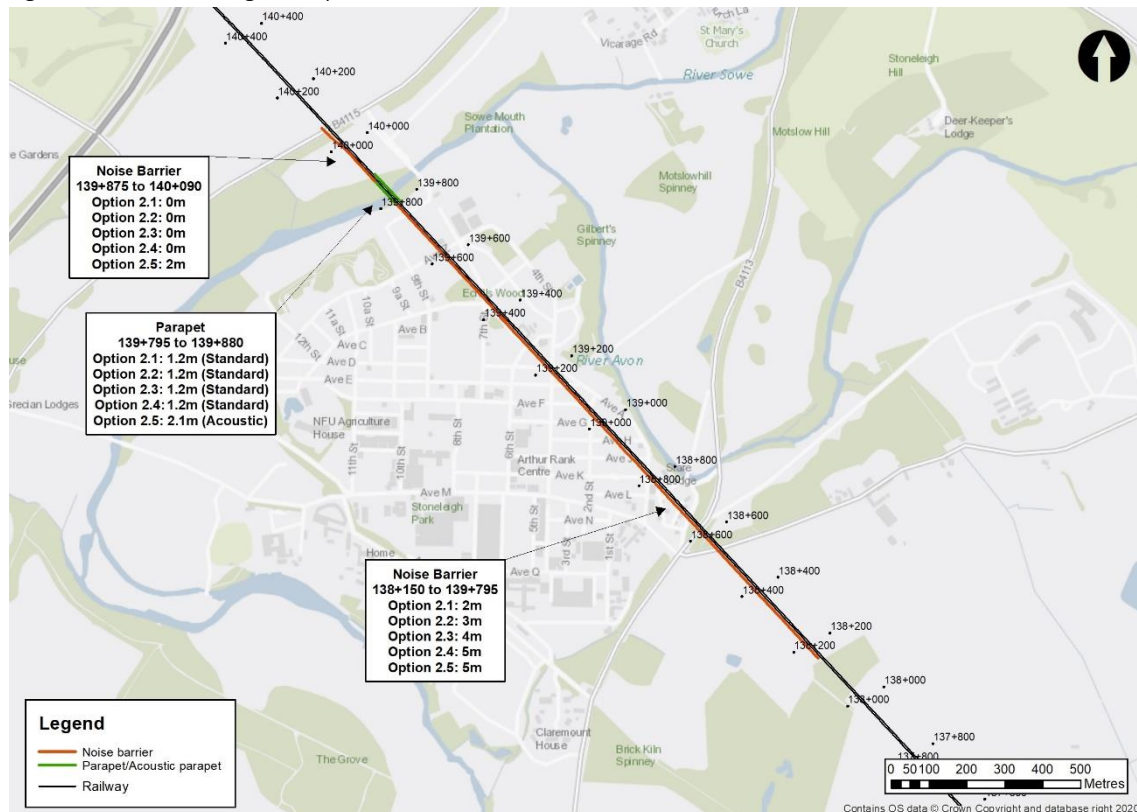
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in comparison to cost. U&A requirements are not met. Option 2.1 is therefore not recommended.

Figure 6. Candidate mitigation options 2.1-2.5



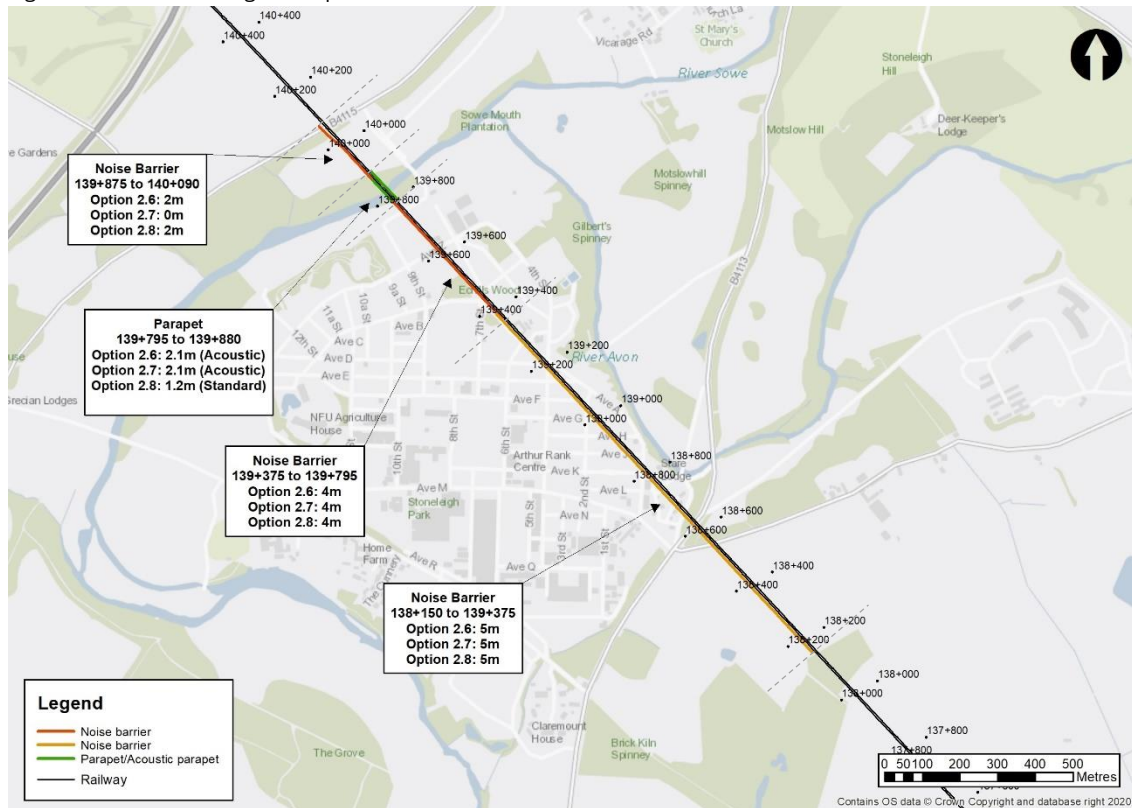
- Option 2.2 was a 3 m high, 1.645 km long trackside noise barrier at 138+150 to 139+795 consisting of sections located on Stoneleigh Park retaining wall, Stonehouse cutting and Agricultural Centre embankment, see Figure 6. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. Two  $L_{pAFmax}$  impacts are reduced to below LOAEL compared to the ES. Option 2.2 would have a low benefit in comparison to cost. U&A requirements are not met, and Option 2.2 is therefore not recommended.
- Option 2.3 was a 4 m high, 1.645 km long trackside noise barrier at 138+150 to 139+795 consisting of sections located on Stoneleigh Park retaining wall, Stonehouse cutting and Agricultural Centre embankment, see Figure 6. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. Two  $L_{pAFmax}$  impacts are reduced to below LOAEL compared to the ES. Option 2.3 would have a low benefit in comparison to cost. U&A requirements are not met, and Option 2.3 is therefore not recommended.

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- Option 2.4 was a 5 m high, 1.645 km long trackside noise barrier at 138+150 to 139+795 consisting of sections located on Stoneleigh Park retaining wall, Stonehouse cutting and Agricultural Centre embankment, see Figure 6. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES. Option 2.4 would have a low benefit in comparison to cost. U&A requirements are not met, and Option 2.4 is therefore not recommended.
- Option 2.5 was a 5 m high, 1.645 km long trackside noise barrier at 138+150 to 139+795 consisting of sections located on Stoneleigh Park retaining wall, Stonehouse cutting and Agricultural Centre embankment, a 2.1 m high, and 85 m long acoustic parapet at 139+795 to 139+880, and a 2 m high, 215 m long trackside noise barrier at 139+875 to 140+090 consisting of sections in Glasshouse wood embankment and Glasshouse wood cutting, see Figure 6. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. Two  $L_{pAFmax}$  impacts are reduced to below LOAEL compared to the ES. Visual impact of the option is considered to be increased compared to the ES but not be materially worse. Option 2.5 would have a low benefit in comparison to cost. U&A requirements are met. This option is therefore shortlisted for the final recommendation as set out below.
- Option 2.6 was a 5 m high, 1.225 km long trackside noise barrier at 138+150 to 139+375 on Stoneleigh Park retaining wall, a 4 m high, 420 m long trackside noise barrier at 139+375 to 139+795 along Stonehouse cutting and Agricultural Centre embankment, a 2.1 m high, and 85 m long acoustic parapet at 139+795 to 139+880, and a 2 m high, 215 m long trackside noise barrier at 139+875 to 140+090 consisting of sections in Glasshouse wood embankment and Glasshouse wood cutting, see Figure 7. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. Two  $L_{pAFmax}$  impacts are reduced to below LOAEL compared to the ES. Option 2.6 would have a low benefit in comparison to cost. Visual impact is considered to be increased compared to the ES but not be materially worse. U&A requirements are met. This option is therefore shortlisted for the final recommendation as set out below.

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Figure 7. Candidate mitigation options 2.6-2.8



- Option 2.7 was a 5 m high, 1.225 km long trackside noise barrier at 138+150 to 139+375 on Stoneleigh Park retaining wall, a 4 m high, 420 m long trackside noise barrier at 139+375 to 139+795 along Stonehouse cutting and Agricultural Centre embankment, and a 2.1 m high, and 85 m long acoustic parapet at 139+795 to 139+880, see Figure 7. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES. Option 2.7 would have a low benefit in comparison to cost. U&A requirements are not met, and Option 2.7 is therefore not recommended.
- Option 2.8 (The Design) was a 5 m high, 1.225 km long trackside noise barrier at 138+150 to 139+375 on Stoneleigh Park retaining wall, a 4 m high, 420 m long trackside noise barrier at 139+375 to 139+795 along Stonehouse cutting and Agricultural Centre embankment, and a 2 m high, 215 m long trackside noise barrier at 139+875 to 140+090 consisting of sections in Glasshouse wood embankment and Glasshouse wood cutting, see Figure 7. Resultant impacts are slightly improved compared to the ES, with three receptors changing impact category from moderate to minor in the night-time, introducing a material benefit. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES. Option

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2.8 would have a low benefit in comparison to cost. Visual impact is considered to be increased compared to the ES but not be materially worse. U&A requirements are met. This option is therefore shortlisted for the final recommendation as set out below.

A summary analysis for the mitigation scenarios that were considered within Assessment Area 2 are presented in Table 5. Option 2.8 in the highlighted grey cells is the recommended design solution as other candidate mitigation options had a lower benefit in relation to cost, and/or engineering constraints, or did not meet the U&A. Option 2.8 was preferred over Option 2.5 and Option 2.6 (which also met the U&A) owing to a higher benefit in relation to cost, and engineering practicability.

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Table 5. Option appraisal summary table (Assessment Area 2)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 2.0	Only mitigation embedded within the design	No cost/benefit	xx Option results in a material change compared to the ES. U&A requirements are not met.	No additional constraints	~	Further stakeholder engagement req'd.
Option 2.1	Noise barrier (2 m) at 138+150 to 139+795	✓	xx Option results in a material change compared to the ES. U&A requirements are not met.	No additional constraints	~	Further stakeholder engagement req'd.
Option 2.2	Noise barrier (3 m) at 138+150 to 139+795	~	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are not met.	No additional constraints	~	Further stakeholder engagement req'd.
Option 2.3	Noise barrier (4 m) at 138+150 to 139+795	x	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are not met.	Additional wind and mass load on retaining wall structure	x Increased visual impact (visual impact will diminish as proposed vegetation grows along the HS2 trace)	Further stakeholder engagement req'd.
Option 2.4	Noise barrier (5 m) at 138+150 to 139+795	x	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are not met.	Additional wind and mass load on retaining wall structure	x Increased visual impact (visual impact will diminish as proposed vegetation grows along the HS2 trace)	Further stakeholder engagement req'd.
Option 2.5	Noise barrier (5 m) at 138+150 to 139+795, Acoustic parapet (2.1 m) at 139+795 to 139+880, Noise barrier (2 m) at 139+875 to 140+090	x	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are met.	Additional wind and mass load on retaining wall and parapet structures	x Increased visual impact (visual impact will diminish as proposed vegetation grows along the HS2 trace)	Further stakeholder engagement req'd.
Option 2.6	Noise barrier (5 m) at 138+150 to 139+375, Noise barrier (4 m) at 139+375 to 139+795, Acoustic parapet (2.1 m) at 139+795 to 139+880, Noise barrier (2 m) at 139+875 to 140+090	x	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are met.	Additional wind and mass load on retaining wall and parapet structures	x Increased visual impact (visual impact will diminish as proposed vegetation grows along the HS2 trace)	Further stakeholder engagement req'd.
Option 2.7	Noise barrier (5 m) at 138+150 to 139+375, Noise barrier (4 m) at 139+375 to 139+795, Acoustic parapet (2.1 m) at 139+795 to 139+880	x	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are not met.	Additional wind and mass load on retaining wall and parapet structures	x Increased visual impact (visual impact will diminish as proposed vegetation grows along the HS2 trace)	Further stakeholder engagement req'd.
Option 2.8	Noise barrier (5 m) at 138+150 to 139+375, Noise barrier (4 m) at 139+375 to 139+795, Noise barrier (2 m) at 139+875 to 140+090	x	✓✓ Noise impacts are somewhat reduced compared to the ES, introducing a material benefit. U&A requirements are met.	Additional wind and mass load on retaining wall structure	x Increased visual impact (visual impact will diminish as proposed vegetation grows along the HS2 trace)	Further stakeholder engagement req'd.

Note:

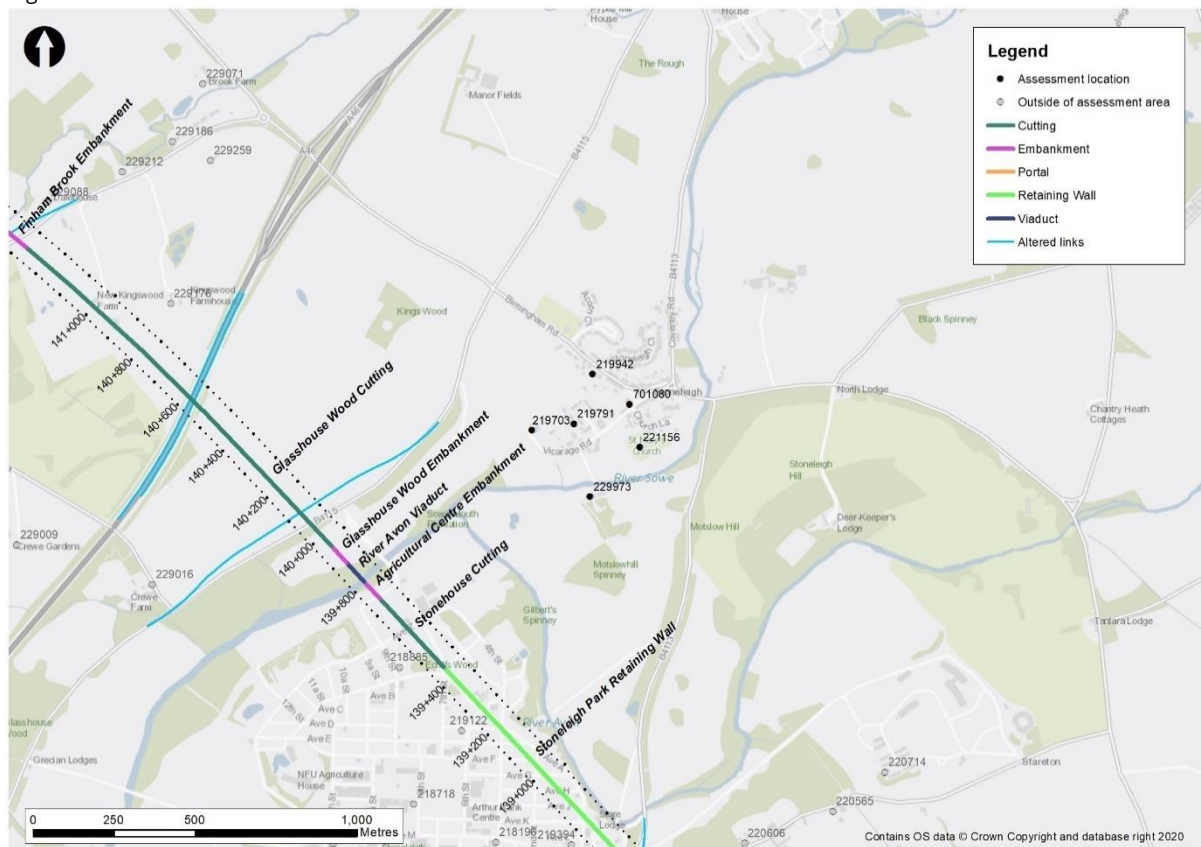
1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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### Assessment Area 3 candidate mitigation options

A total of three options were considered and studied to assess noise mitigation for communities in the vicinity of Stoneleigh on the upside of the HS2 alignment before reaching The Design (Option 3.0) for which consent is sought. Assessment Area 3 is shown in Figure 8.

Figure 8. Assessment Area 3 extents



Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were 23 negligible night-time impacts above  $L_{pAeq}$  LOAEL at residential receptors. There were also 70 receptors where the  $L_{pFmax}$  was at or greater

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than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, and changes in the HS2 track elevation which is increased by up to 0.5 m for a short length at the southern part of the assessment area and then marginally decreased for all of its remaining length.

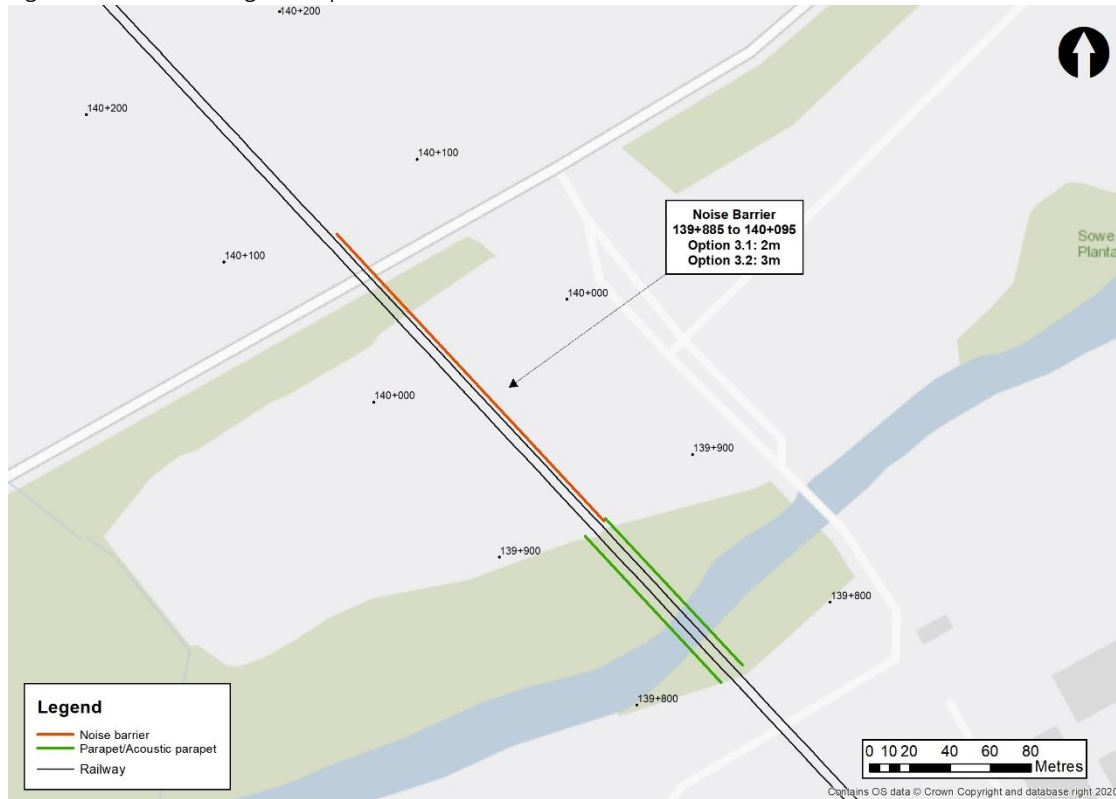
In the absence of additional mitigation (Option 3.0, The design) 12 impacts change category from negligible to minor compared to the ES. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES. Option 3.0 thus results in no material change in noise impacts compared to the ES, however visual impact is materially improved.

Other candidate mitigation options that were considered included:

- Option 3.1 was a 2 m high, 210 m long trackside barrier, see Figure 9, which was proposed in the ES at a height of 3 m. This barrier would extend north from Glasshouse wood embankment and in to Glasshouse Wood cutting. Analysis showed that this option would produce little additional benefit when compared with Option 3.0. No material change in noise impacts compared to the ES is observed while the visual impact of the option is considered to be comparable. Option 3.1 would have a low benefit in comparison to cost, and is therefore not recommended.

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Figure 9. Candidate mitigation Option 3.1-3.2



- Option 3.2 was a 3 m high, 210 m long trackside barrier, see Figure 9, which was proposed in the ES at a height of 3 m. This barrier would again extend north from Glasshouse wood embankment and in to Glasshouse Wood cutting. Analysis showed that this option would produce little additional benefit when compared with Option 3.0, would have a low benefit in comparison to cost, and a worse visual impact at relevant receptor locations compared to the ES. Option 3.2 therefore is not recommended.

A summary analysis for the mitigation scenarios that were considered within Assessment Area 3 are presented in Table 6. Option 3.0 in the highlighted grey cells is the recommended final design solution as other candidate mitigation options had a low benefit in comparison to cost, while a landscape and visual impact assessment considered Option 3.0 to be materially better compared to the ES.

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Table 6. Option appraisal summary table (Assessment Area 3)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 3.0	Only mitigation embedded within the design	No cost/benefit	x 12 impacts change category from negligible to minor compared to the ES. No material change.	No additional constraints	✓✓ Visual impact is materially improved	Further stakeholder engagement req'd.
Option 3.1	Noise barrier (2 m) at 139+885 to 140+095	~	x 12 impacts change category from negligible to minor compared to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 3.2	Noise barrier (3 m) at 139+885 to 140+095	x	x 12 impacts change category from negligible to minor compared to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.

Note:

1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

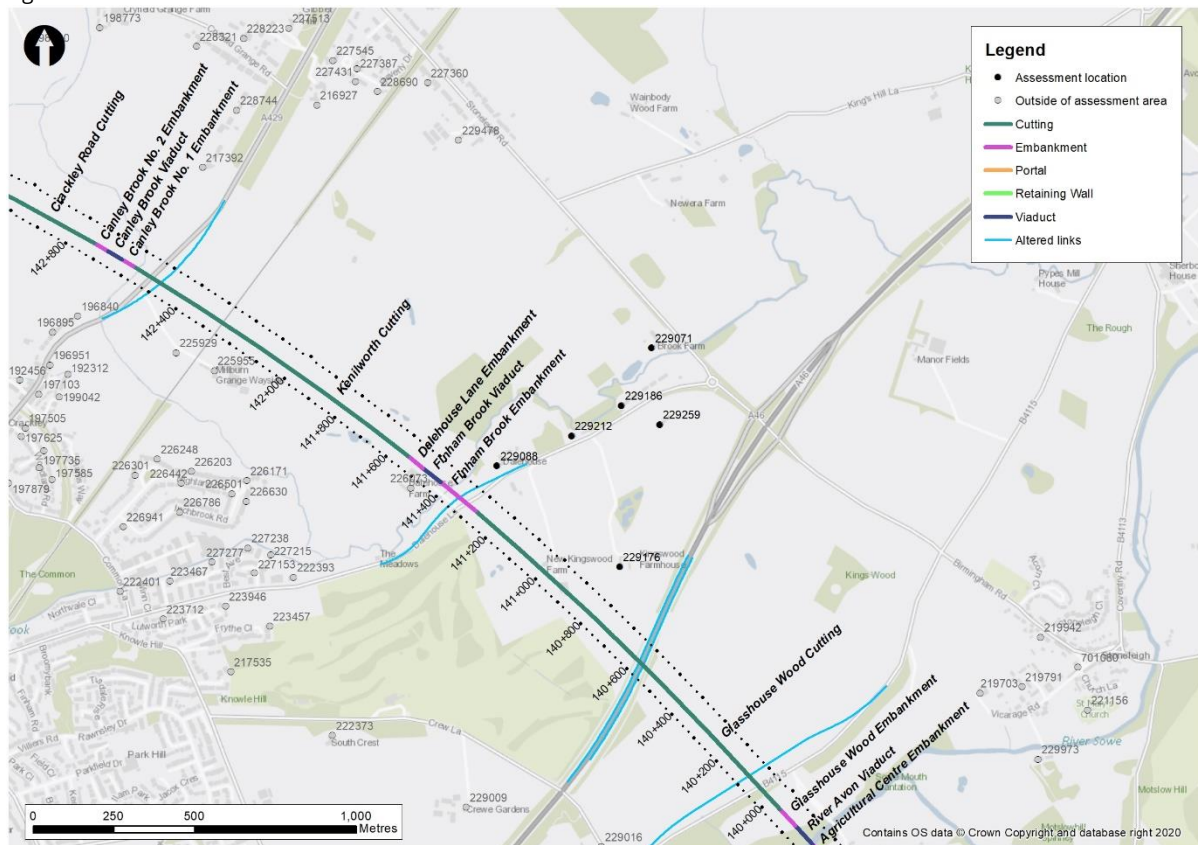
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### Assessment Area 4 candidate mitigation options

A total of four options were considered and studied to assess noise mitigation for communities in the vicinity of Dalehouse Lane on the upside of the HS2 alignment before reaching The Design (Option 4.0) for which consent is sought. Assessment Area 4 is shown in Figure 10.

Figure 10. Assessment Area 4 extents



Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were two moderate and six negligible daytime impacts, and two moderate and 11 negligible night-time impacts at residential receptors above  $L_{pAeq}$  LOAEL. There were also two receptors where the  $L_{pAFmax}$  was at or greater than SOAEL

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(assessment location ID 229088, OSV18-D01), and 12 receptors where the  $L_{pAFmax}$  was at or greater than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, and changes in the HS2 track elevation which is increased by up to approximately 0.5 m and 2 m for short lengths towards the central and northern part of the assessment area respectively, while marginally decreased elsewhere.

In the absence of additional mitigation (Option 4.0, The Design) two  $L_{pAeq}$  impacts above LOAEL change impact category from moderate to major for both day and night-time compared to the ES. No material difference in  $L_{pAeq}$  LOAEL exceedances is observed. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES. Visual impact of Option 4.0 is reduced compared to the ES.

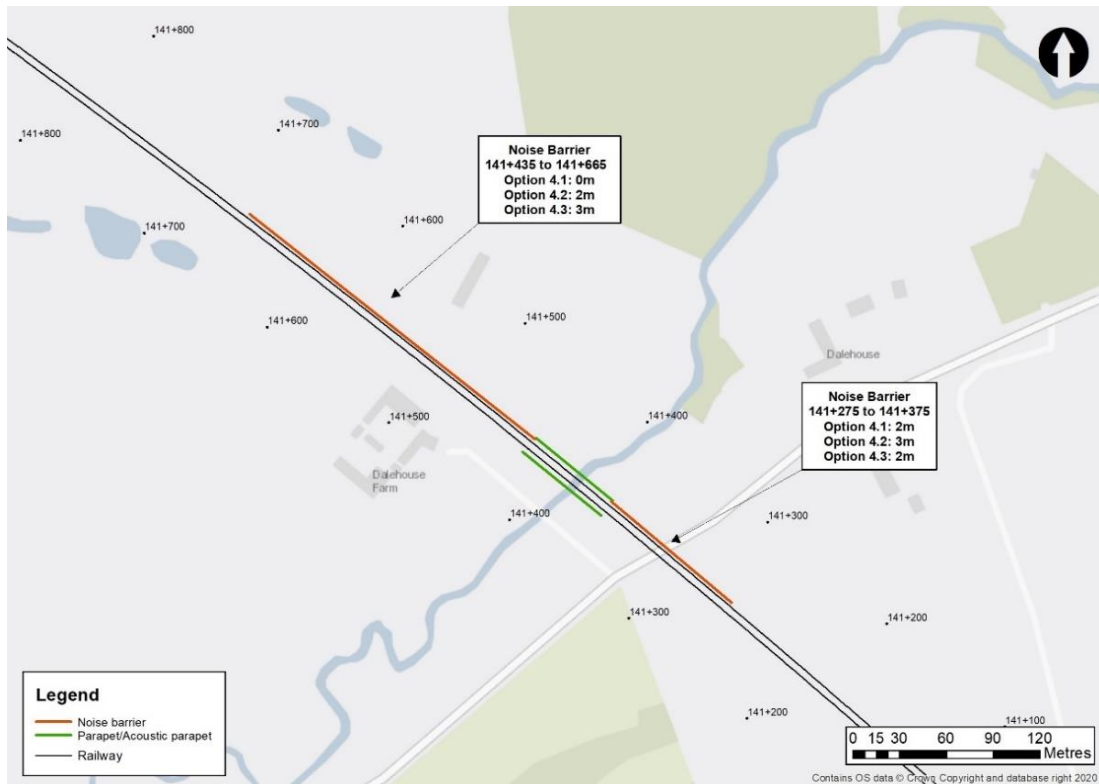
Other candidate mitigation options that were considered included:

- Option 4.1 was a 2 m high, 100 m long trackside barrier on the Finham Brook embankment, see Figure 11, which was proposed in the ES at a height of 3 m. Analysis showed that with this option two impacts change impact category from moderate to major during daytime compared to the ES. No material difference in  $L_{pAeq}$  LOAEL exceedances is observed. No change in  $L_{pAFmax}$  impacts above LOAEL compared to the ES, while visual impact is reduced. Option 4.1 would have a low benefit in comparison to cost, and is therefore not recommended.

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Figure 11. Candidate mitigation Option 4.1-4.3



- Option 4.2 was a 3 m high, 100 m long trackside barrier on the Finham Brook embankment, see Figure 11, which was proposed in the ES at a height of 3 m. No change in impacts above LOAEL is observed compared to the ES. This option would have a low benefit in comparison to cost, and a worse visual impact at relevant receptor locations, and is therefore not recommended.
- Option 4.3 was a 2 m high, 100 m long trackside barrier on the Finham Brook embankment, see Figure 11, which was proposed in the ES at a height of 3 m, and a 2 m high, 230 m long trackside barrier in Kenilworth cutting, which was proposed in the ES at a height of 4 m. No change in impacts above LOAEL is observed compared to the ES, while visual impact at relevant receptor locations is considered to be comparable. Option 4.3 would have a low benefit in comparison to cost, and is therefore not recommended.

A summary analysis for the mitigation scenarios that were considered within Assessment Area 4 are presented in Table 7. Option 4.0 in the highlighted grey cells is the recommended final design solution as other candidate mitigation options had a low benefit in comparison to cost, and/or a worse landscape and visual impact.

Table 7. Option appraisal summary table (Assessment Area 4)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 4.0	Only mitigation embedded within the design	No cost/benefit	x Two impacts change category from moderate to major for day and night-time compared to the ES. No material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 4.1	Noise barrier (2 m) at 141+275 to 141+375	~	x Two impacts change category from moderate to major for daytime compared to the ES. No material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 4.2	Noise barrier (3 m) at 141+275 to 141+375	~	~ No change in impacts at or above LOAEL compared to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 4.3	Noise barrier (2 m) at 141+275 to 141+375, and Noise barrier (2 m) at 141+435 to 141+665	~	~ No change in impacts at or above LOAEL compared to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.

Note:

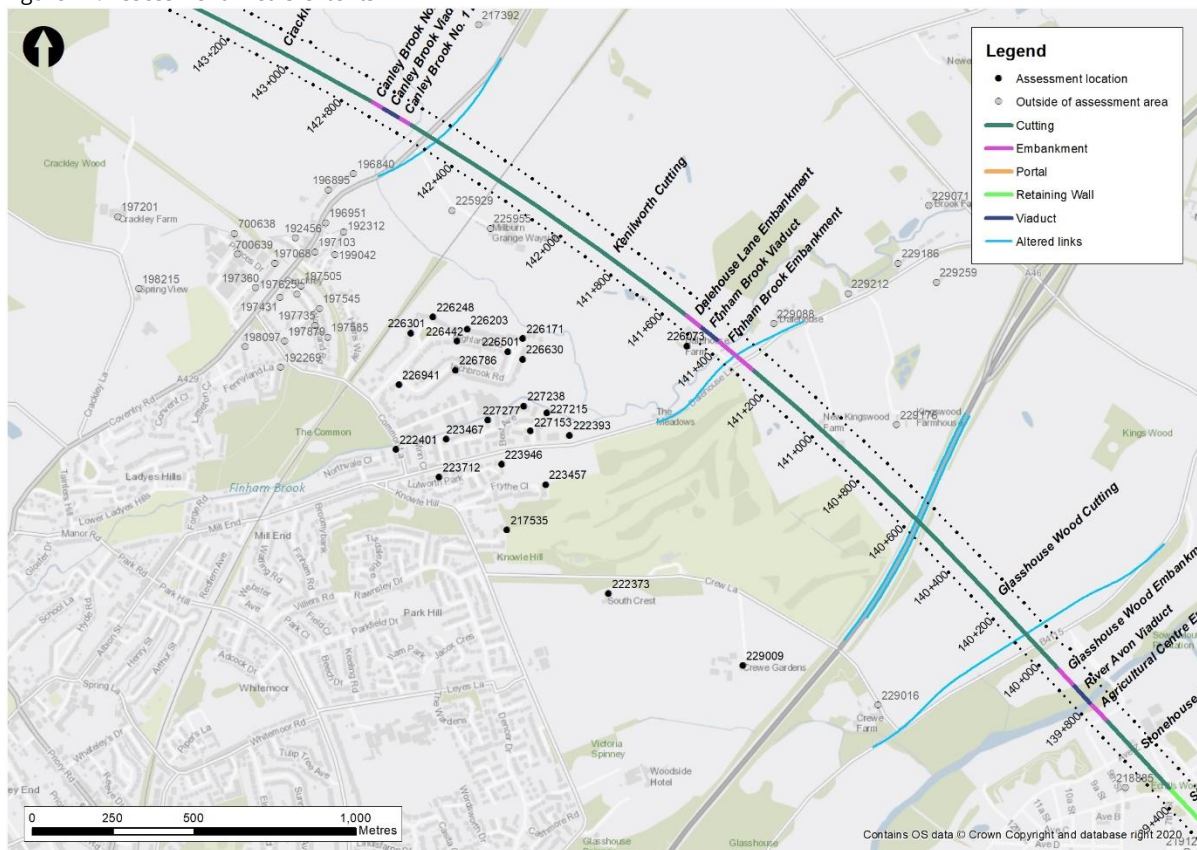
1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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### Assessment Area 5 candidate mitigation options

A total of seven options were considered and studied to assess noise mitigation for communities in the vicinity of The Meadows on the downside of the HS2 alignment before reaching The Design (Option 5.3) for which consent is sought. Assessment Area 5 is shown in Figure 12.

Figure 12. Assessment Area 5 extents



The following additional mitigation measures are proposed, see also Figure 13:

- noise barrier (2 m) at 141+420 to 141+650,
- acoustic parapet (2.1 m) at 141+360 to 141+420, and
- noise barrier (2 m) at 141+150 to 141+360.

Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option;

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- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit and/or
- U&A requirements have not been met.

At the time of the ES there were one negligible and one major daytime impact, and 52 negligible and one major night-time impact at residential receptors above  $L_{pAeq}$  LOAEL. There was also one receptor where the  $L_{pAFmax}$  was at or greater than SOAEL (assessment location ID 226073, OSV18-D02) and 383 receptors where the  $L_{pAFmax}$  was at or greater than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, and an elevation increase up to approximately 2.5 m of the HS2 track. Trackside noise barriers have been moved closer to the track to maximise screening efficiency. The design approach considered the balance between noise mitigation requirements and visual impact from relevant assets.

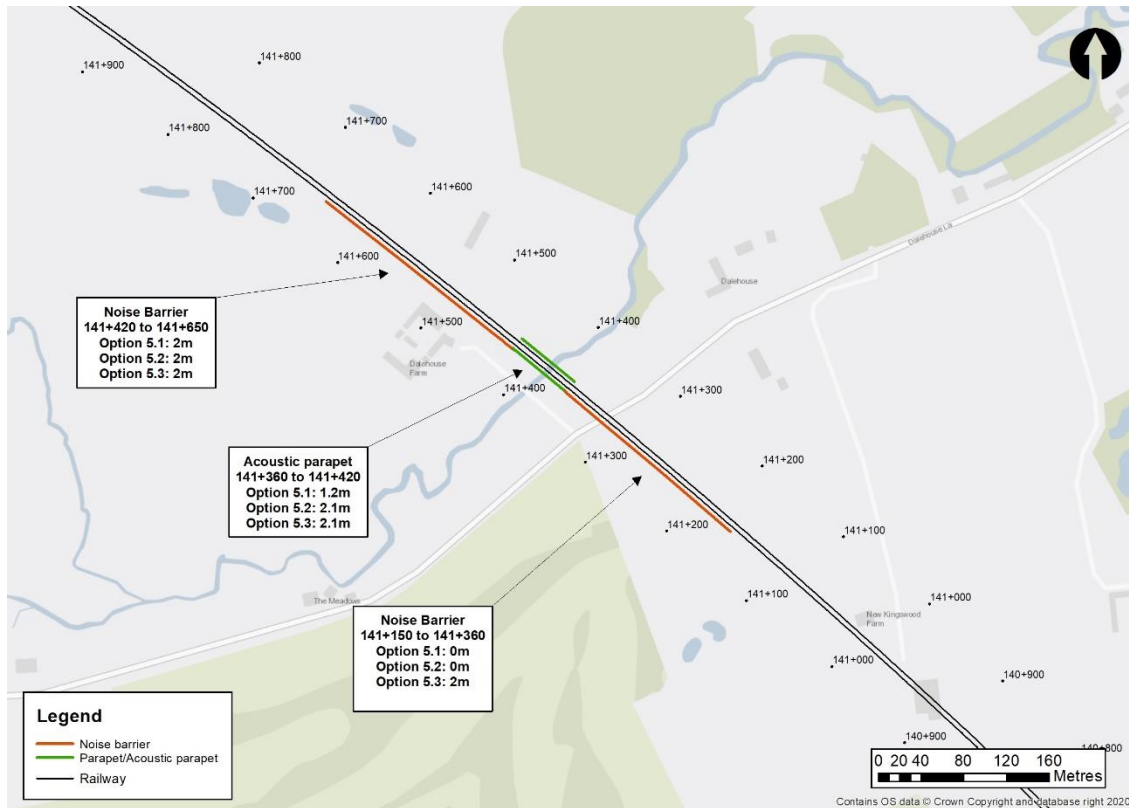
In the absence of additional mitigation (Option 5.0) impacts are increased with 37 additional minor impacts introduced in the daytime and 19 additional moderate impacts introduced in the night-time for residential receptors above  $L_{pAeq}$  LOAEL. 49 additional  $L_{pAFmax}$  LOAEL exceedances are also introduced compared to the ES. Option 5.0 would result in a material worsening of conditions compared to the ES, therefore this option is not recommended.

Other candidate mitigation options that were considered included:

- Option 5.1 was a 2 m high, 230 m long trackside barrier in Kenilworth cutting, see Figure 13, which was proposed in the ES at a height of 4 m. Seven additional minor impacts in the daytime are introduced for residential receptors above  $L_{pAeq}$  LOAEL compared to the ES. 49 additional  $L_{pAFmax}$  LOAEL exceedances are also introduced compared to the ES. No material change is observed. This option would have reduced visual impact compared to the ES, and a low benefit in comparison to cost. Option 5.1 is shortlisted for the final recommendation as set out in this section.

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Figure 13. Candidate mitigation Option 5.1-5.3



- Option 5.2 was a 2 m high, 230 m long trackside barrier in Kenilworth cutting which was proposed in the ES at a height of 4 m, and a 2.1 m high acoustic parapet, 70 m long on Finham Brook viaduct, see Figure 13. Seven additional minor impacts in the daytime are introduced for residential receptors above  $L_{pAeq}$  LOAEL compared to the ES. Eight  $L_{pAFmax}$  impacts between LOAEL and SOAEL are reduced to below LOAEL compared to the ES. No material change is observed. This option would have reduced visual impact compared to the ES, and a low benefit in comparison to cost. Option 5.2 is shortlisted for the final recommendation as set out in this section.
- Option 5.3 (The Design) was a 2 m high, 230 m long trackside barrier in Kenilworth cutting which was proposed in the ES at a height of 4 m, a 2.1 m high, 70 m long acoustic parapet on Finham Brook viaduct, and a 2 m high, 210 m long trackside barrier in Finham Brook embankment which was proposed in the ES at a height of 4 m, see Figure 13. Seven additional minor impacts in the daytime are introduced for residential receptors above  $L_{pAeq}$  LOAEL compared to the ES. 102  $L_{pAFmax}$  impacts between LOAEL and SOAEL are reduced to below LOAEL compared to the ES. No material change is observed. This option would have comparable visual impact to the ES, and a low benefit to cost ratio that is nonetheless similar to the ES and higher than other candidate

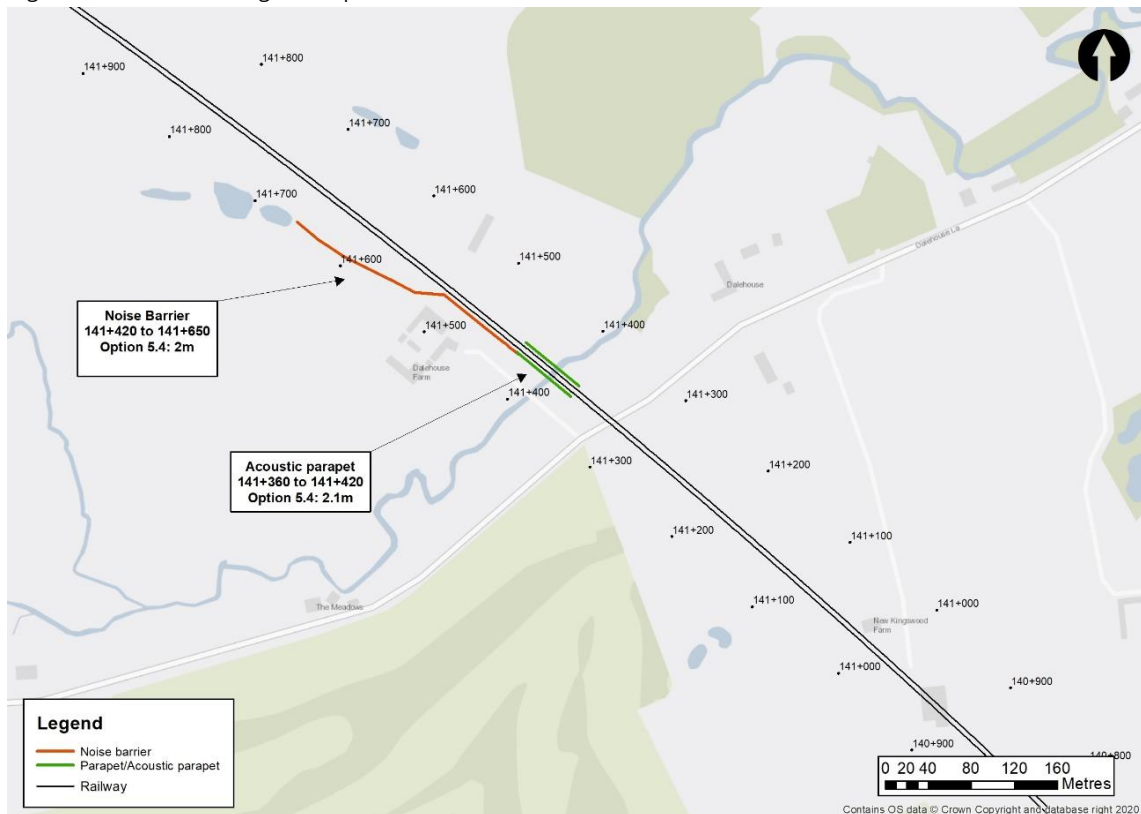
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mitigation options. This option is therefore shortlisted for the final recommendation as set out in this section.

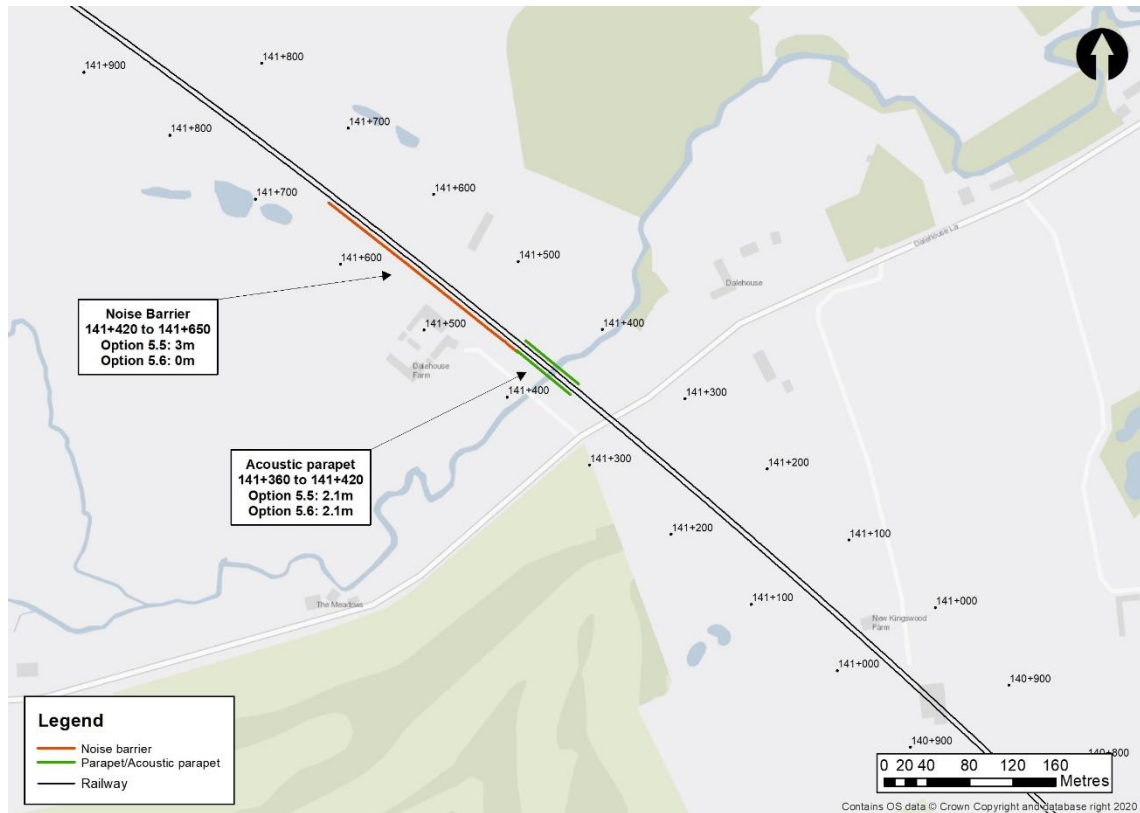
- Option 5.4 was a 2 m high, 230 m long barrier at the crest of Kenilworth cutting, and a 2.1 m high acoustic parapet, 70 m long on Finham Brook viaduct, see Figure 14. Seven additional minor impacts in the daytime are introduced. Eight  $L_{pAFmax}$  impacts between LOAEL and SOAEL are reduced to below LOAEL compared to the ES. No material change is observed. This option would have reduced visual impact compared to the ES, and a low benefit in comparison to cost.

Figure 14. Candidate mitigation Option 5.4



- Option 5.5 was a 3 m high, 230 m long barrier trackside barrier in Kenilworth cutting, and a 2.1 m high acoustic parapet, 70 m long on Finham Brook viaduct, see Figure 15. Seven additional minor impacts in the daytime are introduced. Eight  $L_{pAFmax}$  impacts between LOAEL and SOAEL are reduced to below LOAEL compared to the ES. No material change is observed. This option would have increased visual impact compared to the ES, and a low benefit in comparison to cost, therefore it is not recommended.

Figure 15. Candidate mitigation Option 5.5-5.6



- Option 5.6 was a 2.1 m high acoustic parapet, 70 m long on Finham Brook viaduct, see Figure 15. Seven additional minor impacts in the daytime and 9 additional moderate impacts in the night-time are introduced. 49 additional  $L_{pAFmax}$  LOAEL exceedances are also introduced compared to the ES. Option 5.6 would have reduced visual impact compared to the ES, but a low benefit in comparison to cost, and result in a material worsening of conditions. This option is therefore not recommended.

A summary analysis for the mitigation scenarios that were considered within Assessment Area 5 are presented in Table 8. Option 5.3 in the highlighted grey cells is the recommended final design solution as it provided a noticeably higher benefit in relation to cost compared to other candidate mitigation options. Alternative options had a worse benefit in relation to cost, and/or worse landscape and visual impact, and/or resulted in a material change.

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Table 8. Option appraisal summary table (Assessment Area 5)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 5.0	Only mitigation embedded within the design	No cost/benefit	xx Additional L <sub>pAeq</sub> LOAEL impacts and L <sub>pAFmax</sub> LOAEL exceedances compared to the ES, leading to a material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 5.1	Noise barrier (2 m) at 141+420 to 141+650	x	x Seven additional minor L <sub>pAeq</sub> impacts during the day and 49 additional L <sub>pAFmax</sub> LOAEL exceedances compared to the ES. No material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 5.2	Noise barrier (2 m) at 141+420 to 141+650, Acoustic parapet (2.1 m) at 141+360 to 141+420	x	x Seven additional minor L <sub>pAeq</sub> impacts during the day and eight L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 5.3	Noise barrier (2 m) at 141+420 to 141+650, Acoustic parapet (2.1 m) at 141+360 to 141+420, Noise barrier (2 m) at 141+150 to 141+360	~	~ Seven additional minor L <sub>pAeq</sub> impacts during the day and 102 L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 5.4	Noise barrier (2 m) at 141+420 to 141+650 on crest of cutting, Acoustic parapet (2.1 m) at 141+360 to 141+420	x	x Seven additional minor L <sub>pAeq</sub> impacts during the day and eight L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 5.5	Noise barrier (3 m) at 141+420 to 141+650, Acoustic parapet (2.1 m) at 141+360 to 141+420	x	x Seven additional minor L <sub>pAeq</sub> impacts during the day and eight L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 5.6	Acoustic parapet (2.1 m) at 141+360 to 141+420	x	xx Seven additional minor L <sub>pAeq</sub> impacts during the day and nine additional moderate impacts during the night, and 49 additional L <sub>pAFmax</sub> LOAEL exceedances compared to the ES, leading to a material change.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.

Note:

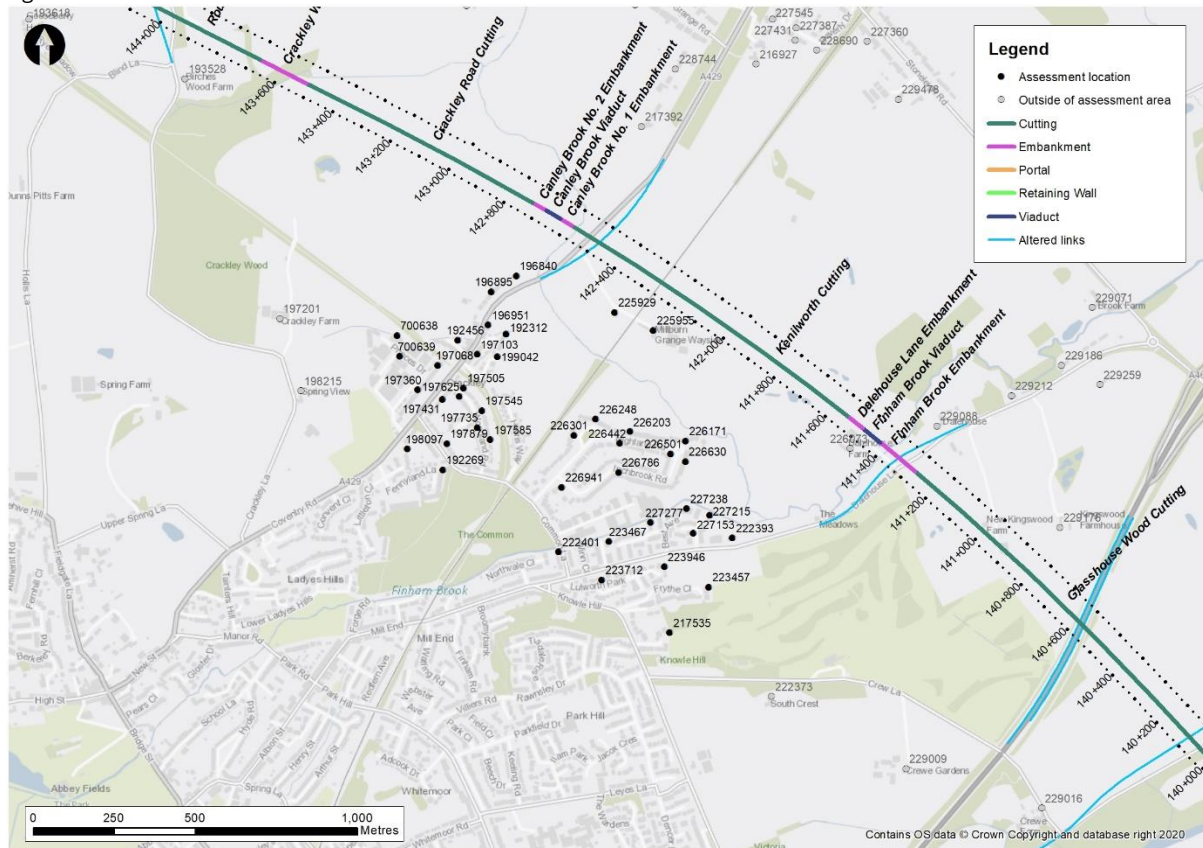
1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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### Assessment Area 6 candidate mitigation options

A total of two options were considered and studied to assess noise mitigation for communities in the vicinity of The Common on the downside of the HS2 alignment before reaching The Design (Option 6.0) for which consent is sought. Assessment Area 6 is shown in Figure 16.

Figure 16. Assessment Area 6 extents



Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were eight negligible and two minor daytime impacts, and 83 negligible and two minor night-time impacts at residential receptors above  $L_{pAeq}$

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LOAEL. There were also 535 receptors where the  $L_{pAFmax}$  was at or greater than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, changes in the HS2 track elevation which is increased by up to approximately 3 m, and marginal earthwork height increases on the downside.

In the absence of additional mitigation (Option 6.0, The Design) there were 12 negligible, 14 minor, and one moderate impact in the daytime and 104 negligible, one minor and 11 moderate impacts in the night-time at residential receptors above  $L_{pAeq}$  LOAEL with the night-time noise level at assessment location ID 226203 moving fractionally above LOAEL, thus accounting for ten out of the 11 moderate impacts during the night (a new significant adverse effect is not considered to arise at this location primarily as a result of noise levels only marginally exceeding LOAEL). 138  $L_{pAFmax}$  impacts are reduced from above LOAEL to below LOAEL. Visual impact of this option is comparable to the ES. Option 6.0 is therefore shortlisted for the final recommendation as set out below.

Other candidate mitigation options that were considered included:

- Option 6.1 was a 2 m high, 255 m long trackside barrier on Kenilworth cutting, see Figure 17, which was proposed in the ES at a height of 2 m. Analysis showed that this option would not change  $L_{pAeq}$  and  $L_{pAFmax}$  impact classification compared to Option 6.0 and would have a low benefit in comparison to cost. Option 6.1 is therefore not recommended.
- Option 6.2 (The Design) was a +1.5 m screening adjustment on the earthwork crest between chainages 141+900 to 142+150, see Figure 18. This screening can be provided either by increasing the crest height or introducing a noise barrier at this location. Analysis showed that this option would produce four additional negligible, 12 minor and one moderate  $L_{pAeq}$  impact during daytime, and 21 additional negligible and one moderate  $L_{pAeq}$  impact during night-time compared to the ES. 156  $L_{pAFmax}$  impacts are reduced from above LOAEL to below LOAEL. This option would have a low benefit in comparison to cost. Visual impact is considered to be increased compared to the ES but not materially changed. No material change is observed compared to the ES therefore this option is shortlisted for the final recommendation as set out below.

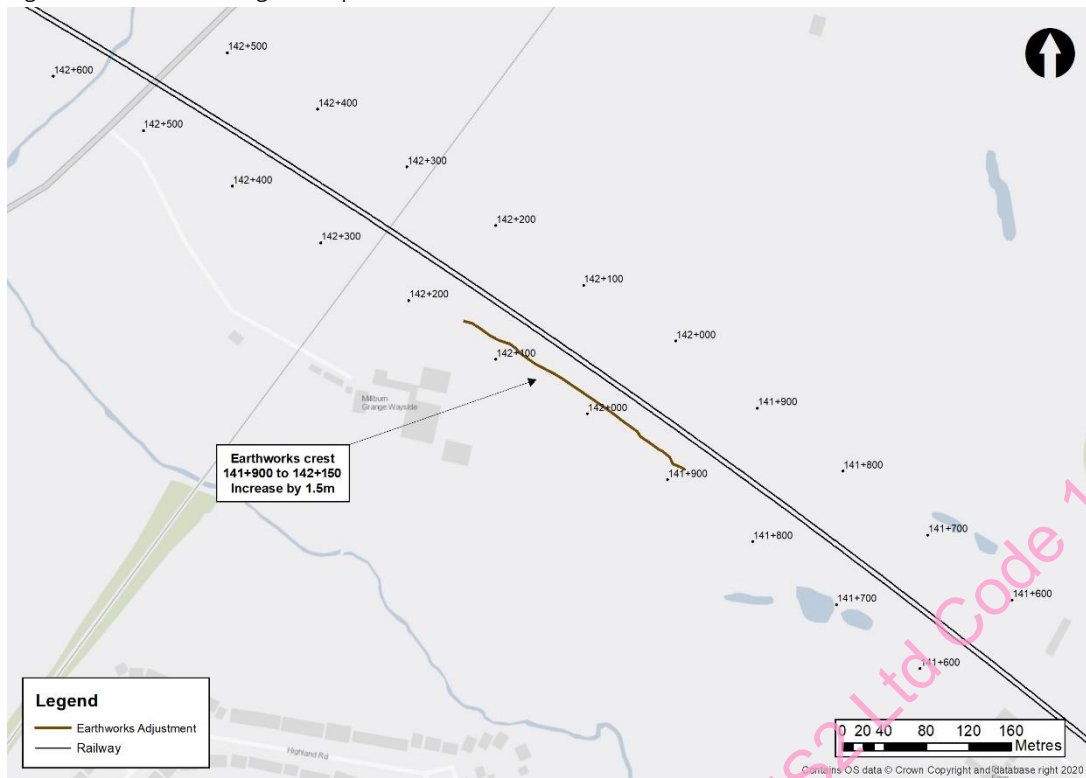
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Figure 17. Candidate mitigation Option 6.1



Figure 18. Candidate mitigation Option 6.2



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A summary analysis for the mitigation scenarios that were considered within Assessment Area 6 is presented in Table 9. The night-time noise level at assessment location 226203 for Option 6.0 is predicted to increase by 1dB compared with the ES. As the predicted level is only fractionally above LOAEL and the predicted increase in noise levels at night-time since the ES is up to 1dB, a new significant adverse effect does not arise at this location. Option 6.0 in the highlighted grey cells is thus the recommended final design solution as other candidate mitigation options had a low benefit in comparison to cost, or increased visual impact compared to the ES.

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Table 9. Option appraisal summary table (Assessment Area 6)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 6.0	Only mitigation embedded within the design	No cost/benefit	<p style="text-align: center;">*</p> L <sub>pAeq</sub> impacts during the daytime and night-time are increased compared to the ES. 138 L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 6.1	Noise barrier (2 m) at 142+090 to 142+345	*	<p style="text-align: center;">*</p> L <sub>pAeq</sub> impacts during the daytime and night-time are increased compared to the ES. 138 L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 6.2	Noise screening (1.5 m) at 141+900 to 142+150 (earthwork crest adjustment or noise barrier)	*	<p style="text-align: center;">*</p> Some additional L <sub>pAeq</sub> impacts during the daytime and night-time compared to the ES. 156 L <sub>pAFmax</sub> impacts reduced to below LOAEL compared to the ES. No material change.	Earthwork crest height increase limited by space available to expand the earthwork's footprint.	* Increased visual impact	Further stakeholder engagement req'd.

Note:

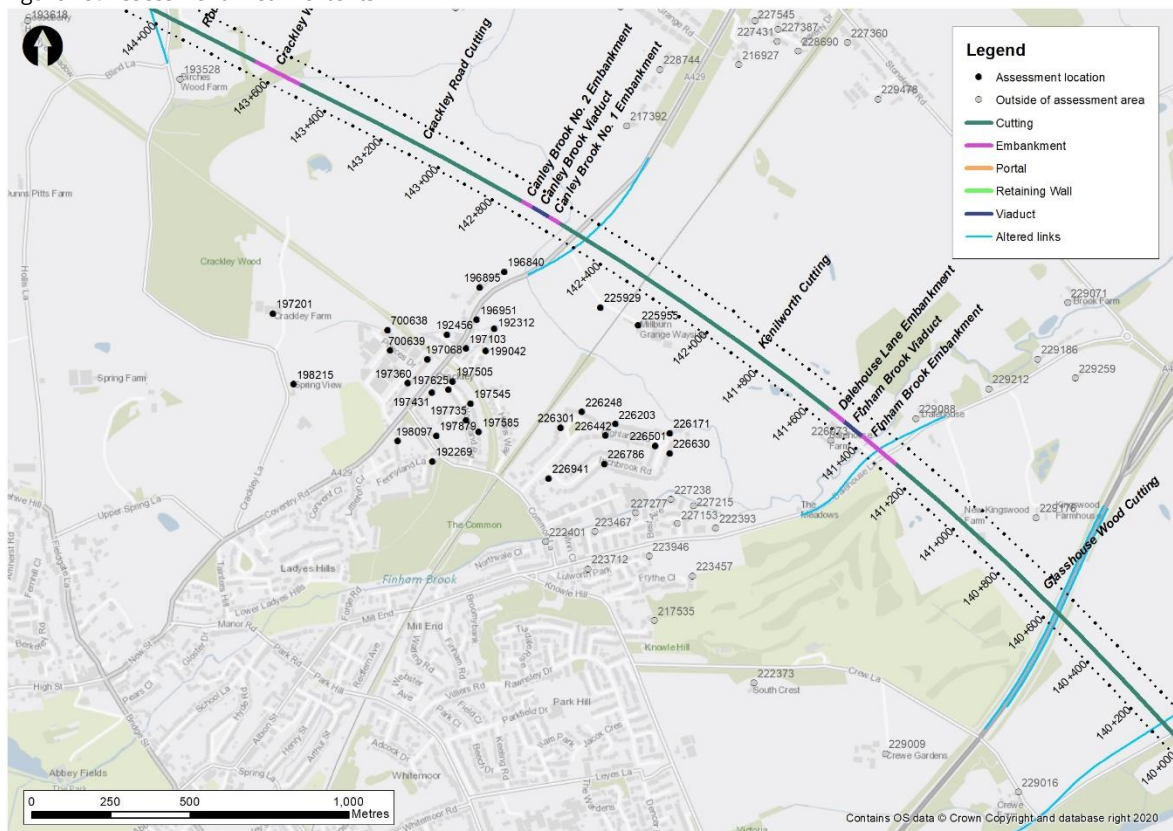
1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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### Assessment Area 7 candidate mitigation options

A total of 11 options were considered and studied to assess noise mitigation for communities in the vicinity of the Canley area on the downside of the HS2 alignment before reaching The Design (Option 7.7) for which consent is sought. Assessment Area 7 is shown in Figure 19.

Figure 19. Assessment Area 7 extents



The following additional mitigation measures are proposed in addition to the earthworks embedded in the design, see also Figure 20:

- noise barrier (4 m) at 142+475 to 142+630,
- acoustic parapet (4.1 m) at 142+630 to 142+675,
- noise barrier (4 m) at 142+675 to 142+775, and
- trackside earthwork crest height increase (+2 m) at 142+750 to 143+000.

Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

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- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were 8 negligible and two minor daytime impacts, and 33 negligible and two minor night-time impacts at residential receptors above  $L_{pAeq}$  LOAEL. There were also 156 receptors where the  $L_{pAFmax}$  was at or greater than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, an elevation increase up to approximately 3 m of the HS2 track, and a reduction in earthwork heights of up to 5 m, most notably at the approximate chainages 141+775 to 142+100 (downside) and 142+725 to 143+075 (downside) to achieve the multidisciplinary benefits described in Community Engagement leaflet 1MC08-BBV\_MSD-PL-PRE-NS01\_NL03-100005 (Community Engagement - Design Summary - Canley Brook). Trackside noise barriers have been moved closer to the track to maximise screening efficiency. The design approach considered the balance between noise mitigation requirements and visual impact from relevant assets.

In the absence of additional mitigation (Option 7.0) additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.

Other candidate mitigation options that were considered included:

- Option 7.1 was a 2 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 2.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, see Figure 20. Option 7.1 would have a low benefit in comparison to cost. Analysis showed that additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.

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- Option 7.2 was a 2 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 2.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 2 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Option 7.2 would have a low benefit in comparison to cost. Analysis showed that additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.
- Option 7.3 was a 3 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 3.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, see Figure 20. Option 7.3 would have a low benefit in comparison to cost. Analysis showed that additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.
- Option 7.4 was a 3 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 3.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 2 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Option 7.4 would have a low benefit in comparison to cost. Analysis showed that additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.
- Option 7.5 was 3 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 3.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 3 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Option 7.5 would have a low benefit in comparison to cost. Analysis showed that additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.
- Option 7.6 was 4 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 4.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, see Figure 20. Option 7.6 would have a low benefit in comparison to cost. Analysis showed that additional  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are introduced resulting in a material change compared to the ES, therefore this option is not recommended.
- Option 7.7 (The Design) was 4 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 4.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 2 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Resultant  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are comparable to the ES. Option 7.7 would have a medium benefit in comparison to cost. Visual impact is considered to be increased compared to the ES but not materially changed.

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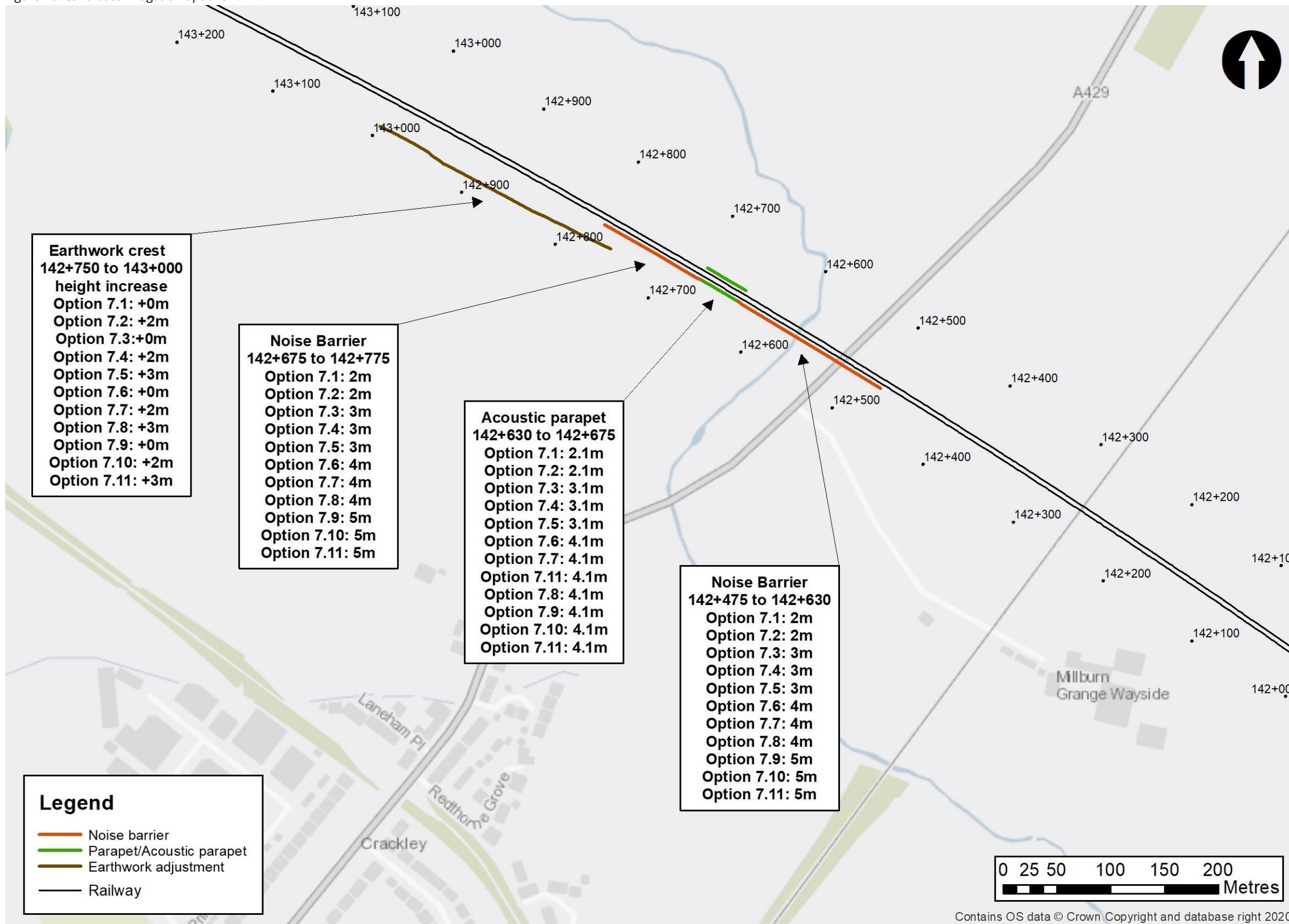
U&A requirements are met. This option is therefore shortlisted for the final recommendation as set out below.

- Option 7.8 was 4 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 4.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 3 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Resultant  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are comparable to the ES. This option would have a medium benefit in comparison to cost while visual impact is considered to be increased compared to the ES but not be materially worse. Option 7.8 would have a lower benefit in comparison to cost when compared to Option 7.7 and is therefore not recommended.
- Option 7.9 was 5 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 4.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, see Figure 20.  $L_{pAeq}$  and  $L_{pAFmax}$  impacts result in worse conditions compared to the ES but not materially worse. This option would have a medium benefit in comparison to cost while visual impact is considered to be increased compared to the ES but not materially changed. Option 7.9 would introduce additional impacts when compared to Option 7.7 and is therefore not recommended.
- Option 7.10 was 5 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 4.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 2 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Resultant  $L_{pAeq}$  and  $L_{pAFmax}$  impacts are comparable to the ES. This option would have a medium benefit in comparison to cost while visual impact is considered to be increased compared to the ES but not materially changed. Option 7.10 would introduce similar impacts when compared to Option 7.7 but at a higher cost, therefore it is not recommended.
- Option 7.11 was 5 m high, 300 m long trackside barrier starting within Kenilworth cutting and ending within Crackley Road cutting, with an intervening 4.1 m high, 45 m long acoustic parapet along Canley Brook viaduct, and a 3 m earthwork crest height increase at 142+750 to 143+000, see Figure 20. Resultant  $L_{pAeq}$  and  $L_{pAFmax}$  noise impacts are comparable to the ES. This option would have a medium benefit in comparison to cost while visual impact is considered to be increased compared to the ES but not materially changed. Option 7.11 would introduce similar impacts when compared to Option 7.7 but at a higher cost, therefore it is not recommended.

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Figure 20. Candidate mitigation options 7.1-7.11



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A summary analysis for the mitigation scenarios that were considered within Assessment Area 7 are presented in Table 10. Option 7.7 in the highlighted grey cells is the recommended final design solution as it provided a medium noise benefit relative to cost, and a visual impact which, while increased compared to the ES, is not considered to be materially changed. Option 7.7 was preferred over options 7.1-7.6 as it did not introduce a material change compared to the ES. Option 7.7 was preferred over options 7.8-7.11 owing to comparable or reduced noise impacts at a lower cost.

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Table 10. Option appraisal summary table (Assessment Area 7)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 7.0	Only mitigation embedded within the design	No cost/benefit	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	✓ Reduced visual impact	Further stakeholder engagement req'd.
Option 7.1	Noise barrier (2 m) at 142+475 to 142+630, Acoustic parapet (2.1 m) at 142+630 to 142+675, Noise barrier (2 m) at 142+675 to 142+775	x	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.2	Noise barrier (2 m) at 142+475 to 142+630, Acoustic parapet (2.1 m) at 142+630 to 142+675, Noise barrier (2 m) at 142+675 to 142+775 Earthworks crest at 142+750 to 143+000 height increase by 2 m	x	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.3	Noise barrier (3 m) at 142+475 to 142+630, Acoustic parapet (3.1 m) at 142+630 to 142+675, Noise barrier (3 m) at 142+675 to 142+775	x	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.4	Noise barrier (3 m) at 142+475 to 142+630, Acoustic parapet (3.1 m) at 142+630 to 142+675, Noise barrier (3 m) at 142+675 to 142+775 Earthworks crest at 142+750 to 143+000 height increase by 2 m	x	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.5	Noise barrier (3 m) at 142+475 to 142+630, Acoustic parapet (3.1 m) at 142+630 to 142+675, Noise barrier (3 m) at 142+675 to 142+775 Earthworks crest at 142+750 to 143+000 height increase by 3 m	xx	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.6	Noise barrier (4 m) at 142+475 to 142+630, Acoustic parapet (4.1 m) at 142+630 to 142+675, Noise barrier (4 m) at 142+675 to 142+775	x	xx L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are increased resulting in a material change compared to the ES.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.7	Noise barrier (4 m) at 142+475 to 142+630, Acoustic parapet (4.1 m) at 142+630 to 142+675, Noise barrier (4 m) at 142+675 to 142+775 Earthworks crest at 142+750 to 143+000 height increase by 2 m	✓	~ L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are comparable to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.8	Noise barrier (4 m) at 142+475 to 142+630, Acoustic parapet (4.1 m) at 142+630 to 142+675, Noise barrier (4 m) at 142+675 to 142+775 Earthworks crest at 142+750 to 143+000 height increase by 3 m	✓	~ L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are comparable to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.9	Noise barrier (5 m) at 142+475 to 142+630, Acoustic parapet (4.1 m) at 142+630 to 142+675, Noise barrier (5 m) at 142+675 to 142+775	✓	x L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are slightly increased compared to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 7.10	Noise barrier (5 m) at 142+475 to 142+630, Acoustic parapet (4.1 m) at 142+630 to 142+675, Noise barrier (5 m) at 142+675 to 142+775, Earthworks crest at 142+750 to 143+000 height increase by 2 m	~	~ L <sub>pAeq</sub> / L <sub>pAFmax</sub> impacts are comparable to the ES. Results are comparable to Option 7.7. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.

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Option 7.11	Noise barrier (5 m) at 142+475 to 142+630, Acoustic parapet (4.1 m) at 142+630 to 142+675, Noise barrier (5 m) at 142+675 to 142+775, Earthworks crest at 142+750 to 143+000 height increase by 3 m	~	~ $L_{pAeq} / L_{pAFmax}$ impacts are comparable to the ES. Results are comparable to Option 7.7. No material change.	No additional constraints	* Increased visual impact	Further stakeholder engagement req'd.
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Note:

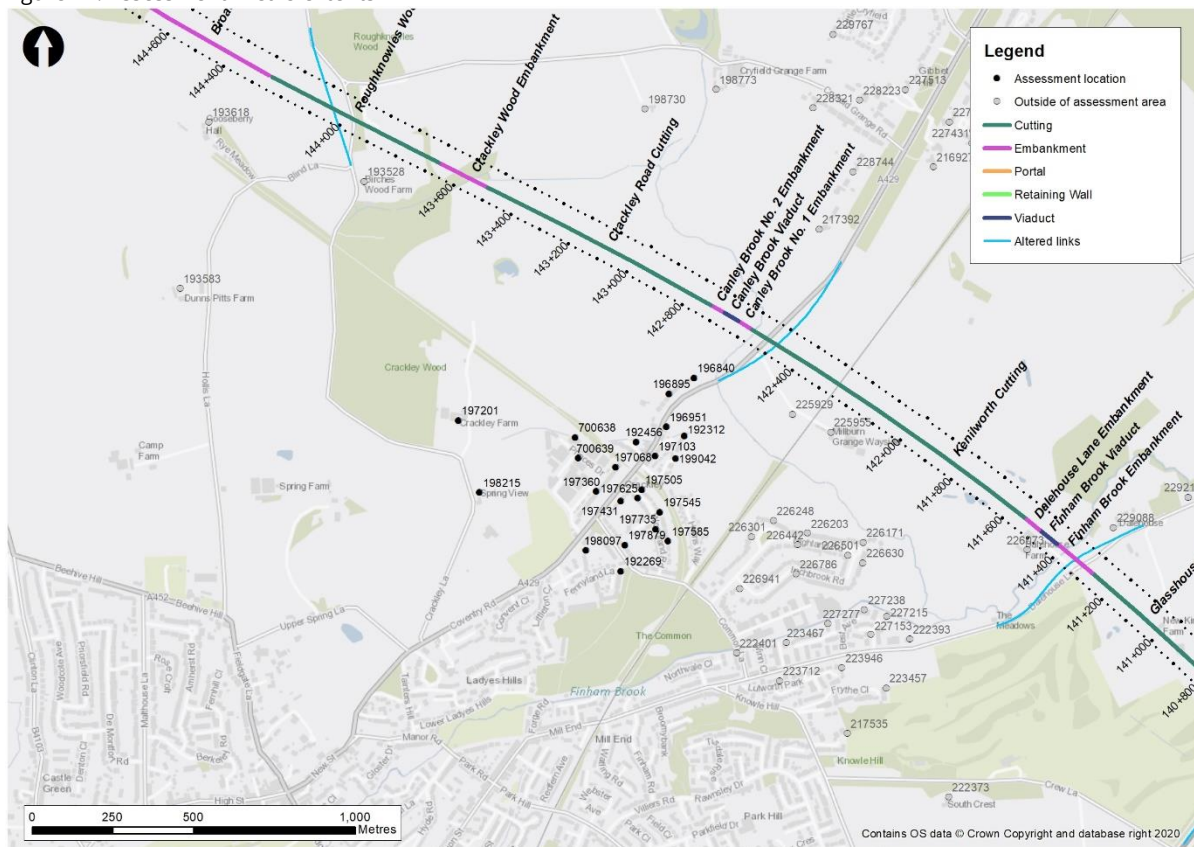
1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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### Assessment Area 8 candidate mitigation options

A total of three options were considered and studied to assess noise mitigation for communities in the vicinity of the Crackley area on the downside of the HS2 alignment before reaching The Design (Option 8.0) for which consent is sought. Assessment Area 8 is shown in Figure 21.

Figure 21. Assessment Area 8 extents



Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were eight negligible daytime impacts and 33 negligible night-time impacts at residential receptors above  $L_{pAeq}$  LOAEL. There were also 154

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receptors where the  $L_{pAFmax}$  was at or greater than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

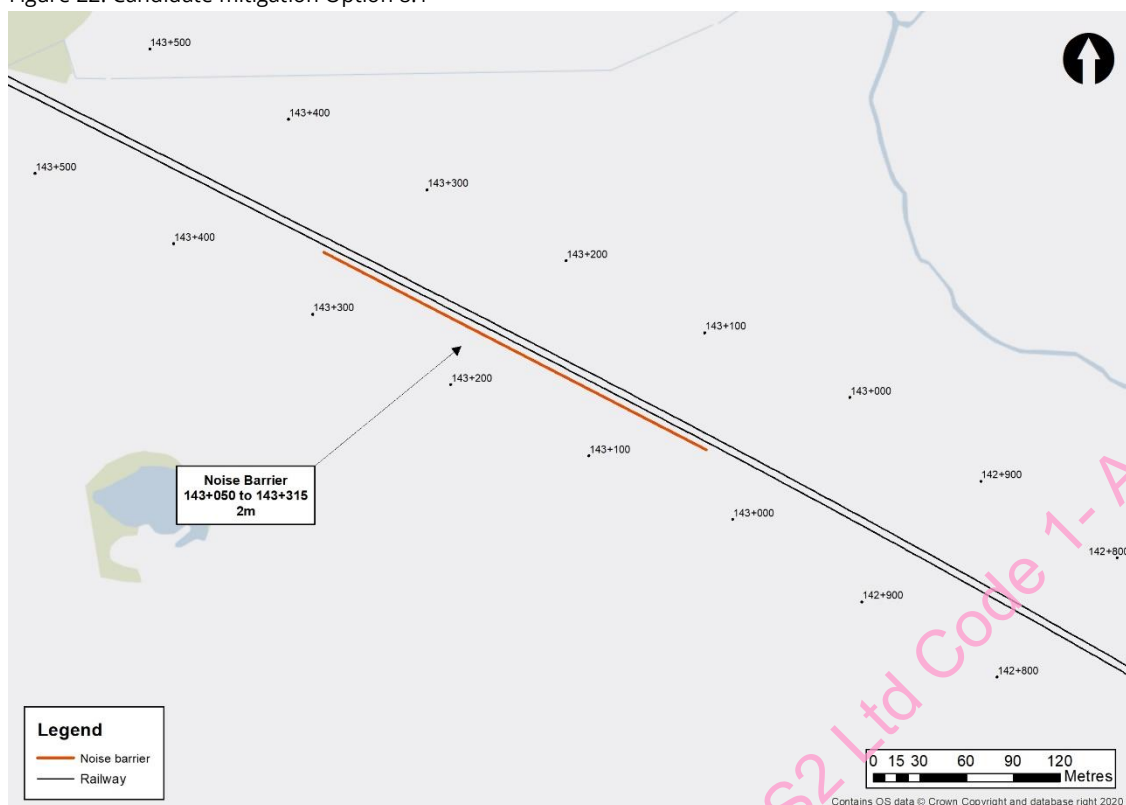
Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, and changes in the HS2 track elevation which is increased by up to approximately 3 m.

In the absence of additional mitigation (Option 8.0) four additional negligible impacts during the day, and 21 additional negligible impacts during the night are introduced at residential receptors above  $L_{pAeq}$  LOAEL. 49  $L_{pAFmax}$  impacts are reduced from above LOAEL to below LOAEL. Visual impact of Option 8.0 is comparable to the ES.

Other candidate mitigation options that were considered included:

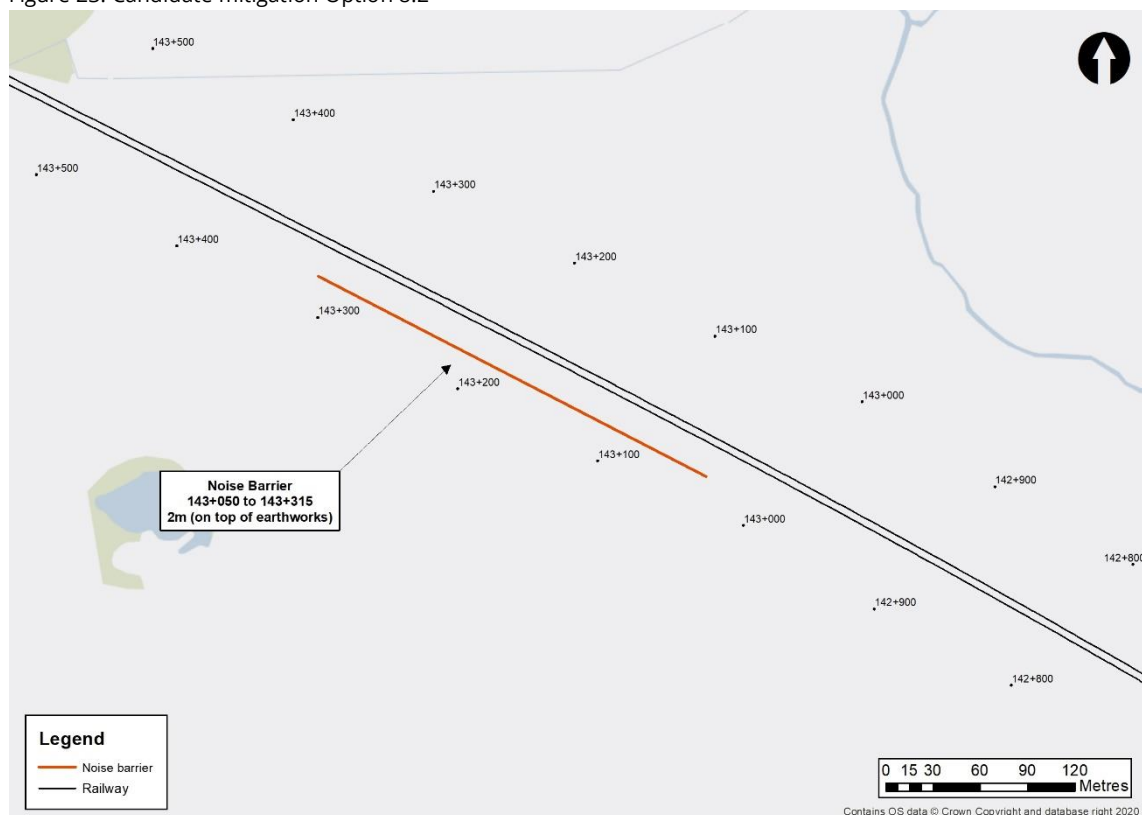
- Option 8.1 was a 2 m high, 265 m long trackside barrier in Crackley Road cutting, see Figure 22, which was proposed in the ES at a height of 3 m. Visual impact of this option is comparable to the ES. Analysis showed that Option 8.1 would produce limited benefit in terms of resultant impacts when compared with Option 8.0 and have a low benefit in comparison to cost. Option 8.1 is therefore not recommended.

Figure 22. Candidate mitigation Option 8.1



- Option 8.2 was a 2 m high, 265 m long barrier on the crest of Crackley Road cutting at 143+050 to 143+315 on the downside, see Figure 23. Visual impact of this option is increased compared to the ES. Analysis showed that Option 8.2 would produce limited benefit in terms of resultant impacts when compared with Option 8.0 and have a low benefit in comparison to cost. Option 8.2 is therefore not recommended.

Figure 23. Candidate mitigation Option 8.2



A summary analysis for the mitigation scenarios that were considered within Assessment Area 8 are presented in Table 11. Option 8.0 in the highlighted grey cells is the recommended final design solution as other candidate mitigation options had a low benefit in comparison to cost, and/or a worse landscape and visual impact, and provided little benefit in resultant noise level terms.

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Table 11. Option appraisal summary table (Assessment Area 8)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 8.0	Only mitigation embedded within the design	No cost/benefit	~ Resultant impacts are comparable to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 8.1	Noise barrier (2 m) at 143+050 to 143+315	~	~ Resultant impacts are comparable to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 8.2	Noise barrier (2 m) on earthworks crest at 143+050 to 143+315	~	~ Resultant impacts are comparable to the ES. No material change.	No additional constraints	* Increased visual impact	Further stakeholder engagement req'd.

Note:

1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

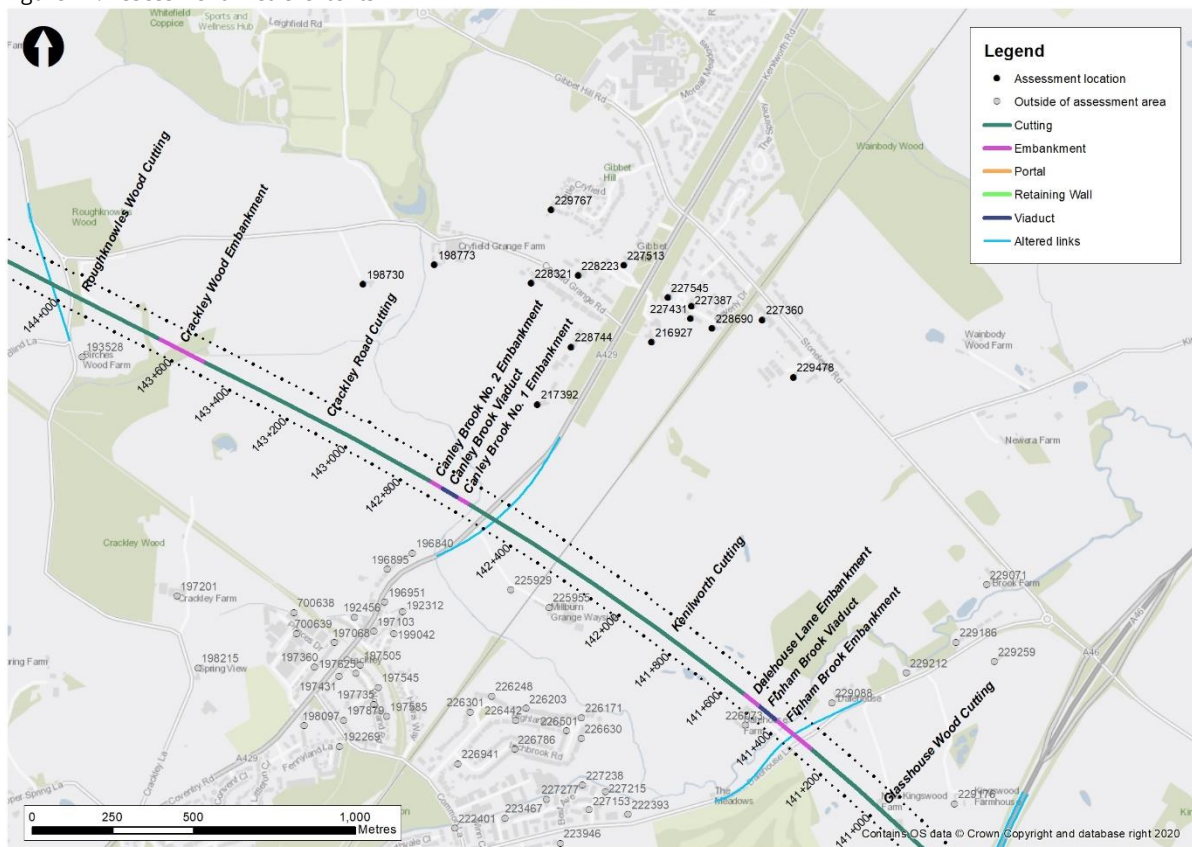
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### Assessment Area 9 candidate mitigation options

A total of four options were considered and studied to assess noise mitigation for communities in the vicinity of Cryfield Grange Road on the upside of the HS2 alignment before reaching The Design (Option 9.0) for which consent is sought. Assessment Area 9 is shown in Figure 24.

Figure 24. Assessment Area 9 extents



Alternative mitigation options considered have not been recommended for one or more of the reasons set out below:

- the candidate option would be considerably more expensive than the recommended mitigation with limited impact in resultant noise levels compared to the recommended option; and/or
- the candidate option would produce a greater adverse visual impact than the recommended option with only marginally improved acoustic benefit.

At the time of the ES there were four negligible and one moderate daytime impacts, and four negligible and one moderate night-time impacts at residential receptors above  $L_{pAeq}$  LOAEL. There were also 62 receptors where the  $L_{pAFmax}$  was at or greater

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than LOAEL. No significant adverse impacts at non-residential receptors have been reported.

Differences in the current design when compared to the ES include a reduction in the HS2 train source terms and associated change in service flow patterns, changes in the HS2 track elevation which is increased by up to approximately 1.5 m, and limited height increases in adjacent earthworks.

In the absence of additional mitigation (Option 9.0, The Design) four additional negligible impacts during the day, and ten additional negligible impacts during the night are introduced at residential receptors above  $L_{pAeq}$  LOAEL. 15 additional impacts above  $L_{pAFmax}$  LOAEL are introduced. No material change is observed. Visual impact of Option 9.0 is comparable to the ES.

Other candidate mitigation options that were considered included:

- Option 9.1 was a 2 m high, 150 m long barrier on the crest of Crackley Road cutting at 143+125 to 143+275, see Figure 25. Analysis showed that Option 9.1 would produce limited benefit in terms of resultant noise impacts when compared with Option 9.0. No material change is observed. This option would have a low benefit in comparison to cost, and increased visual impact compared to the ES, therefore it is not recommended.
- Option 9.2 was a 2 m high, 150 m long trackside barrier at 143+125 to 143+275, see Figure 26. No material change is observed, while visual impact is comparable to the ES. Option 9.2 would produce limited benefit in terms of resultant noise impacts when compared with Option 9.0 and have a low benefit in comparison to cost. This option is therefore not recommended.
- Option 9.3 was a 2 m high, 150 m long trackside barrier at 143+125 to 143+275 (2.1 m acoustic parapet at 142+650 to 142+700), see Figure 27. No material change is observed, while visual impact is comparable to the ES. Option 9.3 would produce limited benefit in terms of resultant impacts when compared with Option 9.0 and have a low benefit in comparison to cost, therefore it is not recommended.

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Figure 25. Candidate mitigation Option 9.1

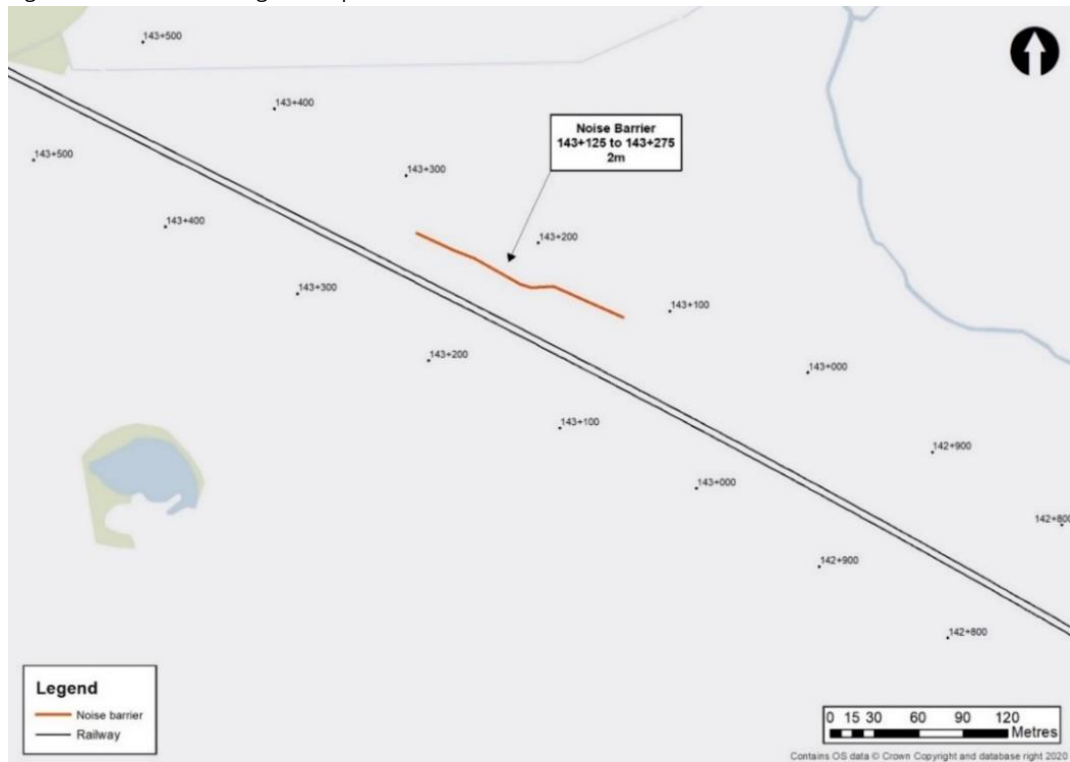
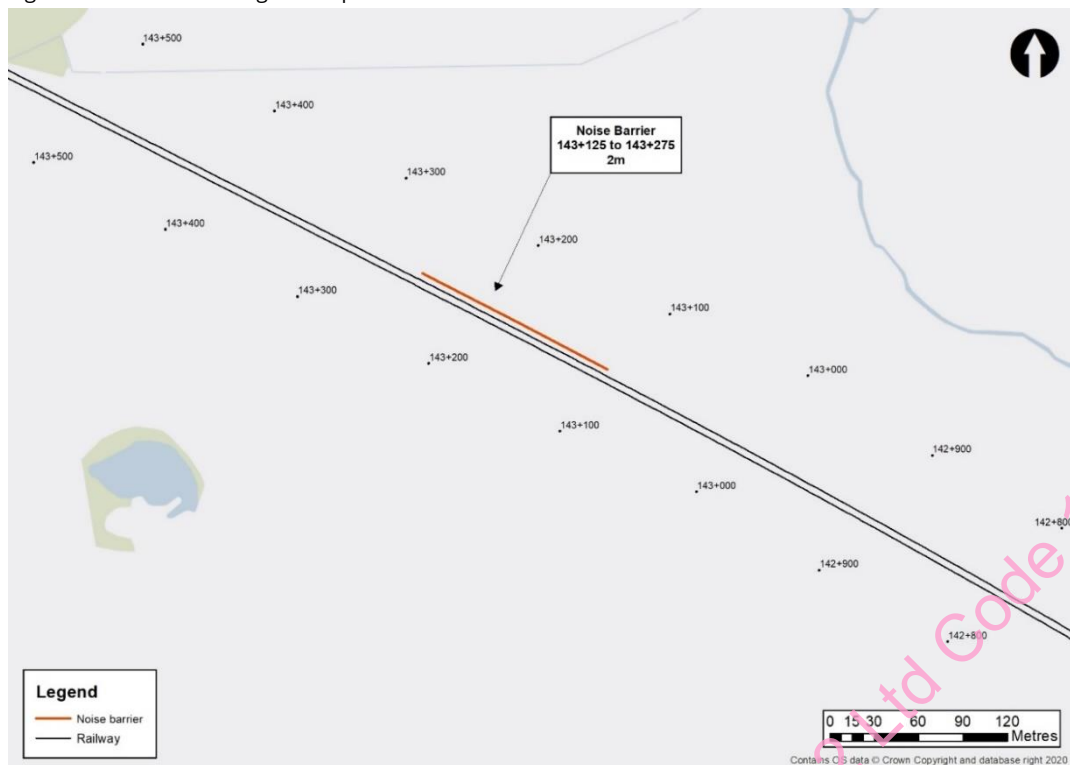
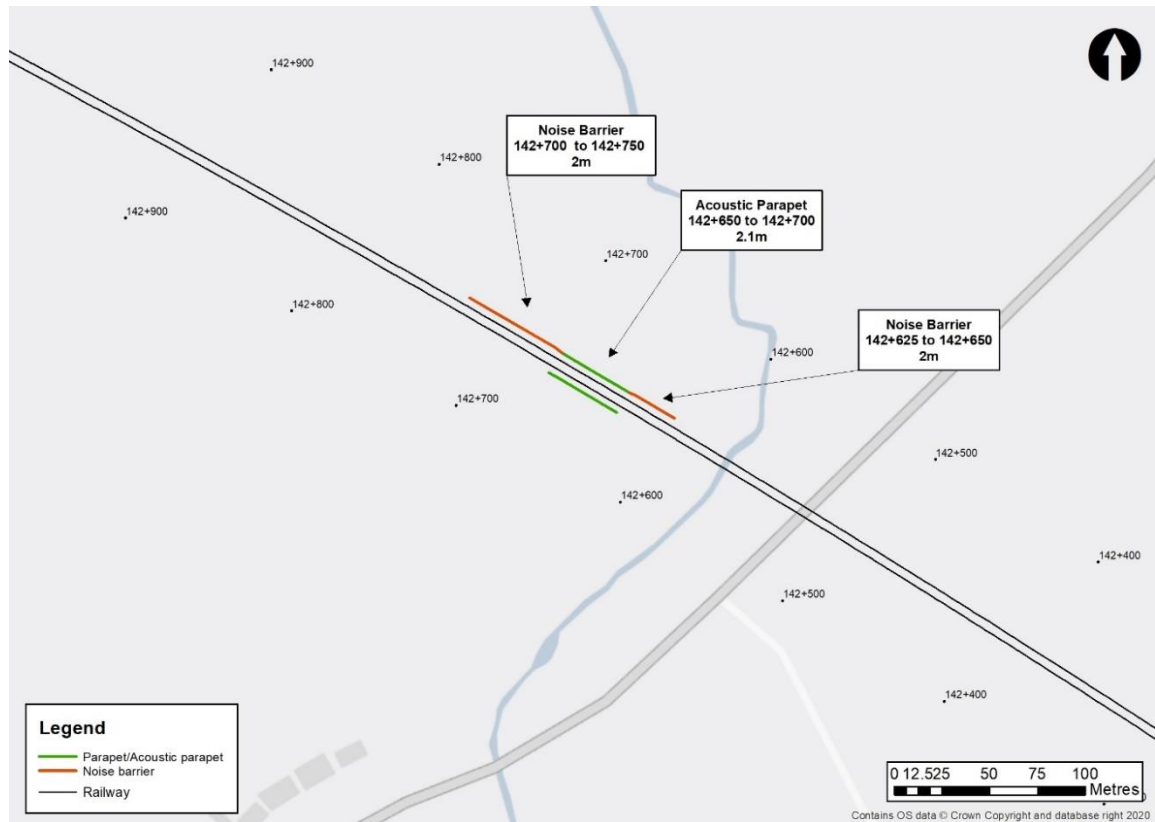


Figure 26. Candidate mitigation Option 9.2



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Figure 27. Candidate mitigation Option 9.3



A summary analysis for the mitigation scenarios that were considered within Assessment Area 9 are presented in Table 12. Option 9.0 in the highlighted grey cells is the recommended final design solution as other candidate mitigation options had a low benefit in comparison to cost, and/or a worse landscape and visual impact, and provided little benefit in resultant noise level terms.

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Table 12. Option appraisal summary table (Assessment Area 9)

Scenario	Description	Noise benefit to relative cost <sup>1</sup>	Noise Impacts <sup>2</sup>	Engineering Constraints	Environmental Implication <sup>3</sup>	Consultation / Stakeholder <sup>4</sup>
Option 9.0	Only mitigation embedded within the design	No cost/benefit	x Four additional negligible L <sub>pAeq</sub> impacts during the day, and ten additional L <sub>pAeq</sub> impacts during the night. 15 additional impacts above L <sub>pAFmax</sub> LOAEL. Resultant impacts are comparable to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 9.1	Noise barrier (2 m) on crest of earthworks at 143+125 to 143+275	x	x Four additional negligible L <sub>pAeq</sub> impacts during the day, and ten additional L <sub>pAeq</sub> impacts during the night. 15 additional impacts above L <sub>pAFmax</sub> LOAEL. Resultant impacts are comparable to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.
Option 9.2	Noise barrier (2 m) trackside at 143+125 to 143+275	x	x Four additional negligible L <sub>pAeq</sub> impacts during the day, and ten additional L <sub>pAeq</sub> impacts during the night. 15 additional impacts above L <sub>pAFmax</sub> LOAEL. Resultant impacts are comparable to the ES. No material change.	No additional constraints	~	Further stakeholder engagement req'd.
Option 9.3	Noise barrier (2 m) at 142+625 to 142+750 (2.1 m acoustic parapet at 142+650 to 142+700)	x	x Four additional negligible L <sub>pAeq</sub> impacts during the day, and ten additional L <sub>pAeq</sub> impacts during the night. 15 additional impacts above L <sub>pAFmax</sub> LOAEL. Resultant impacts are comparable to the ES. No material change.	No additional constraints	x Increased visual impact	Further stakeholder engagement req'd.

Note:

1. Value for money compared to the ES design (or equivalent design)
2. Using EIA methodologies
3. Impacts on other environmental disciplines, including landscape and visual
4. Further stakeholder engagement is required as part of the Schedule 17 process to which this NDR contributes under PFN 14

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## 5. METHODOLOGY

### Calculation Methodology

Appendix B sets out the technical methodology for the prediction of airborne noise from operational trains in detail.

Airborne noise from the operational railway has been assessed according to the HS2 methodology which requires predictions of noise emission from five discrete sources at different heights above the top of the rail to represent the sources of noise associated with High Speed Rail. The total noise emission from the train is calculated from the sum of contribution of these sources, individually corrected for propagation to the assessment location. The methodology includes corrections to account for future rolling stock being quieter than current TSI-compliant trains and to allow representation of an individual track to better allow for divergence of the up and down tracks. Two tracks have been accounted for in the calculations.

### Airborne noise from altered roads

Airborne noise from altered roads has been calculated and assessed in accordance with the methodology set out in the Calculation of Road Traffic Noise (CRTN) and the updated procedure in the Design Manual for Roads and Bridges (DMRB).

### Assessment Methodology

In accordance with the information paper E20 and the EIA methodology, the impact of The Design is assessed against:

- The number of residential properties exceeding the Lowest Observed Adverse Effect Level (LOAEL);
- The number of residential properties exceeding the Significant Observed Adverse Effect Level (SOAEL);
- The number of residential properties with noise impacts;
- The number of properties eligible for noise insulation; and
- The number of non-residential properties with noise impacts, although none of these are considered sensitive.

The outcomes of this assessment are presented in Section 7.

## 6. ASSUMPTIONS

The assumptions for the assessments can be found in Appendix C of this report. These include the available information at this stage of the design. For the operational railway

these are assumed train service patterns, track form, rolling stock parameters and noise sources, and planned operational train speeds; for civil engineering assets the design of noise barriers and other mitigating devices.

The validation of the methodology and potential uncertainty is described below.

### Uncertainties and Limitations

The Train Noise Prediction Method (TNPM) was originally validated against a large number of high speed train noise measurements covering a broad range of scenarios, including propagation over flat ground up to distances of 800 m from the railway, effects of screening (including reflective and absorptive barriers) and varying angles of view. The overall regression analyses gave a standard error, for the goodness of fit between predicted and measured levels of approximately 3 dB(A) for SEL and  $L_{pAFmax}$ . This means that the difference between predicted and measured sound levels is typically within  $\pm 3$  dB(A). Consistent with the Hybrid Bill Scheme the mean levels predicted with TNPM are presented in this report.

Any source of noise that could occur, or any mitigation that is installed or constructed to control noise and/or vibration but is not subject to an acoustic specification / standard requires an assumption. Such assumptions are defined when taking into consideration the likely application of existing technology with reference to the probability of the noise and/or vibration occurring. This includes reference to sensitivity tests and regression analysis between predicted and measured levels such as those presented in Appendix SV-001-000: Annex D2 of the ES and set out in the methodology section of this report. Assumptions in all reasonably foreseeable circumstances are taken on a reasonable worst case. As such, under the majority of operating conditions, lower noise levels than those predicted in this assessment would be expected.

## 7. RESULTS

The proposed mitigation design was described in Section 4. Noise levels predicted for the proposed Noise Mitigation Design (comprising options titled 'The Design' within the description for each assessment area), as well as the noise levels calculated in the Phase 1 ES and those that would be experienced for the proposed civil engineering assets design without any additional noise barrier (named No Mitigation), are provided Table 13 and Table 14 for  $L_{pAeq}$  and  $L_{pAFmax}$  respectively.

Tables show the noise levels due to 'Proposed Scheme only' (operational railway and altered roads) and also the Do Something noise levels by combining Proposed Scheme noise levels and Baseline noise levels, for the cases mentioned above, namely:

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- the ES design (after SES & APs);
- the No Mitigation design (current design of civil engineering assets without any additional noise barrier); and
- the Design (recommended mitigation option).

Tabulated values only indicate assessment locations where LOAEL has been exceeded in any category (shaded in blue). Calculations for all assessment locations irrespective of level are presented in Appendix D.

The assessment location IDs correspond to those used in the Phase 1 ES study, to allow for direct comparison. This is the case for assessment location IDs that represent individual receptor locations as well as groups of receptors. All values reported in tables are rounded to the nearest decibel.

All noise levels presented in the tables are free-field and include the following:

- Daytime noise level  $L_{pAeq,07:00-23:00}$  denoted \*;
- Night-time noise level  $L_{pAeq,23:00-07:00}$  denoted \*\*; and
- Maximum noise levels due to HS2 trains  $L_{pAFmax}$  in the Proposed Scheme only column, denoted \*; the value is always for the HS2 conventional compatible train (CC).

It is further noted:

- Where the Proposed Scheme modifies an existing source, i.e. road or railway realignments, the Proposed Scheme only level in the table includes the sound from the modified source; In this situation the Do something level (Opening year baseline + Year 15 traffic, denoted \*\*\*) has been corrected so as to not double count the sound associated with the road or railway on its new and existing alignment;
- The Proposed-Scheme-Only noise levels are calculated assuming Year 15 traffic;
- The Do-Nothing noise levels correspond to expected Opening year baseline sound levels;
- The Do-Something noise levels are determined as the combination of Opening year baseline sound levels and noise levels due to the Proposed Scheme for Year 15 traffic;
- Receptor label G is for: (G1) theatres, large auditoria and concert halls, (G2) sound recording and broadcast studios, (G3) places of meeting for religious worship, courts, cinemas, lecture theatres, museums and small auditoria or

halls, (G4) schools, colleges, hospitals, hotels and libraries, and (G5) offices and general commercial premises; and

- Receptor label R denotes residential properties.

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Table 13. Noise level summary of the Design compared to the ES Design – all levels are L<sub>pAeq,T</sub>

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
192312	Arborfields Close, Kenilworth	R	6	47	35	49	39	51	41	55	45	55	45	50	40	50	40
192456	Laneham Place, Kenilworth	R	33	62	50	46	37	62	50	51	43	62	51	49	41	62	50
196840	Coventry Road, Kenilworth	R	8	62	50	57	49	63	51	62	54	65	54	58	50	63	51
196895	Crackley Crescent, Kenilworth	R	9	60	52	49	40	60	53	56	47	62	53	50	41	60	52
196951	Coventry Road, Kenilworth	R	4	56	44	49	40	57	45	55	46	58	48	52	44	57	45
197103	Coventry Road, Kenilworth	R	13	56	44	46	38	56	45	50	41	57	46	48	40	56	45
197505	Woodland Road, Kenilworth	R	11	55	45	45	37	55	45	49	41	56	46	47	39	55	45
197545	Woodland Road, Kenilworth	R	12	55	45	47	40	55	46	50	42	56	46	48	40	55	45
197585	Woodland Road, Kenilworth	R	14	47	37	46	39	48	39	50	41	50	41	47	39	49	39
198730	Cryfield Grange Road, Kenilworth	R	1	43	36	52	43	52	43	52	43	53	44	52	43	53	44
199042	Redthorne Grove, Kenilworth	R	5	47	35	49	39	51	41	53	43	53	43	49	39	49	39
217392	Kenilworth Road, Coventry	R	4	64	60	54	46	64	60	56	47	64	60	56	47	64	60
217784	Grovehurst Park, Kenilworth	R	12	55	45	52	44	54	44	54	46	55	46	54	45	55	45
217994	East Gate, Stoneleigh Park	R	3	50	40	53	45	54	45	57	47	57	47	53	43	53	43
218483	Stoneleigh Abbey, Stoneleigh Park	R	2	49	44	48	40	50	45	47	40	50	45	47	39	50	44
218718	National Agricultural Centre, Stoneleigh Park	R	2	47	42	47	38	50	43	49	41	51	44	47	39	50	43
219703	Vicarage Road, Stoneleigh	R	12	48	39	49	41	50	41	50	42	51	42	50	42	51	42
219791	Walkers Orchard, Stoneleigh	R	11	48	39	48	40	49	40	49	41	50	41	49	41	50	41
220606	Stareton, Kenilworth	R	8	52	41	51	43	54	43	52	44	54	44	52	44	54	44
222373	Crew Lane, Kenilworth	R	1	50	43	48	41	51	44	47	40	51	43	47	40	51	43
222393	Dalehouse Lane, Stoneleigh	R	6	52	43	48	40	53	44	51	42	54	45	49	41	53	44
225929	Coventry Road, Kenilworth	R	1	51	42	54	45	55	45	55	47	56	47	55	46	56	47
225955	Coventry Road, Kenilworth	R	1	51	42	53	44	55	45	56	47	57	48	56	47	57	48
226073	Dalehouse Lane, Kenilworth	R	1	45	36	59	50	59	50	67	58	67	58	62	53	62	53
226171	Inchbrook Road, Kenilworth	R	7	48	44	49	41	51	45	51	42	52	46	51	42	52	46
226203	Highland Road, Kenilworth	R	10	46	35	47	39	49	39	50	41	51	41	49	40	50	40
226248	Highland Road, Kenilworth	R	7	51	42	48	40	52	43	50	42	53	44	49	41	53	43
226442	Highland Road, Kenilworth	R	17	46	35	46	38	49	38	50	40	50	40	49	40	50	40
226501	Highland Road, Kenilworth	R	20	48	44	48	40	50	44	50	42	52	45	50	41	51	45
226630	Inchbrook Road, Kenilworth	R	10	48	44	48	40	50	45	50	41	52	45	50	41	51	45
227215	Whitehead Drive, Kenilworth	R	9	50	35	48	38	51	38	50	41	52	41	49	39	52	39



Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
228321	Cryfield Grange Road, Coventry	R	6	47	40	48	39	49	41	50	41	51	43	50	41	51	43
228744	Kenilworth Road, Coventry	R	4	64	60	47	39	64	60	50	42	64	60	50	42	64	60
229009	Crew Lane, Kenilworth	R	1	60	53	56	48	60	53	54	47	60	53	54	47	60	53
229016	Crew Lane, Kenilworth	R	6	60	53	58	51	61	54	57	49	60	53	57	49	60	53
229088	Dalehouse Lane, Kenilworth	R	2	52	43	59	49	59	49	63	54	63	54	63	54	63	54
229176	Dalehouse Lane, Kenilworth	R	3	63	56	61	52	64	57	60	51	64	57	60	51	64	57
229186	Dalehouse Lane, Kenilworth	R	5	60	51	47	40	61	51	49	41	60	51	49	41	60	51
229212	Dalehouse Lane, Kenilworth	R	2	60	51	51	43	61	51	52	44	60	51	52	44	60	51
229259	Dalehouse Lane, Kenilworth	R	1	60	51	50	43	60	51	52	44	60	51	52	44	60	51
711043	East Gate, Stoneleigh Park	R	2	50	40	56	47	57	48	62	52	62	52	56	46	56	46

\* Day denotes L<sub>pAeq,07:00-23:00</sub>

\*\* Night denotes L<sub>pAeq,23:00-07:00</sub>

\*\*\* The Do something level (Opening year baseline + Year 15 traffic) has been corrected so as to not double count the sound associated with the road or railway on its new and existing alignment

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Table 14 Noise level summary of the Design compared to the ES Design – all levels are  $L_{pAFmax}$

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	$L_{pAFmax}$ dB	$L_{pAFmax}^*$ dB	$L_{pAFmax}^*$ dB	$L_{pAFmax}^*$ dB
192269	Fennyland Lane, Kenilworth	R	49	41	54	62	54
192312	Arborfields Close, Kenilworth	R	6	49	62	75	63
192456	Laneham Place, Kenilworth	R	33	67	60	69	60
196840	Coventry Road, Kenilworth	R	8	67	67	80	68
196895	Crackley Crescent, Kenilworth	R	9	64	65	76	65
196951	Coventry Road, Kenilworth	R	4	58	62	75	63
197068	Coventry Road, Kenilworth	R	14	65	58	66	58
197103	Coventry Road, Kenilworth	R	13	58	59	66	60
197201	Crackley Lane, Stoneleigh	R	1	42	59	60	59
197360	Coventry Road, Kenilworth	R	22	65	58	66	57
197431	Coventry Road, Kenilworth	R	18	65	56	65	56
197505	Woodland Road, Kenilworth	R	11	62	58	67	58
197545	Woodland Road, Kenilworth	R	12	62	58	70	58
197585	Woodland Road, Kenilworth	R	14	55	58	69	57
197625	Woodland Road, Kenilworth	R	20	62	57	65	57
197735	Woodland Road, Kenilworth	R	22	56	57	65	57
197879	Common Lane, Kenilworth	R	30	59	56	64	55
198097	Moss Grove, Kenilworth	R	20	62	54	63	54
198215	Crackley Lane, Kenilworth	R	2	42	59	62	56
198730	Cryfield Grange Road, Kenilworth	R	1	46	68	71	71
198773	Cryfield Grange Road, Kenilworth	R	2	46	66	67	67
199042	Redthorne Grove, Kenilworth	R	5	49	60	73	61
216927	Kenilworth Road, Coventry	R	3	60	62	65	65
217392	Kenilworth Road, Coventry	R	4	60	69	75	75
217535	Fairway Rise, Kenilworth	R	53	50	61	65	58
217784	Grovehurst Park, Kenilworth	R	12	60	56	58	57
217994	East Gate, Stoneleigh Park	R	3	58	68	72	65
218483	Stoneleigh Abbey, Stoneleigh Park	R	2	50	58	58	58
218718	National Agricultural Centre, Stoneleigh Park	R	2	52	60	62	60
219703	Vicarage Road, Stoneleigh	R	12	50	64	69	69
219791	Walkers Orchard, Stoneleigh	R	11	50	62	67	67
219942	Birmingham Road, Stoneleigh	R	32	60	60	62	62
220606	Stareton, Kenilworth	R	8	48	63	64	64
220714	Abbey Park, Stareton	R	4	43	55	59	59
221156	Church Lane, Stoneleigh	R	13	48	60	65	65
222373	Crew Lane, Kenilworth	R	1	53	57	59	57
222393	Dalehouse Lane, Stoneleigh	R	6	55	73	71	63
222401	Common Lane, Kenilworth	R	56	50	59	61	55
223457	Frythe Close, Kenilworth	R	10	48	64	68	61
223467	Cotton Drive, Kenilworth	R	48	50	57	60	57
223712	Lulworth Park, Kenilworth	R	46	57	58	60	56
223946	Lulworth Park, Kenilworth	R	18	57	66	65	59
225929	Coventry Road, Kenilworth	R	1	46	68	70	68
225955	Coventry Road, Kenilworth	R	1	46	67	71	71
226073	Dalehouse Lane, Kenilworth	R	1	48	85	87	79
226171	Inchbrook Road, Kenilworth	R	7	55	65	65	65
226203	Highland Road, Kenilworth	R	10	46	62	64	63
226248	Highland Road, Kenilworth	R	7	46	61	65	62
226301	Highland Road, Kenilworth	R	10	46	60	62	61
226442	Highland Road, Kenilworth	R	17	46	63	63	63
226501	Highland Road, Kenilworth	R	20	55	64	64	64
226630	Inchbrook Road, Kenilworth	R	10	55	66	65	63
226786	Inchbrook Road, Kenilworth	R	25	46	62	62	60
226941	Highland Road, Kenilworth	R	18	46	59	61	58
227153	Butler Close, Kenilworth	R	13	51	62	63	60
227215	Whitehead Drive, Kenilworth	R	9	47	72	70	63

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Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L <sub>pAFmax</sub> dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB
227238	Best Avenue, Kenilworth	R	12	47	70	69	62
227277	Garlick Drive, Kenilworth	R	35	50	60	63	59
227360	Stoneleigh Road, Coventry	R	10	54	56	59	59
227387	Beverly Drive, Coventry	R	5	54	56	60	60
227431	Beverly Drive, Coventry	R	2	54	60	63	63
227513	Kenilworth Road, Coventry	R	4	60	59	61	61
227545	Beverly Drive, Coventry	R	2	59	59	63	63
228223	Cryfield Grange Road, Coventry	R	8	46	59	64	64
228321	Cryfield Grange Road, Coventry	R	6	47	63	68	68
228690	Beverly Drive, Coventry	R	4	51	59	62	62
228744	Kenilworth Road, Coventry	R	4	60	64	67	67
229009	Crew Lane, Kenilworth	R	1	63	59	59	59
229016	Crew Lane, Kenilworth	R	6	63	66	66	65
229071	Stoneleigh Road, Coventry	R	1	57	63	66	66
229088	Dalehouse Lane, Kenilworth	R	2	55	82	83	83
229176	Dalehouse Lane, Kenilworth	R	3	63	71	70	70
229186	Dalehouse Lane, Kenilworth	R	5	63	64	68	68
229212	Dalehouse Lane, Kenilworth	R	2	63	67	67	67
229259	Dalehouse Lane, Kenilworth	R	1	63	63	62	62
229767	Little Cryfield, Coventry	R	22	42	61	61	61
229973	Motslow Hill, Stoneleigh	R	2	50	59	64	64
711043	East Gate, Stoneleigh Park	R	2	58	74	78	70

\* denotes L<sub>pAFmax</sub> in the 'Proposed Scheme only' column; the value is always for the HS2 conventional compatible train (CC)

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## Results summary (presented per community area)

The following sections present result summaries for the Stoneleigh, Glasshouse Wood, Canley area, broken down to the individual communities within the assessment area. The number of receptors predicted to exceed LOAEL and SOAEL for the proposed mitigation design and reported in the ES are presented first, followed by the change classification of impacts, and the number of non-residential receptors that exceed the noise impact levels set out in Appendix A and which are subject to a significant adverse effect.

### Stareton area

No material change is observed in the Stareton community. No significant effects are observed for either residential or non-residential assessment locations.

There is no change in the number of  $L_{pAeq}$  LOAEL exceedances for either daytime or night-time. There are eight impacts at assessment location ID 220606 that change impact classification from negligible to minor (night-time), and four additional  $L_{pAFmax}$  LOAEL exceedances at assessment location ID 220714 with the Design.

Table 15. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Stareton)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	8	8	12	0	0	0
ES Design	8	8	8	0	0	0

Table 16. Number of major, moderate and minor community impacts due to The Design and the ES Design (Stareton)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	0	0	0	8
ES Design	0	0	0	0	0	0

Table 17. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Stareton)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

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## Stoneleigh Park area

No adverse material change is observed in the Stoneleigh Park community. No significant effects are observed for residential assessment locations [A significant effect on a community basis has been reported in the ES (OSV18-C01) owing to moderate impacts at assessment locations IDs 217994 and 711043 (East Gate, Stoneleigh Park). Resultant noise levels at the same locations with the proposed design indicate two out of two moderate impacts in the daytime remain, while three out of five moderate night-time impacts are reduced to minor, suggesting only one assessment location (217994) is now subject to moderate impacts. The recommended design has therefore removed this community-based significant effect, introducing a material benefit.].

There are two fewer daytime  $L_{pAeq}$  LOAEL exceedances compared with the ES. Three impacts change from minor to negligible (daytime) and from moderate to minor (night-time) at assessment location ID 217994 with the Design.

Six daytime significant effects are observed at non-residential assessment location IDs 218885, 219122, and 219394, as was the case at the time of the ES.

Table 18. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Stoneleigh Park)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	17	17	9	0	0	0
ES Design	17	19	9	0	0	0

Table 19. Number of major, moderate and minor community impacts due to The Design and the ES Design (Stoneleigh Park)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	2	2	0	3
ES Design	0	0	2	5	3	0

Table 20. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Stoneleigh Park)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	6	0	6	0
ES Design	6	1	6	0

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### Birmingham Road area

No material change is observed in the Birmingham Road community. No significant effects are observed for either residential or non-residential assessment locations.

There are 12 additional daytime  $L_{pAeq}$  LOAEL exceedances compared with the ES. 12 impacts change from negligible to minor (daytime/ night-time) at assessment location ID 219703 with the Design.

Table 21. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Birmingham Road)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	12	23	70	0	0	0
ES Design	0	23	70	0	0	0

Table 22. Number of major, moderate and minor community impacts due to The Design and the ES Design (Birmingham Road)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	0	0	12	12
ES Design	0	0	0	0	0	0

Table 23. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Birmingham Road)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### Dalehouse Lane area

No material change is observed in the Dalehouse Lane community. No significant effects are observed for either residential or non-residential assessment locations.

There is no change in the number of  $L_{pAeq}$  LOAEL exceedances for either daytime or night-time. Two impacts change from moderate to major (daytime/ night-time)

at assessment location ID 229088 with the Design.  $L_{pAFmax}$  SOAEL is exceeded at assessment location ID 229088 (Dalehouse Lane, Kenilworth), as was the case at the time of the ES (OSV18-D01). This receptor would qualify for insulation to control operational noise.

Table 24. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Dalehouse Lane)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	8	13	12	0	0	2
ES Design	8	13	12	0	0	2

Table 25. Number of major, moderate and minor community impacts due to The Design and the ES Design (Dalehouse Lane)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	2	2	0	0	0	0
ES Design	0	0	2	2	0	0

Table 26. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Dalehouse Lane)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### The Meadows area

No material change is observed in The Meadows community. No significant effects are observed for either residential or non-residential assessment locations.

There is no change in the number of  $L_{pAeq}$  LOAEL exceedances for either daytime or night-time, and no change in impact classification. 102  $L_{pAFmax}$  LOAEL exceedances at assessment location IDs 222401 and 223712 are reduced to below LOAEL with the Design.

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Table 27. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (The Meadows)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	0	6	156	0	0	0
ES Design	0	6	258	0	0	0

Table 28. Number of major, moderate and minor community impacts due to The Design and the ES Design (The Meadows)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	0	0	0	0
ES Design	0	0	0	0	0	0

Table 29. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (The Meadows)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### Common Lane area

No material change is observed in The Meadows community (assessment location ID 226203 moves fractionally above LOAEL with associated impacts now classified, thus accounting for ten out moderate impacts during the night; a new significant adverse effect is not considered to arise at this location as a result of noise levels only marginally exceeding LOAEL). No significant effects are observed at non-residential assessment locations.

There are seven additional daytime (assessment location ID 226171) and 10 additional night-time (assessment location ID 226203)  $L_{pAeq}$  LOAEL exceedances compared with the ES. Seven impacts change from non-classified to minor (daytime) at assessment location ID 226171, and ten impacts change from non-classified to moderate (night-time) at assessment location ID 226203 with the Design.

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Table 30. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (The Meadows)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	7	54	124	0	0	0
ES Design	0	44	124	0	0	0

Table 31. Number of major, moderate and minor community impacts due to The Design and the ES Design (The Meadows)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	0	10*	7	0
ES Design	0	0	0	0	0	0

\* Predicted level fractionally exceeds LOAEL; a significant adverse effect is thus not considered to arise at this location

Table 32. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (The Meadows)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### Coventry Road area

No material change is observed in the Coventry Road community. No significant effects are observed for either residential or non-residential assessment locations.

There are ten additional daytime (assessment location IDs 192312 and 196951) and 21 additional night-time (33 impacts at assessment location ID 192456 are introduced and 12 impacts at assessment location ID 197545 are removed)  $L_{pAeq}$  LOAEL exceedances for which the increase in HS2 traffic noise produces impacts that are classified up to negligible. Six impacts change from non-classified to minor (daytime) at assessment location ID 192312 with the Design.

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Table 33. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Coventry Road)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	18	54	115	0	0	0
ES Design	8	33	151	0	0	0

Table 34. Number of major, moderate and minor community impacts due to The Design and the ES Design (Coventry Road)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	0	0	6	0
ES Design	0	0	0	0	0	0

Table 35. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Coventry Road)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### Stoneleigh Road area

No material change is observed in the Stoneleigh Road community. No significant effects are observed for either residential or non-residential assessment locations.

There is no change in the number of  $L_{pAeq}$  LOAEL exceedances for either daytime or night-time. There are 15 additional  $L_{pAFmax}$  LOAEL exceedances at assessment location IDs 227360 and 227387 with the Design.

Table 36. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Stoneleigh Road)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	0	0	26	0	0	0
ES Design	0	0	11	0	0	0

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Table 37. Number of major, moderate and minor community impacts due to The Design and the ES Design (Stoneleigh Road)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	0	0	0	0
ES Design	0	0	0	0	0	0

Table 38. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Stoneleigh Road)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### Cryfield Grange Road area

No material change is observed in the Cryfield Grange Road community. No significant effects are observed for either residential or non-residential assessment locations.

There are four additional daytime (at assessment location ID 228744) and ten additional night-time (at assessment location IDs 228321 and 228744)  $L_{pAeq}$  LOAEL exceedances for which the increase in HS2 traffic noise produces impacts that are classified up to negligible with the Design.

Table 39. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Cryfield Grange Road)

	> = LOAEL but < = SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	9	15	51	0	0	0
ES Design	5	5	51	0	0	0

Table 40. Number of major, moderate and minor community impacts due to The Design and the ES Design (Cryfield Grange Road)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	0	0	1	1	0	0
ES Design	0	0	1	1	0	0

Table 41. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Cryfield Grange Road)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	0	0	0	0
ES Design	0	0	0	0

### Isolated assessment locations

No significant effects are observed for either residential or non-residential assessment locations. It is noted noise levels at non-residential assessment location IDs 225955 and 226073 indicate a potentially significant adverse effect could have been introduced at these locations, however their associated commercial operations are not considered to be noise sensitive (mixed agricultural uses/ mechanical workshop for 225955, and farm / industrial buildings for 226073) therefore a significant effect does not arise.

There is one fewer night-time  $L_{pAeq}$  LOAEL exceedance compared with the ES. One impact changes from minor to moderate (daytime/ night-time) at assessment location ID 225955 with the Design.  $L_{pAFmax}$  SOAEL is exceeded at assessment location ID 226073 (The Dalehouse, Dalehouse Lane), as was the case at the time of the ES (OSV18-D02). This receptor would qualify for insulation to control operational noise.

Table 42. Number of residential receptors exceeding LOAEL and SOAEL in The Design and the ES Design (Isolated assessment locations)

	≥ LOAEL but ≤ SOAEL			> SOAEL		
	Total Day	Total Night	Total Lmax	Total Day	Total Night	Total Lmax
The Design	10	10	10	0	0	1
ES Design	10	11	12	0	0	1

Table 43. Number of major, moderate and minor community impacts due to The Design and the ES Design (Isolated assessment locations)

	Major Impacts		Moderate Impacts		Minor Impacts	
	Day	Night	Day	Night	Day	Night
The Design	1	1	1	1	1	1
ES Design	1	1	0	0	2	2

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Table 44. Number of non-residential receptors that exceed the noise impact levels and are subject to significant adverse effects (Isolated assessment locations)

	Exceed the noise impact levels		Subject to significant adverse effects	
	Total Day	Total Night	Total Day	Total Night
The Design	3	0	0	0
ES Design	2	0	0	0

It is noted resultant noise levels indicate a potentially significant adverse effect could have been introduced at assessment location ID 225955 where noise levels marginally exceed the impact threshold, as defined for particular types of non-residential receptors in Table 48. The change in noise level is however identified not to give rise to a significant effect as the receptor is made up of agricultural/industrial buildings (mixed agricultural uses, mechanical workshop) whose operation is not considered to be noise sensitive. Noise levels at assessment location ID 226073 where a significant adverse effect could have been similarly introduced, were identified not to give rise to a significant effect as the receptor is made up of farm / industrial buildings whose operation is not considered to be noise sensitive (as also noted in the ES assessment).

### Undertakings and assurances

Undertakings and assurances (U&As) that are relevant to the Stoneleigh, Glasshouse Wood, Canley area, and specifically to the Stoneleigh Park Estate within Assessment Area 2, are set out in Section 3. Table 45 and Table 46 explain how the requirements of this U&A have been met.

Table 45. How U&A requirements have been met

U&A requirement	How this is met
<p><b>U&amp;A 2837_19</b></p> <p>12.1 The Nominated Undertaker will seek to secure that noise and vibration levels experienced at the Stoneleigh Park Estate arising from the operation of the Railway during the Operational Period shall not exceed the levels set out in the Environmental Statement deposited with the Act, such levels to be achieved by the implementation of the Environmental Minimum Requirements in relation to the design and construction of the Proposed Scheme and the provision of suitable noise and vibration mitigation.</p>	<p>U&amp;A is met on the basis of noise modelling indicating operational noise levels for the proposed design will satisfy the requirement of not exceeding the levels reported at the time of the ES, see Table 46.</p>

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Table 46. Comparison of absolute noise level between the Design and the ES for assessment locations within Stoneleigh Park Estate

Receptor ID	Type	ES design (Do Something)			Current design (Do Something)		
		L <sub>pAeq</sub> DAY	L <sub>pAeq</sub> NIGHT	L <sub>pAFmax</sub>	L <sub>pAeq</sub> DAY	L <sub>pAeq</sub> NIGHT	L <sub>pAFmax</sub>
217994	R	54	45	68	53	43	65
218196	G5	50	40	65	48	39	61
218483	R	50	45	58	50	44	58
218483	G5	50	45	58	50	44	58
218718	R	50	43	60	50	43	60
218718	G5	50	43	60	50	43	60
218718	G5	50	43	60	50	43	60
218885	G5	59	49	74	58	48	73
219122	G5	60	50	73	57	47	72
219122	G5	60	50	73	57	47	72
219394	G4	56	46	70	55	45	68
711043	R	57	48	74	56	46	70

## Landscape and visual impacts

Barrier noise mitigation in the vicinity of Stoneleigh Park retaining wall, see Figure 7, is located at the base of both east and west of Stoneleigh Park retaining wall cuttings at a height of 5 m. The noise barrier transitions on to Stonehouse cutting where it reduces to 4 m, and then on to Stoneleigh Agricultural Centre embankment where it reduces to 1.2 m over the parapet before continuing at a height of 2 m at Glasshouse Wood embankment. Mitigation planting will partially screen the barrier within 5 years as the planting establishes. The visual impact of proposed mitigation is expected to result in a marginal worse effect when compared to what was proposed as part of ES mitigation. Visual impact will diminish as proposed vegetation grows along the trace.

Barrier noise mitigation in the vicinity of Finham Brook viaduct, see Figure 13, is located at the base of Kenilworth cutting at a height of 2 m. The noise barrier transitions through Finham Brook viaduct at 2.1 m before continuing to Glasshouse Wood cutting at 2 m. The height of the cutting along with the proposed mitigation planting in this area will limit the negative visual effects caused by the noise barrier. This option is considered to be similar to that reported in the ES.

Noise mitigation in the vicinity of Canley Brook viaduct, see Figure 20, is located at the base of Kenilworth cutting, transitioning on to Canley Brook embankment and viaduct, and then on to Crackley Road cutting. Noise mitigation ranges in height from 2 to 4.1 m and includes barriers and earthworks. The proposed design is considered to increase visual impact compared to the ES however without resulting in materially worse conditions (aided by the combination of earthworks and proposed planting).

### Summary of additional mitigation within all assessment areas

The analysis set out above indicates that in addition to the mitigation provided by inherent design such as earthworks and cuttings, further mitigation in the form of noise barriers or earthwork optimisation is required, and this is proposed as follows from south to north:

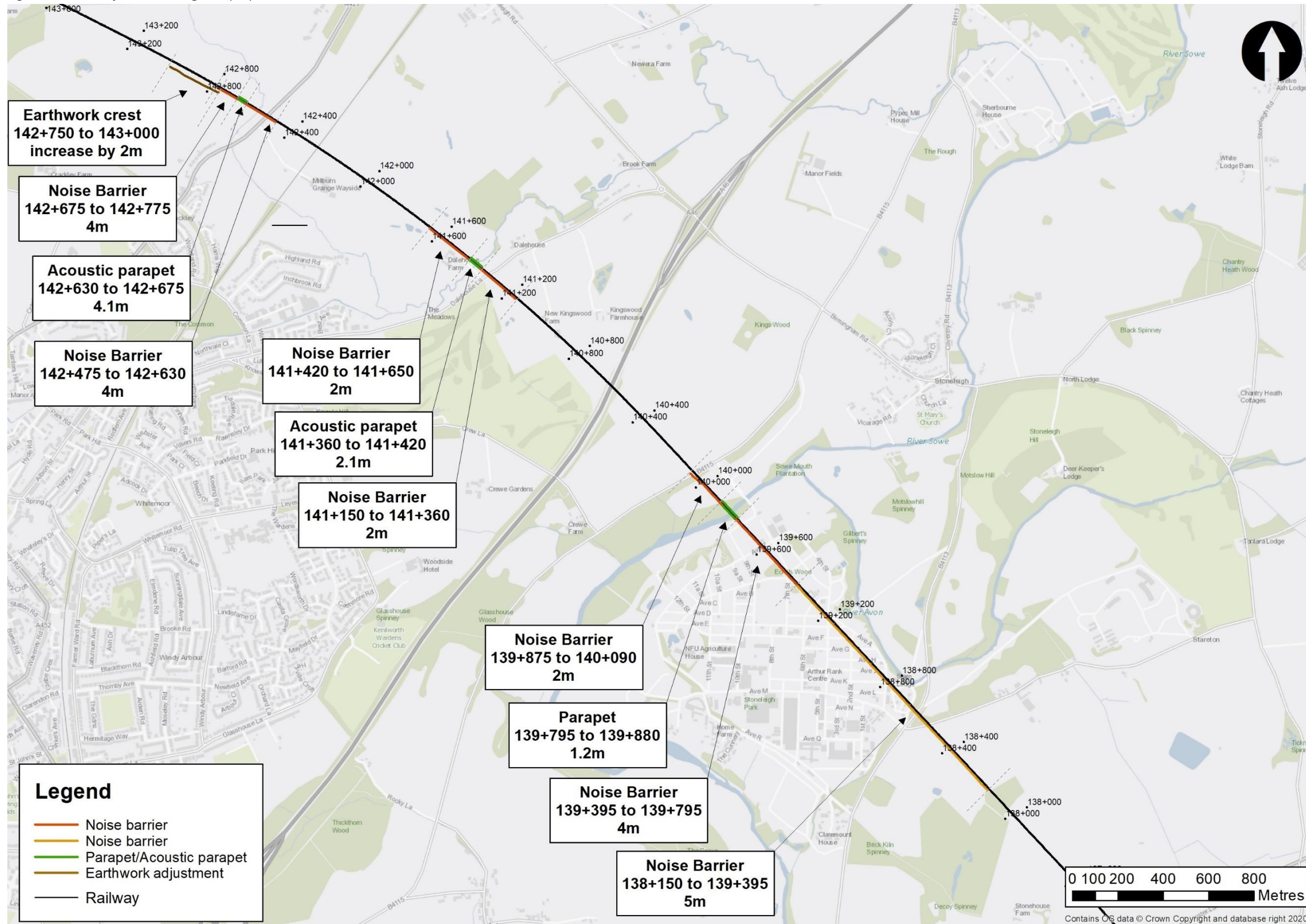
- Noise barrier at 138+150 to 139+375 (downside) @5m (1225 m long);
- Noise barrier at 139+375 to 139+795 (downside) @4m (420 m long);
- Noise barrier at 139+875 to 140+090 (downside) @2m (215 m long);
- Noise barrier at 141+150 to 141+360 (downside) @2m (210 m long);
- Noise barrier at 141+360 to 141+420 (downside) @2.1m (acoustic parapet) (80 m long);
- Noise barrier at 141+420 to 141+650 (downside) @2m (230 m long);
- Noise barrier at 142+475 to 142+630 (downside) @4m (155 m long);
- Noise barrier at 142+630 to 142+675 (downside) @4.1m (acoustic parapet) (45 m long);
- Noise barrier at 142+675 to 142+775 (downside) @4m (100 m long); and
- Trackside earthwork at 142+750 to 143+000 crest height increase (downside) @+2 m (250 m long).

Proposed noise mitigation listed in this section is shown in context within Figure 28.

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Figure 28. Summary of noise mitigation proposed within all assessment areas



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## 8. CONCLUSIONS

The report demonstrates how all reasonable steps have been taken to ensure that the predicted cumulative airborne noise from altered roads and operational railways in all reasonably foreseeable circumstances does not exceed the lowest observed adverse effect levels. Where it has not been reasonably practicable to achieve this objective, the report shows how airborne noise has been reduced as far as reasonably practicable. The mitigation has been assessed as far as reasonably practicable at this stage of the design process and has been shown to result in effects within the scope of those reported in the HS2 ES. As such the report complies with the requirements of planning forum notes 10 and 14.

In addition to the earthworks embedded in the design, the report proposes the following noise mitigation measures as reasonably practicable in the Stoneleigh, Glasshouse Wood, Canley area:

- Noise barrier at 138+150 to 139+375 (downside) @5m (1225 m long);
- Noise barrier at 139+375 to 139+795 (downside) @4m (420 m long);
- Noise barrier at 139+875 to 140+090 (downside) @2m (215 m long);
- Noise barrier at 141+150 to 141+360 (downside) @2m (210 m long);
- Noise barrier at 141+360 to 141+420 (downside) @2.1m (acoustic parapet) (80 m long);
- Noise barrier at 141+420 to 141+650 (downside) @2m (230 m long);
- Noise barrier at 142+475 to 142+630 (downside) @4m (155 m long);
- Noise barrier at 142+630 to 142+675 (downside) @4.1m (acoustic parapet) (45 m long);
- Noise barrier at 142+675 to 142+775 (downside) @4m (100 m long); and
- Trackside earthwork at 142+750 to 143+000 crest height increase (downside) @+2 m (250 m long).

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## Appendix A – LOAEL and SOAEL values from Information Paper E20

Table 47 and Table 48 outline the applicable LOAEL and SOAEL values, and design objectives from Information Paper E20.

Table 47. Noise effect levels for permanent residential buildings from the operation of altered roads and railway

Time of day	Lowest Observed Adverse Effect Level (dB)	Significant Observed Adverse Effect Level (dB)
Day (0700 – 2300)	50 $L_{pAeq, 16hr}$	65 $L_{pAeq, 16hr}$
Night (2300 – 0700)	40 $L_{pAeq, 8hr}$	55 $L_{pAeq, 8hr}$
Night (2300 – 0700)	60 $L_{pAFmax}$ (at the façade, from any nightly noise event)	80 $L_{pAFmax}$ (at the façade, from more than 20 nightly train passbys), or 85 $L_{pAFmax}$ (at the façade, from 20 or fewer nightly train passbys)

Table 48. Noise impact levels for noise sensitive non-residential buildings and external amenity spaces from the operation of altered roads and railway

Examples	Day 0700 - 2300	Night 2300 - 0700
Large and small auditoria; concert halls; sound recording & broadcast studios; and theatres	60 $L_{pAFmax}$ 50 $L_{pAeq, 16hr}$	60 $L_{pAFmax}$ 50 $L_{pAeq, 8hr}$
Places of meeting for religious worship; courts; cinemas; lecture theatres; museums; and small auditoria or halls	50 $L_{pAeq, 16hr}$	n/a
Schools; colleges; hospitals; hotels; and libraries	50 $L_{pAeq, 16hr}$	45 $L_{pAeq, 8hr}$
Offices and external amenity spaces	55 $L_{pAeq, 16hr}$	n/a

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## Appendix B – Detailed Technical Methodology

### Airborne Noise from the Operational Railway

Rail noise modelling has been undertaken using the NoiseMap software package. This implements the airborne noise calculation methodology (commonly referred to as the Train Noise Prediction Model (TNPM)). This validated methodology has been used for the HS2 Environmental Statement and, prior to that, the detailed design of the Channel Tunnel Rail Link (HS1). The method to predict airborne sound from operation has modelled the propagation including the following effects: topography, ground type, reflections, shielding by barriers and buildings, air absorption, and meteorology.

The TNPM methodology allows for sources of varying heights to be put onto the same track segments. Figure 29 shows the heights of the five sources defined as distances above rail. The source terms which have been used for each of these source contributions are set out in Appendix C.

Figure 29. Train noise sources



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The speed dependence relationships for each of the above sources, in terms of SEL, which is used to predict  $L_{pAeq,T}$  at the receptors, are:

- $R_{SEL} + 20\log_{10}V$  for rolling sound;
- $B_{SEL} + 60\log_{10}V$  for body aerodynamic sound;
- $S_{SEL} - 10\log_{10}V$  for starting sound ( $V < 250$  kph); and
- $P_{SEL} + 60\log_{10}V$  for pantograph and pantograph recess sound.

where  $R_{SEL}$  is the source term for rolling sound,  $B_{SEL}$  is the source term for body aerodynamic sound,  $S_{SEL}$  is the source term for starting sound and  $P_{SEL}$  is the source term for pantograph and pantograph recess sound and  $V$  is the train speed in kph.  $S_{SEL}$  is not applicable for predictions of airborne noise when train speeds are 250 kph or above.

The speed dependence relationships for each of the above sources, in terms of  $L_{pAFmax}$  are:

- $R_{LpAF,max} + 30\log_{10}V$  for rolling sound;
- $B_{LpAF,max} + 70\log_{10}V$  for body aerodynamic sound;
- $S_{LpAF,max}$  for starting sound; and
- $P_{LpAF,max} + 70\log_{10}V$  for pantograph and pantograph recess sound.

where  $R_{LpAF,max}$  is the source term for rolling maximum sound,  $B_{LpAF,max}$  is the source term for body aerodynamic maximum sound,  $S_{LpAF,max}$  is the source term for starting sound and  $P_{LpAF,max}$  is the source term for pantograph and pantograph recess maximum sound and  $V$  is the train speed in kph.

To account for the differing source heights resulting in different distance attenuation, ground absorption and shielding the calculations for propagation from source to receptors have been undertaken for each source individually for both  $L_{pAeq,T}$  and  $L_{pAF,max}$  calculations.  $L_{pAeq,T}$  will be logarithmically summed at the receptor location to provide a single figure value and  $L_{pAF,max}$  will be summed in accordance with Equation 1 at the receptor location to provide a single figure value.

$$L_{pAFmax} = \text{MAX} [ (R_{LpAF,max} \oplus B_{LpAF,max} \oplus S_{LpAF,max}), (R_{LpAF,max} \oplus P_{LpAF,max} \oplus S_{LpAF,max}) ] \text{ (Equation 1)}$$

Where  $\oplus$  is the symbol for logarithmical addition of values.

Predictions of airborne sound take into account the acoustic performance of civil engineering assets, trackwork and trains throughout the life of the operational railway with a maintenance programme agreed with HS2 and thereby account for all reasonably foreseeable circumstances in accordance with HS2 Information Paper E20.

Predictions of airborne sound from existing conventional railways unaltered by the proposed scheme and construction railways have been made in accordance with the technical memorandum the Calculation of Railway Noise (CRN), the CRN Supplement 1 and the AEAT supplementary sources terms. This will include source terms and rolling noise corrections as specified by the CRN methodology.

### Airborne Noise from Altered Roads

Airborne noise from altered roads has been calculated in accordance with the methodology set out in the Calculation of Road Traffic Noise (CRTN) and assessed in accordance with the updated procedure in the Design Manual for Roads and Bridges (DMRB).

When there have been no significant changes since the ES study, results from road noise calculations from roads altered by the scheme presented for the ES have been utilised. This data will be updated as further information comes available.

### Noise levels used in the assessment

The baseline (Do-Nothing) noise level is the  $L_{pAeq}$  for the daytime or night-time as reported in the CFA report of the ES and amended by the APs/SESSs.

There are three values for the noise level due to HS2 traffic: the daytime  $L_{pAeq}$ , the night-time  $L_{pAeq}$  and the  $L_{pAFmax}$ . The daytime  $L_{pAeq}$  is a combination of noise from the HS2 trains calculated using NoiseMap for the daytime service pattern and source terms, added to the noise from the daytime  $L_{pAeq}$  for altered links at a receptor. A similar calculation is carried out for night-time  $L_{pAeq}$  values using a combination of night-time  $L_{pAeq}$  for the HS2 trains combined with the night-time  $L_{pAeq}$  for altered links. The  $L_{pAFmax}$  traffic noise is the maximum  $L_{pAFmax}$  for the night-time service pattern for the HS2 sources using the same methodology as set out in the ES. The daytime/ night-time HS2 traffic  $L_{pAeq}$  and the  $L_{pAFmax}$  for residential receptors are compared with the respective LOAEL and SOAEL values for dwellings as set out in Information Paper E20, Control of airborne noise from altered roads and the operational railway and which are also set out in Appendix A.

Do-Something levels are the noise levels with HS2. There are three values for Do-Something: the daytime  $L_{pAeq}$ , the night-time  $L_{pAeq}$  and the  $L_{pAFmax}$ . The daytime  $L_{pAeq}$  is a combination of the daytime Do-Nothing  $L_{pAeq}$  less the associated daytime  $L_{pAeq}$  contribution from the links that are to be altered, the daytime  $L_{pAeq}$  from the trains, and the daytime  $L_{pAeq}$  from the altered links. The night-time Do-Something level is calculated in a similar way but using the night-time levels in each case. The Do-Something  $L_{pAFmax}$  is the same as the HS2 traffic  $L_{pAFmax}$ . The correction applied when the scheme modifies a link, involving the subtraction of the noise that would be altered



by HS2 is done so as not to double count the sound associated with the link on its new and existing alignment.

For the ES cases, the values used in calculations for Do-Nothing, HS2 traffic and Do-Something are as reported in the CFA report of the ES updated where appropriate by the APs or SESs. For the proposed design, noise from the HS2 trains is calculated using NoiseMap for the daytime service pattern in Table 50 and source terms given in Table 51. In both cases where receptors have multiple assessment heights, the maximum value corresponding to HS2 traffic is used in the subsequent analysis.

### Classification of impact

The Do-Something noise levels are compared with the Do-Nothing noise levels for the daytime and night-time. These differences are classified as major, minor, moderate, negligible, or beneficial as set out in Table 49. The number of major, moderate and minor impacts are reported in **Error! Reference source not found..**

Table 49. Classification of noise impacts

Do-Something less Do-Nothing	Impact classification
10 dB or more	Major
5 dB to 9.9 dB	Moderate
3 dB to 4.9 dB	Minor
0 dB to 2.9 dB	Negligible
<0 dB	Beneficial

On a precautionary basis the design exercise has considered mitigation for all receptors that would be exposed to noise at or above LOAEL (not just above LOAEL) with calculations carried out to the nearest 0.1 dB. The summary tables set out within the associated section for the different assessment areas for the Design and ES comparison present noise levels rounded to the nearest 1dB as presented in the Community Forum Area reports for consistency and assessment locations are highlighted only when the unrounded levels are equal to, or exceed LOAEL.

### Relevant U&As

When considering candidate mitigation any U&As setting out required noise levels, mitigation types or heights etc. are also considered and over-ride any barrier height reduction that could otherwise be achieved through noise control that is identified as reasonably practicable by considering the monetary benefit of noise reduction compared to cost and other factors.

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### Non-residential receptors

The noise impact on non-residential receptors is calculated and reported. When the HS2 traffic noise exceeds the noise impact level professional judgement is used to determine if a new significant adverse effect arises, and includes factors such as whether a significant adverse effect was reported at the time of the ES and SES and the baseline noise level at the receptor.

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## Appendix C – Assumptions

### Rail modelling assumptions

The HS2 rolling stock and service pattern is made up of two train fleets:

- Phase 1 fleet will be made up of Conventional Compatible (CC) trains that can run on both the High Speed and the classic rail network, and
- Phase 2b fleet will be made up of Captive (CP) trains that are dedicated to the High Speed network.

The one-way train service pattern data is summarised in Table 50 and train source data in Table 51, normalised to 200 m long trains.

Table 50. Train flow data

Scheme	Train	Daytime Flow, 16h 07:00 – 23:00	Night-time Flow, 8h 23:00 – 07:00
Phase 1 Year 15 Flows	CC (360kph)	22	1
	CC (330kph)	191	12
	CP (360kph)	22	1
	CP (330kph)	222	13

Table 51. Train source data

Source	SEL dB at 25m		L <sub>pAFmax</sub> dB at 25m	
	Conventional Compatible train	Captive train	Conventional Compatible train	Captive train
Rolling	92	92	89	89
Body Aerodynamic	92	90	89	87
Start-up / Power	74	74	73	73
Pantograph Well	n/a	n/a	n/a	n/a
Raised Pantograph	76	76	78	78

Note: Sound emissions from each train running at 320 kph on assumed HS2 infrastructure, expressed in terms of the SEL and L<sub>pAFmax</sub> 25 m from nearest track and 3.5m above ground

Where swing nose crossovers were envisaged in the ES, no correction to the rolling sound source term was applied. For other crossovers a correction factor of +2.5 dB defined in CRN was applied to the affected track segments when predicting airborne noise from the railway.

A +1 dB correction has been applied to track sections on viaducts.

### Noise from porous portals

Train sources (rail/wheel interface, body aerodynamic, start-up, and pantograph) will continue to produce noise while within a tunnel/ porous portal and some of this will be transmitted into the community through the openings on the roof of the porous portal and at the open end of the porous portal. Noise contribution from these sources has been considered by retaining the track length within the porous portals with a 10 dB attenuation and positioning the source at the top of the porous portal. This is the same assumption as was made at the time of the ES.

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## Appendix D – Calculation results at all receptors

Table 52 and Table 53 show the predicted  $L_{pAeq}$  noise levels for the daytime and night-time, and predicted  $L_{pAFmax}$  noise levels respectively. The information in these tables is similar to the results presented within the main body of the report except that noise levels in this appendix are reported for all assessment locations as opposed to only for assessment locations where LOAEL is exceeded.

Table 52. Noise level summary of the Design compared to the ES Design – all levels are  $L_{pAeq,T}$  (all receptor locations)

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
192269	Fennyland Lane, Kenilworth	R	49	46	37	43	35	47	38	46	38	48	39	44	37	47	38
192269	Crackley Hall School, Coventry Road, Kenilworth, (School)	G4	1	46	37	43	35	47	38	46	38	48	39	44	37	47	38
192312	Arborfields Close, Kenilworth	R	6	47	35	49	39	51	41	55	45	55	45	50	40	50	40
192456	Laneham Place, Kenilworth	R	33	62	50	46	37	62	50	51	43	62	51	49	41	62	50
196840	Coventry Road, Kenilworth	R	8	62	50	57	49	63	51	62	54	65	54	58	50	63	51
196895	Crackley Crescent, Kenilworth	R	9	60	52	49	40	60	53	56	47	62	53	50	41	60	52
196951	Coventry Road, Kenilworth	R	4	56	44	49	40	57	45	55	46	58	48	52	44	57	45
196951	Crackley Crescent, Kenilworth (General Commercial)	G5	1	56	44	51	43	57	46	55	46	58	48	52	44	57	45
197068	Coventry Road, Kenilworth	R	14	52	44	43	34	53	44	48	39	53	45	45	36	53	45
197103	Coventry Road, Kenilworth	R	13	56	44	46	38	56	45	50	41	57	46	48	40	56	45
197201	Crackley Lane, Stoneleigh	R	1	41	35	42	33	45	37	45	36	46	38	44	35	45	38
197360	Coventry Road, Kenilworth	R	22	52	44	42	33	52	44	46	37	53	45	43	34	53	44
197431	Coventry Road, Kenilworth	R	18	52	44	43	35	53	44	48	40	53	45	46	38	53	45
197505	Woodland Road, Kenilworth	R	11	55	45	45	37	55	45	49	41	56	46	47	39	55	45
197545	Woodland Road, Kenilworth	R	12	55	45	47	40	55	46	50	42	56	46	48	40	55	45
197585	Woodland Road, Kenilworth	R	14	47	37	46	39	48	39	50	41	50	41	47	39	49	39
197625	Woodland Road, Kenilworth	R	20	59	54	43	35	59	54	48	39	59	54	45	37	59	54
197735	Woodland Road, Kenilworth	R	22	52	42	43	35	52	43	48	40	53	43	46	38	53	43
197879	Common Lane, Kenilworth	R	30	51	46	43	35	52	46	47	39	52	46	45	37	52	46
198097	Moss Grove, Kenilworth	R	20	59	54	42	35	59	54	46	38	59	54	44	37	59	54
198215	Crackley Lane, Kenilworth (Club)	G5	2	41	35	41	32	44	37	44	36	45	38	43	34	44	37
198215	Crackley Lane, Kenilworth	R	2	41	35	41	32	44	37	44	36	45	38	43	34	44	37
198730	Cryfield Grange Road, Kenilworth	R	1	43	36	52	43	52	43	52	43	53	44	52	43	53	44
198773	Cryfield Grange Road, Kenilworth	R	2	43	36	48	39	49	40	49	40	49	41	49	40	49	41
199042	Redthorne Grove, Kenilworth	R	5	47	35	49	39	51	41	53	43	53	43	49	39	49	39

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
216927	Kenilworth Road, Coventry	R	3	59	55	46	38	59	55	48	40	59	55	48	40	59	55
217392	Kenilworth Road, Coventry	R	4	64	60	54	46	64	60	56	47	64	60	56	47	64	60
217535	Fairway Rise, Kenilworth	R	53	47	38	45	38	48	39	47	39	49	40	46	39	48	40
217784	Grovehurst Park, Kenilworth	R	12	55	45	52	44	54	44	54	46	55	46	54	45	55	45
217994	East Gate, Stoneleigh Park	R	3	50	40	53	45	54	45	57	47	57	47	53	43	53	43
218196	National Agricultural Centre, (General Commercial)	G5	10	42	31	50	40	50	40	52	43	52	43	48	39	48	39
218483	Stoneleigh Abbey, Stoneleigh Park	R	2	49	44	48	40	50	45	47	40	50	45	47	39	50	44
218483	Stoneleigh Abbey, Stoneleigh Park (Office)	G5	3	49	44	48	40	50	45	47	40	50	45	47	39	50	44
218718	National Agricultural Centre, Stoneleigh Park	R	2	47	42	47	38	50	43	49	41	51	44	47	39	50	43
218718	National Agricultural Centre, Stoneleigh Park (Office)	G5	11	47	42	47	38	50	43	49	41	51	44	47	39	50	43
218718	Stoneleigh Park Lodge Hotel, Stoneleigh Park (Hotel)	G5	1	47	42	47	38	50	43	49	41	51	44	47	39	50	43
218885	National Agricultural Centre, Stoneleigh Park (Office)	G5	2	42	31	59	49	59	49	60	51	60	51	58	48	58	48
219122	National Agricultural Centre, Stoneleigh Park (Office)	G5	2	43	32	60	50	60	50	61	51	61	51	57	47	57	47
219122	Federation House, National Agricultural Centre (General Commercial)	G5	1	43	32	60	50	60	50	61	51	61	51	57	47	57	47
219394	National Agricultural Centre, Stoneleigh Park (Ambulance Station)	G4	1	50	40	55	46	56	46	59	50	59	50	54	45	55	45
219703	Vicarage Road, Stoneleigh	R	12	48	39	49	41	50	41	50	42	51	42	50	42	51	42
219791	Walkers Orchard, Stoneleigh	R	11	48	39	48	40	49	40	49	41	50	41	49	41	50	41
219942	Birmingham Road, Stoneleigh	R	32	55	46	46	39	55	47	47	39	55	46	47	39	55	46
219942	Stoneleigh Village Hall, Birmingham Road (Hall)	G3	1	55	46	46	39	55	47	47	39	55	46	47	39	55	46
220565	Stareton, Kenilworth	R	3	48	37	46	38	49	38	46	38	49	39	46	38	49	39
220606	Stareton, Kenilworth	R	8	52	41	51	43	54	43	52	44	54	44	52	44	54	44
220714	Abbey Park, Stareton	R	4	47	36	46	36	47	36	45	37	48	38	45	37	48	38
220714	The Management Suite, Abbey Park (General Commercial)	G5	2	47	36	46	38	47	38	45	37	48	38	45	37	48	38

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Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
220714	Abbey Park, Stareton (General Commercial)	G5	10	47	36	46	38	47	38	45	37	48	38	45	37	48	38
221156	Church Lane, Stoneleigh	R	13	47	46	45	37	48	46	47	39	49	46	47	39	49	46
221156	(church)	G3	1	47	46	45	37	48	46	47	39	49	46	47	39	49	46
222373	Crew Lane, Kenilworth	R	1	50	43	48	41	51	44	47	40	51	43	47	40	51	43
222393	Dalehouse Lane, Stoneleigh	R	6	52	43	48	40	53	44	51	42	54	45	49	41	53	44
222401	Common Lane, Kenilworth	R	56	49	44	41	33	50	44	43	35	50	44	42	34	50	44
222401	Common Lane, Kenilworth (General Commercial)	G5	2	49	44	41	33	50	44	43	35	50	44	42	34	50	44
223457	Frythe Close, Kenilworth	R	10	42	33	46	37	46	37	48	39	48	39	47	37	47	37
223467	Cotton Drive, Kenilworth	R	48	49	44	42	34	50	44	44	36	50	44	44	35	50	44
223467	Dalehouse Lane Industrial Estate (General Commercial)	G5	5	49	44	42	34	50	44	44	36	50	44	44	35	50	44
223712	Lulworth Park, Kenilworth	R	46	59	54	41	33	59	54	44	36	59	54	43	35	59	54
223712	Clifden Grove, Kenilworth (Office)	G5	1	59	54	41	33	59	54	44	36	59	54	43	35	59	54
223946	Lulworth Park, Kenilworth	R	18	59	54	45	37	59	54	47	39	59	54	46	38	59	54
225929	Coventry Road, Kenilworth	R	1	51	42	54	45	55	45	55	47	56	47	55	46	56	47
225955	Coventry Road, Kenilworth	R	1	51	42	53	44	55	45	56	47	57	48	56	47	57	48
225955	Millburn Grange, Coventry Road (General Commercial)	G5	1	51	42	53	44	55	45	56	47	57	48	56	47	57	48
226073	Dalehouse Lane, Kenilworth	R	1	45	36	59	50	59	50	67	58	67	58	62	53	62	53
226073	The Dalehouse, Dalehouse Lane (General Commercial)	G5	2	45	36	59	50	59	50	67	58	67	58	62	53	62	53
226171	Inchbrook Road, Kenilworth	R	7	48	44	49	41	51	45	51	42	52	46	51	42	52	46
226203	Highland Road, Kenilworth	R	10	46	35	47	39	49	39	50	41	51	41	49	40	50	40
226248	Highland Road, Kenilworth	R	7	51	42	48	40	52	43	50	42	53	44	49	41	53	43
226301	Highland Road, Kenilworth	R	10	51	42	45	37	52	42	48	40	53	43	47	39	52	43
226442	Highland Road, Kenilworth	R	17	46	35	46	38	49	38	49	40	50	40	49	40	50	40
226501	Highland Road, Kenilworth	R	20	48	44	48	40	50	44	50	42	52	45	50	41	51	45
226630	Inchbrook Road, Kenilworth	R	10	48	44	48	40	50	45	50	41	52	45	50	41	51	45
226786	Inchbrook Road, Kenilworth	R	25	46	35	46	38	48	38	48	39	49	39	48	39	49	39
226786	Common Lane Industrial Estate (General Commercial)	G5	10	46	35	46	38	48	38	48	39	49	39	48	39	49	39
226941	Highland Road, Kenilworth	R	18	46	35	44	37	47	37	47	38	48	38	46	37	48	37

HS2 Ltd C08 7 - Accepted

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
226941	Common Lane Industrial Estate (General Commercial)	G5	1	46	35	44	37	47	37	47	38	48	38	46	37	48	37
227153	Butler Close, Kenilworth	R	13	55	40	44	36	55	40	47	39	56	42	46	38	55	41
227215	Whitehead Drive, Kenilworth	R	9	50	35	48	38	51	38	50	41	52	41	49	39	52	39
227238	Best Avenue, Kenilworth	R	12	50	35	47	38	51	38	49	40	52	40	48	39	52	39
227277	Garlick Drive, Kenilworth	R	35	49	44	44	36	50	44	46	38	50	45	45	37	50	44
227277	Common Lane Industrial Estate (General Commercial)	G5	1	49	44	44	36	50	44	46	38	50	45	45	37	50	44
227360	Stoneleigh Road, Coventry	R	10	56	52	43	35	56	52	45	37	56	52	45	37	56	52
227387	Beverly Drive, Coventry	R	5	58	54	41	33	58	54	44	36	58	54	44	36	58	54
227431	Beverly Drive, Coventry	R	2	58	54	44	37	58	54	46	38	58	54	46	38	58	54
227513	Kenilworth Road, Coventry	R	4	64	60	43	34	64	60	45	37	64	60	45	37	64	60
227545	Beverly Drive, Coventry	R	2	63	59	43	35	63	59	45	37	63	59	45	37	63	59
228223	Cryfield Grange Road, Coventry	R	8	45	36	44	36	47	37	46	38	48	39	46	38	48	39
228321	Cryfield Grange Road, Coventry	R	6	47	40	48	39	49	41	50	41	51	43	50	41	51	43
228690	Beverly Drive, Coventry	R	4	55	51	44	37	55	51	46	38	55	51	46	38	55	51
228744	Kenilworth Road, Coventry	R	4	64	60	47	39	64	60	50	42	64	60	50	42	64	60
228816	Stoneleigh Abbey, Kenilworth	R	18	48	43	45	38	48	43	47	39	49	43	46	39	49	43
228816	Stoneleigh Chapel, Stoneleigh (Chapel)	G3	1	48	43	45	38	48	43	47	39	49	43	46	39	49	43
229009	Crew Lane, Kenilworth	R	1	60	53	56	48	60	53	54	47	60	53	54	47	60	53
229016	Crew Lane, Kenilworth	R	6	60	53	58	51	61	54	57	49	60	53	57	49	60	53
229071	Stoneleigh Road, Coventry	R	1	54	45	44	37	55	45	47	39	54	45	47	39	54	45
229088	Dalehouse Lane, Kenilworth	R	2	52	43	59	49	59	49	63	54	63	54	63	54	63	54
229176	Dalehouse Lane, Kenilworth	R	3	63	56	61	52	64	57	60	51	64	57	60	51	64	57
229186	Dalehouse Lane, Kenilworth	R	5	60	51	47	40	61	51	49	41	60	51	49	41	60	51
229212	Dalehouse Lane, Kenilworth	R	2	60	51	51	43	61	51	52	44	60	51	52	44	60	51
229259	Dalehouse Lane, Kenilworth	R	1	60	51	50	43	60	51	52	44	60	51	52	44	60	51
229478	Stoneleigh Road, Coventry	R	19	48	44	43	36	48	44	45	38	49	44	45	38	49	44
229767	Little Cryfield, Coventry	R	22	46	34	43	35	48	36	45	37	48	37	45	37	48	37
229973	Motslow Hill, Stoneleigh	R	2	48	39	44	36	49	40	47	39	50	41	47	39	50	41
230115	The Cunnery, Kenilworth	R	19	47	42	46	39	48	43	47	39	48	43	46	38	48	42
700638	Princes Drive Industrial Estate, (General Commercial)	G5	13	45	37	45	36	48	39	48	39	49	41	46	37	48	39

HS2 Ltd C08 1- Accepted

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)		ES Design Proposed Scheme only		ES Design Do Something ***		No Mitigation Proposed Scheme only		No Mitigation Do Something ***		The Design Proposed Scheme only		The Design Do Something ***	
ID	Area represented	Type of receptor	Number of impacts	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB	Day* dB	Night** dB
700639	Princes Drive Industrial Estate, (General Commercial)	G5	17	47	39	44	35	48	40	48	39	50	41	45	37	49	40
701080	Vicarage Road, Stoneleigh	R	17	47	46	43	36	47	46	44	36	48	46	44	36	48	46
701080	Vicarage Road, Stoneleigh (Club)	G5	1	47	46	43	36	47	46	44	36	48	46	44	36	48	46
711043	East Gate, Stoneleigh Park	R	2	50	40	56	47	57	48	62	52	62	52	56	46	56	46

\* Day denotes L<sub>pAeq,07:00-23:00</sub>

\*\* Night denotes L<sub>pAeq,23:00-07:00</sub>

\*\*\* The Do something level (Opening year baseline + Year 15 traffic) has been corrected so as to not double count the sound associated with the road or railway on its new and existing alignment

HS2 Ltd Code 1- Accepted

Table 53. Noise level summary of the Design compared to the ES Design - all levels are L<sub>pAFmax</sub> (all receptor locations)

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L <sub>pAFmax</sub> dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB
192269	Fennyland Lane, Kenilworth	R	49	41	54	62	54
192269	Crackley Hall School, Coventry Road, Kenilworth, (School)	G4	1	41	54	62	54
192312	Arborfields Close, Kenilworth	R	6	49	62	75	63
192456	Laneham Place, Kenilworth	R	33	67	60	69	60
196840	Coventry Road, Kenilworth	R	8	67	67	80	68
196895	Crackley Crescent, Kenilworth	R	9	64	65	76	65
196951	Coventry Road, Kenilworth	R	4	58	62	75	63
196951	Crackley Crescent, Kenilworth (General Commercial)	G5	1	58	62	75	63
197068	Coventry Road, Kenilworth	R	14	65	58	66	58
197103	Coventry Road, Kenilworth	R	13	58	59	66	60
197201	Crackley Lane, Stoneleigh	R	1	42	59	60	59
197360	Coventry Road, Kenilworth	R	22	65	58	66	57
197431	Coventry Road, Kenilworth	R	18	65	56	65	56
197505	Woodland Road, Kenilworth	R	11	62	58	67	58
197545	Woodland Road, Kenilworth	R	12	62	58	70	58
197585	Woodland Road, Kenilworth	R	14	55	58	69	57
197625	Woodland Road, Kenilworth	R	20	62	57	65	57
197735	Woodland Road, Kenilworth	R	22	56	57	65	57
197879	Common Lane, Kenilworth	R	30	59	56	64	55
198097	Moss Grove, Kenilworth	R	20	62	54	63	54
198215	Crackley Lane, Kenilworth (Club)	G5	2	42	59	62	56
198215	Crackley Lane, Kenilworth	R	2	42	59	62	56
198730	Cryfield Grange Road, Kenilworth	R	1	46	68	71	71
198773	Cryfield Grange Road, Kenilworth	R	2	46	66	67	67
199042	Redthorne Grove, Kenilworth	R	5	49	60	73	61
216927	Kenilworth Road, Coventry	R	3	60	62	65	65
217392	Kenilworth Road, Coventry	R	4	60	69	75	75
217535	Fairway Rise, Kenilworth	R	53	50	61	65	58
217784	Grovehurst Park, Kenilworth	R	12	60	56	58	57
217994	East Gate, Stoneleigh Park	R	3	58	68	72	65
218196	National Agricultural Centre, (General Commercial)	G5	10	38	65	66	61
218483	Stoneleigh Abbey, Stoneleigh Park	R	2	50	58	58	58
218483	Stoneleigh Abbey, Stoneleigh Park (Office)	G5	3	50	58	58	58
218718	National Agricultural Centre, Stoneleigh Park	R	2	52	60	62	60
218718	National Agricultural Centre, Stoneleigh Park (Office)	G5	11	52	60	62	60
218718	Stoneleigh Park Lodge Hotel, Stoneleigh Park (Hotel)	G5	1	52	60	62	60
218885	National Agricultural Centre, Stoneleigh Park (Office)	G5	2	43	74	75	73
219122	National Agricultural Centre, Stoneleigh Park (Office)	G5	2	40	73	76	72
219122	Federation House, National Agricultural Centre (General Commercial)	G5	1	40	73	76	72
219394	National Agricultural Centre, Stoneleigh Park (Ambulance Station)	G4	1	58	70	75	68
219703	Vicarage Road, Stoneleigh	R	12	50	64	69	69
219791	Walkers Orchard, Stoneleigh	R	11	50	62	67	67
219942	Birmingham Road, Stoneleigh	R	32	60	60	62	62
219942	Stoneleigh Village Hall, Birmingham Road (Hall)	G3	1	60	60	62	62
220565	Stareton, Kenilworth	R	3	40	57	57	57
220606	Stareton, Kenilworth	R	8	48	63	64	64
220714	Abbey Park, Stareton	R	4	43	55	59	59
220714	The Management Suite, Abbey Park (General Commercial)	G5	2	43	55	59	59
220714	Abbey Park, Stareton (General Commercial)	G5	10	43	55	59	59
221156	Church Lane, Stoneleigh	R	13	48	60	65	65

HS2 Ltd Content - Accepted

Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L <sub>pAFmax</sub> dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB
221156	(church)	G3	1	48	60	65	65
222373	Crew Lane, Kenilworth	R	1	53	57	59	57
222393	Dalehouse Lane, Stoneleigh	R	6	55	73	71	63
222401	Common Lane, Kenilworth	R	56	50	59	61	55
222401	Common Lane, Kenilworth (General Commercial)	G5	2	50	59	61	55
223457	Frythe Close, Kenilworth	R	10	48	64	68	61
223467	Cotton Drive, Kenilworth	R	48	50	57	60	57
223467	Dalehouse Lane Industrial Estate (General Commercial)	G5	5	50	57	60	57
223712	Lulworth Park, Kenilworth	R	46	57	58	60	56
223712	Clifden Grove, Kenilworth (Office)	G5	1	57	58	60	56
223946	Lulworth Park, Kenilworth	R	18	57	66	65	59
225929	Coventry Road, Kenilworth	R	1	46	68	70	68
225955	Coventry Road, Kenilworth	R	1	46	67	71	71
225955	Millburn Grange, Coventry Road (General Commercial)	G5	1	46	67	71	71
226073	Dalehouse Lane, Kenilworth	R	1	48	85	87	79
226073	The Dalehouse, Dalehouse Lane (General Commercial)	G5	2	48	85	87	79
226171	Inchbrook Road, Kenilworth	R	7	55	65	65	65
226203	Highland Road, Kenilworth	R	10	46	62	64	63
226248	Highland Road, Kenilworth	R	7	46	61	65	62
226301	Highland Road, Kenilworth	R	10	46	60	62	61
226442	Highland Road, Kenilworth	R	17	46	63	63	63
226501	Highland Road, Kenilworth	R	20	55	64	64	64
226630	Inchbrook Road, Kenilworth	R	10	55	66	65	63
226786	Inchbrook Road, Kenilworth	R	25	46	62	62	60
226786	Common Lane Industrial Estate (General Commercial)	G5	10	46	62	62	60
226941	Highland Road, Kenilworth	R	18	46	59	61	58
226941	Common Lane Industrial Estate (General Commercial)	G5	1	46	59	61	58
227153	Butler Close, Kenilworth	R	13	51	62	63	60
227215	Whitehead Drive, Kenilworth	R	9	47	72	70	63
227238	Best Avenue, Kenilworth	R	12	47	70	69	62
227277	Garlick Drive, Kenilworth	R	35	50	60	63	59
227277	Common Lane Industrial Estate (General Commercial)	G5	1	50	60	63	59
227360	Stoneleigh Road, Coventry	R	10	54	56	59	59
227387	Beverly Drive, Coventry	R	5	54	56	60	60
227431	Beverly Drive, Coventry	R	2	54	60	63	63
227513	Kenilworth Road, Coventry	R	4	60	59	61	61
227545	Beverly Drive, Coventry	R	2	59	59	63	63
228223	Cryfield Grange Road, Coventry	R	8	46	59	64	64
228321	Cryfield Grange Road, Coventry	R	6	47	63	68	68
228690	Beverly Drive, Coventry	R	4	51	59	62	62
228744	Kenilworth Road, Coventry	R	4	60	64	67	67
228816	Stoneleigh Abbey, Kenilworth	R	18	48	56	57	57
228816	Stoneleigh Chapel, Stoneleigh (Chapel)	G3	1	48	56	57	57
229009	Crew Lane, Kenilworth	R	1	63	59	59	59
229016	Crew Lane, Kenilworth	R	6	63	66	66	65
229071	Stoneleigh Road, Coventry	R	1	57	63	66	66
229088	Dalehouse Lane, Kenilworth	R	2	55	82	83	83
229176	Dalehouse Lane, Kenilworth	R	3	63	71	70	70
229186	Dalehouse Lane, Kenilworth	R	5	63	64	68	68
229212	Dalehouse Lane, Kenilworth	R	2	63	67	67	67
229259	Dalehouse Lane, Kenilworth	R	1	63	63	62	62
229478	Stoneleigh Road, Coventry	R	19	46	57	56	56

HS2 Ltd Code of Practice - Accepted



Assessment location – note: blue shading is used where noise levels in subsequent columns are at or above LOAEL				Do Nothing (Opening year baseline)	ES Design Proposed Scheme only	No Mitigation Proposed Scheme only	The Design Proposed Scheme only
ID	Area represented	Type of receptor	Number of impacts	L <sub>pAFmax</sub> dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB	L <sub>pAFmax</sub> * dB
229767	Little Cryfield, Coventry	R	22	42	61	61	61
229973	Motslow Hill, Stoneleigh	R	2	50	59	64	64
230115	The Cunnery, Kenilworth	R	19	52	56	57	57
700638	Princes Drive Industrial Estate, (General Commercial)	G5	13	58	60	65	59
700639	Princes Drive Industrial Estate, (General Commercial)	G5	17	60	58	64	58
701080	Vicarage Road, Stoneleigh	R	17	48	53	56	56
701080	Vicarage Road, Stoneleigh (Club)	G5	1	48	53	56	56
711043	East Gate, Stoneleigh Park	R	2	58	74	78	70

\* denotes L<sub>pAFmax</sub> in the 'Proposed Scheme only' column; the value is always for the HS2 conventional compatible train (CC)

HS2 Ltd Code 1- Accepted