Biodiversity Loss in the Chilterns AONB

AN EXAMINATION OF THE HS2 BIODIVERSITY CALCULATIONS - PART 1

Great Missenden - Haul Road Construction

DR JIM CONBOY, C.PHYS, M.INST PHYS

Table of Contents

*

1.1 Introduction

The Wildlife Trusts recently published a study of the biodiversity calculations[1] for HS2 phase 1, which HS2 claim shows 'No Net [overall] Loss'.[2] The WT report found that the biodiversity of existing habitats was underestimated, while the biodiversity of the newly created habitats was overestimated. HS2 also employed an outdated methodology, and many errors were identified.

The Chiltern Society has opposed the construction of HS2 from the outset, and petitioned to have the Chiltern Tunnel extended under the entire width of the AONB. It has kept detailed photographic records of the route[3] starting before construction work commenced, and so is well placed to make a detailed study of the effects of construction and environmental impacts to date. While the mitigation habitats are (in most cases) yet to be planted, some were established during the 'preliminary works' phase and are reported on below.

The AONB affected by construction corresponds to Community Forum Areas (CFAs)[4] 9 (Little Missenden to Leather Lane) and 10 (Leather Lane to Smalldean). This report covers the above ground section in CFA9 - the Chiltern Tunnel North Portal and cuttings, and a case study of the North Portal

1.2 Biodiversity

The biodiversity metric used by HS2 is summarised in appendix 1. It is assumed that various habitat types identified by the plants and trees present can be assigned a weighting and act as a proxy for the total biodiversity of wildlife present, so avoiding the need to count the more mobile elements. Additional factors reflect the connectivity between habitats, habitat condition and (for new habitat) time to completion and difficulty in achieving the claimed condition. In most cases, the HS2 figures have been accepted in this analysis.

While the details of the calculation are not an issue, there are some features which affect the presentation –

---

[1] "Double Jeopardy"- https://www.wildlifetrusts.org/sites/default/files/2023-02/23JAN_HS2_Double_Jeopardy_FINAL01.02.23.pdf
[2] https://data.jncc.gov.uk/data/9578d07b-e018-4c66-9c1b-47110f14df2a/Handbook-Phase1-HabitatSurvey-Revised-2016.pdf
[3] https://chilternsociety.org.uk/hs2-photo-diary/
[4] These were divisions of the route adopted during the 'consultation' phase, prior to the publication of the hybrid bill

- The biodiversity calculations for linear features (i.e. hedges) and polygons (fields, woods…) are incommensurate – they cannot meaningfully be combined.
- Isolated Trees were not considered at all in the HS2 metric; in later metric versions[5], the biodiversity of a tree is calculated from the area of the (nominal) root protection zone

1.2.1   Data

The Geographical Information System (GIS) data is provided in four datasets – Polygons (fields etc) and Lines (Hedges, waterways) before and after HS2 construction. Each dataset covers the entire phase 1 route, but as each element is labelled by CFA, the AONB section (CFAs 9 & 10) can easily be extracted. The record for each element contains the Biodiversity, and all the factors enquired to calculate it.

One surprising omission is any correlations between the four datasets; a post construction area has no indication which pre construction area it forms part of, a hedge fragment has no indication of which pre-construction hedge it is a remnant of, hedges have no reference to any fields they may be dividing. Some of this information must have been available when the post construction biodiversity was calculated, but does not appear in the datasets. It can be determined for individual elements by inspecting the maps, but an automated comparison of pre and post construction parameters for the same polygons (for example) is not possible.

1.2.2   Representation

Although there are around 100 habitat types defined in the metric, only 30 are present in the AONB. Six existing and three 'new' habitats account for over 90% of the calculated biodiversity, and a comparison of the area and biodiversity of these habitats gives a good indication of the changes anticipated during construction.

For each individual feature (field, wood …) the HS2 GIS dataset gives the habitat type, the area (in hectares), various additional factors and the overall biodiversity(in Biodiversity Units, BU) . From these, the total area and total biodiversity for a given habitat type in a region (such as a CFA) can be calculated by summing the individual areas, from which the mean biodiversity (BU/ha) can be derived. A plot showing the mean biodiversity against area for each habitat type has the convenient property that the size of each rectangle is proportional to the biodiversity contributed by that habitat, so providing an overview of how the

---

[5] E.g. Natural England Biodiversity Metric 4

different habitats contribute to the total biodiversity. See figure CFA9 1b below for an example.

2 CFA 9

CFA9 starts with the Chiltern Tunnel North Portal after which the line continues in cuttings to the Leather Lane overbridge, which marks the boundary with CFA10.The cutting is spanned by an overbridge for footpath GMI/12 and an accommodation bridge for Havenfields house. 95% of the pre-construction habitat is arable or grassland, with a small amount of high biodiversity broad leaved woodland.

Habitat type	Habitat ID	Pre Construction			Post Construction				
		# areas	Hectares	Bio Units	# areas	Hectares	% of Pre	Bio Units	% of Pre
Poor semi-improved grassland	37	41	1.66	13.28	*98*	*8.9*	*538%*	*78.4*	*590%*
Cultivated/disturbed land - arable	149	26	54.92	109.83	62	33.9	62%	67.7	62%
Neutral grassland - semi-improved	29	14	17.21	110.87	*33*	*10.0*	*58%*	*29.8*	*27%*
Improved grassland	33	36	24.59	49.18	79	11.2	46%	22.4	46%
Broadleaved woodland - semi-natural	4	16	2.67	70.98	*30*	*1.3*	*50%*	*13.7*	*19%*
Other Habitat		56	5.83	26.64	129	5.7	98%	9.6	36%
Preserved					**270**	**50.8**	**48%**	**99.8**	**26%**
Total		**189**	**106.9**	**380.8**	**431**	**71.1**	**67%**	**221.6**	**58%**
K2.4 - Landscape mitigation planting	182				41	21.1		142.4	
K2.3 - Grassland habitat creation	181				4	3.6		41.0	
K2.6 - Grassed areas	184				56	1.5		10.1	
Total					**532**	**97.3**	**91%**	**415.2**	**109%**

CFA9 T1 Pre and post construction areas and biodiversity
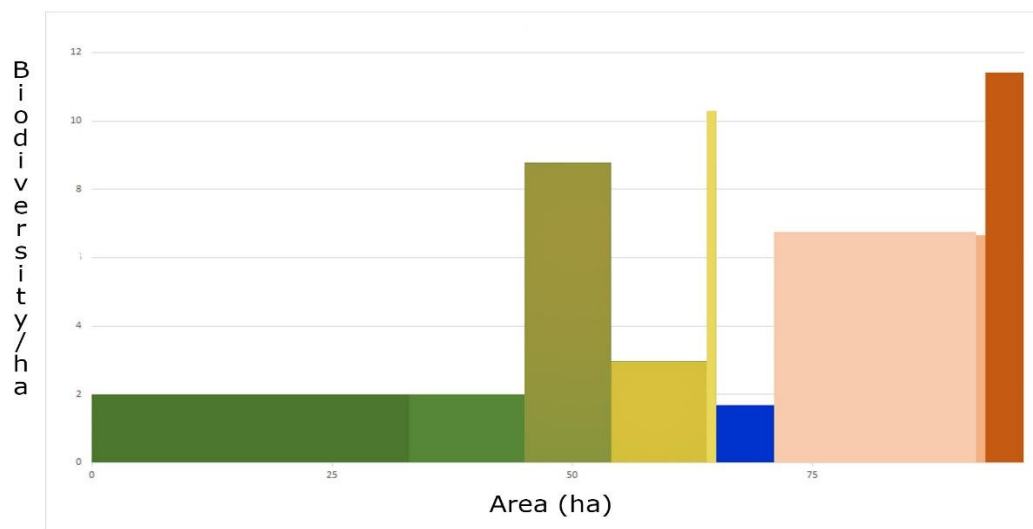
Table 1 above shows the area and biodiversity of the 5 major pre-existing habitats and the 3 main newly created habitats. The fragmentation of the landscape is immediately apparent – the number of distinct areas having increased from 189 to 532.

2.1 Habitat Areas – Pre and Post construction
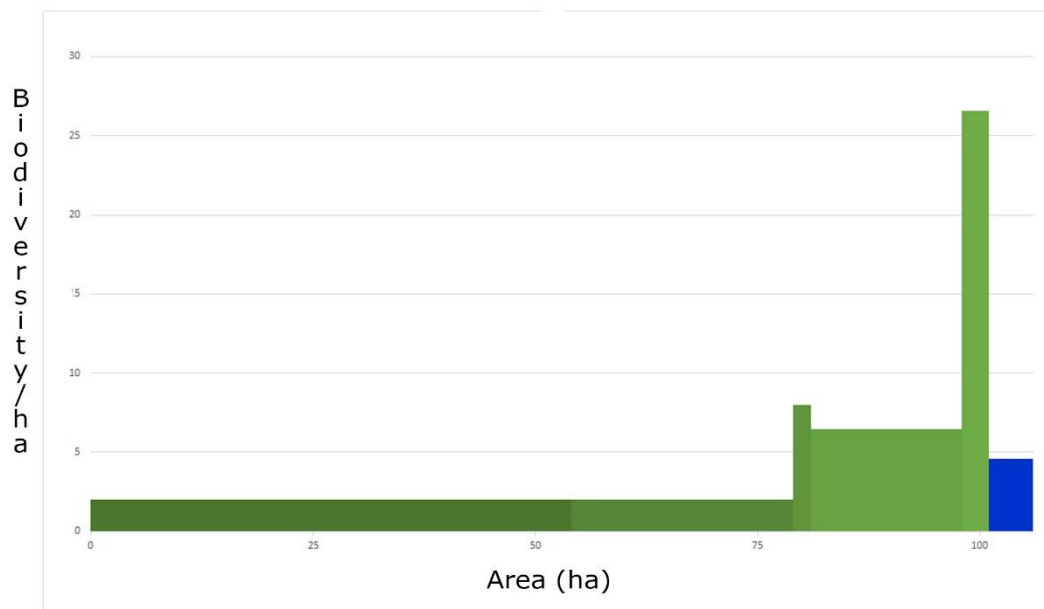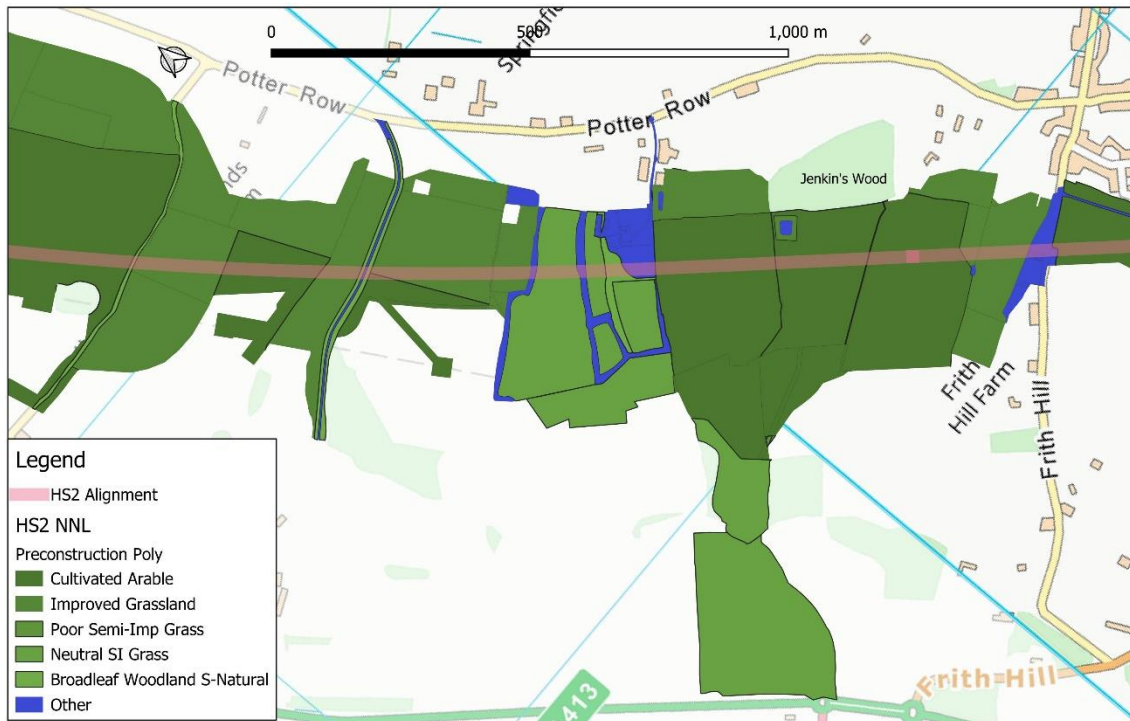
CFA9 1a) Pre Construction Habitat map and b) Biodiversity ratios
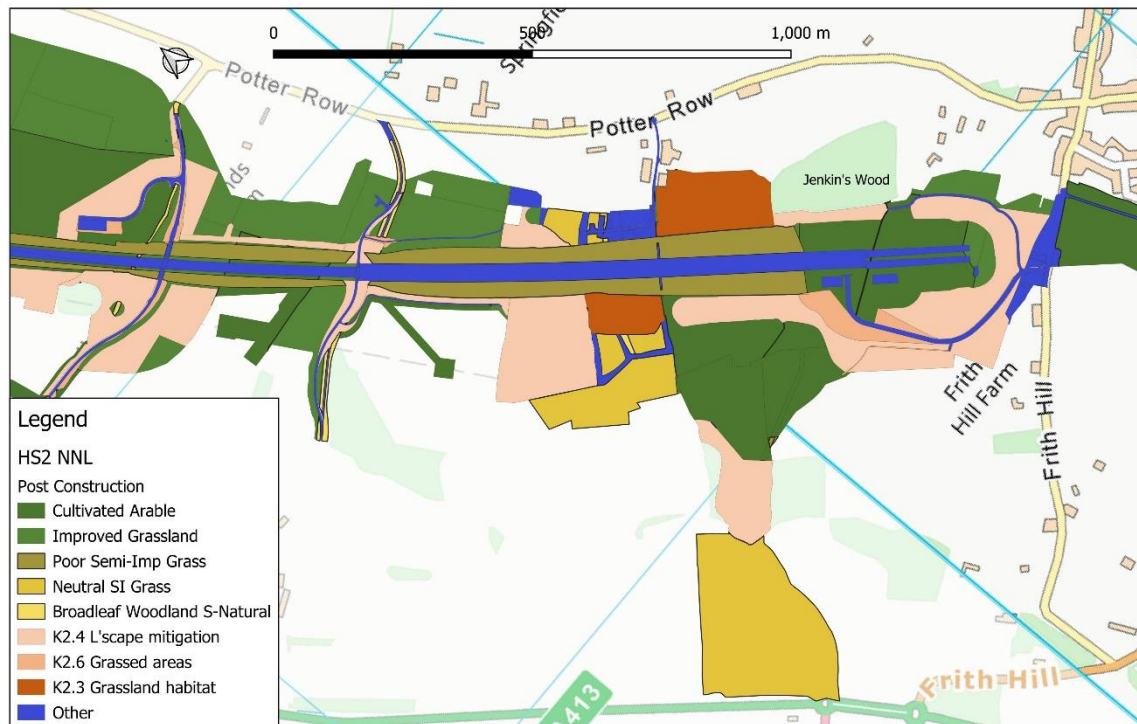
**CFA9 2a) Post Construction Habitat map and
b) Biodiversity ratios**

At first sight, it would appear that 70 ha of the original habitat and 58% of biodiversity is retained after construction. However, all post-construction areas of semi-improved grassland ('SIG', ID = 37, 29) have an associated 'time to completion' (TTC) of 5 years, as does all but one area of broadleaf woodland – which would imply that they are actually newly created habitats - not remaining pre-construction habitats - of that type. While the cutting slopes (ID 37, poor SIG) are clearly newly created, some areas of ID 29 (neutral SIG) might in part be retained original habitat[6] – which suggests that the TTC factor was added to all habitats of these two types, rather than by considering each area individually.

Broadleaf Woodland presents further problems – some areas having been assigned to the incorrect CFA[7], and some being less than 10 sq m in size – small for a woodland and invisible on the map. The two significant areas actually in CFA9 formed part of a wide hedge (now removed) beside Mulberry house, and so will need restoring.

These habitats are shown in yellow shades in the post-construction plots, to show the extent of reconstructed habitat and distinguish them from pre-construction habitats assigned to the same category.

The reduced amount of original habitat (after excluding IDs 4, 29 & 37) is shown in the 'preserved' row of table 1 – 50.8 ha and 99.8 Biodiversity units, 26% of the pre-construction value.

This biodiversity loss is compensated by 26 ha of new habitat, characterised by (claims of) a high biodiversity/ha. At the time of writing, the destruction of existing habitat is nearing completion, while the new habitat has yet to be started, leading to a current biodiversity loss of 75%, which is likely to remain for a decade or so.

One exception to the reduction in pre-construction habitat area is a 5 fold increase in Poor Semi-improved Grassland post construction. Pre-construction, this high biodiversity category was assigned to the field boundary strips, with small total area. Post construction, the (much larger) cutting slopes have been assigned to this category. This (mis)assignment is discussed in more detail in section 3 (North Portal), as is the status of some Neutral Semi-improved grassland areas.

---

[6] Small parts of the original field beside the A413 still remain
[7] For example, the remains of Grims Ditch in CFA10 are labelled CFA9

2.2 Difficulty and Time to Completion
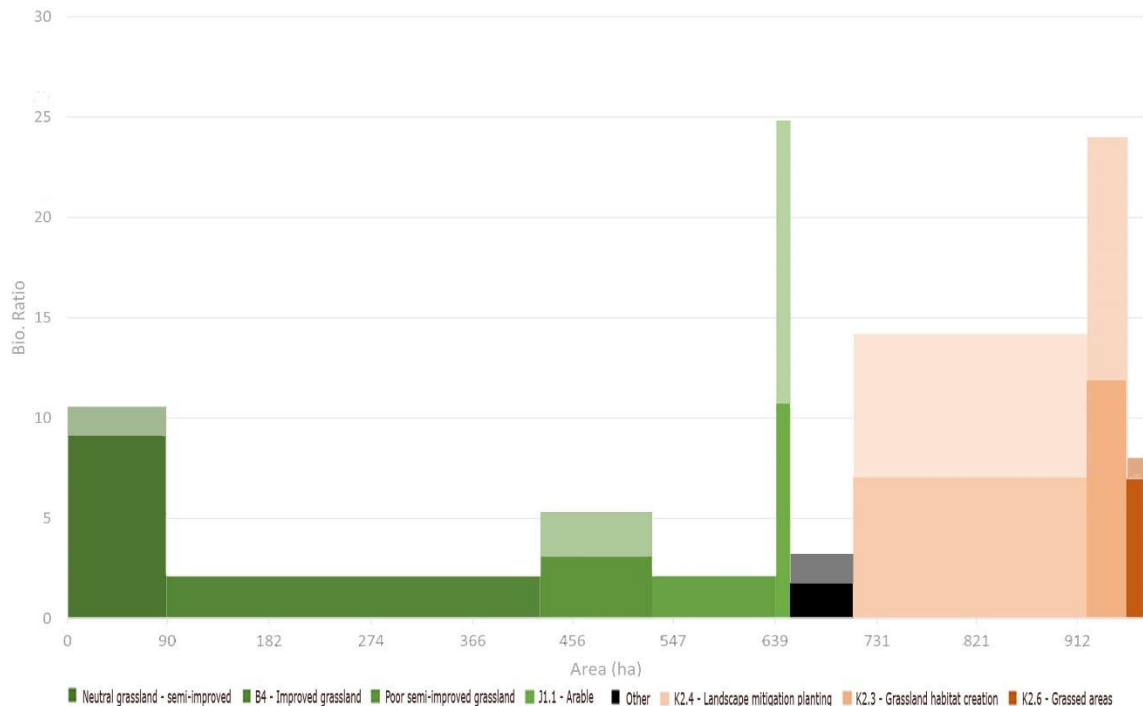
CFA9 3 Biodiversity ratios, with and without Time to Completion & difficulty factors

Figure CFA9-4 shows the Biodiversity ratio plot for the CFA9 habitat types, as calculated by the metric (lower), and without the difficulty and time to completion factors (upper, fainter) plot. Table CFA9-5 below shows the Biodiversity units in each category *before* application of the two correction factors – the total CFA9 biodiversity before these corrections is 688 units, 165% of the calculated post construction figure and 180% of the pre-construction biodiversity.

Biodiversity Units		Difficulty
Time to Completion	Low,1.	Medium, 0.66
1.0	101.3	0.0
0.83 (5yr)	106.6	53.7
0.71 (10yr)	0.0	397.9
0.58 (15yr)	0.0	3.8
0.33 (30+ yr)	0.0	24.8

CFA9-5 Biodiversity totals, before application of Time to Completion and difficulty factors. Only low and medium difficulty are used in CFA9

This suggests that in 10 years' time, if all goes to plan, the biodiversity in CFA9 will have increased by 80% from the pre-construction values, despite being divided in two by a high speed rail line . This (rather unlikely) outcome is largely due to the high biodiversity ratios assigned to newly created habitats and the areas adjacent to the track. As these new habitats have close to zero biodiversity at present, leaving only 220 B.Us (Table CFA9-3), a threefold increase is required to meet this target. Only time will tell if this can be achieved.

The difficulty and TTC factors are discussed further in Appx 1. It would seem that in this case, they have reduced an improbably high target condition to produce a modest overall improvement in biodiversity. *Were the target biodiversity factors chosen with this outcome in mind* ?

2.3 Hedges

Hedgerow parameters for CFA9, from the GIS data:

		Pre Construction			
	ID	No	km	k Bio Units	Bio Ratio
Hedge with trees - species-poor	163	21	2.00	11.03	5.5
Intact hedge - species-poor	157	40	1.92	9.33	4.9
Hedges	154	24	1.22	9.68	8.0
Hedge with trees - native species-rich	162	7	0.73	3.72	5.1
K2.5 - Hedgerow habitat creation	183	0			
Defunct hedge - species-poor	160	5	0.60	2.65	4.4
Intact hedge - native species-rich	156	5	0.39	2.13	5.5
Sum		102	6.46	36.40	5.6

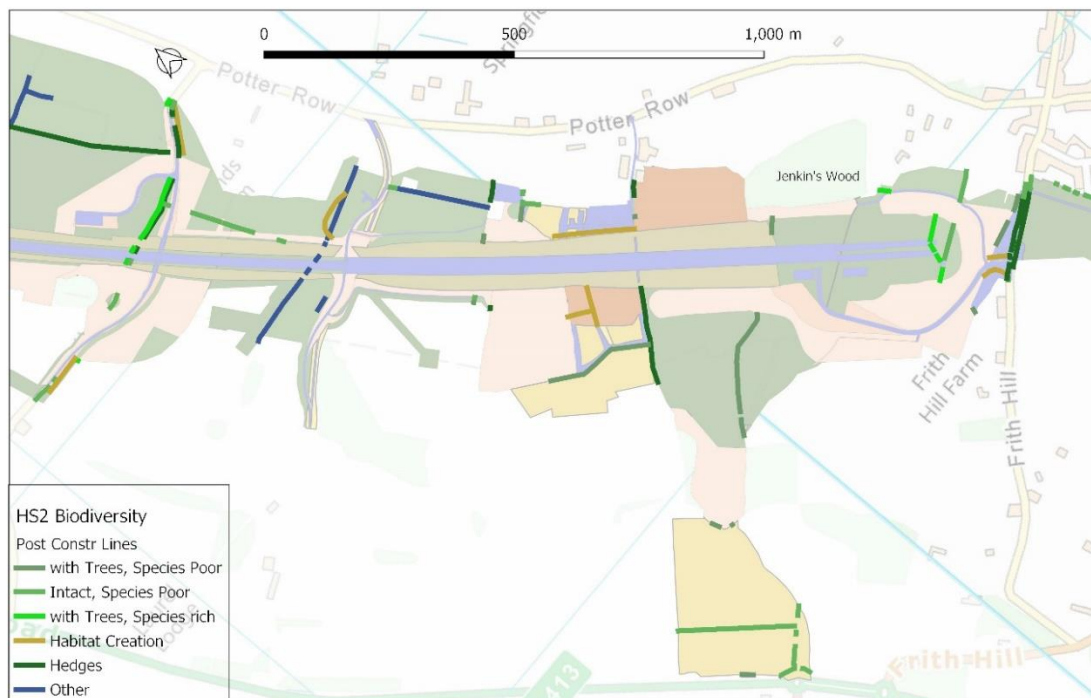|		Post Construction					
	ID	No	km	%Len	Bio Units	%BU	Bio Ratio
Hedge with trees - species-poor	163	18	0.66	33%	3.85	35%	5.9
Intact hedge - species-poor	157	49	1.05	55%	4.75	51%	4.5
Hedges	154	19	0.74	61%	4.23	44%	5.7
Hedge with trees - native species-rich	162	13	0.28	39%	1.53	41%	5.4
K2.5 - Hedgerow habitat creation	183	10	0.66		3.59		5.4
Defunct hedge - species-poor	160	9	0.51	86%	2.46	93%	4.8
Intact hedge - native species-rich	156	5	0.39	100%	2.27	106%	5.9
Sum		123	4.29	66%	22.69	62%	5.3

CFA9 4 Hedge types, lengths and Biodiversity. Post construction, %Len and %BU are the percentages of pre-construction parameters for that habitat type.

Fragmentation of the habitat is again apparent, with the average length declining from 63m to 35m. 2.2km (33%) of hedge length is lost, as is 38% of biodiversity. Biodiversity/m is much the same for different hedge types, between 4 and 6, with the exception of pre-construction 'hedges'. It is unclear what characterises 'hedges' to produce this result, but all are rated condition 3, and 2/3rds (by length) with high connectivity.

All post construction hedges are assigned a maximum habitat condition (3), to be achieved in 10 years, giving a biodiversity factor of 3x0.71 = 2.13. 80% of pre-construction hedges have condition 2, and the length weighted average condition is 2.17 – much the same factor. *The measures to be taken to improve hedge conditions over 10 years are unspecified*; this looks more like a workaround for failing to correlate hedge condition before and after construction, for the remnants of pre-existing hedges.
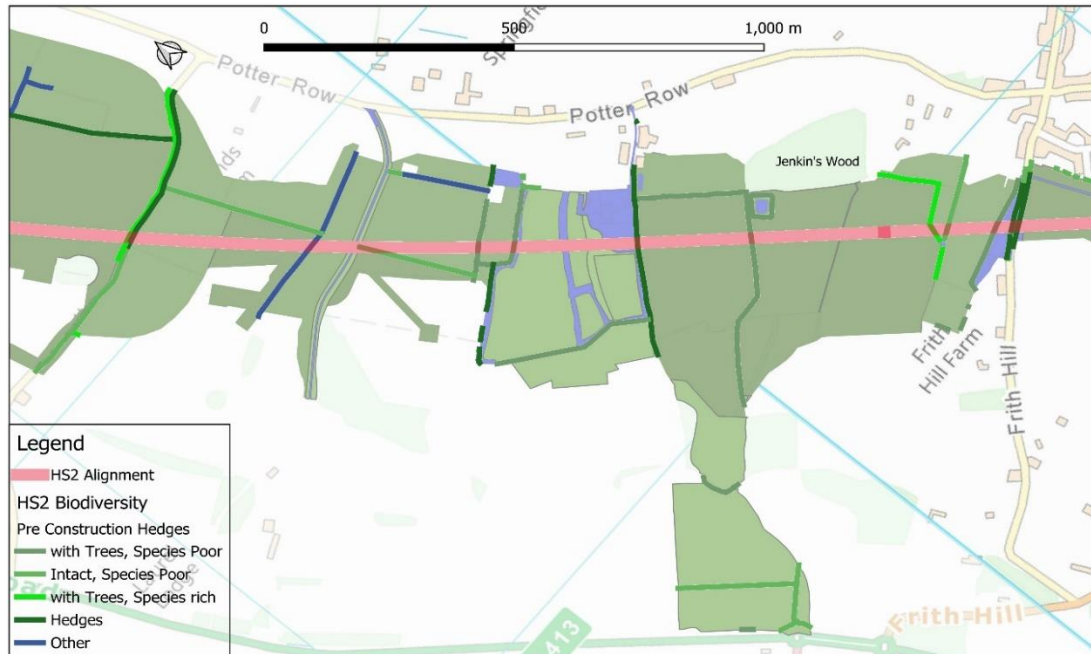
CFA9 5 Pre-construction hedges

CFA9 6 Post construction hedges

Figures CFA9 5 & 6 show hedges pre and post construction overlaying the corresponding landscape habitats. *The fragmentation resulting from construction is again evident*. It is also clear that several post-construction hedges, particularly around the tunnel portal, would never remain – and many have already disappeared. This is investigated in some detail, in the North Portal case study.

2.4 Trees and Water Features

The HS2 biodiversity metric ignores the existence of trees, so they are not recorded in the GIS datasets, but the impact on trees is also considered in the NP study.

One pond (to the SW of Jenkins Wood) has been filled in , with a loss of 0.75 biodiversity units. Otherwise, water features are not a significant factor in the biodiversity of CFA9.

3 Chiltern Tunnel, North Portal

January 2023

The Chiltern Tunnel North Portal lies just to the NW of South Heath, between Frith Hill and (the route of) footpath GMI/12. This was previously an area of farmland, divided up by well established hedges. This report analyses the biodiversity before and after construction in the area surrounding the portal, and the 'haul road' from the portal to the A413 roundabout at Great Missenden – about 35ha in all.

In the proposal considered by the hybrid bill committee, this area was to be the portal of the South Heath cut and cover ('green') tunnel, while the Chiltern Tunnel emerged in Mantle's Wood. The deep cuttings and 'green' tunnel would have affected three areas of ancient woodland. However, a well organised (and expensive) campaign funded by local residents persuaded the committee to extend the Chiltern Tunnel as far as South Heath – one of very few major changes to the original design to result from the select committee hearings. While this was an improvement, the portal is still adjacent to South Heath and close to houses on Potter Row, and to Jenkins Wood.

3.1 Polygons (or fields)

Table 3 shows the area, and Biodiversity totals, for different habitat types pre and post construction. *One unexpected result is immediately apparent – despite the near total destruction of half the site, the total post construction biodiversity (103+65 BU) is assessed to be 60% higher than that previously existing*.

	Pre-Constr		Post-Constr	
	Ha	BioUnit	Ha	BioUnit
Neutral grassland – semi-improved	8.48	41.06	6.70	14.92
B4 – Improved grassland	6.09	12.17	1.44	2.87
Poor semi-improved grassland	0.28	2.27	2.66	26.42
J1.1 – Arable	20.96	41.93	10.02	20.04
Other	0.50	1.95	1.09	0.83
K2.4 – Landscape mitigation planting			8.84	67.29
K2.3 – Grassland habitat creation			2.50	28.52
K2.6 – Grassed areas			1.07	7.10
Totals (Old)	**36.32**	**99.38**	**21.91**	**65.07**
Totals (New)			**12.41**	**102.90**

**Table NP1 Habitats, pre and post construction**

It is apparent that half of the post construction biodiversity is ascribed to 'new' landscape areas – mitigation planting and habitat creation, which occupy 1/3rd of the total area. How has this destruction apparently led to such a gratifying increase in biodiversity ?

One clue is provided by the 'Biodiversity ratio' plots (NP2 & 3) - It is immediately obvious that the BR of newly created habitat (shown in shades of orange) is considerably higher than that of the pre-existing habitats – with the exception of 'poor semi-improved grassland' with a BR of 8 (pre) or 10 (post) construction. Only arable field boundaries were assigned to this category before construction, so the area (and Biodiversity contribution) are both small. Post-construction, the cutting slopes were added while still retaining the high BR. This is discussed further in the next section.

The high BR assigned to newly created habitat is a result of high distinctiveness, and high habitat condition. It remains to be seen if these objectives are achieved in practice.
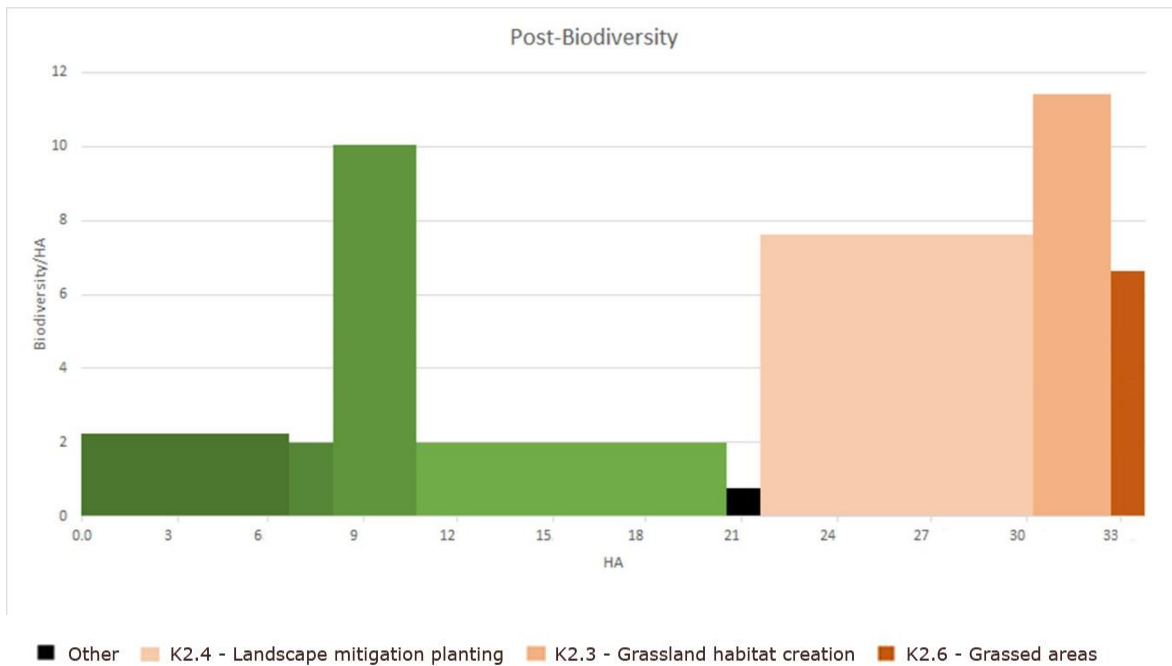
NP2 - Pre-construction – areas by habitat type
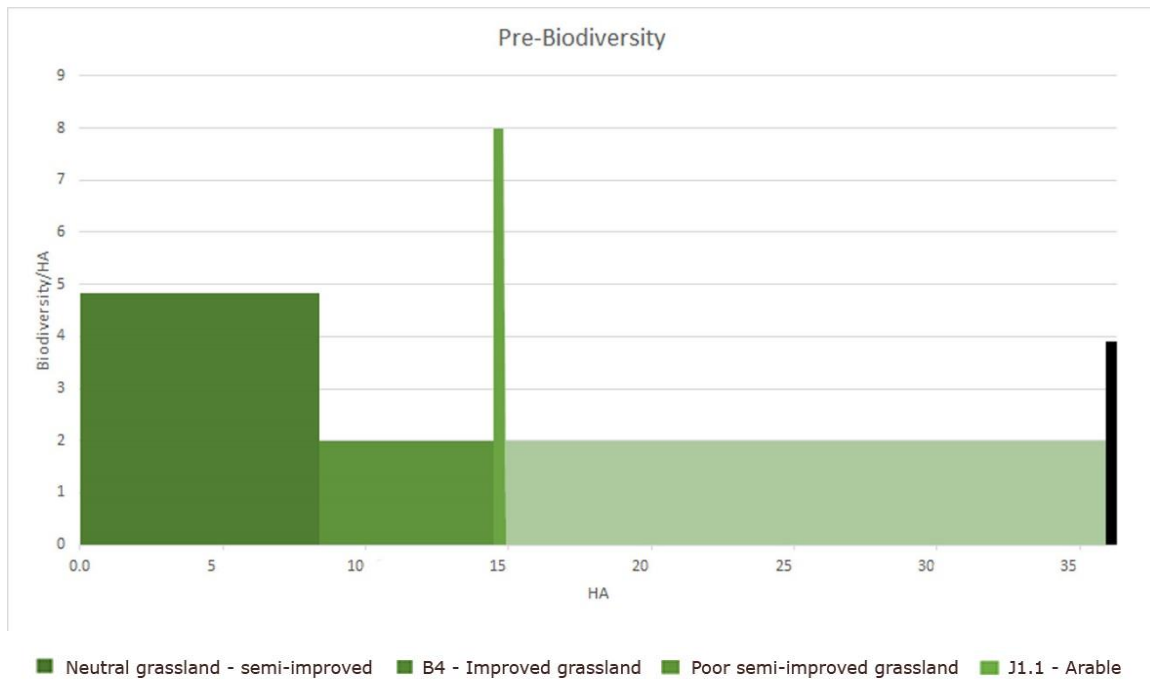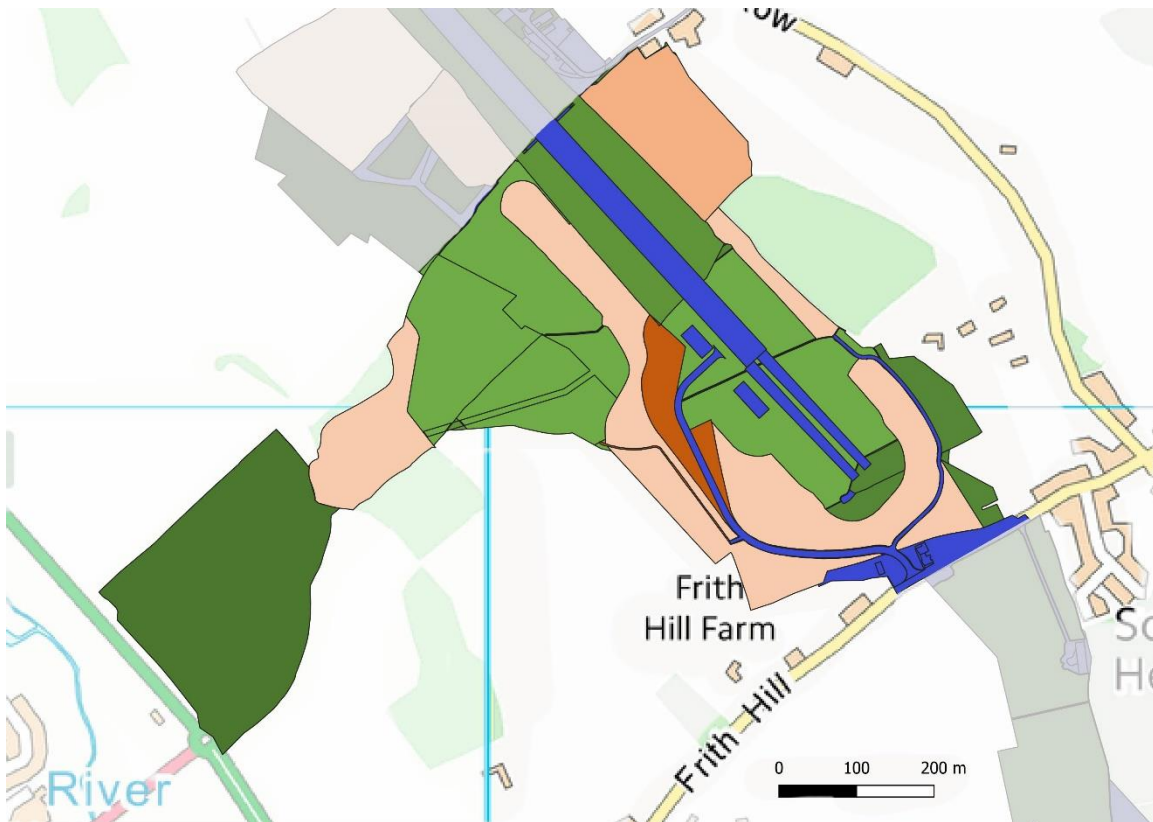
NP3 - Post-construction – areas by habitat type

3.1.1 Track Border

NP 4 Track border (artist's impression)

The quite large areas immediately adjacent to the track were assigned to category 37 – 'poor semi-improved grassland' – with distinctiveness 4, condition 2.

Several factors suggest that this assessment is incorrect –

- These areas lie within the track security fencing, so the 'Environmental position' from the viewpoint of large mammals is much reduced.
- Artists impressions of the bridges (above) suggest that the areas will be plain vanilla grassland, to avoid 'leaves on the line'
- HS2 admit that the line will eliminate barn owls within 1.5 km of the track[8]. Other flying species within these areas are likely to be severely impacted (with fatal results)
- High noise levels and disturbed air will further reduce the attractiveness of this habitat.

Taken together, these suggest that a BR less than the average value would be more appropriate.
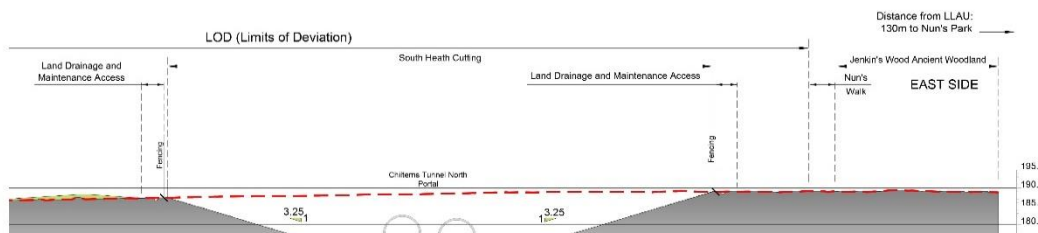
NP 5 Cross-section through the portal, showing position of the security fencing

---

[8] https://www.barnowltrust.org.uk/high-speed-2-barn-owl-trusts-response/

A further anomaly is the *lack of any 'time to completion' assigned to the grassland immediately adjacent to the track* and within the tunnel portal, while the newly created habitat surrounding it has a TTC of 10 years. Excavation of the portal continued through most of 2023, and no habitat has yet been established on the slopes.
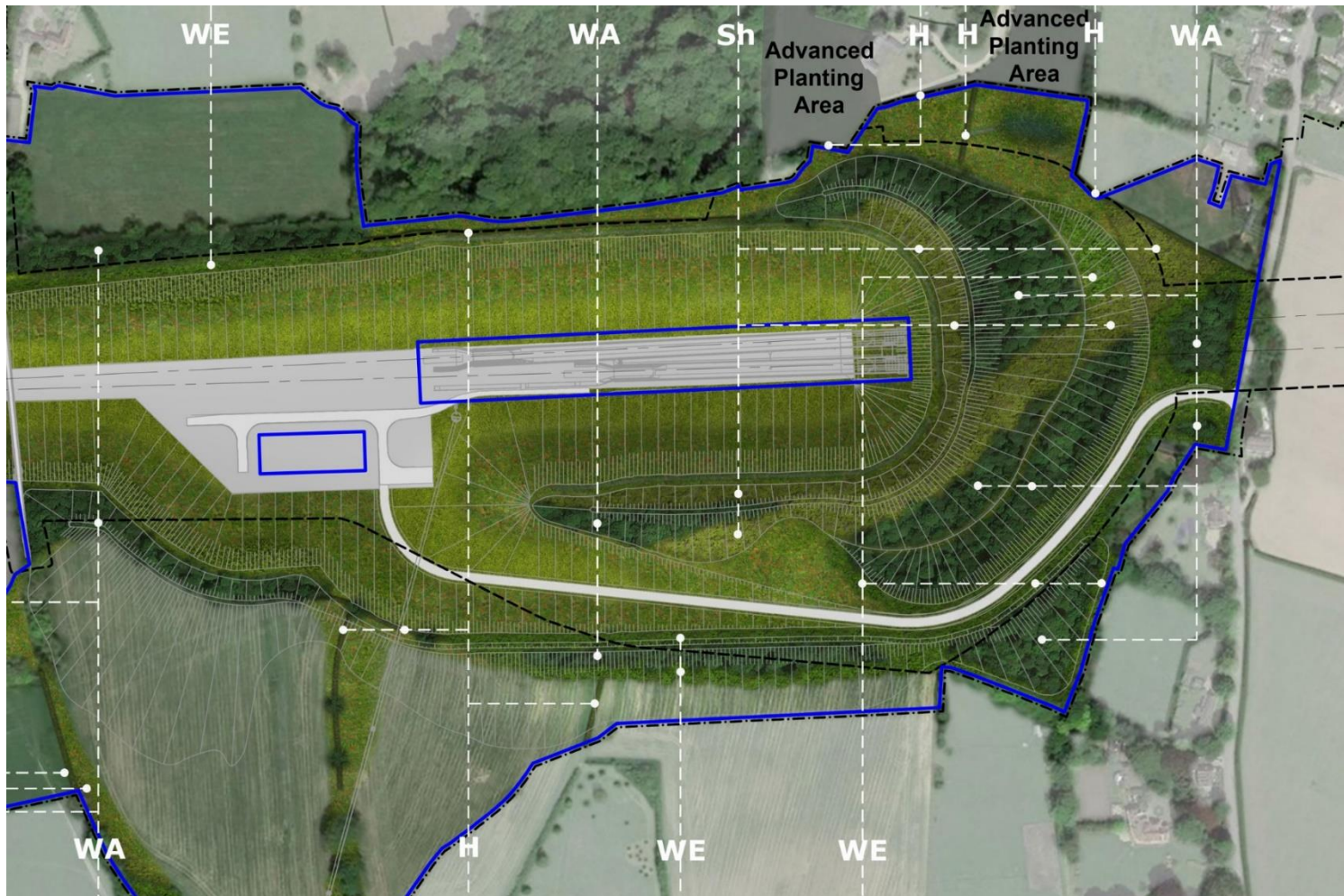
3.2 New Habitats

A schedule 17 application for the construction of the North Portal has been submitted (to Bucks UA) for approval. This includes the planned planting for the area, which is reproduced on the next two pages. While the species to be planted are listed, the relative numbers of each are not, so it is unclear if the result will resemble a typical Chiltern's landscape. An artist's impression of the site[9] was released in connection with the Schedule 17 (planning) application for the North Portal building, which looks rather more like a municipal park than Chiltern 'Beech and Holly' woodland-

NP 6 North Portal (when established)

The HS2 No Net Loss document (3.2.7) states that
"All other compensation in response to the loss of ancient woodland (including losses of plantation on ancient woodland) will be provided through the creation of new woodland habitat targeting at the 'high' distinctiveness category (6 x weighting - i.e. woodland that will aim to meet the criteria to qualify as habitat of principal importance under Section 41 of the Natural Environment and Rural Communities Act, 2006)."

---

[9] https://assets.hs2.org.uk/wp-content/uploads/2023/03/Chiltern-Tunnel-North-Portal-You-said-We-did-Information-Boards-March-2023.pdf

NP7 North Portal Planting plan

from http://www.hs2amersham.org.uk/Resources/Construction/SH_cutting/Sched17_1/HS2-
PLANTING_PLAN__WOODLAND_AND_HEDGEROWS__SHEET_2-4461193.pdf

Woodland Area

- Quercus robur (Oak)
- Fagus sylvatica (Beech)
- Prunus avium (Wild cherry)
- Populus tremula (Aspen)
- Crataegus monogyna (Hawthorn)
- Corylus avellana (Hazel)
- Cornus sanguinea (Dogwood)
- Rosa canina (Dogrose)
- Taxus baccata (Yew)
- Euonymus europaeus (Spindle)
- Pinus sylvestris (Scots pine)
- Sorbus aucuparia (Rowan)
- Acer campestre (Field maple)
- Ilex aquifolium (Holly)
- Betula pendula (Silver birch)
- Prunus spinosa (Blackthorn)
- Juniperus communis (Juniper)

Woodland Edge

- Acer campestre (Field maple
- Betula pendula (Birch
- Corylus avellana (Hazel
- Crataegus monogyna (Hawthorn
- Ilex aquifolium (Holly
- Prunus avium (Wild cherry
- Cornus sanguinea (Dogwood
- Rosa canina (Dog-rose)

Woodland Understory

- Hyacinthoides non-scripta (English bluebell
- Digitalis purpurea (Foxglove
- Lonicera periclymenum (Honeysuckle
- Leucanthemum vulgare (Ox-eye daisy
- Primula vulgaris (Primrose
- Galanthus nivalis (Snowdrop
- Helleborus foetidus (Stinking hellebore
- Anemone nemorosa (Wood anemone
- Stachys officinalis (Wood betony)

Shrub Planting

- Acer campestre (Field maple)
- Ilex aquifolium (Holly)
- Rhamnus cathartica (Buckthorn)
- Blechnum spicant (Deer fern)
- Cornus sanguinea (Dogwood)
- Rosa canina (Dogrose)
- Rubus fruticosa (Bramble)
- Viburnum opulus (Guelder-rose)
- Juniperus communis (Juniper)
- Prunus avium (Wild cherry)
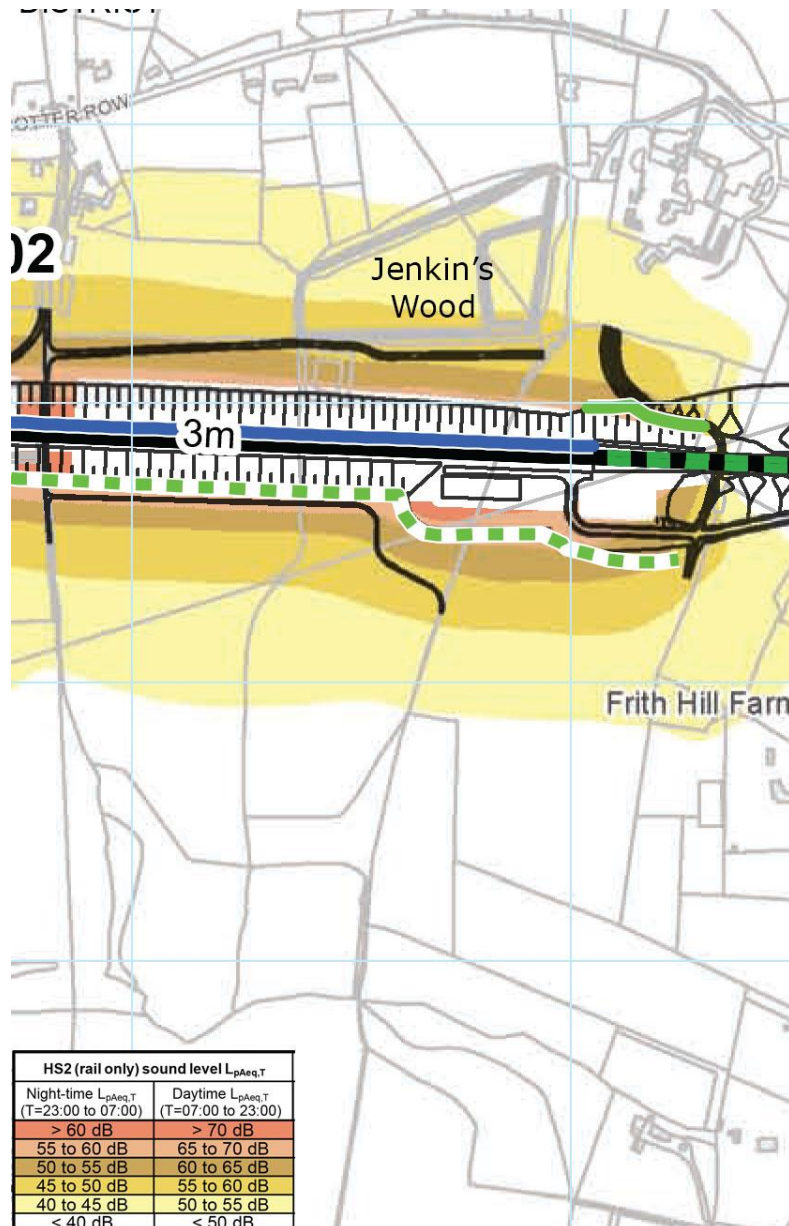- Malus sylvestris (Crab apple)

Hedgerow

- Crataegus monogyna (Hawthorn)
- Corylus avellana (Hazel)
- Rhamnus cathartica (Buckthorn)
- Acer campestre (Field maple)
- Ilex aquifolium (Holly)*
- Rosa canina (Dog-rose)
- Cornus sanguinea (Dogwood)*
- Prunus spinosa (Blackthorn)
- Sambucus nigra (Elder)

Since no such habitat has become established, it is not possible to assess if this aim has or will be achieved. Nor is it clear what criteria are referred to. However, there are some reasons for taking a sceptical view of this ambition.

1. The true biodiversity of an area is measured by the number of species present, of all varieties. Flora based biodiversity metrics take habitat types (which can more easily be assessed and enumerated) as a proxy for the more general biodiversity. Unless the new habitats are sufficiently similar to the typical local habitats, then the more mobile fauna may not be attracted in the expected numbers.
As the relative amounts of each species are not specified, it is not clear if the new planting is intended to reproduce a typical Chilterns landscape.
2. If the new habitats do resemble typical local habitats, it is difficult to see how they can also be significantly more distinctive.
3. Care for the new habitats already created (for example, near Jones Hill Wood) has so far led to poor outcomes.
4. Proximity to the railway line has the potential to negatively impact overall biodiversity -
    i. Restriction of movement due to security fencing
    ii. Disturbance by noise and air movements
    iii. Collisions with trains
    iv. Deliberate dispersal of species (e.g. Badgers) from the area and surroundings during construction

3.3 Peripheral habitats

While the HS2 biodiversity study is confined to areas within the HS2 act limits, the effects of construction may extend over a far wider area. For example, the airborne sound study area extends over 1km from the line. While the 'receptors' within this area which are assessed for noise impact are (mostly residential) buildings, there are many other significant habitats which may be affected in various ways.

HS2 (rail only) sound level $L_{pAeq,T}$	
Night-time $L_{pAeq,T}$ (T=23:00 to 07:00)	Daytime $L_{pAeq,T}$ (T=07:00 to 23:00)
> 60 dB	> 70 dB
55 to 60 dB	65 to 70 dB
50 to 55 dB	60 to 65 dB
45 to 50 dB	55 to 60 dB
40 to 45 dB	50 to 55 dB
< 40 dB	< 50 dB

NP8 Sound Contours surrounding the portal

(from the original Environmental Statement, South Heath cut & cover tunnel portal)

NP 9 – Jenkins Wood

Jenkins Wood is an area of ancient woodland, immediately adjacent to the north portal. Footpath GMI/13 from Potter Row to Gt Missenden (now stopped up) passes through it. The edge of the wood lies in the 60 to 65db noise zone, protected by a 3m high bund. However, this bund will not benefit the mature beech trees, some 30m in height, and noise is likely to have an adverse effect on bird populations. The area to be occupied by the tunnel portal, to the south of the wood, was previously an arable field, separated from the wood by an insubstantial boundary hedge. This would presumably have provided food for small mammals at harvest time, a resource which will no longer be available. The fields to the north side are used as horse pasture, and so are rather less of a resource.

3.3.1   Stocking's Wood

Stocking's wood is 500m to the west of Jenkin's wood, across arable fields and joined by hedges. The two woods were separated by the Gt Missenden haul road in 2018, and more recently by the tunnel portal works. *This is just one example of the separation of habitats, occurring throughout the AONB.* The reduction in connectivity between habitats along the line may result in a further reduction of biodiversity, which has not been taken into account as these areas lie just outside the act limits.

3.4 Hedges

NP10 Hedges – Pre construction

NP 11 Hedges – Post construction

Figure NP10 shows the landscape before construction (from Google Earth, 2017) overlaid with the HS2 pre-construction data for linear features (hedges).

Excavations for the portal extend over 14 ha, leaving no trace of the original landscape, *resulting in a very significant loss of hedgerows*. This is shown in figure NP11, where the post-construction data is superimposed on the Oct 2022 Google Earth data. It was immediately apparent that a significant length of the claimed post construction hedgerow no longer exists; this is shown in red in the figure and described as 'Lost' in the tables below.

Habitat	Pre-construction	Post-Construction	'Lost'	New
J2 – Hedges	550	285	0	0
J2.1.2 – Intact hedge – species-poor	635	434	67	0
J2.3.1 – Hedge with trees – native species-rich	307	0	110	0
J2.3.2 Hedge with trees – species-poor	1596	390	152	0
K2.5 – Hedgerow habitat creation	0	0	0	248
Total	3089	1111	332	252
Percentage	100%	36%	11%	8%

Table NP12a – Hedgerow Loss by length (km)

Habitat	Pre-construction	Post-Construction	'Lost'	New
J2 – Hedges	4.39	1.54	0.00	0.00
J2.1.2 – Intact hedge – species-poor	1.98	1.30	0.29	0.00
J2.3.1 – Hedge with trees – native species-rich	1.23	0.00	0.47	0.00
J2.3.2 Hedge with trees – species-poor	8.59	2.32	0.80	0.00
K2.5 – Hedgerow habitat creation	0.00	0.00	0.00	1.40
Total	16.19	5.16	1.56	1.40
Percentage	100%	32%	10%	9%

Table NP12b – Hedgerow Biodiversity Loss , kBU

As shown in table NP12, of the 3km of hedgerow in the area, just under 1.5km was to have been retained – *but 25% (332m) of this retained hedgerow has already been destroyed*. Only one third of the original hedgerow now remains.

Some hedgerow was 'lost' during the construction of 4 lines of 24 'Barrettes', or concrete columns, between Frith Hill and the portal retaining wall. These were required because the portal is situated in an area of deep clay (adjacent to Potter Row !) which could not support the weight of the tunnel structure. Such discoveries are not unusual, since the Hybrid Bill procedure requires that the initial design be produced before the bill becomes law, without right of access to carry out ground investigations. This contributes to the steadily rising cost of the project, and generally increases the loss of Biodiversity, since unforeseen changes rarely result in any savings.

3.4.1   Hedge 199 – an example

Feature 199 was the hedge linking Stockings and Jenkin's Woods, with a slight kink in the vicinity of an electricity pylon in the middle. It illustrates several problems which emerge, when the NNL calculations are scrutinised carefully.

NP 13 – Hedge 199, Pre construction

Figure NP13 shows an aerial photograph of the hedge before construction above a map (from Google Earth 2017), and the corresponding feature from the HS2 pre construction file. NP14 shows the situation as of 2022

NP 14 Post construction remnants + Google Earth 2022

Hedge 199 – Pre and during construction

	HS2 Assessment				Reassessment			
ID	Condition	Length	Env. Pos	Bio Units	Condition	Length	Env. Pos	Bio Units
199	2	468.4	3	2810.6				
538	3	139.1	3	888.8	2	81	3	345.1
538					2	21	2	59.6
365	3	32.5	3	207.6	2	32.5	3	138.4
78	3	60.2	3	384.4	2	0		0
203	3	28.3	3	180.5	2	0		0
				1661.3				543.1
				59%				19%

Biodiversity Parameters

The table shows the biodiversity assessed by HS2, and a reassessment after correcting for several problems –

- The remnants identified as 78 and 203 no longer exist; it is difficult to see how they might have been expected to survive.

- Feature 538 has been divided by the haul road into two fragments; the short (20m) fragment to the right of the road has been assigned an Environmental position (i.e. connectivity) of 2 as a consequence.
- While the original hedge was assigned a condition of 2, the fragments remaining were assigned 3. In the absence of an explanation of how this improvement was to be achieved, the fragments were reassigned to condition 2.
- The factor of 0.71 for a 10 year 'time to completion' has been retained. It seems unlikely that any significant biodiversity recovery will occur within 10 years of completion of the project, which appears as distant as ever.

While HS2 assessed the post construction biodiversity as 60% of the original amount, our reassessment indicates the remainder to be just 20%. While we would not claim that all HS2 biodiversity estimates are overestimated by a factor of 3, the issues described above are not unique to this hedge. Nor is the portal work area unusually wide; the land take in the AONB is typically of this order to accommodate the haul road and vast spoil dumps.
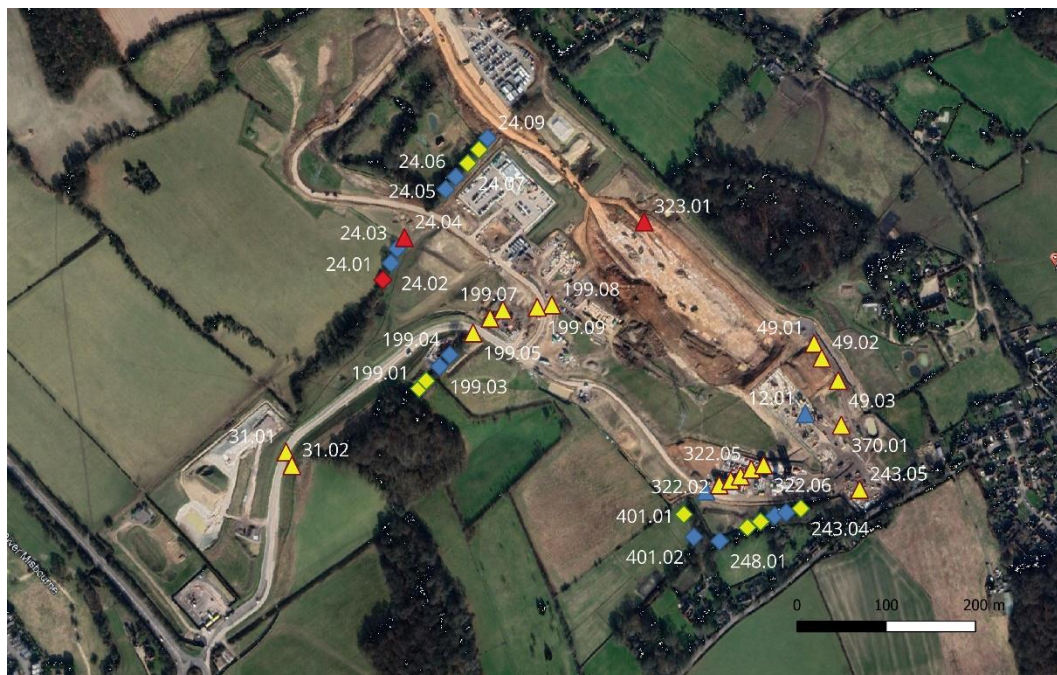

NP 15 - Destruction of Hedge199 – Nov 2019

3.5 - Trees
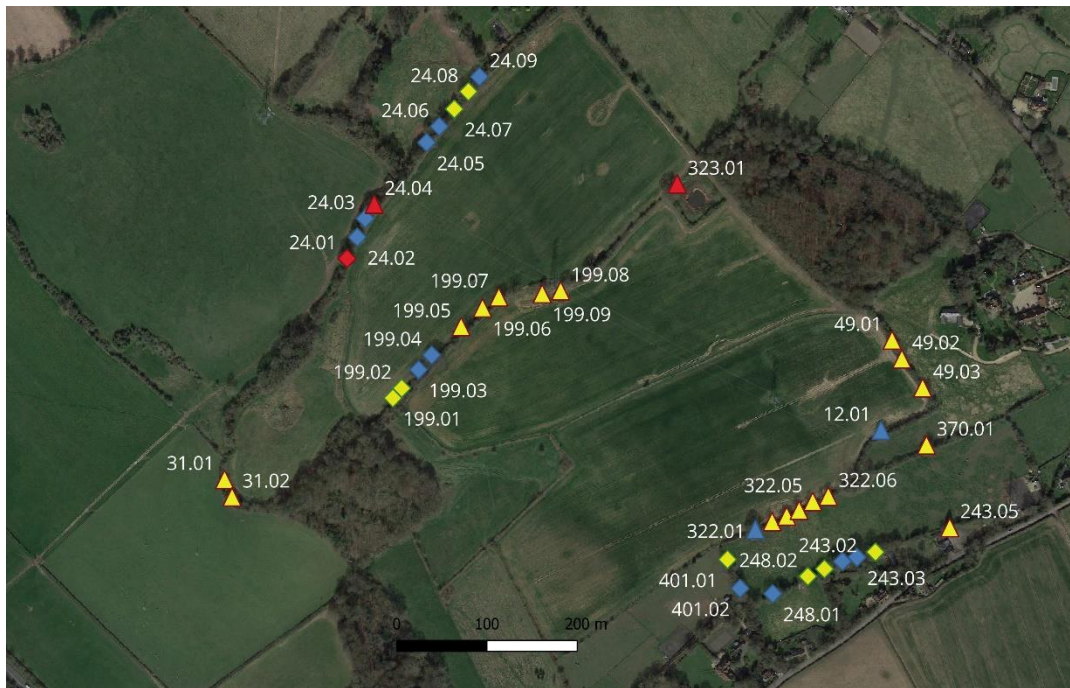
NP16 Trees , pre-construction

NP17 Trees, post construction

Category ◆1 ◆2 ◆3 Lost ▲1 ▲2 ▲3

Tree Biodiversity	Small		Medium		Large		Total		
	#	BU	#	BU	#	BU	#	BU	%
Retained	8	1.05	11	19.32	1	3.67	20	24.04	65%
Lost	17	2.23	2	3.51	2	7.33	21	13.08	35%

Table NP18 – trees retained and lost in each size category, and in total

HS2 had no metric for trees, which played no part in their biodiversity assessment. Here we use the Natural England Metric 4[10] assessment (8.3.8-9), which divides trees into 3 categories, and assigns each tree an area equal to the Root Protection Zone. Since HS2 did not record the presence of trees, they do not appear in the GIS datasets, which may appear to be a major problem. However, the Chiltern Society (and others) have maintained an extensive photographic record of HS2 works in the AONB, and Google Earth can produce 'Satellite' images of the area before construction. These images can be aligned with the GIS data, and the tree positions and sizes shown on the previous page can be determined. Trees have been numbered sequentially, along the pre-construction hedge in which they were found. Biodiversity factors were assigned following the methods described by the Bristol Trees Forum[11] -

- Distinctiveness – medium (2)
- Condition is less easy to assess, as the trees are either inaccessible, or in some cases, felled. Medium and large trees were classified as good (3), since photographic evidence suggests that they satisfy all 6 of the BTF criteria. For small trees this is less clear, and they have been classified as moderate (2).

Tree 'protection' – near Mulberry Park

---

[10] https://naturalengland.blog.gov.uk/2023/03/28/measuring-biodiversity-net-gain-publication-of-biodiversity-metric-4-0/
[11] https://bristoltreeforum.org/2023/04/01/biodiversity-metric-4-0-whats-it-all-about/

This results in a pre-construction biodiversity of 37 BU, increasing the area based biodiversity by 1/3rd . 35% of the tree based contribution has (so far) been lost. The current condition of the remainder is uncertain, as the only indication of Root Protection Zones appears to be newt fencing.

The following sections illustrate the lost large and medium category trees :-

3.5.1 Hedge 24

Trees in hedge 24, pre-construction. Footpath GMI12 runs beside the hedge

Tree 24.04, immediately before, and after felling

Tree 24.01 still remains, while 24.02-04 were felled, to create a gap for the 'haul road' as it loops south around the Mulberry park habitat area.

1.1 3-Feb-2024

3.5.2 Tree 323.01

Oak tree, beside the pond at the edge of Jenkin's Wood.

A loss of 3.7 units ??

Hedge 31, to the west of Stocking's Wood
Removed to make way for the haul road

Frith Hill – showing the two 'medium' trees lost,
322.01 & 12.01. The permanent portal access road leaves
Frith Hill at what was the Weights and Measures car park

3.6 Summary

3.6.1 Fields

The preconstruction biodiversity is assessed at 99.4 units for 36 Ha. Post construction this increases to 65 units for retained areas and 103 units for new habitat, 168 units in all, an increase of 69%. The 12Ha of new habitat contributes 102.9 BU, slightly more than the entire 36.3 Ha of original habitat.

As there is no new habitat available for inspection, it is not clear if the claimed levels of distinctiveness and condition will be achieved. The close proximity of the new habitat to the tracks is likely to reduce the final diversity, and this does not seem to have been considered.

3.6.2 Hedges

The original 16.2 kBU was reduced to 6.7 kBU + 1.4kBU of new habitat. However, 1.56 kBU of the supposedly remaining original hedgerow appears to have already disappeared. Overall loss of (linear) biodiversity = 60%.

3.6.3 Trees

Trees are absent from the HS2 metric, and were assessed using the Natural England metric 4. The biodiversity units may not be comparable with those of the HS2 metric.

The preconstruction biodiversity of 37.1 units from 41 identified trees was reduced to 24 units (65%) by the loss of 21 trees, 2 of which were in the 'large' category accounting for 7.3 BU.

This suggests that the trees contribute an additional 27% to the initial area based biodiversity, which seems reasonable, although it would be hard to demonstrate that the two metrics produce biodiversity units of equal value.

3.6.4 Peripheral Habitats

The effects of train noise, and of severance of links on the habitats neighbouring the line has not been assessed, but will surely decrease the overall biodiversity of the landscape. This can only be measured some years after train operations commence.

In conclusion, the claim of no net biodiversity loss is based on data containing several significant errors, the neglect of adverse factors and on heroic optimism regarding the quality to be achieved by new habitats.

1 Biodiversity Calculation

Biodiversity is not a well defined concept, but is related to the number of species, and the number of individuals of each species, in an area. To evaluate this across the full range of possible species and in different seasons would be both difficult and time consuming, so a Biodiversity Metric is employed. This evaluates the fixed features of the area (flora), with appropriate weights, to calculate Biodiversity units, which are a proxy for the overall, unmeasured biodiversity.

The HS2 calculation is made with an early version of the biodiversity metric, which has since been further refined; however, the same basic principles apply.

1.1 Biodiversity Metric

The scores of each **polygon/habitat parcel** present will be

calculated utilising the following criteria:

Number of biodiversity units generated by **habitat polygon** =

```
habitat area                          (ha), hectare
x target habitat distinctiveness rating (hd)  {0,2,4,6,8}
x target habitat condition            (hc)  {1,2,3}
x position within existing ecological
                network                (hp)  {1,2,3}
```

Number of biodiversity units generated by individual **hedgerow** feature =

```
 Length of hedgerow (m)               (hl), metre
x condition multiplier attributed     (hc)       {1,2,3}
x position in the network             (hp)       {1,2,3}
```

Two further factors are applied to post construction biodiversity elements -

difficulty of re-creating/restoring   *(dr)*

{0.10,0.33,0.75,1.0}
x time to target condition   *(tt)   {0.33 – 0.83}*

There are two major difficulties with this (and other) metrics –

1. The multiplicative factors applied are rather subjective, or in the case of habitats yet to be created, entirely speculative.
2. The two types of biodiversity are incommensurate; there is no conversion between linear and area based diversity and so biodiversity of a landscape is represented by two separate totals.

The two post-construction factors create a further problem – when is the calculated biodiversity achieved, if ever ? For example, if the difficulty of restoring a habitat is high, then a dr of 0.33 is assigned. Should the restoration eventually be deemed successful, then this factor can presumably be removed, but in the case of a partially successful restoration, some or all of (hd, hc, hp) will not attain the predicted values. Assuming that this will reduce the biodiversity by $1/3^{rd}$ seems entirely arbitrary.

Time to target condition reflects '*the difference in time between the negative impact on biodiversity and the offset reaching the required quality or level of maturity.'* and is based on the treasury green book discount rate of 3.5%, so $tt = 0.965^Y$ where Y is the number of years until the system has recovered. How the treasury discount rate is related to biodiversity is not explained, but Biodiversity Metric 4 includes this clarification –

5.3.3 *The metric assumes a quality 'jump' from the baseline condition to the target condition once the relevant number of years have elapsed. Metric calculations do not consider incremental increases in quality of the habitat and do not need to be re-calculated annually.*

- but this has no relation to what actually happens. The initial habitat destruction reduces the biodiversity to effectively zero, and it remains at this level for several years during construction. At some point, restoration works will hopefully commence, following which the biodiversity will start to increase and converge (linearly, or more likely logarithmically) towards some stable level. This is clearly a dynamic situation, represented badly (if at all) by the time to target factor.

Biodiversity Metric 4 Principle 4 (Table 3.3) states "*Biodiversity units are a proxy for biodiversity and should be treated as relative values*." As the time to target calculation does not describe any plausible behaviour of the true biodiversity, it appears inconsistent with this principle.

Section CFA9-2.2 examines the effect of the time dependent factors on the CFA9 calculation, where they obscure the very high biodiversity ratios which are predicted for the newly created habitats.

2 About the Author

Dr Conboy was employed as a Physicist/Programmer by the University College London High Energy Physics group, during which time he analysed (and participated in) experiments at the CERN laboratories in Geneva. This was followed by 10 years working for the Culham Centre for Fusion Energy, studying Plasma Physics in support of the Plasma Theory group. He has considerable experience in computer analysis of complex systems.

He became interested in Environmental questions while preparing responses to the HS2 Environmental Statement for Amersham Town Council, the Chesham Society and the Chiltern Society. This led to several appearances before the HS2 hybrid bill select committees.

He is chairman of the HS2 Amersham Action Group, secretary of the Leather Lane Conservation Group, and a member of the Chiltern Society HS2 group. These groups hold regular meetings with HS2 contractors, to mitigate the effects of HS2 construction where possible. As a member of the Resident's Environmental Protection Association (now dissolved), he was instrumental in obtaining the 2.5km extension of the Chiltern Tunnel from Mantle's Wood to South Heath[12], at the 2015 select committee hearings.

---

[12] http://myurl.me.uk/ChmHome/HS2/AoNB%20Roads_V1.pdf