HS2 LONDON - WEST MIDLANDS

No net loss in biodiversity calculation

Methodology and results

December 2015

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Executive summary

High Speed Two Limited (HS2 Ltd) is seeking to achieve the goal of Phase One (London-West Midlands route) of the proposed High Speed Two (HS2) railway ('the scheme') resulting in no net loss in biodiversity at a route-wide level.

The November 2013 Environmental Statement ('main ES') included a Technical Note *Methodology for demonstrating no net loss in biodiversity (*Main ES Volume 5 Appendix CT-001-000/2) covering the methodology to be used in the no net loss in biodiversity calculation. A metric is used to represent, and provide a measure of, overall biodiversity. The HS2 methodology is based on the Department for Environment, Food and Rural Affairs (Defra) metric[1] for calculating biodiversity values in its biodiversity offsetting pilot project, and its development included consultation with Defra and Natural England. It uses habitats as a proxy for considering losses and gains in biodiversity.

The metric calculates losses and gains to biodiversity on an area basis, except for linear features (hedgerows and watercourses), for which separate calculations are made based on the length of these habitats affected. The metric, therefore, results in three separate figures: one for the area-based calculation and one for each of the length-based calculations.

This report sets out further details relating to the methodology used to undertake the calculation, and a summary of the results. In addition, the limitations in the data set and the guidance which has been used during completion of the calculations are described.

The no net loss calculation reported in this document has been undertaken based on the Additional Provision 4 (AP4) scheme design (i.e. the original scheme design, taking into account all relevant AP1, AP2, AP3 and AP4 amendments[2]). Undertaking the calculation has been an iterative process and takes into account guidance and lessons learned from earlier trials, in order to achieve consistency in the scoring of features. All data sets have been subject to quality assurance (QA) checks.

Table 3 and Table 4 of the report show that good progress has been made towards the route-wide biodiversity objective. The overall number of biodiversity units for the area-based aspects, which are the largest component of the calculation, currently indicate approximately a 3% reduction in the number of biodiversity units post-construction. However, there is a significant loss for hedgerows (about 21%) and a net gain for watercourses (6%).

The reported loss in hedgerows is a worst-case scenario. The precautionary methodology used assumes that all hedgerows in areas required temporarily during construction will be removed. However, until detailed design is carried out, it is not possible to determine the proportion of these hedgerows that can be retained. In addition, the metric is based on the high-level indication of the landscape design in the hybrid Bill, and it is likely that more hedgerows than currently shown can be created in areas that are permanently required for construction and operation. This is also likely to significantly increase the number of hedgerow biodiversity units after construction.

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[1] Defra (2012), *Biodiversity Offsetting Pilots: Technical Paper: the metric for the biodiversity offsetting pilot in England*.
[2] In a small number of cases, earlier Additional Provision (AP) amendments have been superseded by a subsequent AP change. The no net loss calculation considers the consolidated scheme up to and including AP4.

The overall goal of achieving no net loss in biodiversity as set out in the principles of the Defra metric is to ensure that there is no 'trading down', such that units are generated by habitats of the same or higher distinctiveness rating than those lost as a result of the scheme. The output from this Phase One calculation shows a significant trading down in relation to woodland, whereas the distinctiveness for grassland is upgraded.

Despite the precautionary approach adopted, the results of the metric suggested good progress has been made towards the stated goal. Given the precautionary assumptions used in the current calculation (e.g. that all habitats within areas of temporary land use will be lost), there remain many opportunities to improve the overall balance of biodiversity units generated by Phase One as detailed design progresses.

In accordance with the draft Code of Construction Practice and the Environmental Minimum Requirements, the project will continue to seek to avoid or further reduce the impacts of the scheme. For example, efforts will be made to reduce the loss of hedgerows within areas of temporary land use, and this should lead to a further improvement in the results. In addition, HS2 will continue to pursue opportunities to gain greater biodiversity value from the habitats created across the scheme.

Abbreviations, acronyms and descriptions

Table 1: Abbreviations, acronyms and descriptions

Abbreviation/Acronym	Description
AP	Additional Provision
ha	hectare
km	kilometre
m	metre
CAD	computer-aided design
Defra	Department for Environment, Food and Rural Affairs
ES	Environmental Statement
EIA	Environmental Impact Assessment
EMR	Environmental Minimum Requirements
GIS	Geographical Information System
SSSI	Site of Special Scientific Interest
LNR	Local Nature Reserve
LWS	Local Wildlife Site
SINC	Site of Importance for Nature Conservation
SMR	Scope and Methodology Report

1 Introduction

1.1 Background to High Speed Two

1.1.1 The hybrid Bill for high speed rail between London and the West Midlands ('the Bill') was submitted to Parliament together with an Environmental Statement (ES) in November 2013 ('the main ES'). If enacted by Parliament, the Bill will provide the powers to construct, operate and maintain Phase One of High Speed Two. This phase will provide a new high speed railway between London, Birmingham and the West Midlands.

1.1.2 Since the deposit of the Bill, the need for a variety of changes to the scheme has arisen through the High Speed Rail (London - West Midlands) Select Committee ('the Select Committee') process, ongoing discussions with petitioners and key stakeholders, and as a result of design refinements.

1.1.3 Those changes which do not require an amendment to the Bill (e.g. changes to construction assumptions, new environmental baseline information and corrections to the main ES) have been reported in a series of Supplementary Environmental Statements (SES). Changes to the scheme that require amendments to the Bill have been promoted in Parliament through a series of Additional Provisions (AP), which were each accompanied by an ES.

1.2 Purpose of this document

1.2.1 The Government is committed to halting overall loss in biodiversity[3] by 2020[4]. In line with government policy, HS2 Ltd is seeking to achieve the goal of Phase One of the proposed railway ('the Scheme') resulting in no net loss in biodiversity at a route-wide level.

1.2.2 The main ES was accompanied by a Technical Note (Main ES Volume 5 Appendix CT-001-000/2 - see Appendix A) on the methodology to be used in the no net loss in biodiversity calculation. This methodology was based on the Defra metric[5] for calculating biodiversity values in its biodiversity offsetting pilot project, and its development included consultation with Defra and Natural England. HS2 Ltd is using the methodology to calculate and compare the likely losses and gains in biodiversity as a consequence of Phase One (London-West Midlands), and to gauge progress towards the published goal of seeking to achieve no net loss to biodiversity.

1.2.3 There is no statutory requirement for HS2 Ltd to undertake such a calculation; as such, this report does not form part of the information the promoter is required to provide to support the hybrid Bill. However, a commitment was made to publish the outputs of the calculation in order to demonstrate transparency in recording HS2 Ltd's progress towards the goal.

1.2.4 A calculation on this scale is a significant undertaking and the process set out in this document is the first such calculation being provided for a major UK transport infrastructure project. Available baseline information has been used to calculate the number of biodiversity units generated by the habitats present within the land required for Phase One before construction.

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[3] The variety of life in the world or in a particular habitat or ecosystem.
[4] Defra (2011), Biodiversity 2020: *A strategy for England's wildlife and ecosystem services*. Defra.
[5] Defra (2012), *Biodiversity Offsetting Pilots: Technical Paper: the metric for the biodiversity offsetting pilot in England*. Defra.

The same methodology has then been used to calculate the number of biodiversity units that will be present post-construction following habitat creation or the enhanced management of existing habitats. Both spatial risk and delivery risk multipliers are applied in order to address the inherent uncertainty involved in habitat creation. The number of biodiversity units generated by habitats that are present pre-construction and post-construction have then been compared.

1.2.5   The calculation has been iterative. It has taken into account:

- revisions to internal guidance, designed to achieve consistency in scoring and approach across the route; and

- the ongoing alterations to the scheme which have been introduced through Additional Provisions[6] (APs) to the November 2013 Bill.

1.2.6   This document sets out further details relating to the methodology used to undertake the no net loss in biodiversity calculation for the HS2 scheme. In addition, it provides an interim summary of the results from the calculation undertaken.

1.2.7   The specific aims of this report are to provide details of:

- the methodology ('metric') used, including any revisions to the November 2013 Technical Note (Main ES Volume 5 Appendix CT-001-000/2);

- how the calculation has been undertaken;

- the assumptions and limitations that have been made;

- how to access and interrogate the final data sets;

- the results of the calculation; and

- conclusions on progress towards the goal of seeking to achieve no net loss.

1.3   Mitigation hierarchy

1.3.1   In seeking to minimise the effects of the scheme on biodiversity, the mitigation hierarchy outlined in Figure 1 has been implemented

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[6] The High Speed Rail (London – West Midlands) Bill, deposited in Parliament on 25 November 2013, provides powers for the construction and operation of Phase One of High Speed Two (HS2) (the 'original scheme'). The Additional Provision covers changes which involve the acquisition or use of land outside the original limits of the Bill, additional access rights, or other extensions of the powers conferred by the Bill.

Figure 1: Mitigation hierarchy

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┌─────────────────────────────────────┐
│              Avoid                   │
│                                      │
│  e.g. re-design proposals to avoid   │
│  an impact on the ecological         │
│  resource                            │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│          Reduce/mitigate             │
│                                      │
│  e.g. minimise loss of habitat       │
│  required for construction of a new  │
│  structure; or employ dust controls  │
│  to limit deposition on adjoining    │
│  habitats                            │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│            Compensate                │
│                                      │
│  e.g. plant new woodland to address  │
│  losses that could not be avoided    │
└─────────────────────────────────────┘
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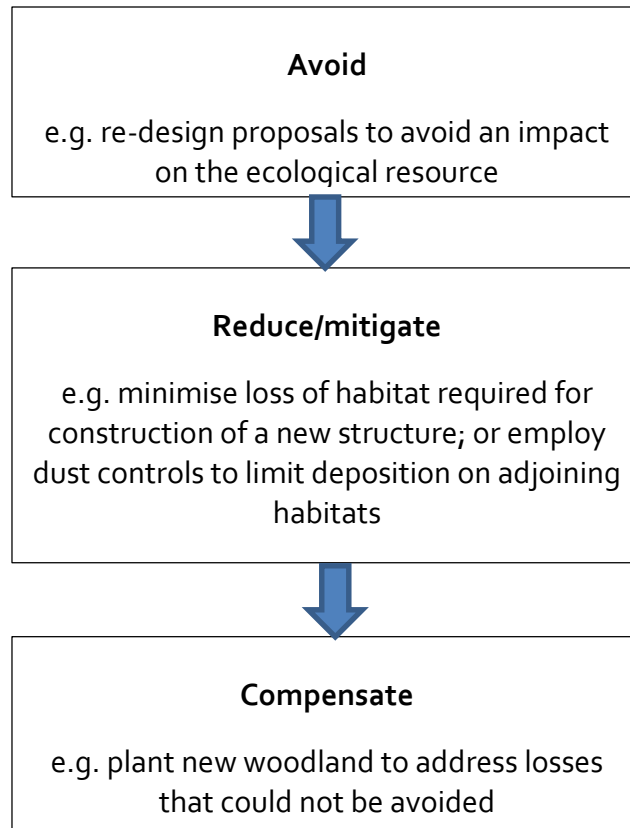
1.3.2   The scheme has been designed, where reasonably practicable, to avoid impacts on sensitive ecological receptors. Where the potential for significant adverse ecological effects was identified, feedback has been provided to the design team and the scope for avoiding or reducing the impacts has been considered. This process has been driven by collaborative working between the engineering, design and environmental teams and has been informed by the consultation and engagement process associated with the main ES, and subsequent Additional Provision ESs.

1.3.3   Given the scale of the scheme, and a series of sometimes conflicting environmental constraints, there are locations where impacts on ecological effects cannot be reasonably avoided. In such circumstances, measures to mitigate (i.e. reduce) the impacts of the scheme have been incorporated. Where avoidance and mitigation measures are not sufficient to address the effects of the scheme, then compensation (in the form of habitat creation) or the enhancement of retained habitat is proposed, which will secured via the Bill.

1.3.4   The main ES and subsequent AP ESs document the avoidance, mitigation and compensation measures that have been incorporated into the scheme. The extent of habitat mitigation and compensation included has been determined through application of professional judgement at a site-specific level, rather than through the use of a biodiversity offsetting metric or other loss-to-gain ratios. Where necessary, this process has involved consultation with relevant stakeholders.

1.3.5   For Phase One, the intention has been to secure the ability to deliver all necessary mitigation and compensation through Bill powers, rather than through agreements with third parties. This ensures that the identified measures can be delivered.

1.4   Role of the no net loss calculation

1.4.1   Biodiversity offsets are conservation activities designed to deliver biodiversity benefits in compensation for losses, in a measurable way[7]. Offsetting methodologies compare the losses resulting from the impact of a development with the gains achieved through the provision of offsets. They aim to provide a transparent mechanism by which the impacts of a development can be quantified, and an appropriate level of compensation agreed.

1.4.2   Biodiversity in its entirety is impossible to measure, so offsetting uses a 'metric' to represent, and provide a measure of, overall biodiversity[8]. Metrics are surrogates[9], or combinations of measurements, that together provide an assessment of the biodiversity value of a particular area. The use of a metric allows the biodiversity impact of a development to be quantified so that the offset requirement, and the value of the compensatory action, can be clearly defined. Metrics are transferable between sites and habitats, allowing an impact on one habitat type to be offset with conservation action elsewhere, or involving a different habitat type and/or quality of habitat where certain key principles are met (e.g. that the offset results in an improvement in the extent or condition of the ecological network). Further details are provided in Section 2.2.

1.4.3   A biodiversity offsetting metric allows the losses and gains in biodiversity as a result of a development to be directly compared. It provides a means of quantifying progress towards the goal of seeking to achieve no net loss in biodiversity ('no net loss calculation').

1.4.4   The no net loss calculation that has been undertaken for Phase One is therefore associated with the last step in the mitigation hierarchy, providing the opportunity to compare the losses and gains in biodiversity that will occur if the Bill and associated AP are approved by Parliament. It does not represent an alternative to the normal application of the mitigation hierarchy. The earlier stages in the mitigation hierarchy have in each case been considered sequentially, before the end point of a requirement for compensation was reached. The approach should be considered in this context and separated from considerations associated with the avoidance, reduction and mitigation aspects of the hierarchy; these have been explored in depth independently at earlier stages in the design process, and are not intended to be documented in this report.

1.5   Habitat management

1.5.1   In predicting the biodiversity value that can be achieved through creating new habitats, or management to improve the condition of existing ones, it is assumed that the biodiversity value of the created or restored habitats will be secured through a commitment to long-term management.

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[7] Defra (2012a), *Biodiversity Offsetting Pilots: Information note for Local Authorities*
[8] Defra (2012b), *Biodiversity Offsetting Pilots: Technical Paper: the metric for the biodiversity offsetting pilot in England.*
[9] Defra (2012b), *Biodiversity Offsetting Pilots: Technical Paper: the metric for the biodiversity offsetting pilot in England.*

1.5.2   HS2 Ltd has set out indicative commitments to the management and monitoring of habitats created for Phase One, during the period of establishment within Information Paper E26: *Indicative Periods for the Management and Monitoring of Habitats Created for HS2 Phase One*[10].

1.5.3   In addition, the Environmental Minimum Requirements (EMR) for Phase One state at paragraph 4.8.5 that: "*The nominated undertaker will maintain or make provision to maintain and monitor any new or managed habitat for a sufficient period to ensure that the objectives of the proposals for nature conservation and protection of the historic environment are achieved.*"

1.5.4   The duration, exact nature and frequency of maintenance, management and monitoring works for individual locations will be developed during detailed design. Such management is likely to be delivered through a combination of mechanisms, including:

- legal agreements with existing landowners;

- legal agreements with other interested stakeholders (e.g. local wildlife trusts); and

- creation of a dedicated land management trust.

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[10] HS2 (2015) High Speed Two Information Paper - E26: Indicative Periods for the Management and Monitoring of Habitats Created for HS2 Phase One. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/437413/E26_-__Indicative_Periods_for_the_Management_and_Monitoring_of_Habitats_v1.1.pdf Accessed 7th December 2015.

2 Methodology

2.1 Introduction

2.1.1 The no net loss calculation for Phase One represents the only UK example of such a calculation being provided for a transport project of national significance. As a result of both the scale of the project and the novelty of the undertaking, the development of the process has required considerable effort.

2.1.2 The calculation has been undertaken directly within a geographical information system (GIS) in order to maximise the accuracy and consistency of the outputs, and to allow interested stakeholders to interrogate the outputs.

2.1.3 Developing guidance to support the calculation process, and the task of undertaking the calculation itself has been an iterative process. Refinements to the Defra pilot metric for its application within Phase One were developed during 2013 and published in November 2013 alongside the Bill. The metric was then subject to ongoing revision and development during 2014 and 2015. During this period, a series of draft calculations have been undertaken. On each occasion, workshops were held before and after undertaking the calculations to incorporate feedback from both ecologists and GIS specialists, resolve problems and revise the guidance. This process aimed to maximise consistency in the application of the metric, and at each step sought to 'sense check' the outputs of the calculation, in order to ensure that the outputs remain realistic and reliable.

2.1.4 The following sections of this document consolidate relevant internal HS2 Ltd guidance that has been used to ensure robust and consistent application of the HS2 metric, when undertaking the no net loss in biodiversity calculation.

2.2 HS2 London-West Midlands metric

2.2.1 The Defra offsetting pilot methodology[11] was identified by HS2 Ltd in 2013 to represent the best available basis for an offsetting methodology that would allow the biodiversity losses and gains of the scheme to be robustly assessed.

2.2.2 The Defra pilot methodology involves mapping and then scoring habitats present before the development against pre-defined scales based on 'distinctiveness' and 'condition'. The metric considers hedgerows as linear features (in metres) and all other habitat parcels are considered in terms of their area (in hectares). The scores obtained for distinctiveness and condition are multiplied and then adjusted on the basis of area or length of that habitat type present. This process calculates the total number of biodiversity units generated by habitats present before development.

2.2.3 The metric is then used to score the likely distinctiveness and condition of habitats to be created. However, in this stage of the calculation the 'offset provider' applies a series of risk multipliers which reduce the number of biodiversity units generated by the habitats to be created. This mechanism seeks to address the inherent risk associated with creating new

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[11] Defra (2012), Biodiversity Offsetting Pilots: Technical Paper: the metric for the biodiversity offsetting pilot in England. Defra

habitats. A number of amendments to Defra's pilot methodology were considered necessary to address feedback from its application to date, and to ensure that it is suitable for a landscape-scale project such as Phase One.

2.2.4   Details of the HS2 biodiversity metric that is used to equate losses and gains as a consequence of the scheme for Phase One of HS2 are provided in the Technical Note *Methodology for demonstrating no net loss in biodiversity* (Main ES Volume 5 Appendix CT-001-000/2), which is included as Appendix A. The key amendments to the Defra pilot methodology which have been implemented are:

- adding an additional 'very high' score (8 x weighting) under habitat distinctiveness to take account of those habitats of principal importance identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[12] which cannot be adequately re-created if lost;

- increasing the distinctiveness score attributed to all habitats that form part of an area that qualifies as the habitat of principal importance open mosaic habitat on previously developed land, thus ensuring that the value of these habitats is fully recognised within the calculation;

- removing the application of a variable condition weighting for habitats of low distinctiveness - all low distinctiveness habitats will instead automatically attract a condition weighting of 'poor' (1 x weighting), thus recognising that condition has a negligible effect on the overall value of those habitats which are intrinsically of low distinctiveness;

- incorporating greater consideration of the importance of both habitats lost and gained (in relation to the function of ecological networks) into the spatial risk multipliers, in order to recognise the landscape scale of the project and its impacts;

- removing the blanket one-step restriction on the change in condition and replacing this with the condition that, for high distinctiveness target habitats, a maximum future target condition of moderate can be claimed; and

- considering watercourses as a linear rather than an area-based measure.

2.2.5   Since production of the November 2013 Technical Note, the requirement for a small number of revisions and additions to the published methodology has been identified. These are documented below and supersede the content of the November 2013 Technical Note.

Habitat distinctiveness

Ancient woodland (applicable to post-construction only)

2.2.6   Section 3 of the November 2013 Technical Note (see Appendix A) stated that the 'very high' distinctiveness category (8 x weighting) would not be used in the post-construction calculation in order to acknowledge that such habitat types are irreplaceable.

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[12] Natural Environment and Rural Communities Act (2006) Chapter 16. Her Majesty's Stationery Office, London

2.2.7 This rule has been adjusted to account for the inclusion of an additional approach to delivering compensatory measures for ancient woodland introduced through AP, whereby the land subject to Bill powers now includes some areas where ancient woodland has been incorporated within Bill limits for the specific purpose of enhancement (e.g. through the removal of invasive non-native species such as rhododendron). In such instances where the existing areas of ancient woodland will be retained or enhanced, the 'very high' distinctiveness category (8 x weighting) has been used in the post-construction calculation.

2.2.8 As per the November 2013 Technical Note the 'very high' distinctiveness category (8 x weighting) has not been used as the target for any new habitats to be created as part of the compensation proposals.

Reedbeds

2.2.9 Areas of reedbed that are not being specifically created for ecological benefit (e.g. where these have been included to provide filtration beds) are assumed not to fall within the habitat of principal importance definition. They are considered to be of 'moderate' distinctiveness (4 x weighting), as their ecological value is likely to be limited by their functional role as filtration for railway drainage. This is a change from that specified in the November 2013 Technical Note.

Habitat condition
Scrub (applicable to both pre- and post- construction)

2.2.10 Following inconsistency in the scoring of scrub habitats during initial passes at the calculation, a standard condition score of 'moderate' (2 x weighting) has been allocated in both the pre- and post-construction calculations to all habitat areas mapped as scrub (both dense scrub and scattered scrub) that are afforded a distinctiveness of 'moderate' (4 x weighting) or above[13]. Guidance provided in the Higher Level Stewardship Farm Environment Plan Manual[14] is used in the Defra pilot methodology as the basis for grading the condition of habitats. However, the manual does not provide clear guidance to enable scrub habitats to be distinguished, and following further consideration it was decided that there would be limited merit in distinguishing between the condition of such habitats.

Hedgerows (applicable to post-construction only)

2.2.11 The November 2013 Technical Note stated that, as for other habitat types, a cap would be placed on the condition rating (no higher than 2 x weighting) for ecology-led habitat creation that is targeted at 'high' distinctiveness (6 x weighting) habitats.

2.2.12 Following initial passes at the calculation and feedback from workshop sessions, it was decided that, for hedgerows, the proposed cap is overly precautionary. Based on feedback and experience from ecologists working on transport infrastructure projects, it is considered

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[13] Any scrub habitats of 'low' distinctiveness (2 x weighting) follow the rule that all habitats of 'low' distinctiveness are afforded a 'low' (1 x weighting) condition score
[14] Natural England (2010), Higher Level Stewardship – Farm Environment Plan (FEP) Manual – Technical guidance on the completion of the FEP and identification, condition assessment and recording of HLS FEP features. Natural England.

realistic to expect that newly created hedgerows can reliably be created to achieve both high distinctiveness (6 x weighting) and high condition (3 x weighting).

2.2.13   Therefore, in relation to hedgerows, it is allowable to target both 'high' distinctiveness (6 x weighting) and 'high' condition (3 x weighting) within the post-construction calculation.

Watercourses (applicable to both pre- and post-construction)

2.2.14   Section 3.5 of the November 2013 Technical Note (see Appendix A) includes a typographical error at paragraph 3.5.3. The published text makes reference to the condition score of watercourses being allocated according to the scale shown in Table 5 of the Technical Note. This should have referred to Table 4.

2.2.15   In all cases the condition scoring of watercourses has been undertaken using the Higher Level Stewardship Farm Environment Plan Manual guidance[15] alongside professional judgement.

Risk multipliers

Difficulty of restoration multiplier (applicable to post-construction)

2.2.16   The Technical Note published in November 2013 (Main ES, Volume 5 Appendix CT-001-000/2) included an error, introduced in the transposing of the difficulty of restoration risks from published Defra guidance into decimal figures.

2.2.17   Table 8 of the November 2013 Technical Note (see Appendix A) states that a 'medium' delivery risk habitat would be afforded a difficulty of re-creation/restoration multiplier of 0.75. This is an error and the correct multiplier for a medium difficulty habitat would be 0.67.

2.2.18   The 0.67 figure has been used in the calculations reported in this document and the methodology is therefore consistent with that Defra pilot methodology.

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[15] Natural England (2010), Higher Level Stewardship – Farm Environment Plan (FEP) Manual – Technical guidance on the completion of the FEP and identification, condition assessment and recording of HLS FEP features. Natural England.

2.3   Undertaking the calculation

Scope of calculation

2.3.1   The no net loss calculation has been undertaken based on the AP4 scheme design (i.e. the original scheme design, taking into account all relevant AP1, AP2, AP3 and AP4 amendments[16]).

2.3.2   Due to the lead-in time required to undertake the calculation, it has not been possible to include consideration of AP5 amendments. However, the AP5 amendments are minor with regard to ecology, and will add only very limited additional areas of habitat loss or gain. They are unlikely to result in any significant change in the outputs of the calculation.

2.3.3   The scope of the calculation has incorporated:

- all habitats within Bill limits (i.e. located within the extent of the land required for the construction of the scheme) - by definition, this term encompasses areas permanently required for operation, and those required temporarily during construction;

- habitats located within any areas proposed for habitat creation or habitat enhancement (including where these lie outside the boundaries of the land required for the construction of the scheme); and

- areas of habitat outside the land required for the construction of the scheme where the main ES (or any subsequent ES) identifies that the habitat is likely to be subject to an effect on its conservation status that is significant at the district/borough level or above.

2.3.4   Where a specific commitment has been made to retain an area of habitat located within the land required, then such areas are included within both the pre- and post-construction calculation, with all relevant risk multipliers set to a multiplier of 1.0. However, the position in the network calculation for each area or length of habitat concerned may change during the course of the development, where the scheme results in changes in the nature of the habitats that surround these retained areas. For example, a retained fragment of woodland within land identified in the Bill may generate a lower position in the network score post-construction than it did prior to development.

2.3.5   All habitat areas within both the pre-construction and post-construction mapping that relate to watercourses[17] have, for the purposes of the area aspect of the calculation, been given a score of 'null' for all categories. This is to ensure that the total area of land covered by the calculation remains the same in the pre- and post-construction calculation, but that no biodiversity units are generated (as watercourses are considered and scored as a linear unit).

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[16] In a small number of cases earlier AP amendments have been superseded by a subsequent AP change. The no net loss calculation considers the consolidated scheme up to and including AP4 (i.e. the scheme for which HS2 are currently seeking Parliament's consent).
[17] i.e. Phase One habitat features identified under the 'Running Water' habitat types, and those in the post-construction design identified as watercourses.

Roles and responsibilities

2.3.6   Due to the scale of the scheme, the route has been divided into four sections for the purposes of the no net loss calculation. These are:

- CFA1 Euston Station to CFA6 South Ruislip to Ickenham;

- CFA7 Colne Valley to CFA15 Greatworth to Lower Boddington;

- CFA16 Ladbroke and Southam to CFA22 Whittington to Handsacre; and

- CFA23 Balsall Common and Hampden in Arden to CFA 26 Washwood Heath to Curzon Street.

2.3.7   Work in each of the four route sections has been undertaken by a team of specialist ecological consultants. The above route sections correspond to those used for survey and ecological assessment, thus ensuring that the scoring process has in all cases been undertaken by people who are familiar with the areas concerned.

2.3.8   Guidance has been provided to the consultants undertaking the calculation in each route section by an overview consultant and HS2 Ltd to ensure a consistent approach. Quality assurance (QA) checks have been undertaken at a variety of levels in order to test both adherence to the rules of metric, and consistency of outputs across all route sections. Further details of the QA process are provided in Section 2.8.

Data sources

2.3.9   Table 2 provides a summary of the key data sources that have been used in undertaking the no net loss calculation.

Table 2: Summary of key data sources used in the no net loss calculation

Data type	Data types used	Sources
Scheme design	GIS layers derived from SES3 and AP4 CAD Model for the following map series included within the SES3 and AP4 ES: - CT-05: Construction Phase; - CT-06 Proposed Scheme.	HS2 Ltd (publicly available via the data.gov.uk website[18])
Existing habitats	Phase One habitat survey[19] and National Vegetation Classification (NVC) data[20]	Surveys undertaken by HS2 Ltd (publicly available via the data.gov.uk website[21])

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[18] Data.gov.uk (2015) London-West Midlands Environmental Statement https://data.gov.uk/dataset/london-west-midlands-environmental-statement-november-2013

[19] A habitat classification and field survey technique to record semi-natural vegetation and other wildlife habitats.

[20] The National Vegetation Classification (NVC) is a system for categorising the plant communities of Britain. In habitats with the potential to be of greater ecological value, an NVC survey has been undertaken according to the approved NVC survey methodology to allow the habitats present to be categorised.

[21] Data.gov.uk (2015) London-West Midlands Environmental Statement https://data.gov.uk/dataset/london-west-midlands-environmental-statement-november-2013

Data type	Data types used	Sources
	Priority Habitat Inventory[22]	data.gov.uk website
	Habitat inventories (and relevant data from third parties)	Local Biological Records Centres (LBRC) Planning applications for nearby developments.
	HS2 aerial photography of the route alignment	HS2 Ltd
Ancient woodland inventory	Location of ancient woodlands	Natural England via data.gov.uk website[23]
	Review of historic mapping undertaken in support of SES.	HS2 Ltd
Statutory designated sites	GIS Shapefiles for statutory designated sites	Multi-agency Geographical Information for the Countryside (MAGIC) website
Non-statutory designated sites	Details obtained through Local Biological Records Centre (LBRC) data searches	LBRC
Guidance on allocating habitat condition scores	Higher Level Stewardship - Farm Environment Plan Manual[24]	Natural England
Location and extent of proposed habitat creation	GIS layers derived from SES3 and AP4 CAD Model for the CT-06 Proposed Scheme map series included within the SES3 and AP4 ES. HS2 Phase One habitat data layer (derived from data sources above) used to confirm habitat type for all areas where land is required only temporarily[25]	HS2 Ltd

GIS schema

2.3.10 The no net loss calculation has been undertaken within a geographical information system (GIS) using ArcGIS software.

2.3.11 The recording of all data in support of the calculation has been produced in accordance with a standardised geodatabase schema to ensure consistency in presentation of outputs, and allow data sets delivered by individual route sections to be consolidated into route-wide datasets.

2.3.12 The geodatabase contains four feature classes[26] as follows:

- pre-construction polygons (i.e. parcels of habitat with a defined spatial area) - this is

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[22] Data.gov.uk (2015) Priority Habitat Inventory (England)https://data.gov.uk/dataset/priority-habitat-inventory-england Accessed 7th December 2015
[23] https://data.gov.uk/dataset/ancient-woodlands-england1
[24] Natural England (2010), *Higher Level Stewardship – Farm Environment Plan (FEP) Manual – Technical guidance on the completion of the FEP and identification, condition assessment and recording of HLS FEP features*.
[25] It is assumed that, in all cases, areas of temporary land take will be returned to a habitat type and condition similar to that currently present.
[26] A collection of geographic features with the same geometry type.

used for all pre-construction parcels of habitat that are dealt with in the calculation according to an area-based measure;

- post-construction polygons - this is used for all post-construction parcels of habitat that are dealt with in the calculation according to an area-based measure;

- pre-construction polylines (i.e. linear features with no defined area) - this is used for hedgerows and watercourses present pre-construction which are considered within the methodology as linear-based features;

- post-construction polylines - this is used for hedgerows and watercourses present post-construction which are considered within the methodology as linear-based features.

2.3.13   Both feature classes contain the same standard fields and a description of each of the key fields is provided within Appendix B.

2.3.14   Each habitat polygon or polyline has been populated with the appropriate multipliers, allowing the area (ha) or length (m) of the feature and the selected multipliers to be used to automatically calculate the number of biodiversity units generated by each feature. The GIS data is then queried in order to ascertain the total number of biodiversity units generated pre- and post-construction.

2.3.15   Where a field in the GIS schema is not used in the calculation for a particular feature, the cell is marked 'null'. This approach has been used in order to retain the numerical functionality of the GIS layers, such that it is possible for stakeholders to undertake their own numerical analysis of the outputs. Null values have been actively allocated and do not indicate an absence of data.

2.3.16   For the scoring of distinctiveness values, an entry of '0' indicates that the distinctiveness value has been considered against the provided guidance and has been actively scored as falling within this category. Where the distinctiveness value is allocated a score of zero, all other scoring fields (i.e. habitat condition, position in the ecological network, difficulty of restoration, and time to target condition) have been populated with a 'null' value to reflect the fact that these criteria have not been actively scored, on the basis that the overall biodiversity units will, in any event, always be zero (as to calculate the biodiversity units, these other fields would be multiplied by the distinctiveness score of '0').

2.4   Calculating the pre-construction biodiversity units

Habitat distinctiveness

2.4.1   GIS habitat polygons from scheme Phase One habitat mapping (Main ES Volume 5 Map Series EC-02) were used as the basis for the pre-construction calculation layer. The layer structure was adjusted to include all fields within the GIS schema shown in Appendix B.

2.4.2   Scoring has predominantly been based upon Phase One habitat survey and National Vegetation Classification (NVC) data reported in the main ES, and displayed in Map Series EC-02 and EC-10 (Main ES Volume 5 Ecology Map Books).

2.4.3   The categories used within the metric for the Defra pilot methodology are principally aligned with the use of the Integrated Habitat System (IHS), which splits out habitats of principal importance from those that do not qualify under these criteria.

2.4.4   Given that Phase One habitat categories and habitat of principal importance definitions do not entirely correlate, where necessary Phase One habitat polygons have been sub-divided in order to allow differing distinctiveness scores (and, in some cases, condition ratings) to be attributed. Table A1 in Appendix A of the November 2013 Technical Note (see Appendix A of this document) was used to maximise consistency in the process of translating available Phase One habitat data into distinctiveness categories.

2.4.5   Due to access restrictions, field survey information is not available for all land due to be affected by the scheme. In support of the main ES, the EC-02 map series was created to provide Phase One habitat data for all areas within and adjacent to the land required for the scheme. Where field survey data was not available, gaps were infilled using both aerial photograph analysis and data from available habitat inventories (e.g. Priority Habitat Inventory[27]).

2.4.6   Where additional survey and desk study information has become available since the main ES, this information has been used to update the data presented in the EC-02 map series, and ensure that the calculation is based on the best dataset available.[28]

2.4.7   Where robust data is available from Phase One habitat surveys or National Vegetation Classification (NVC) surveys undertaken in support of the scheme, that information has been used as the primary basis for allocating habitat distinctiveness scores in accordance with the criteria set out in Table 1 of the November 2013 Technical Note (see Appendix A), and has taken precedence over other third-party data. Therefore, for example, if the area has been identified within the Priority Habitat Inventory[29] as likely to qualify as priority habitat, but a field survey has demonstrated otherwise, then the distinctiveness rating has been allocated on the basis of the HS2 Ltd field survey information.

2.4.8   Where no HS2-specific survey has been possible due to access constraints, or where a survey is sub-optimal (e.g. if access was restricted or the timing of the survey lies outside best practice guidance), then third-party data (e.g. Priority Habitat Inventory) and aerial photography were used to allocate distinctiveness scores, and a precautionary approach has been adopted. In these instances the following guidance was adhered to:

- habitat distinctiveness scores have been based primarily on the habitat type present. Statutory and non-statutory designations have not been used alone as the sole reason for adjusting the distinctiveness score, but have been considered as part of the

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[27] Data.gov.uk. Priority Habitat Inventory (England) Downloadable at https://data.gov.uk/dataset/priority-habitat-inventory-england Accessed 4th December 2015.

[28] HS2 surveys are ongoing as land becomes accessible, as a general guide data that was obtained before the end of September 2015 has been considered within the calculation.

[29] Priority Habitats are those that were identified as being most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP). The UK BAP has now been superseded. However, the same criteria were used to define habitats of principal importance under Section 41 of the Natural Environment and Rural Communities (NERC) Act, 2006. Therefore, an area identified as priority habitat under the UK BAP also represents a habitat of principal importance. In most cases the extent of these areas has been established via aerial photograph interpretation only.

available data;

- '2¡ ®¡'high' distinctiveness (weighting x) applied to all habitat areas falling within areas of ancient semi-natural woodland listed on Natural England's ancient woodland inventory or that are assumed likely to be ancient woodland based on interpretation of historic mapping;

- '¤¥£¤' distinctiveness (weighting x) applied to all habitat areas falling within areas of plantation on ancient woodland (PAWS) listed on Natural England's ancient woodland inventory;

- where the Natural England Priority Habitat Inventory data identifies that an area may represent a habitat of principal importance, a 'high' distinctiveness score (weighting x 6) has generally been allocated. Exceptions have been made only where clear evidence suggests that this is not the case (e.g. where it is clear from aerial photographs that an area of habitat has recently been cleared for development);

- a precautionary approach has been taken and where in doubt between categories, the higher distinctiveness category has been allocated; and

- data from interpretation of HS2 aerial photography taken in 2012/2013 was given priority over local habitat inventories where the photography provided more up-to-date data.

2.4.9   Phase One habitat categories which are recorded as point data (e.g. scattered scrub or individual trees) have been considered on the basis of the distinctiveness rating of the underlying habitat polygon. Where the presence of a point data category was considered to add to the distinctiveness rating of the underlying habitat type (e.g. the presence of the scattered scrub within an area of ephemeral/short perennials), then the distinctiveness rating of the underlying habitat type polygon has been adjusted manually to account for this.

2.4.10   Where a combination of habitat polygons are considered to collectively meet the criteria for the open mosaic on previously developed ground (a habitat of principal importance) then all habitat parcels which fall under the scope of the definition have been upgraded to a 'high' distinctiveness rating (weighting x 6). For example, areas of tall ruderals and short ephemerals which may alone have scored 2 for distinctiveness each have been upgraded to a distinctiveness weighting of x 6 where they form part of a habitat mosaic meeting the habitat of principal importance (i.e. priority habitat) category definition.

Arable fields

2.4.11   For all arable fields falling within the scope of the pre-construction calculations, it has been assumed that an uncultivated arable margin of 1m width (and 'moderate' distinctiveness) is present. Such features are too small to map accurately; however, given the scale of the scheme, they could contribute a significant number of biodiversity units at the route-wide level.

Ponds and water bodies

2.4.12 Early iterations of the calculations identified the requirement for additional guidance to ensure consistency in the scoring of water bodies. For ponds, other standing water and canals, the following assumptions have now been applied in relation to distinctiveness:

- if great crested newts, otters, water voles or white-clawed crayfish were present, then the water body was considered to represent a habitat of principal importance and was assigned a high distinctiveness score (6 x weighting); and

- all other water bodies were assigned a moderate distinctiveness score (4 x weighting).

Street trees

2.4.13 In urban locations containing lines of street trees, a thin linear polygon was created parallel to the road that is indicative of the general canopy spread. Such areas were allocated a moderate distinctiveness score and a condition score as appropriate to the trees in question.

Habitat condition

2.4.14 With the exception of watercourses (which are dealt with as linear feature and are subject to separate metric rules), all pre-construction habitat polygons were allocated a condition score category. Scoring was undertaken in accordance with the guidance provided in the Higher Level Stewardship FEP manual and Section 3.2 of the November 2013 Technical Note (See Appendix A), and the additional guidance provided below.

2.4.15 The FEP guidance does not cover all habitat types that fall within the scope of the calculation. Where the guidance provided no relevant criteria, then professional judgement has been applied to allocate a condition score against the three-point scale. In such cases a brief rationale for the score allocated has been recorded within the available comment field in the GIS schema (see Appendix B).

2.4.16 Overall, the HS2 metric has adopted a precautionary approach in relation to the scoring of target condition for created habitats. It is the intention of HS2 Ltd that habitat created primarily for ecological compensation will be managed in the long term with the aim of achieving 'high' condition (3 x weighting). However, in order to acknowledge the difficulty of reaching this goal, the HS2 metric only uses in the post-construction element of the calculation the units that would be achieved if habitats achieve 'moderate' habitat condition (2 x weighting). Therefore, if appropriate management continues in the long term, it is likely that the number of biodiversity units that will eventually be achieved will exceed those currently stated.

2.4.17 Where access has not been available for survey, it was necessary to allocate a score based on a precautionary approach, informed by professional judgement:

- all habitats identified as being of 'low' habitat distinctiveness (2 x weighting) were automatically allocated a 'low' condition score (weighting x 1) (the same rule applies for those that have been surveyed).

- for all other areas as a general rule, in the absence of access to conduct a survey, a moderate condition (2 x weighting) was assumed. A condition score of poor (1 x

weighting) was allocated where there is a very clear justification based on the information available; and

- where access was not available for survey and there was reason to believe that an area is being actively managed to benefit nature conservation, then a condition weighting of 3 has been allocated.

2.4.18   Where habitat polygons are within the boundaries of a Site of Special Scientific Interest (SSSI), an effort has been made to ensure that the condition rating takes account of results from any HS2 Ltd field survey and the condition assessment score allocated by Natural England. A precautionary approach has been adopted to prevent under-estimating the condition of pre-construction habitats, as follows:

- where a site survey has indicated that the condition of habitats exceeds that reported during the Natural England condition assessment, then the higher condition scores should be allocated; and

- where the site survey indicates that the habitat condition may be lower than that indicated by the Natural England condition assessment monitoring, then the output of the condition assessment monitoring has been used.

Scrub

2.4.19   All scrub polygons (both dense scrub and scattered scrub) that are afforded a distinctiveness score of 'moderate' (4 x weighting) or above have been allocated a standard condition score of moderate (2 x weighting)

Ponds and water bodies

2.4.20   In the absence of detailed guidance within the FEP Manual in relation to condition scoring of ponds, the following criteria were developed:

- If a pond was not surveyed, it was assigned a condition weighting of moderate (2 x weighting).

- Where ponds were surveyed and met one of the following criteria they were assigned a condition weighting of x 2, if they met two or more criteria they were assigned a condition weighting of x 1:

  - more than 500m from any other water body;

  - not within semi-natural habitat (i.e. if they are within hard standing, arable, pasture); or

  - contain non-native (signal) crayfish.

Position within existing ecological network

2.4.21   A key consideration of current nature conservation policy and guidance is the goal of working towards the creation of "bigger, better and more joined up"[30] ecological networks.

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[30] Lawton J (Chair) (2010), *Making Space for Nature: A review of England's Wildlife Sites and Ecological Network. Report to Defra*

2.4.22   Based on the landscape scale of the scheme, a multiplier has been used in the pre- and post-construction calculations to take account of the importance of habitats lost to existing ecological networks.

2.4.23   With the exception of watercourses, each polygon within the scope of the pre-construction calculation was allocated a position within the ecological network score, taking into account the guidance provided in the November 2013 Technical Note (See Appendix A).

2.4.24   Attempts were made to develop a method for automating the calculation of the position within the ecological network multiplier for habitat polygons. However, such a method proved too complex to automate while still incorporating the full range of factors that an ecologist would consider in allocating the score. The scoring of the position in the network multiplier has therefore been allocated manually and considering a range of factors including:

- distribution of existing habitats based on aerial photography and available Phase One habitat mapping;

- consideration of the size of the habitat block concerned (ha) (interrogated within pre- and post-construction GIS layers);

- distinctiveness ratings allocated as part of the no net loss calculation (to readily identify those habitat parcels that support habitats of principal importance); and

- connectivity to other habitat areas, in particularly habitats of principal importance (distance measured in metres).

2.4.25   In the absence of a fully automated GIS query, greater emphasis has been placed on professional judgement in order to grade the habitats present, against the three-point scale set out in Table 3 of the November 2013 Technical Note (see Appendix A) to ensure that these considerations have been fully incorporated. The criteria are intended to ensure that

- the broad concepts of 'bigger, better and more joined up' are incorporated, and

- the inherent value of areas of better connected habitat, particular those that are support habitats of principal importance, are taken into account.

Hedgerows

2.4.26   Hedgerow[31] connectivity scores have been calculated on the basis of field survey information where access was available. In areas where no access was available, a GIS query has been used to calculate the appropriate score:

- each hedgerow was given a count based on the number of other hedgerows that either connect with it or are within 10m [HedgerowCount];

- each hedgerow was given a count based on the number of areas of broadleaved woodland (semi-natural/plantation) or ponds intersecting or within 10m [WoodlandPondCount]. If a pond is in woodland and both are within 10m, the

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[31] For the purposes of the calculation hedgerows have been defined as those features that would qualify under any of the 'intact hedge', 'defunct hedge' or 'hedge and trees' categories within the JNCC's Phase 1 habitat classification.

network score was given as 1 rather than 2 (i.e. the analysis assumed the count recorded would be for either habitat, rather than both);

- a score for hedgerow connections was created [HedgerowScore]. This was populated with the same values as [HedgerowCount] as no multiplier is required;

- a score for woodland/pond connections was created [WoodlandPondScore]. This was calculated as [WoodlandPondCount] x 2;

- a final score was added [TotalScore] which was calculated as [HedgerowScore] + [WoodlandPondCount];

- the [Eco_Position] field was then calculated:

  - 3 If [TotalScore] >= 4

  - 2 If [TotalScore] is 3 or 2

  - 1 If [TotalScore] is 1 or less.

2.5   Calculating the post-construction biodiversity units

2.5.1   The AP4 design was used as the basis for creating a GIS layer to undertake the post-construction calculation. Suitable data fields were added in order to make the layer format consistent with that set out in the HS2 GIS schema (see Appendix B).

Temporary land use

2.5.2   A large proportion of the land where works are proposed under the Bill is required only temporarily, and under the terms of the Bill the undertaker will be required to return these areas to the landowner in a similar form to that currently present.

2.5.3   Therefore, for all areas of temporary land use, it has been assumed that on completion of construction, habitats similar to those currently present will be created. On that basis, the habitat distinctiveness and condition data for these areas within the pre-construction dataset have been used to populate the equivalent fields in the post-construction GIS layer.

2.5.4   The 'time to target condition' and difficulty of restoration multipliers set out in the Defra metric have been used for the majority of habitat types that will be subject to temporary land use, then return to their previous land use. This reflects the scale of change that will occur as a result of these habitats being unavailable during the period of construction and subsequent re-establishment, where these have a notable biodiversity value. However, in the majority of cases the habitats subject to temporary works are of lower ecological value. All of the following habitat types have been attributed a difficulty of restoration multiplier of 1.0 and a time to target condition of 1.0: arable fields, improved grassland, buildings, spoil heaps, bare ground, and amenity grassland.

2.5.5   For hedgerows, it has been assumed in the calculations that within the areas of temporary land use, all hedgerows will be removed and then subsequently recreated in their previous locations post-construction. Therefore, previous Phase One habitat data has been used to indicate the likely locations at which habitats will be recreated. At all such locations, it has been assumed that the hedgerow will be recreated and will achieve the same distinctiveness

and condition scores as were present pre-construction. However, due to field modifications and access requirements, it is likely that at least some of the pre-construction hedgerows will not be reinstated. On this basis, a manual adjustment has been made to the post-construction calculation outputs, with a 10% reduction applied to the number of hedgerow units generated in areas of temporary land use.

Habitat creation

Habitat distinctiveness and condition targets

2.5.6   In line with the rules set out in the November 2013 Technical Note and the updates set out in Section 2.2 of this document, all polygons that are being created for the primary purpose of ecological mitigation/compensation (i.e. those polygons identified on the CT-06 mapping as either wetland habitat creation, woodland habitat creation or grassland habitat creation) have been given the following default weightings:

- habitat distinctiveness = 'high' (6 x weighting); and

- habitat condition = 'moderate' (2 x weighting). The rules of the HS2 metric set a cap on target habitat condition to recognise that habitats of high distinctiveness and high condition are difficult to achieve in practice with confidence.

2.5.7   As a general rule, where proposed ecological compensation included in the design (and shown on the CT-06 drawings[32]) is intended to represent a mosaic of habitats, the entire extent of those areas has been considered on the basis of the scores generated by the dominant habitat type. Based on the habitats present along the route of the scheme, this is considered likely to provide a precautionary view. For example, grassland rides in an area identified in CT-06 drawings as woodland are likely to be easier to create than the surrounding woodland. Areas shown as grassland are likely to be interspersed with habitats such as scrub, ruderals and open ground that will be easier to recreate, thus generating more biodiversity units. However, in a limited number of cases, where a habitat with a high restoration difficult or time to target condition multiplier forms a significant proportion of the overall habitat mosaic, the multipliers for this habitat have been applied for the entire extent of the mosaic in order to ensure a precautionary output.

2.5.8   The intended ecological function of some such areas is not accurately reflected in all of the CT-06 Proposed Scheme plans, as the symbology used did not allow a dual purpose to be displayed. Where planting shown in the CT-06 drawings is listed within the scheme mitigation register as provision for the dual purpose of ecology and landscaping, then these areas are scored as polygons of 'high' distinctiveness (6 x weighting), and 'moderate' condition (2 x weighting) as above.

2.5.9   For all other areas of non-ecology-led planting/landscaping works that are due to occur within the areas of land required permanently for the scheme, those semi-natural habitats created as part of the landscaping design have been assumed as a default to achieve the following target multipliers:

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[32] The CT-06 (Proposed Scheme) plans are included within the Volume 2 map books for the main ES and all subsequent ESs.

- habitat distinctiveness = 'moderate' (4 x weighting); and

- habitat condition = 'moderate' (2 x weighting).

2.5.10   The default targeted values for non-ecology-led planting/landscaping areas have been altered only where there is a clear indication from commitments made in the ES that a different outcome can be anticipated. The assumed habitat condition rating of 'moderate' (2 x weighting) for such areas takes into account that management commitments in relation to landscape planting are likely to cover a shorter timescale, and will not be specifically aimed at maximising their ecological value.

2.5.11   For hedgerows, an exception will be made to the cap placed on the condition rating that can be allocated for habitats of high distinctiveness. This is based on the view that it is feasible to achieve a high condition score for a high distinctiveness habitat. As such, for all new hedgerows to be created as part of the scheme, calculations use 'high' condition scores (3 x weighting).

Management to enhance retained habitats

2.5.12   The scheme includes several areas where there are commitments to undertake management works to enhance the condition of a retained area of habitat (e.g. enhanced management of a retained area of ancient woodland). In such cases, the extent of the area that will be subject to works has been included in both the pre- and post- construction calculations. In the post-construction calculation, the habitat condition value has been increased by a maximum of one step (i.e. low to moderate condition or moderate to high condition). A risk multiplier of 1 has been applied in each case.

2.6   Assumptions and limitations - route-wide

Assumptions

2.6.1   As a general rule, it has been assumed that if features occur in the CT-05 Construction Phase GIS layers, but do not occur in the CT-06 Proposed Scheme layers, then they are required for temporary land use only. An exception has been made in relation to replacement floodplain storage areas, which appear on the CT-06 drawings, but it has generally been assumed that these areas will be reinstated to their pre-construction habitat type.

2.6.2   Where HS2 Ltd has made formal assurances[33] that compulsory purchase powers included in the Bill will not be exercised, or ongoing design work has confirmed that certain areas of land are no longer required, the calculation assumes that habitats within these areas are to be retained. Retained areas of habitat have been scored with the same 'distinctiveness' and 'habitat condition' weightings in both the pre- and post-construction aspects of the calculation. In addition, risk multipliers of 1 have been used for 'time to target condition' and 'difficulty of restoration'. Therefore, such areas affect the balance of biodiversity units only if their 'position in the ecological network' weighting is altered by the construction of the

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[33] These are unilateral commitments given directly to Petitioners or affected parties which do not have the status of legally binding contracts enforceable by the courts, but are made binding on the project by being included on the Register of Undertakings and Assurances. Enforcement is through the Secretary of State,

scheme (e.g. an area of formerly well-connected woodland becoming severed and isolated may be allocated a lower position in the network score post-construction).

2.6.3   In those locations where HS2 Ltd is in discussion with third-party landowners regarding the potential for alternative habitat provision to that included in the Bill, such areas are only included in the calculation where a signed legal agreement is in place. In all other cases, the mitigation included within the Bill scheme is considered by the calculation.

2.6.4   It has been assumed that all areas of land shown in the CT-06 drawings as landscaped earthworks which do not show specific detail of proposed landscaping (e.g. tree planting on the earthwork) will return to agriculture.

2.6.5   Landscape planting that will be scrub or plantation has been allocated a default time to target condition of 10 years (equating to a multiplier of 0.71) and a difficulty of restoration score of 1.

2.6.6   Species-poor grassland habitats that will form part of the landscape planting have been given a default time to target condition of 5 years (equating to a multiplier of 0.83) and a difficulty of restoration score of 1. Where there is evidence to suggest commitments to providing more diverse habitats within landscaping areas, then values have been adjusted and an indication of reasoning provided within the comments in the GIS data.

2.6.7   It has been assumed that the restoration period will be only five years for street trees, on the basis that it is likely that larger specimens would be provided at those locations where trees are to be replaced.

2.6.8   As the detailed design of proposed green bridges is ongoing, the post-construction calculation has not considered the value of proposed green bridges. This represents a precautionary approach, as they will eventually add habitat area and connectivity that would in some cases lead to higher position in the network scores.

Limitations

2.6.9   There is a difference of approximately 2.51ha in the total area of the pre-construction and post-construction habitat polygons. The discrepancy represents approximately 0.03% of the total area. The discrepancy is created by many very small gaps between mapped features within the GIS layers. Given the very small scale of this discrepancy, it will create a negligible difference in biodiversity units and therefore is not a significant constraint to the calculation.

2.6.10   Detailed landscape design is yet to be undertaken. As a consequence, the AP4 design only includes broad categories for habitats to be created (e.g. grassland habitat creation). These categories limit the ability to provide detailed comparisons between the pre- and post-construction outputs of the calculation. However, such a constraint is unavoidable prior to detailed design.

2.6.11   In line with the worse-case scenario assumed in the main ES, the calculation assumes that all hedgerows within areas required temporarily for the construction of the scheme will be removed, and following completion of construction re-created on their existing alignments. However, in practice the final layout of re-created hedgerows will be adjusted to accommodate the reconfiguration of field boundaries, and revised access requirements. In the absence of detailed design, the hedgerow data cannot be edited to reflect these changes.

2.6.12   Neither the pre- or post-construction calculations overtly acknowledge the biodiversity units that may be generated by roadside verges. This is a consequence of both the scale of the initial Phase One mapping, and the level of detail currently available through the CT-06 drawings. However, it is likely that in many cases the road diversion routes included within the scheme will be longer in extent than those which are currently present. As such, even when risk multipliers are considered, the overall effect of this element on the wider calculation is likely to be minimal.

2.7   Assumptions, limitations, and variations - route section specific

CFA1 to CFA 6

2.7.1   The GIS query for calculating the ecological position in the network score for hedgerow features was not used in the CFA1 to CFA6 section of the route, due to complications applying this to the previously digitised hedgerow data. Due to the limited number of hedgerow features in this section of the route, the same criteria as set out in the November 2013 Technical Note were applied manually. In undertaking the post-construction calculation, it has been assumed that hedgerows recreated in areas of temporary land use will have the same position in the network multiplier as pre-construction. Given the length of hedgerows in CFA1 to 6 represent only a small fraction of the total pre-construction hedgerow length, this is considered unlikely to have significantly altered the output of the calculation.

2.7.2   At Wormwood Scrubs (CFA4, Kilburn (Brent) to Old Oak Common) HS2 Ltd provided an assurance to London Borough of Hammersmith and Fulham on 1 July 2015, regarding the provision of alternative ecological mitigation provision. The area of land at Wormwood Scrubs identified in the Bill for the purpose of ecological mitigation will not now be used. It is replaced by a legal agreement to provide mitigation in other areas of Wormwood Scrubs located outside the land included in the Bill.

2.7.3   For the purposes of the calculation the areas of proposed compensatory habitat that we included in the Bill have been included in both the pre-construction and post-construction aspects of the calculation, with no risk multipliers applied. Therefore, these aspects score the same number of biodiversity units on both sides of the calculation, and have no impact on the balance of biodiversity units.

2.7.4   The alternative mitigation areas that will provided in accordance with the legal agreement have been digitised from the drawings in the Wormwood Scrubs Ecological Enhancement Proposals dated 11 March 2015 and considered in both the pre- and post-construction aspects of the calculation. The area of Japanese knotweed shown on the enhancement plan has been coded as woodland as per the underlying Phase One habitat type (the Japanese knotweed is invading this area), and the wader scrapes as wetland.

CFA7 to CFA15

2.7.5   Natural England's ancient woodland inventory dataset released in January 2015 identified areas of land on the cuttings of the Aylesbury link railway line, and the FCC sidings to the south of Calvert as ancient woodland. These areas are highly unlikely to represent ancient woodland habitat due to the removal of topsoil required for the construction of railway

infrastructure. The approximately 1.38ha of habitat, unlikely to be ancient woodland has therefore been given a distinctiveness weighting of 6 in the calculation.

2.7.6   The large sustainable placement areas at the tunnel portal in CFA7, Colne Valley include areas at the Chiltern Tunnel South Portal (CFA7, Colne Valley) identified in the CT-06 Proposed Scheme drawings (Main ES Volume 2 CFA7 Map Book) as ecological habitat creation (CT-06 'grassland habitat creation'). However, these areas were not included within the ecological habitat creation figures reported in the main ES due to uncertainty over the final restoration design in these areas. For the purposes of the calculation, a precautionary approach has been adopted and the large area of grassland habitat creation to the south of Chalfont Lane has been assumed to be of 'moderate' distinctiveness (4 x weighting).

2.7.7   The CT-06 Proposed Scheme drawings currently show over 100ha of ecologically led grassland habitat creation to be provided to the west of Aylesbury. However, they were not included in the ecological habitat creation figures reported in the main ES. The no net loss calculation assumes that, based on current proposals, approximately 60ha of grassland habitat creation will be provided to the north of Oxford Road. It is assumed that areas to the south of Oxford Road will return to their existing land use

CFA16 to CFA22

2.7.8   ESs undertaken in support of the scheme have identified that hedgerows at Waggoner's Lane Site of Biological Importance (SBI) (CFA 21, Drayton Bassett, Hints and Weeford) and Wood End Lane (Hedge 1) Biodiversity Alert Site (BAS) (CFA22, Whittington to Handsacre) will be translocated as mitigation. However, these hedgerows are not marked on the CT-06 Proposed Scheme drawings. As such, they have been manually added to the AP4 design dataset at the locations recommended for translocation in the relevant ES documents.

CFA23 to CFA26

2.7.9   No route section specific assumptions, limitations or variations.

2.8   Quality assurance process

Development of metric and trialling implementation

2.8.1   Natural England and Defra provided feedback on the HS2 metric via a series of meetings prior to its publication in November 2013.

2.8.2   Internal drafts to trial the implementation of the metric and identify key issues were undertaken by HS2 Ltd and its consultants during March 2014 and January 2015.

2.8.3   Each draft trial of the implementation of the metric was informed by updated supplementary guidance drafted by HS2 Ltd and its overview consultants, aimed on each occasion at increasing consistency in implementation. To inform each draft pass at the calculation, the teams of ecologists undertaking the calculation in each route section provided lists of any additional assumptions implemented in undertaking their work. These lists of assumptions have subsequently been reviewed and used to identify ongoing inconsistencies. Workshop sessions have then been undertaken in order to resolve these issues and reach an agreed approach to be incorporated into revised guidance. The guidance set out in this document has

been derived through this iterative process, and forms part of the overall QA process that has been associated with the final calculation output.

2.8.4 Route-wide QA incorporated a review of scored outputs through comparison of mapped multiplier scores for distinctiveness, habitat condition and position in the ecological network for both pre- and post-construction. In addition, these outputs were compared to the data shown on the following map products published in the November 2013 ES:

- CT-06 Proposed Scheme drawings; and

- EC-02 Phase One habitat map.

2.8.5 As a result of this review, further feedback and guidance was provided to aid consistency in undertaking the final calculation.

QA checks within route section

2.8.6 As set out in Section 2.3 the route has been divided into four sections for the purposes of the no net loss calculation. Work in each section has been undertaken by a team of ecological consultants.

2.8.7 Each of the teams of consultants involved in implementing the no net loss calculation has been responsible for undertaking a quality audit on their data outputs. The route section specific audits have focused on ensuring that:

- the scoring of features within the calculation has been informed by the most suitable available baseline information and sound professional judgement; and

- scoring has been undertaken in accordance with the prescribed metric.

2.8.8 As part of the QA process, route section consultants were asked to undertake the following:

- review the main ES EC-02 Phase One habitat map data, and update it in light of any additional information obtained since the publication of the main ES;

- undertake numerical queries on the GIS database to check for potential outputs that are contrary to the 'rules' set out in the prescribed methodology;

- compare scored distinctiveness values with available data from habitat inventories, including the Natural England Priority Habitat Inventory data set;

- document any route section specific assumptions and limitations;

- undertake peer review of application of the metric to ensure consistency within route section, and verification of professional judgements; and

- undertake GIS data checks to confirm that data conforms to the requirements of the HS2 GIS schema.

Route-wide QA checks

2.8.9 Following self-assurance, data sets produced in each of the four route sections were subject to a further series of QA procedures undertaken at a route wide level.

2.8.10   These checks were principally aimed at ensuring that the metric and associated guidance have been consistently implemented. It has not been the focus at this step in the QA process to scrutinise the underlying baseline information or the scoring of individual habitat features. The QA checks undertaken at the route-wide level consisted of:

- repeating numerical queries on the GIS database to check for potential outputs that are contrary to the 'rules' set out in the prescribed methodology

    - where entries failed these checks, data sets were marked with an error reference and returned to the originators to address;

    - checks were repeated on resubmission of the data and all accompanying rationale considered.

- checking that the area (ha) of pre- and post-construction calculations is equal;

- GIS data checks to confirm that data conforms to the requirements of the HS2 GIS schema;

- documenting all route-wide assumptions and limitations, identifying and resolving inconsistencies in application;

- high-level check of summary biodiversity unit calculations to ensure that outputs do not contain major errors; and

- peer review of implementation to ensure consistency between route sections, and verification of professional judgements.

2.8.11   On resolution of outstanding issues the overview consultant has then been responsible for merging the individual route section data sets in order to provide a single consolidated GIS data set, and a summary of the route-wide calculation outputs.

2.9   Accessing the data

2.9.1   In order to enable third party scrutiny of the no net loss calculation the GIS data, as well as a non-GIS format, will be made available via the Government's data.gov.uk website.

2.9.2   The data (covering all areas of the route) is available to download from the Data.gov.uk website at the following URL:

https://data.gov.uk/publisher/high-speed-2

2.9.3   The non-GIS format of the data has been provided in a spreadsheet format. This is a direct extract from the GIS data.

2.9.4   An explanation of key fields used within the GIS database is provided in Appendix B.

2.9.5   Several of the other data sets that have underpinned the calculation (e.g. HS2 Phase One habitat data) are also updated periodically at the data.gov.uk site. A summary of the data sources utilised in the no net loss calculation in each route section is provided in Table 2.

3   Results and discussion

3.1   Route-wide summary of calculation outputs

3.1.1   Tables 3 and 4 respectively provide a summary of the no net loss calculation outputs for habitat polygons (area-based units) and polylines (linear-based units) at a route-wide level. These totals are derived from the data contained within the GIS data. In each case, the comparison between the pre- and post-construction totals gives an indication of progress towards the goal of no net loss in biodiversity.

3.1.2   For habitat polygons (area-based units), Table 3 shows the number of biodiversity units sub-divided by habitat types and distinctiveness weightings in order to aid comparison of how the biodiversity units are distributed.

3.1.3   Table 4 provides a summary at the route-wide level of the calculation outputs for hedgerows and watercourses, which are both considered within the metric as linear features. It should be noted that the methodology for calculating the number of biodiversity units differs between hedgerows and watercourses, and so units are not interchangeable.

Table 3: Route-wide summary of biodiversity units generated pre- and post-construction (area based features)

HABITAT POLYGONS (AREA-BASED UNITS)

Pre-construction			Post-construction			SUMMARY
Habitat category (distinctiveness weighting)	Area (ha)	Biodiversity units generated	Habitat category (distinctiveness weighting)	Area (ha)	Biodiversity units generated	Net change in Biodiversity Units
Woodland (8)	45.49	2625.22	Woodland (8)	31.69	1701.24	**-923.98**
Woodland (6)[34]	207.33	6979.57	Woodland (6)	437.64	3537.09	**-3442.48**
Woodland and scrub (4)	249.34	2495.07	Woodland and scrub (4)	741.82	5664.97	**3169.89**
Woodland and scrub (2)	31.06	76.83	Woodland and scrub (2)	19.01	31.24	**-45.59**
Grassland (8)	0.00	0.00	Grassland (8)	0.00	0.00	**0.00**
Grassland (6)	70.73	2637.03	Grassland (6)	418.74	6474.42	**3837.38**
Grassland (4)	730.97	7172.50	Grassland (4)	1036.91	7502.98	**330.48**
Grassland (2)	1239.96	2518.36	Grassland (2)	668.41	1335.95	**-1182.42**
Other habitats (8)	3.78	122.11	Other habitats (8)	0.00	0.00	**-122.11**
Other habitats (6)	16.85	652.29	Other habitats (6)	64.39	1092.08	**439.79**
Other habitats (4)	75.03	780.12	Other habitats (4)	141.04	1117.62	**337.50**
Other habitats (2)	3418.07	7190.30	Other habitats (2)	1930.34	3725.64	**-3464.66**
Other habitats (0)	507.86	0.00	Other habitats (0)	1108.51	0.00	**0.00**
TOTALS	**6596.47**	**33249.42**		**6598.98**	**32183.22**	
			ROUTE-WIDE NET CHANGE IN BIODIVERSITY UNITS			**-1066.19**

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[34] This category is predominately woodland, but contains very small areas of scrub that have been considered to meet a habitat of principal importance definition based on their role in a habitat mosaic.

Table 4: Route-wide summary of biodiversity units generated pre- and post-construction (linear features)

POLYLINES (LINEAR-BASED UNITS)						
Pre-construction			Post-construction			SUMMARY
Habitat type	Length (m)	Biodiversity units generated	Habitat type	Length (m)	Biodiversity units generated	Net change in Biodiversity Units
Hedgerow	444189.47	2201764.40	Hedgerow	397847.37	1926040.81	**-275723.58**
Watercourse	74517.46	136039.97	Watercourse	83515.56	144683.54	**8643.56**

3.2 Discussion of calculation outputs

Area-based features

3.2.1 Each row in Table 3 reports the change in area and biodiversity units that are expected as a consequence of Phase One for key habitat categories, and distinctiveness bands. The categories used for comparison have been governed by the level of detail that is currently available for post-construction areas in the design that accompanied the Bill and subsequent AP (as shown in the CT-06 Proposed Scheme drawings mapping that accompanied the main ES).

3.2.2 A summary of the features included in each of the habitat categories used for results analysis is provided as Appendix C.

3.2.3 A distinctiveness score of 'very high' (8 x weighting) is allocated only to those habitats that cannot be adequately recreated if lost. For the purposes of Phase One, this definition is considered to apply only in relation to areas of Ancient Semi-Natural Woodland and Lowland Fen. The metric does not allow habitat creation (e.g. planting of new areas of woodland) to be targeted at a 'very high' distinctiveness rating (8 x weighting), thus recognising that these habitats are irreplaceable.

3.2.4 A commentary in relation to the key habitat types is provided below.

Woodland and scrub

3.2.5 A total of approximately 45.5ha of ancient semi-natural woodland are located within the land covered by the calculation. Approximately 14ha will be removed to allow the construction and operation of the scheme. The remaining approximately 31.7ha within the scope of the calculation will be retained, and will not be subject to construction works. As outlined in the SES3 and AP4 ES (SES3 and AP4 ES Volume 2 CFA18) approximately 8.7ha of ancient semi-natural woodland at Black Waste Wood will be subject to ongoing management to enhance the habitat condition of the retained areas as part of the compensation to be provided through the Bill.

3.2.6 The retained and enhanced areas of ancient woodland covered by the calculation scope are responsible for generating all of the biodiversity units attributed to habitat of 'very high' distinctiveness (8 x weighting) shown in the post-construction calculation. There will be a

significant reduction (approximately 924 biodiversity units) in the biodiversity units generated post-construction within the 'very high' distinctiveness band (8 x weighting) for woodland.

3.2.7   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).

3.2.8   At the route-wide level there will be a net gain of approximately 230ha in the extent of 'high' distinctiveness woodland (approximately 207ha pre-construction c.f approximately 438ha post-construction). All ecologically led woodland habitat creation has been targeted at habitats of 'high' distinctiveness (6 x weighting). However, considered in biodiversity units there will be a reduction of approximately 3442 units generated by 'high' distinctiveness woodland.

3.2.9   In contrast there will be a net gain of approximately 3170 biodiversity units due to a net gain of approximately 492 ha of woodland and scrub habitats of 'moderate' distinctiveness[35]. These gains are primarily a result of the creation of areas identified in the post-construction design and CT-06 Proposed Scheme drawings as 'landscape mitigation planting (scrub/woodland)'.

3.2.10   Overall, the woodland and scrub habitats created post-construction are expected to generate fewer biodiversity units than the woodland and scrub habitats currently present, with approximately a 10% reduction in the number of biodiversity units present. In addition there will be a 'trading down' between the 'high' (6 x weighting) and 'moderate' (4 x multiplier) distinctiveness bands with a greater proportion of the total biodiversity units being generated by habitats of moderate distinctiveness post-construction.

Grassland

3.2.11   Approximately 71ha of grassland that meet the 'habitat of principal importance' definitions will be present pre-construction. The scheme is expected to result in a 'trading up' across the distinctiveness categories, with approximately 419ha of 'high' distinctiveness grassland (6x weighting) created which generates a net gain of approximately 348ha. This translates into a net gain of over 3800 biodiversity units generated by grasslands that are likely to meet habitat of principal importance definitions. In addition, there will be a small increase in the biodiversity units generated by moderate distinctiveness grassland, and a reduction in those generated by low distinctiveness grassland.

3.2.12   Overall, there is expected to be a net gain of approximately 2985 biodiversity units generated by grassland habitats established post-construction (equivalent to just over a 24% gain in grassland biodiversity units).

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[35] All landscape led tree planting has been assumed to reach moderate habitat distinctiveness.

Other habitats

3.2.13   Collectively, across all habitat distinctiveness bands, there is expected to be a net loss of approximately 2687 biodiversity units generated by 'other habitat' types (approximately a 31% decrease on that present pre-construction).

3.2.14   The scheme will result in the loss of approximately 3.8ha of lowland fen habitat which is classified within the 'very high' distinctiveness (8 x weighting). As this habitat is considered irreplaceable, there will be a significant reduction (approximately 122 biodiversity units) in the biodiversity units generated post-construction by 'other habitat' of 'very high' distinctiveness (8 x weighting).

3.2.15   The scheme will have an impact on approximately 17ha of 'other habitat' that qualifies as habitat of principal importance (i.e. a 'high' distinctiveness score - weighting x 6), including the loss of approximately 0.5ha of remnant heathland classified in the Phase One habitat survey as dry dwarf shrub heath[36], 3ha of swamp and nearly 6ha of ephemeral/short perennial habitats .The 17ha also includes approximately 7ha of standing water, although not all of this extent will be directly lost due to the scheme.

3.2.16   Post-construction there will be approximately 64ha of 'other habitat' that qualifies as habitat of principal importance. This is an increase of approximately 47.5ha from the 16.8ha of 'high distinctiveness' habitat present prior to construction. This translates to an increase of approximately 439 biodiversity units.

3.2.17   The 'other habitat' of 'high distinctiveness' (6 x weighting) created by HS2 Ltd will include significant areas of heathland/grassland mosaic (approximately 19.5ha), wetland (approximately 35ha), standing water habitat (approximately 2.5ha). However, it is not possible to isolate exact habitat types due to the broad habitat creation categories used in the AP4 design. In addition this category will incorporate small areas thought likely to return to supporting the habitat of principal importance 'habitat mosaic on previously developed ground'.

3.2.18   There will be a net gain of approximately 66ha of 'moderate distinctiveness' (4 x weighting) 'other habitats' post-construction. This translates to an increase in biodiversity units of approximately 340 biodiversity units.

3.2.19   There will be a net loss in biodiversity units of approximately 3460 biodiversity units due the loss of 'other habitats' of 'low distinctiveness' (2 x weighting). This habitat group includes arable fields, improved grassland and areas of amenity grassland. These habitats occupy an area of approximately 3418ha pre-construction, but only 1930ha post-construction. Therefore, there is a net reduction in their extent of approximately 1487ha.

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[36] This habitat type occurs in CFA22 Whittington to Handsacre as part of the Whittington Heath Golf Course Site of Biological Importance. It consists of habitat mosaic that includes elements of acid grassland and scrub which are reported in the grassland and woodland and scrub aspects of Table 3. Given the remnant nature of the heath it is not considered to represent habitat of 'very high' distinctiveness.

3.3   Linear-based features

Hedgerows

3.3.1   Table 4 sets out the outputs of the pre- and post-construction calculations for hedgerows. The calculation predicts that the scheme will result in the loss of approximately 444km of hedgerow which are present prior to construction. Assuming the creation of hedgerows identified within the AP4 design, and the recreation of all hedgerows in areas of temporary land use, then approximately 397km of hedgerow are likely to be present post-construction. In biodiversity units, this equates to a net reduction of approximately 275700 hedgerow biodiversity units.

3.3.2   However, in line with the precautionary approach adopted for the rest of the assessment, it is considered appropriate to apply a further manual adjustment to the calculation outputs to gain a worst-case estimate. The scheme contains large areas of land that will be used temporarily and then returned to landowners after construction. For the purposes of the calculation reported in Table 4, it has been assumed that all hedgerows within areas required temporarily will be reinstated on their existing alignments. In practice, it is likely that there will be at least a proportion of these hedgerows that will not be reinstated, in order to accommodate the reconfiguration of field boundaries, and to accommodate revised access requirements.

3.3.3   Based on a visual review of the post-construction dataset in each route section to study the arrangement of hedgerows in areas of permanent and temporary land use, it is estimated that reconfigurations could result in approximately a 10% reduction in the length currently estimated in the post-construction calculation. Taking this into account, a broad adjustment has been made to the likely number of biodiversity units generated post-construction, through assuming that the 10% reduction in the length will also equate to a 10% reduction in the number of biodiversity units. The adjustment is set out in Table 5, and increases the net reduction in hedgerow biodiversity units to approximately 468300 units. This equates to approximately an additional 110km of hedgerow habitat creation being required to balance the post-construction hedgerow biodiversity units[37].

Table 5: Adjustment to hedgerow biodiversity units to take into account likely reconfiguration of hedgerows in areas of temporary land use

Pre-construction hedgerow biodiversity units (based on metric output - see Table 4)	Post-construction hedgerow biodiversity units generated (based on metric output - see Table 4)	Adjusted Post-construction hedgerow biodiversity units (10% reduction from metric output applied)	Adjusted net change in biodiversity units	Equivalent of adjusted biodiversity units in km of hedgerow habitat creation
2201764.39	1926040.81	1733436.73	-468327.67	-109.94

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[37] This figure has been generated through assumed 'high' condition (3 x weighting) and position within existing network score of 2. As the metric uses metres as a unit, the outputs has been converted to km by multiplying by 0.001. i.e. Equivalent km of hedgerow creation = (Total number of biodiversity units /3)/2 x 0.001.

Watercourses

3.3.4   Table 4 sets out the outputs of the pre- and post-construction calculations for watercourses. There will be an increase of approximately 9km in the length of watercourses due to the scheme. This translates to a net gain of approximately 8643 watercourse biodiversity units. This represents an increase of approximately 6% on the biodiversity units generated by watercourses present prior to construction.

4   Conclusions

4.1.1   The metric calculates losses and gains to biodiversity on an area basis except for linear features (hedgerows and watercourses), for which separate calculations are made based on the length of these habitats affected. The metric, therefore, results in three separate figures: one for the area-based calculation and one for each of the length-based calculations.

4.1.2   The results of the area-based aspects of the no net loss calculation, which is the largest component, suggest that at the route-wide level good progress has been made towards the goal of no-net loss. The calculation currently predicts that there will be approximately a 3% reduction in the number of biodiversity units.

4.1.3   The overall goal of achieving no net loss in biodiversity as set out in the principles of the Defra metric is to ensure that there is no 'trading down', such that biodiversity units are generated by habitats of the same or higher distinctiveness rating than those lost. The output from this Phase One calculation shows that in the AP4 design there is a significant 'trading down' in relation to woodland (i.e. biodiversity units are being generated by habitats of lower distinctiveness than those lost to the scheme), with approximately 1240 less biodiversity units generated by woodland and scrub habitats post-construction.

4.1.4   However, the results in relation to grasslands are positive and suggest the habitat creation measures proposed will achieve a clear 'trading up' in the distinctiveness of the habitats created, with an increase in the total number of biodiversity units generated by grassland, and a higher proportion of these units being generated by habitats of 'high distinctiveness' (i.e. those that would qualify as habitat of principal importance).

4.1.5   In the absence of a detailed landscape design it is not possible to isolate habitat losses and gains in biodiversity units due to other specific habitat types[38]. More biodiversity units will be generated by 'other habitats' of 'high' and 'moderate' distinctiveness. The net loss of approximately 3500 biodiversity units generated by 'other habitats' of 'low' distinctiveness is significant. This reflects the large scale of the cumulative losses within this habitat category. However, in addition it in part reflects the precautionary approach that has been adopted in allocating 'time to target condition' risk multipliers to some low distinctiveness habitats such as 'tall ruderal' communities.

4.1.6   The outputs of the linear-based calculation reported in Section 3.2 suggest that there remains a significant deficit in biodiversity units in relation to hedgerows. However, this output is likely to be a worst-case scenario for two reasons:

- In the absence of detailed design information, the calculation has adopted a precautionary approach in the assumptions that have been made in areas of temporary land use. At present, the calculation assumes all hedgerows in areas required temporarily during construction will be removed. However, as detailed design progresses, HS2 will seek to minimise loss of hedgerows within areas of temporary land use. Therefore, it is likely that a significant proportion of these

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[38] While detailed information is available for the pre-construction calculation, in the absence of a detailed landscape design the scheme design does not differentiate all habitat types within the post-construction design.

hedgerows can be retained during construction. Retained hedgerows would no longer be afforded a risk multiplier in the calculation (the multipliers reduce the biodiversity units available to deal with inherent risks of creating new habitats) - thus the post-construction hedgerow biodiversity units would be likely to increase.

- The AP4 design provides a high-level indication of the final landscape design and it is likely that more hedgerows than currently shown in the design will be created within the areas that are permanently required for the construction and operation of the scheme. This is also likely to significantly increase the number of hedgerow biodiversity units available post-construction.

4.1.7   In relation to watercourses the calculation predicts a gain in watercourse biodiversity, once the scheme has been constructed. This result largely reflects the fact that the scheme will result in the removal from culvert of several sections of watercourse, add a network of new wet ditches, and will in many cases create a more meandering and diverse channel than is currently present.

4.1.8   As described within the ES published in support of Phase One of HS2, the mitigation measures included in the Bill are sufficient to address the significant adverse effects of the scheme. Overall, Phase One is likely to result in significant increases in the overall extent of habitats achieving habitat of principal importance status, including net increases of approximately 348ha of habitat of principal importance grasslands and approximately 230ha of habitat of principal importance woodlands.

4.1.9   The goal of seeking no net loss in biodiversity at the project level is beyond that currently required by legislation and policy. This calculation represents the first attempt to apply such a calculation to a transport scheme of national significance. Despite, the precautionary approach adopted the calculation outputs suggest good progress has been made towards this goal.

4.1.10   Given the precautionary assumptions adopted in the current calculation (e.g. that all habitats within areas of temporary land use will be lost) there remain many opportunities to improve the overall balance of biodiversity units generated by Phase One as detailed design progresses.

4.1.11   In accordance with the draft Code of Construction Practice and the Environmental Minimum Requirements, the project will continue to seek to avoid or further reduce the impacts of the scheme. For example, efforts will be made to reduce the loss of hedgerows within areas of temporary land-use, and this should lead to a further improvement in the results. In addition, HS2 will continue to pursue opportunities to gain greater biodiversity value from the habitats created across the scheme.

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Appendix A - Technical Note - Methodology for demonstrating no net loss in biodiversity

HS2 London-West Midlands

Ecology

Technical note – Methodology for demonstrating no net loss in biodiversity

A report to HS2 Ltd by Arup/URS

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1   Introduction

1.1   Purpose of this document

1.1.1   The UK Government is committed to halting overall loss in biodiversity by 2020. In line with government policy, High Speed Two Limited (HS2 Ltd) is seeking to ensure that the Phase One London and West Midlands route of the proposed High Speed 2 (HS2) railway (hereafter referred to as the Proposed Scheme) results in no net loss in biodiversity at a route-wide level.

1.1.2   Demonstrating no net loss to biodiversity represents a significant challenge to a large project such as HS2 London-West Midlands (LWM). This document sets out the approach that HS2 Ltd proposes to use to compare biodiversity losses and gains, as a consequence of the Proposed Scheme.

1.2   Biodiversity offsetting

1.2.1   Biodiversity offsets are conservation activities designed to deliver biodiversity benefits in compensation for losses, in a measurable way[1]. Offsetting methodologies compare the losses resulting from the impact of a development with the gains achieved through the provision of offsets, thus aiming to provide a transparent mechanism by which the impacts of a development can be quantified, and an appropriate level of compensation agreed.

1.2.2   Biodiversity in its entirety is impossible to measure so offsetting utilises a 'metric' to represent, and provide a measure of, overall biodiversity (Defra 2012b)[2]. Metrics are surrogates[3], or combinations of measurements, that together provide an assessment of the biodiversity value of a particular area (Defra, 2012b). The metric allows the biodiversity impact of a development to be quantified so that the offset requirement, and the value of the compensatory action, can be clearly defined. Metrics are transferable between sites and habitats, allowing an impact on one habitat type to be offset with conservation action elsewhere, or involving a different habitat type and/or quality of habitat (Defra, 2012b).

1.2.3   Use and further development of offsetting methodologies is considered vital to ensuring that the planning system secures meaningful compensation which can contribute to the Government's commitment to expand and restore the ecological network in England, and to halt overall biodiversity loss by 2020[4].

1.3   Position within the mitigation hierarchy

1.3.1   In seeking to minimise the effects of the Proposed Scheme on biodiversity, the 'mitigation hierarchy' outlined in Figure 1 will be applied.

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[1] Defra (2012a), *Biodiversity Offsetting Pilots: Information note for Local Authorities.*
[2] Defra (2012b)*, Biodiversity Offsetting Pilots: Technical Paper: the metric for the biodiversity offsetting pilot in England.*
[3] Surrogates are measurements that act as substitute for a complete measurement of the total biodiversity found within a particular area.
[4] Defra (2011), *Biodiversity 2020: A strategy for England's wildlife and ecosystem services.*

Figure 1:   Mitigation hierarchy

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┌─────────────────────────────────────────────────┐
│                      Avoid                        │
│      e.g. re-design proposals to avoid an impact  │
│              on the ecological resource           │
└─────────────────────────────────────────────────┘
                          ↓
┌─────────────────────────────────────────────────┐
│                 Reduce/mitigate                   │
│     e.g. minimising loss of habitat required for  │
│        construction of a new structure; or        │
│     employing dust controls to limit deposition   │
│              on adjoining habitats                 │
└─────────────────────────────────────────────────┘
                          ↓
┌─────────────────────────────────────────────────┐
│                   Compensate                      │
│      e.g. plant new woodland to address losses    │
│              that could not be avoided            │
└─────────────────────────────────────────────────┘
```
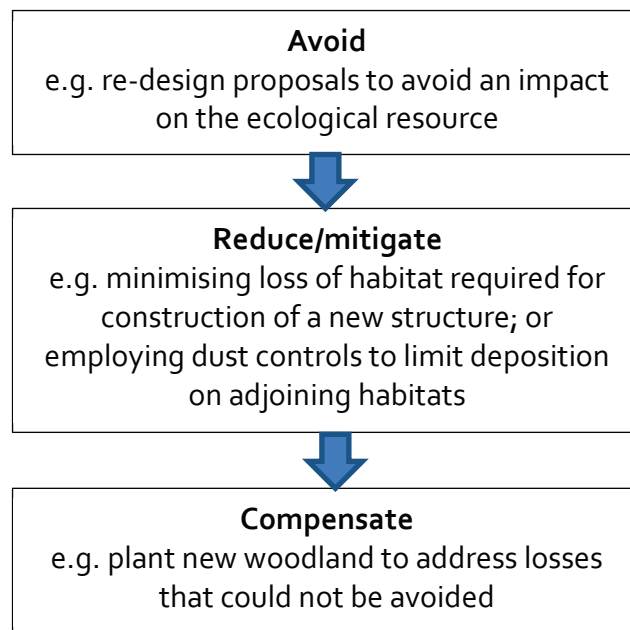
1.3.2   Offsetting (and the use of offsetting metrics) represents a method of defining an acceptable level of compensatory provision. It occupies a position at the bottom of the mitigation hierarchy, providing the opportunity to quantify compensation, when it has been determined that compensation is required. It does not represent an alternative to the normal application of the mitigation hierarchy. In all cases the earlier stages in the mitigation hierarchy should be considered sequentially before the end point of a requirement for compensation, and thus a need to adopt an offsetting approach is reached.

1.3.3   Where it is accepted that reasonable efforts have been made to explore alternatives during the design process, and the mitigation hierarchy has been applied then the offsetting metric outlined in this document will be utilised to compare the losses and gains in biodiversity that occur as a consequence of the Proposed Scheme.

1.3.4   The approach advocated in the following document should be considered in this context and separated from considerations associated with the avoidance, reduction and mitigation aspects of the hierarchy, which will have been explored in depth independently at earlier stages in the process.

1.4   Defra offsetting pilot

1.4.1   The development of a consistent framework for biodiversity offsetting was identified as a priority in the Natural Environment White Paper[5] (2011). In line with this goal, in April 2012 Defra launched a two-year pilot study to trial the use of offsetting in six test areas. The pilot is based upon use of a habitat based 'metric' for considering losses and gains in biodiversity.

1.4.2   The approach involves measuring each area of habitat present before the development against pre-defined scales based on 'distinctiveness' and 'condition'. The scores obtained are then multiplied to give a number of biodiversity units per hectare, and adjusted on the basis of the area of that habitat type present.

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[5] HM Government (2011), *The Natural Choice: Securing the value of nature*. HMSO, London.

1.4.3   For example a development will result in the loss of 6 hectares of lowland meadow in moderate condition (further details of the scoring system are provided in Section 3). The number of biodiversity units is calculated as follows :

>   Distinctiveness score (6) x habitat condition score (2) x habitat extent (6)
>   = 72 biodiversity units

1.4.4   This step is then repeated for each habitat area within the extent of the development to calculate the number of biodiversity units that will be lost.

1.4.5   The calculation as a whole is then repeated to consider the number of biodiversity units that will be provided by the habitat creation or habitat restoration which has been committed to as part of the proposed development. This calculation considers the extent, distinctiveness and target condition for proposed habitats and a series of multipliers are utilised to ensure the compensation strategy takes into account spatial, temporal and delivery risks associated with the provision of the replacement habitats.

1.5   Biodiversity offsetting and HS2 LWM

1.5.1   The Defra offsetting pilot methodology is considered to represent the best available basis for an offsetting methodology that will allow the biodiversity losses and gains of the Proposed Scheme to be robustly assessed. However, a number of amendments to the published pilot methodology are considered necessary to address feedback that has arisen from use of the methodology within the pilot areas, and to ensure that it is suitable for use in support of a landscape scale project.

1.5.2   The key amendments to the Defra pilot methodology which are proposed are:

a.   adding an additional 'very high' score under habitat distinctiveness to take account of those habitats of principal importance identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[6] which cannot be adequately re-created if lost;

b.   Increasing the distinctiveness score attribute to all habitats that form part of an area that qualifies as the habitat of principal importance type open mosaic habitat on previously developed land. Thus ensuring the value of these habitats is fully recognised within the calculation;

c.   removing the application of a variable condition weighting for habitats of low distinctiveness - all low distinctiveness habitats will instead automatically attract a condition weighting of 'poor', thus recognising that condition has negligible effect on the overall value of those habitats which are intrinsically of low distinctiveness;

d.   incorporating greater consideration of the importance of both habitats lost and gained (in relation to the function of ecological networks) into the spatial risk multipliers, in order to recognise the landscape scale of the project and its impacts; and

e.   removing the blanket one-step restriction on the change in condition and replacing this with the condition that for high distinctiveness target habitats a maximum future target condition of moderate can be claimed.

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[6] Natural Environment and Rural Communities Act (2006) Chapter 16. Her Majesty's Stationery Office, London.

1.5.3   Details of how these amendments have been incorporated into the metric for the Defra pilot methodology are provided in Sections 2 , 3 and 4 of this report.

1.5.4   HS2 Ltd intends to utilise the methodology contained within this report to calculate and compare the likely biodiversity losses and gains that will occur as a consequence of the Proposed Scheme. In doing so, it will seek to demonstrate in a transparent manner the current position that HS2 LWM has reached in relation to its commitment to seek no net loss of biodiversity at the route-wide level.

1.5.5   The post-development calculation will include consideration of the bespoke areas of ecological compensation to be provided, areas of planting which have been primarily provided to address landscaping considerations, and those habitats that will form part of the operational railway (e.g. cutting slopes). Both spatial risk and delivery risk multipliers will be applied to address the inherent uncertainty involved in habitat creation. These multipliers will serve to temper the number of biodiversity units that can be achieved through the creation of habitats where there is an increased risk of failure.

1.5.6   The focus of ecological compensation for habitat losses to be provided by the Proposed Scheme will be the provision of areas of habitat of principal importance in a manner that will contribute to the 'more, bigger, better' ideals identified in Making Space for Nature (Lawton, 2010)[7].

1.5.7   While an offsetting metric has been used as the means of comparing habitat losses and gains as a consequence of the Proposed Scheme, it is the intention of the project to delivering the new habitats through powers under the hybrid Bill rather than via the establishment of formal offsetting agreements with third parties. The use of formal offsetting agreements with third parties is not envisaged to deliver any of the required measures at this stage, although such agreements may be required to deliver additional measures should these be required.

1.5.8   In all cases where impacts on Sites of Special Scientific Interest (SSSI) occur as a consequence of the Proposed Scheme the requirements for mitigation and compensation have been discussed with Natural England, and will be agreed on a site by site basis (as they would be in the absence of an offsetting approach). This process has followed standard implementation of the mitigation hierarchy.

1.5.9   For completeness, the final compensation package agreed with Natural England for each SSSI will be scored on the basis of the metric outlined in this document and will be included as part of the calculations to be undertaken to consider the balance of losses and gains at the route-wide level.

1.5.10   As the offsetting metric is not being used to drive the level of compensation provided for impacts on SSSI, the inclusion of habitats falling within SSSI within the offsetting calculation is not considered to condone impacts on SSSI, nor act to contradict current planning guidance or Natural England processes for dealing with these impacts.

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[7] Lawton J (Chair) (2010), *Making Space for Nature: A review of England's Wildlife Sites and Ecological Network.* Report to Defra.

2 Units within the metric

2.1 Habitat parcels

2.1.1 The metric to be utilised for HS2 LWM represents a modified version of the Defra pilot methodology, and will predominantly utilise habitat parcels as the basis for comparing losses and gains in biodiversity as a consequence of the Proposed Scheme.

2.1.2 Phase 1 habitat survey and National Vegetation Classification (NVC) data (where available) will be utilised to identify all habitats parcels that meet one of the following criteria:

- habitats located within the extent of the land required for the construction of the Proposed Scheme[8];

- habitats located within the extent of any areas proposed for habitat creation or habitat enhancement (where these lie outside the boundaries of the land required for the construction of the Proposed Scheme); and

- areas of habitat outside the land required for the construction of the Proposed Scheme where the Environmental Statement (ES) identifies that the habitat is likely to be subject to adverse effects considered to be significant at the district/borough level or above[9] as a consequence of the Proposed Scheme.

2.1.3 Each habitat parcel which meets one of the criteria identified in paragraph 2.1.3 will be allocated a weighted score on the basis of each of the following criteria:

- habitat distinctiveness;

- habitat condition; and

- position within ecological network.

2.1.4 The modified metric will be used to calculate the number of biodiversity units afforded to the habitat parcels that will be affected by the Proposed Scheme. This total will subsequently be compared with the number of biodiversity units that are achieved by habitat parcels present post-development.

Arable field margins

2.1.5 Arable field margins specifically managed for wildlife and likely to qualify as the habitat of principal importance type arable field margins are infrequent across the route of the Proposed Scheme. Where field survey or interpretation of aerial photographs identifies the presence of margins that may qualify, then a standard width of 10m will be used to provide an estimate of the number of biodiversity units that are contributed by such features.

2.1.6 For all other arable fields falling within the scope of the pre-development calculations it will be assumed that an uncultivated arable margin of 1m width and moderate distinctiveness is present. Such features are too small to map accurately but given the

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[8] The land required for the construction of the Proposed Scheme is defined as the combined extent of all areas of land required either temporarily during construction or permanently during operation.
[9] The significance of effects described in the ecological impact assessment of the Proposed Scheme follows the methodology set out in: Institute of Ecology and Environmental Management, (2006), *Guidelines for Ecological Impact Assessment in the United Kingdom*. IEEM, Winchester.

scale of the Proposed Scheme could contribute a significant number of biodiversity units at the route-wide level.

2.1.7   The biodiversity units generated by arable field margins will be considered as part of the overall biodiversity units score generated by habitat parcels.

2.2   Linear features – hedgerows and watercourses

2.2.1   Hedgerows and watercourses will be considered as linear features and each will form a separate aspect of the offsetting calculation.

2.2.2   Both hedgerows and watercourses will generate their own number of biodiversity units pre- and post-development. Due to the unique nature of both habitat types it will only be suitable to offset losses on these habitat types through the provision of the same habitat type (i.e. loss of hedgerow can only be offset by creation of more hedgerows).

2.2.3   Losses and gains will generate biodiversity units based on the length of hedgerow or watercourse lost or gained. Other multipliers will be utilised where applicable, and in order to ensure clarity, consideration of hedgerows and watercourses as part of the calculation is covered separately in this document.

3 Calculating pre-development biodiversity units

3.1 Habitat distinctiveness

3.1.1 Habitat distinctiveness will be scored against a five category scale as detailed in Table 1.

3.1.2 Under the Defra pilot methodology all areas of habitat of principal importance fall within a 'high' category which scores a weighting of 6. Under the HS2 LWM methodology this category has been sub-divided to create a new 'very high' distinctiveness category, which will score a weighting of 8.

3.1.3 The 'very high' category will be utilised for all examples of habitat of principal importance present prior to development that cannot be adequately re-created if lost. For the Proposed Scheme this category will cover semi-natural ancient woodland, mature heathland and lowland fen.

3.1.4 The 'very high' category will not be used in the post-development calculation (see Section 4.2) (i.e. the maximum target distinctiveness weighting available post-development will be 6) in order to acknowledge that such habitat types (including ancient semi-natural woodland) are irreplaceable and losses cannot be addressed within the timeframes of the offsetting calculation. The undertaker will continue to adopt best practice measures to translocate the soils and seed/bud bank from such habitats, in order to give the best possible chance of providing similar habitat in the long term.

3.1.5 This approach in relation to irreplaceable habitats is considered acceptable taking into account the position that offsetting occupies within the mitigation hierarchy (i.e. after due consideration of avoidance, reduction and mitigation measures).

Table 1:   Habitat type bands

Distinctiveness	Habitats types included	Weighting
Very high	Habitats of principal importance (Tier 1)	8
	This category consists of habitats meeting habitat of principal importance definition and which cannot be adequately re-created if lost.	
	Habitats occurring within the HS2 LWM route which fall into this category are as follows[10]:	
	Ancient semi-natural woodland;	
	Mature lowland heathland;	
	Lowland fen.	
	N.B. Plantation on ancient woodland should be considered to fall under the 'high' distinctiveness category.	

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[10] Mature heathland and lowland fen are included here as a precaution due to their known occurrence within proximity to the land required for the construction of the Proposed Scheme.

Distinctiveness	Habitats types included	Weighting
High	Habitats of principal importance (Tier 2) i.e. those which meet the criteria[11] to qualify as habitats of principal importance but do not qualify under the definition for 'very high' category above.	6
Moderate	Other semi-natural habitats that do not fall within the scope of habitats of principal importance definitions, i.e. all other areas of woodland (e.g. non-native coniferous plantation), other grassland (e.g. species poor semi-improved), uncultivated field margins, road verge and railway embankments (excluding those that are intensively managed).	4
Low	Improved grassland, arable fields (excluding any uncultivated margins), built up areas, domestic gardens, regularly disturbed bare ground (e.g. quarry floor, landfill sites etc.), verges associated with transport corridors.	2
None	Transport corridors (without associated verges), landfill sites, spoil heaps.	0

3.1.6   Phase 1 habitat survey and National Vegetation Classification (NVC) (where available) data will be utilised as the basis for allocating a distinctiveness score to all habitats parcels that meet the criteria outlined in paragraph 2.1.2.

3.1.7   Where Phase 1 habitat data collected during field surveys in support of the Proposed Scheme are available, this data will be utilised. Where no field survey information is available, gaps should be filled utilising either Phase 1 habitat data derived from aerial photography analysis or through use of Phase 1 habitat data derived from habitat inventories (where available).

3.1.8   The categories utilised within the metric for the Defra pilot are principally aligned with the use of the Integrated Habitat System (IHS) (an alternative habitat classification methodology) which splits out habitats of principal importance from those that do not qualify under these criteria. Appendix A provides guidance to be utilised in translating Phase 1 habitat data into the habitat distinctiveness categories identified in Table 1. It aims to ensure each habitat type is broadly aligned with the guidance provided in Appendix 1 to the Defra guidance for offset providers and developers.[12]

3.1.9   As Phase 1 habitat categories and habitats of principal importance definitions do not always strongly correlate, in some cases a single Phase 1 habitat type could include both areas that qualify as habitats of principal importance and other areas that do not. As a consequence in allocating distinctiveness ratings it will be necessary to subdivide some Phase 1 habitat polygons for the purposes of the offsetting calculation.

3.1.10 Phase 1 habitat categories which are recorded as point data (e.g. scattered scrub or individual trees) will be considered on the basis of the distinctiveness rating of the underlying habitat polygon. Where the presence of a point data category is considered to add to the distinctiveness rating of the underlying habitat type (e.g. the presence of the scattered scrub within an area of ephemeral/short perennials) then the distinctiveness rating of the underlying habitat type polygon will be adjusted manually to account for this.

3.1.11 For those Phase 1 habitat types where more than one potential weighting score has been identified it will be necessary for an ecologist to review available habitat data

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[11] UK BAP (2011), UK Biodiversity Action Plan – Priority Habitat Descriptions. http://jncc.defra.gov.uk/PDF/UKBAP_PriorityHabitatDesc-Rev2011.pdf Accessed 17 August 2013.
[12] Defra (2012), Appendix 1 - Distinctiveness Bands for the Biodiversity Offsetting Pilot.
http://archive.defra.gov.uk/environment/biodiversity/offsetting/documents/1204-bio-offset-pilot-appendix.pdf Accessed: 09 Feb 2013.

(including information from any subsequent Phase 2 surveys conducted) and allocate a score, based on the guidance provided in Table 1.

3.1.12   When scoring habitat polygons, consideration will be given to those locations where the combination of habitats present may fall within the definition of the habitat of principal importance 'open mosaic habitat on previously developed ground'.

3.1.13   Where a combination of habitat polygons are considered to collectively meet the criteria for the open mosaic on previously developed ground (habitat of principal importance type) then all habitat parcels which fall under the scope of the definition should be upgraded to a distinctiveness rating of high (6 points) (e.g. areas of tall ruderals and short ephemerals which may alone have scored 2 for distinctiveness would each be upgraded to scoring 6, while the areas of interconnecting bare ground would continue to score a 2).

3.1.14   The habitat definition for open mosaic habitat on previously developed ground sets a minimum threshold for this habitat type of 0.25ha. The minimum size refers to the potential open mosaic habitat which could be part of a larger site, containing other elements such as woodland or developed land.

3.1.15   Continuous blocks of a closed plant community greater than 0.25 ha should as a general rule be classified according to the relevant habitat category, although those containing very fine-grained mosaics might qualify under the open mosaic on previously developed ground definition.

3.2   Habitat condition

3.2.1   All habitat parcels classified as falling within distinctiveness bands very high, high and moderate will be rated against a three-point condition scale with reference to the Higher Level Stewardship (HLS) agri-environment scheme condition assessment tool (Natural England, 2010)[13] utilised within the pilot methodology.

3.2.2   The condition scale is basic and where it is applicable, habitat survey notes will be utilised to allocate a condition score to each habitat parcel (see Table 2 below). Where all of the stated criteria are met then a condition assessment category of good (or A rating) is given. Where one of the criteria is missed or failed then a moderate (B rating) is given, and where two or more criteria are failed/missed then a low condition (C rating) is allocated.

Table 2   Condition weighting scale

Condition score	HLS condition assessment category	Framework for those habitats which are not covered by HLS condition assessment
3	A rating	Good
2	B rating	Moderate
1 N.B A condition score of 1 will also be automatically applied to all habitats of low distinctiveness	C rating	Poor

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[13] Natural England (2010), *Higher Level Stewardship – Farm Environment Plan (FEP) Manual – Technical guidance on the completion of the FEP and identification, condition assessment and recording of HLS FEP features.* Natural England.

3.2.3   The HLS guidance does not cover all habitat types that fall within the scope of this assessment, and where the HLS assessment guidance (Natural England, 2010) provides no relevant criteria then professional judgement will be applied to allocate a condition score against the three-point scale. Ecologists undertaking the condition scoring will be encouraged to discuss those situations where it is necessary to apply professional judgement, and a decision log will be maintained in order to ensure such judgements are consistently applied across the route.

3.2.4   All habitats identified as being of low habitat distinctiveness will automatically be allocated a condition weighting of 1. This modification to the metric reflects the view that for habitats of low distinctiveness the condition of the habitat has negligible influence on the overall value of that habitat type. For similar reasons no condition rating will be applied to assumed arable field margins.

3.2.5   Where access has not been obtained for survey then it will be necessary to allocate a condition score based on a precautionary approach informed by professional judgement. A condition score of 3 (good) is likely to be achieved only by those habitats which are being actively managed to maximise their value for nature conservation. As a consequence, where existing data suggest that land is likely to be subject to management aimed to maximise its nature conservation value, then a score of 3 will be allocated.

3.2.6   As a general rule, in the absence of access to conduct survey a moderate condition (2 points) will be assumed. A condition score of poor (1 point) should be allocated where there is a very clear justification for this conclusion based on the information available.

3.3   Position within existing ecological network

3.3.1   A key consideration of current nature conservation policy and guidance is the goal of working towards the creation of 'bigger, better and more joined up'[14] ecological networks.

3.3.2   While the offsetting pilot methodology considers spatial risks associated with the location of compensation provision, it does not implicitly consider the importance of the habitats lost to existing ecological networks. Based on the landscape scale of the Proposed Scheme a multiplier will be utilised in both the pre- and post-development calculations to take account of the importance of habitats lost to existing ecological networks.

3.3.3   Incorporating consideration of the spatial distribution of habitats both before and after development, and their potential role in the function of ecological networks is considered to represent a more accurate method of quantifying how the project as a whole will affect progress towards the Lawton Review goals of 'bigger, better and more joined up' (Lawton, 2010).

3.3.4   Therefore for each habitat parcel a score will be allocated based on the importance of the habitat lost for the surrounding ecological network, according to the criteria shown in Table 3 .

3.3.5   The criteria utilised seek to acknowledge the inherent value of larger and well-connected habitat blocks, particularly those that support habitats of principal

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[14] Lawton J (2010), *Making Space for Nature: A review of England's Wildlife Site's and Ecological Network*.

importance. The criteria are intended as a means of ensuring these broad concepts are taken into account in the offsetting calculation. They should not be interpreted as an attempt to consider species-specific requirements within the calculation.

3.3.6   It is envisaged that Geographical Information Systems (GIS) software will be used to write queries to assist in the process of calculating scores relating to the position in the ecological network.

Table 3:   Consideration of position within ecological network prior to development

Importance within existing ecological network	Multiplier
• Habitat areas which form part of a contiguous area of habitat(s) of principal importance which is of more than 1ha in size[15] (core habitat block') and have connectivity with other areas of semi-natural habitat[16]	3
• Habitat areas which form part of a contiguous area of habitat(s) of principal importance which is of more than 1ha in size but have little or no connectivity with other areas of semi-natural habitat (i.e. those that do not fall under score of 3 above); • Habitat areas which form part of a contiguous area of habitat(s) of principal importance which is of between 0.25ha and 1ha in size (regardless of connectivity – these are considered as 'stepping stones'); • Habitat which forms part of an area of semi-natural habitat[17] which provides continuous physical connectivity between existing 'core habitat blocks'[18].	2
• Any other areas which do not meet the criteria identified for either a multiplier of 2 or 3 above.	1

3.4   Hedgerows

3.4.1   For hedgerows, as the vast majority of all hedgerows will meet the definition for this habitat of principal importance type, the distinctiveness criteria will not be utilised within the calculation.

3.4.2   Gaps of greater than 15m will be considered to represent a break in the hedgerow. Where double hedgerows occur then the length of each constituent hedgerow will be fed into the metric.

3.4.3   As in the Defra pilot method the condition of each hedgerow (or hedgerow section) will be scored against a three-point condition scale (see Table 4), with reference to the guidance provided in the Higher Level Stewardship Farm Environmental Plan handbook (Natural England, 2010).

Table 4:   Multiplier to be applied for condition of hedgerows and watercourses

Condition of feature lost	Multiplier applied
Good	3
Moderate	2
Poor	1

3.4.4   Where field survey was undertaken then notes from hedgerow surveys will be utilised to inform the scoring for habitat condition. Where no access was available for survey

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[15] For the purposes of the calculation where areas of habitat of principal importance are separated by gaps of non-qualifying habitat of 15m or less then these should be considered to be contiguous (unless professional judgement of an ecologist considers otherwise).

[16] Based on professional judgement those core areas which have little or no connectivity with other areas of semi-natural habitat should be downgraded to a multiplier of 2 where it is considered that their lack of connectivity is likely to limit their value within the existing ecological network (e.g. for example a severed area of woodland surrounded by an arable field would be downgraded to a multiplier of 2).

[17] Defined for the purposes of this calculation as any area allocated a very high, high or moderate distinctiveness score.

[18] Physical connectivity is defined for this purpose as a 'continuous' corridor of moderate, high or very high distinctiveness habitat parcels. As a general rule a gap in qualifying habitat of more than 15m in extent, or a section where the minimum width of connective habitat drops below 5m in width (note hedgerows are considered as part of a separate calculation) should be considered to represent a break in connectivity.

then this will be informed solely by information obtained from aerial photographs and a precautionary approach will be adopted.

3.4.5   In addition to the condition score for hedgerows, a multiplier will be attributed (see Table 5) for the position in the ecological network in order to ensure that the value of the features lost within existing ecological networks are considered fully within the offsetting calculation.

Table 5:   Position of hedgerow within existing network

Position within existing network	Multiplier applied
Hedgerows which under the Hedgerows Regulations (1997[19]) scoring achieves a connection score of 4 points or more [20]	3
Hedgerow achieving a connection score of 3 or 2	2
Hedgerow achieving a connection score of 1 point or less	1

3.5   Watercourses

3.5.1   For watercourses, it is assumed that all watercourses will be considered as being of high distinctiveness. As a consequence, distinctiveness multipliers are not to be used in the calculation.

3.5.2   For watercourses the use of the position in the network multiplier is also not considered worthwhile given that all watercourses will provide linear connectivity along their route, and that compensation will likely be provided through the realignment of the same channel. As such, position in the landscape is unlikely to change.

3.5.3   As a consequence the number of biodiversity units generated by the watercourses currently present would be calculated by multiplying the length (m) by a condition score using the scale shown in Table 5. This should utilise the criteria set out in the Higher Level Stewardship Farm Environmental Plan handbook (Natural England, 2010), alongside professional judgement where necessary.

3.6   Deriving the total biodiversity units present pre-development

Habitat parcels/polygons

3.6.1   Following the scoring of all habitat parcels for habitat distinctiveness, condition and position within existing ecological networks, the total number of pre-construction biodiversity units will be calculated for each parcel/polygon (including those assumed for arable field margins) using the following formula:

> Number of biodiversity units generated by habitat polygon = Habitat distinctiveness rating x habitat condition x habitat area x position within existing ecological network.

3.6.2   The scores generated by each individual habitat parcel will then be summed to provide the total number of biodiversity units generated by the habitat parcels present pre-development.

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[19] The Hedgerows Regulations (1997) (SI 199 No. 1160). Her Majesty's Stationery Office. London.
[20] Under the criteria used to define connections within The Hedgerows Regulations (1997) a connection with another hedgerow scores one point and a connection with a pond or a woodland in which the majority of trees are broadleaved trees scores 2 points; and a hedgerow is connected with something not only if it meets it but also if it has a point within 10 metres of it and would meet it if the line of the hedgerow continued.

Linear features

3.6.3   The number of biodiversity units present pre-development should be calculated for both hedgerows and watercourses.

3.6.4   The number of hedgerow units present prior to construction of the Proposed Scheme would be calculated as follows

Number of biodiversity units generated by individual hedgerow feature = length of hedgerow (m) x condition multiplier attributed x position in the network.

3.6.5   For watercourses the number of units present pre-development should be calculated as follows:

Number of biodiversity units generated by individual watercourse = length (m) x condition multiplier attributed

3.6.6   Separate totals will then be calculated for biodiversity units generated by a) hedgerows and b) watercourses present prior to development.

4 Calculating post-development biodiversity units

4.1 General

4.1.1 The post-development side of the no net loss calculation will be based upon the final design, and will incorporate consideration of the habitats that are to be created as part of the Proposed Scheme. This will include both those habitat areas to be created with the primary purpose of providing ecological compensation, and those where the primary purpose is non-ecological (e.g. planting to address landscape effects).

4.2 Habitat distinctiveness

4.2.1 For all habitat parcels to be created as part of the Proposed Scheme a target distinctiveness score will be allocated according to the 'high', 'moderate', 'low' or 'none' categories provided in Table 1.

4.2.2 Where the Proposed Scheme results in the loss of habitats that fall within the 'very high' distinctiveness band then it is acknowledged that such habitats cannot be adequately re-created within the timeframe of the project. As a consequence while habitat creation, restoration and on-going management will still seek to achieve areas of similar distinctiveness in the long term (e.g. through the translocation of ancient woodland soils), for the purposes of the post-development calculations it will not be possible to allocate distinctiveness score of very high.

4.2.3 In line with the principles set out in the Defra pilot methodology, the offsetting approach will seek to improve the extent or condition of the ecological network. Unavoidable losses of habitats within the very high distinctiveness category (e.g. ancient semi-natural woodland) will therefore be addressed through the provision of larger areas of 'high' distinctiveness habitat as compensation.

4.2.4 If the habitat impacted by the Proposed Scheme is in the high distinctiveness band, the offset will usually be 'like for like' i.e. it will aim to create or restore the same type of habitat.

4.2.5 For habitat of medium distinctiveness, the offset will largely be made up of habitat from the same distinctiveness band or higher (i.e. habitat from the medium or high distinctiveness band). Where the habitat lost was low distinctiveness, the offset should involve a 'trade up' in distinctiveness (i.e. be largely made up of habitat from the medium or high distinctiveness band).

4.3 Target condition

4.3.1 The offsetting approach for the Proposed Scheme will not utilise the two-step constraint that has been implemented within the Defra offsetting pilot. Instead a cap will be placed on the target condition that can be predicted for the creation of high distinctiveness habitats, with a maximum of a moderate target condition utilised for any such habitats. This approach seeks to recognise the fact that there can be limited confidence in achieving high distinctiveness habitats.

4.3.2 Where habitat restoration or enhancement is proposed then a habitat condition of high can be targeted for habitats of high, moderate or low distinctiveness.

4.3.3   All predictions of target condition should assume that suitable management will be available as a minimum for the period required to ensure target condition is achieved. It should thus be assumed that all habitats that are to be created for the primary purpose of ecological mitigation will aim to achieve the maximum target condition available (i.e. a score of 3 for habitats of moderate distinctiveness and 2 for habitats of high distinctiveness). Given the provision of appropriate management these are considered realistic targets.

4.4   Position within the surrounding ecological network

4.4.1   Where new habitats are created or restoration works are undertaken, position within the surrounding ecological network, as defined in Table 6, will be utilised to promote compensation provision that will contribute to the Lawton Review principles of 'bigger, better and more joined up' (Lawton, 2010). The criteria used mirror those used in the pre-development side of the calculation, with the addition that a score of 3 will be gained for areas of compensation that fall within the aims of a specified Nature Improvement Area (NIA) or Biodiversity Opportunity Area (BOA) scheme.

4.4.2   Each element of compensation or enhancement provision that is provided as part of the Proposed Scheme should be allocated a score (on a scale of 1-3) to identify the role that the habitat area will play in the ecological network that is present post-development.

Table 6:   Consideration of position within ecological network post-development

Importance within ecological network	Multiplier
• Habitat areas which form part of a contiguous area of habitat(s) of principal importance which is more than 1ha in size [21] (this may be as a result of either creation of new areas of habitat or the expansion of existing habitat areas) and have connectivity with other areas of semi-natural habitat [22]; • Areas of habitat creation or expansion within the aims of a specified Nature Improvement Area (NIA) or Biodiversity Opportunity Area (BOA) scheme.	3
• Habitat areas which form part of a contiguous area of habitat(s) of principal importance which is of more than 1ha in size but have little or no connectivity with other areas of semi-natural habitat (i.e. those that do not fall under score of 3 above); • Habitat areas which form part of a contiguous area of habitat(s) of principal importance which is between 0.25ha and 1ha in size (regardless of connectivity – these are considered as 'stepping stones'); • Habitat which forms part of an area of semi-natural habitat [23] which provides continuous physical connectivity between existing 'core habitat blocks'. [24]	2
• any other areas which do not meet the criteria identified for either a multiplier of 2 or 3 above.	1

4.5   Hedgerows

4.5.1   The post-development number of biodiversity units generated by hedgerows should be calculated based on the following criteria:

• length of hedgerow to be created (m);

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[21]For the purposes of the calculation where areas of habitat of principal importance are separated by gaps of non-qualifying habitat of 15m or less then these should be considered to be contiguous (unless professional judgement of an ecologist considers otherwise).

[22] Based on professional judgement those core areas which have little or no connectivity with other areas of semi-natural habitat should be downgraded to a multiplier of 2 where it is considered that their lack of connectivity is likely to limit their value within the existing ecological network (e.g. for example a severed area of woodland surrounded by an arable field would be downgraded to a multiplier of 2).

[23] Defined for the purposes of this calculation as any area allocated a very high, high or moderate distinctiveness score.

[24] Physical connectivity is defined for this purpose as a 'continuous' corridor of moderate, high or very high distinctiveness habitat parcels. A gap in qualifying habitat of more than 15m in extent, or a section where the minimum width of connective habitat drops below 5m in width (note hedgerows are considered as part of a separate calculation) should as a general rule be considered to represent a break in connectivity.

- target condition – based on the three-point scale provided in Table 4; and

- position of the hedgerow within the post-development network – based on the same criteria used in Table 5.

4.6 Watercourses

4.6.1 For watercourses the post-development number of biodiversity units generated should be calculated through multiplying the length (m) by the multiplier for target condition shown in Table 4.

4.7 Difficulty of re-creating/restoring

4.7.1 The multipliers proposed in the Defra pilot methodology will be utilised to recognise delivery risk. Habitats will be assigned to the following broad categories of re-creation/restoration risk based on professional judgement, input of Natural England specialists and previous research work. Full details are presented in the Technical Paper which accompanies the offsetting pilot methodology (Defra, 2012).

Table 7: Consideration of difficulty of re-creating/restoring

Difficulty of re-creation/restoration	Multiplier
Very High	0.10
High	0.33
Medium	0.75
Low	1.00

4.8 Time to target condition

4.8.1 In delivering offsets there may be a mismatch in the timing of impact and offset. This is defined in the offsetting pilot methodology as the difference in time between the negative impact on biodiversity and the offset reaching the required quality or level of maturity. This mismatch results in loss of biodiversity for a period of time.

4.8.2 It is intended that the time discounting rate of 3.5% proposed in the pilot methodology and detailed in Table 8 below is utilised unchanged for the Proposed Scheme. This is based on the discounting rate recommended in the Treasury's Green Book[25]. For practical purposes a cap on the multiplier has been placed at 0.33.

Table 8: Consideration of time to target condition

Years to target condition	Multiplier
5	0.83
10	0.71
15	0.58
20	0.50
25	0.41
30	0.36
32 or above	0.33

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[25] HM Treasury (2011) *The Green Book: Appraisal and Evaluation in Central Government*, Her Majesty's Stationery Office, London.

4.8.3　Table 9 provides the main habitat types and associated time to target condition categories that will be applied in the calculation. For hedgerows and grassland the most appropriate category should be selected based on the type of hedgerow/grassland that has been targeted.

Table 9:　Time to target condition multipliers for main compensation habitats proposed

Habitat type	Years to target condition category
Open mosaic habitats on previously undeveloped ground	5
Ponds	5
Grasslands	5 or10
Hedgerows	5 or 10
Woodland (for landscaping)	10
Young heathland/acid grassland	15
Mature heathland	32 or above
Woodland (for ecological purposes)	32 or above

4.9　Deriving the total number of biodiversity units present post-development

Habitat parcels/polygons

4.9.1　The scores of each polygon/habitat parcel present post-development will be calculated utilising the following criteria:

> Number of biodiversity units generated by habitat polygon post-development = target habitat distinctiveness rating x target habitat condition x habitat area x position within existing ecological network x difficultly of re-creating/restoring x time to target condition

4.9.2　The scores of each polygon will then be added to give the total number of biodiversity units provided by the habitats present post-construction.

Linear features

4.9.3　The number of biodiversity units present post-development should be calculated for both hedgerows and watercourses as follows:

> Number of biodiversity units generated by individual hedgerow feature = length of hedgerow (m) x condition multiplier attributed x position in the network x difficulty of re-creating/restoring x time to target condition

> Number of biodiversity units generated by individual watercourse = length (m) x condition

4.9.4　The figures for the biodiversity units present post-development will then be compared with the overall pre-development score for the scheme to establish the overall balance of biodiversity units (negative or positive).

4.10 Deriving the change in biodiversity units as a consequence of the Proposed Scheme

4.10.1 In order to establish the change in biodiversity units as a consequence of the Proposed Scheme the number of biodiversity units generated post-development will be subtracted from the number available pre-development:

> Net change in biodiversity units = post-development total units – pre-development total units for the same area

4.10.2 This calculation will be conducted at the route wide level for each of the following separate elements of the calculation:

- habitat parcels (including arable field margins);

- hedgerows; and

- watercourses.

5 Undertaking the calculation

5.1.1 The principles of the metric described in this document have been utilised to guide the size, location and type of compensatory habitat provision that has been incorporated into the design of the Proposed Scheme. Trial calculations have also been undertaken in order to test use of the revised metric throughout the development of the metric.

5.1.2 HS2 Ltd is committed to utilising the metric to provide a calculation showing what the project has achieved in working towards the goal of seeking no net loss in biodiversity.

5.1.3 It may be appropriate to repeat the calculation both as the hybrid Bill progresses through Parliament, and as result of detailed design. The metric therefore has the potential to provide an iterative mechanism to review changes in the balance of ecological loss versus compensation associated with the Proposed Scheme.

6   References

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Appendix A: Habitat distinctiveness scores for Phase 1 habitat survey categories

Table A 1: Habitat distinctiveness scores for Phase 1 Habitat categories

Phase 1 code	Habitat description	Distinctiveness	Weighting	Guidance
A1.1.1	Broadleaved woodland - semi-natural	Very high/high	8/6	Very high rating to be applied to all areas qualifying as ancient semi-natural woodland. All other areas to be identified as high distinctiveness.
A1.1.2	Broadleaved woodland - plantation	Moderate	4	-
A1.2.1	Coniferous woodland - semi-natural	High	6	-
A1.2.2	Coniferous woodland - plantation	Moderate	4	-
A1.3.1	Mixed woodland - semi-natural	Very high/high/ moderate	8/6/4	Consider potential to split out areas of woodland that qualify as a habitat of principal importance, or as ancient semi-natural woodland (very high) and validity of including as part of the underlying habitat of principal importance where the coniferous cover is less than 25%. Such areas could score a high distinctiveness rating. All others will score a moderate rating.
A1.3.2	Mixed woodland - plantation	High/moderate	6/4	High distinctiveness rating to be allocated to those sites which meet the criteria to qualify under habitat of principal importance type 'traditional orchard'. Moderate rating to be applied for all others.
A2.1	Scrub - dense/ continuous	Moderate	4	-
A2.2	Scrub - scattered	Low	2	This habitat type could have been created as either a polygon or point data. Only polygon data should be utilised within the assessment.
A3.1	Broadleaved parkland/ scattered trees	High/moderate	6/4	This habitat type only to be utilised where mapped as a polygon. High distinctiveness rating to be applied to habitats falling under the wood pasture and parkland habitat of principal importance type. Moderate rating to be applied in all other cases.
A3.2	Coniferous parkland/ scattered trees	Moderate	4	This habitat type only to be utilised where mapped as a polygon.
A3.3	Mixedparkland/ scattered trees	Moderate	4	This habitat type only to be utilised where mapped as a polygon.
A4.1	Broadleaved woodland - recently felled	Moderate	4	
A4.2	Coniferous woodland - recently felled	Moderate	4	
A4.3	Mixed woodland - recently felled	Moderate	4	
B1.1	Acid grassland - unimproved	High	6	
B1.2	Acid grassland - semi-improved	High	6	
B2.1	Neutral grassland -	High	6	

Phase 1 code	Habitat description	Distinctiveness	Weighting	Guidance
	unimproved			
B2.2	Neutral grassland - semi-improved	High/moderate	6/4	Split out those areas of grassland that fall within the lowland meadows habitat of principal importance type, and identify these as being of high distinctiveness. Moderate rating to be applied in all other cases.
B3.1	Calcareous grassland - unimproved	High	6	
B3.2	Calcareous grassland - semi-improved	High/moderate	6/4	Split out those areas falling under the definition of lowland calcareous grassland habitat of principal importance type. All other areas of grassland which contain elements of a calcareous sward should be considered to be of moderate distinctiveness.
B4	Improved grassland	Low	2	
B5	Marsh/marshy grassland	High/moderate	6/4	Split out any areas that represent habitats of principal importance (in particular purple moor grass and rush pasture) and identify these as of high distinctiveness. All others should be considered to be of moderate distinctiveness.
B6	Poor semi-improved grassland	Moderate	4	
C1.1	Bracken - continuous	Low	2	
C1.2	Bracken - scattered	Low	2	Only those areas mapped as polygons should be used within the calculation.
C3.1	Other tall herb and fern - ruderal	Low	2	
C3.2	Other tall herb and fern - non ruderal	Low	2	
D1.1	Dry dwarf shrub heath - acid	High	6	
D1.2	Dry dwarf shrub heath - basic	High	6	
D2	Wet dwarf shrub heath	High	6	
D5	Dry heath/acid grassland	Very high/high	8/6	Only mature and diverse areas of heath should be taken as qualifying in the very high category. All other areas to be classified as high.
D6	Wet heath/acid grassland	Very high/high	8/6	Only mature and diverse areas of heath should be taken as qualifying in the very high category. All other areas to be classified as high.
E2.1	Flush and spring - acid/neutral flush	High	6	
E2.2	Flush and spring - basic flush	High	6	
F1	Swamp	High/moderate	6/4	Identify those areas that qualify under the reedbed or purple moor grass and rush pasture habitat of principal importance definitions as being in the high category. Identify all others areas as being of moderate distinctiveness.
F2.1	Marginal and	High/moderate	6/4	This Phase 1 category is defined as strips of

Phase 1 code	Habitat description	Distinctiveness	Weighting	Guidance
	inundation - marginal vegetation			emergent vegetation that are of less than 5m in width. Identify those areas that qualify under purple moor grass and rush pasture habitat of principal importance definitions as being of high distinctiveness.
F2.2	Marginal and inundation - inundation vegetation	High/moderate	6/4	Consider potential for this habitat to fall under any habitat of principal importance definition (considered unlikely). All other to be identified as moderate.
G1	Standing water	High/moderate	6/4	Habitats of principal importance should be identified as being of high distinctiveness.
G1.1	Standing water - eutrophic	High/moderate	6/4	All other occurrences of this habitat type should be identified as being of moderate distinctiveness.
G1.2	Standing water - mesotrophic	High/moderate	6/4	
G1.3	Standing water - oligotrophic	High/moderate	6/4	
G1.4	Standing water - dystrophic	High/moderate	6/4	
G1.5	Standing water - marl	High/moderate	6/4	
I1.1.1	Inland cliff - acid/neutral	High	6	
I1.1.2	Inland cliff – basic	High	6	
I1.4.1	Other exposure - acid/neutral	Moderate	4	
I1.4.2	Other exposure - basic	Moderate	4	
I1.5	Cave	Moderate	4	
I2.1	Quarry	High/moderate/low/ none	6/4/2/0	Re-allocate these areas based on the habitats present and score accordingly.
I2.2	Spoil	None	0	
I2.3	Mine	High/moderate/low/ none	6/4/2/0	Re-allocate these areas based on the habitats present and score accordingly.
I2.4	Refuse-tip	None	0	-
J1.1	Cultivated/ disturbed land - arable	Moderate/low	4/2	Where uncultivated field margins are present these areas should be split off and classified as of moderate distinctiveness. All other arable or un-vegetated ground should be classified as being of low distinctiveness.
J1.2	Cultivated/ disturbed land - amenity grassland	Low	2	
J1.3	Cultivated/ disturbed land - ephemeral/ short perennial	High/moderate/low	6/4/2	Areas which form part of an open mosaic habitat on previously developed ground (a habitat of principal importance) should be identified as of high distinctiveness. Other stands should be classified as moderate or low distinctiveness based on the species present.
J1.4	Introduced shrub	Low	2	
J2.8	Earth bank	Low	2	

Phase 1 code	Habitat description	Distinctiveness	Weighting	Guidance
J3.4	Caravan site	High/moderate/low/none	6/4/2/0	Re-allocate these areas based on the habitats present and score accordingly.
J3.6	Buildings	Low	2	
J4	Bare ground	Low	2	
J5	Other habitat	High/moderate/low/none	6/4/2/0	Based on habitats and species present.
N/A	Roads and other hardstanding	Low	0	

Appendix B - Description of key fields used within GIS schema

Table 6: Description of fields utilised within the HS2 no net loss GIS schema

Field Alias	Field Name	Field relevant to Pre or Post ?	Description
Ecology ID	Ecology_ID	Pre/Post	Unique alphanumeric identifier code for each feature in database. Internal reference only.
CFA	CFA	Pre/Post	Identifies Community Forum Area (CFA) in which habitat features is located.
Habitat description	Hab_Desc	Pre/Post	Coding to describe the allocated habitat type. Codes commencing with letters A to J relate to the standard Phase 1 habitat category codes. For further details refer to : JNCC (2010) *Handbook for Phase 1 habitat survey. A technique for environmental audit*. JNCC, Peterborough. Codes commencing with letter' K' relate to HS2 created categories utilised in the CT-06 Proposed Scheme model. Further details relating to these category names is provided within the data dictionaries provided within map book issued alongside the November 2013 ES e.g. Main ES Volume 2 CFA10 map book. Download at http://webarchive.nationalarchives.gov.uk/20140806172102/http://assets.dft.gov.uk/hs2-environmental-statement/volume-2/MB10_VOL2_CFA10_WATERMARKED.pdf
Source	Source	Pre/Post	Primary source that has been used to determine the extent of the feature.
Pre or post-construction	Pre_Post	Pre/Post	This field indicates if the feature is relevant to the pre- construction or post-construction element of the calculation.
Preconstruction biological units	PreCon_Bio_Units	Pre	This field documents the number of biodiversity units generated by the polygon/polyline in question. The formula utilised to calculate this output differs between polygons and for polyline features. **For polygons** Number of preconstruction biodiversity units generated by habitat polygon = PreCon_Distinct_Rate x PreCon_Hab_Cond x PreCon_Hab_Area x PreCon_Eco_Pos. **For watercourses:** Number of pre-construction biodiversity units = PreCon Hab Length x PreCon Hab Condition **For hedgerows:** Number of pre-construction biodiversity units = PreCon Hab Length x PreCon_Hab_Cond x PreCon_Eco_Pos

Field Alias	Field Name	Field relevant to Pre or Post ?	Description
Preconstruction distinctiveness rating	PreCon_Distinct_Rate	Pre	This field records the pre-construction habitat distinctiveness weighting allocated to the polygon/polyline in question. A weighting of 0, 2, 4,, 6, or 8 has been utilised where the habitat distinctiveness is used as part of the biodiversity units calculation for that particular feature . Scores have been allocated against the criteria set out in Appendix A An entry of 'Null' is used where distinctiveness is not utilised in the biodiversity units for that particular habitat type (e.g. hedgerows).
Preconstruction distinctiveness rating comment	Distinct_Comment	Pre	Where appropriate this provides a text comment to explain the preconstruction distinctiveness score allocated. Where no comment is necessary the field is marked 'Null'
Preconstruction ecological position in network	PreCon_Eco_Pos	Pre	This field records the pre-construction ecological position in the network weighting allocated to the polyline/polygon in question. A weighting of 1, 2 or 3 has been utilised where ecological position in the network is used as part of the biodiversity units calculation for that particular feature. Scores have been allocated against the criteria set out in Appendix A. An entry of 'Null' is used where ecological position in the network is not utilised in the biodiversity units calculation for that particular habitat type.
Preconstruction ecological position in network comment	Eco_Pos_Comment	Pre	Where appropriate this provides a text comment to explain the preconstruction ecological position in the network score allocated. Where no comment is necessary the field is marked 'Null'
Preconstruction habitat area	PreCon_Hab_Area	Pre	For preconstruction polygon features this field shows the area of the polygon in hectares (ha) 'Null' for linear features
Preconstruction Habitat condition	PreCon_Hab_Con	Pre	For pre-construction features this field records the habitat condition score allocated to the polygon/polyline in question. A weighting of 1, 2, or 3 has been utilised where habitat condition is used as part of the biodiversity units calculation for that particular feature. Scores have been allocated against the criteria set out in Appendix A. An entry of 'Null' is used where distinctiveness is not utilised in the biodiversity units for that particular habitat type.
Preconstruction Habitat condition comment	Condition_Comment	Pre	Where appropriate this provides a text comment to explain the preconstruction habitat condition score allocated. Where no comment is necessary the field is marked 'Null'

Field Alias	Field Name	Field relevant to Pre or Post ?	Description
Preconstruction habitat length	PreCon_Hab_Length	Pre	For polyline features this field records the length of the pre-construction feature in metres (m). For polygon features this field is marked 'Null'.
Post-construction biological units	PostCon_Bio_Unit	Post	This field documents the number of biodiversity units generated by the polygon/polyline in question. The formula utilised to calculate this output differs between polygons and for polyline features. **For polygons** Number of post-construction biodiversity units generated by habitat polygon = PostCon_Distinct_Rate x PostCon_Hab_Cond x PostCon_Hab_Area x PostCon_Eco_Pos x PostCon_Diff_Rating x PostCon_Time_TargCond **For watercourses:** Number of post-construction biodiversity units = PostCon_Hab_Length x PostCon_Hab_Cond **For hedgerows:** Number of post-construction biodiversity units = PostCon_Hab_Length x PostCon_Hab_Cond x PostCon_Eco_Pos x PostCon_Diff_Rating x PostCon_Time_TargCond
Post-construction difficulty rating	PostCon_Diff_Rating	Post	This field records the allocated difficulty of restoration multiplier used in for the feature in question. Values have been attributed according to the guidance set out in Technical Note: Methodology for demonstrating No Net Loss in Biodiversity. Where the difficult to restoration field is not used in the biodiversity units calculation for a feature the field is marked 'Null'
Post-construction distinctiveness rating	PostCon_Distinct_Rate	Post	This field records the post-construction habitat distinctiveness weighting allocated to the polygon/polyline in question. A weighting of 0, 2, 4, 6, or 8 has been utilised where the habitat distinctiveness is used as part of the calculation for that particular feature class, and has been scored against the criteria set out in Appendix A.. An entry of "Null' is used where distinctiveness is not utilised in the biodiversity units for that particular habitat type (e.g. hedgerows).
Post-construction distinctiveness rating comments	Distinct_Comment	Post	Where appropriate this provides a text comment to explain the post-construction habitat condition score allocated. Where no comment is necessary the field is marked 'Null'

Field Alias	Field Name	Field relevant to Pre or Post ?	Description
Post-construction ecological position	PostCon_Eco_Pos	Post	This field records the post-construction ecological position in the network weighting allocated to the polyline/polygon in question. A weighting of 1, 2 or 3 has been utilised where ecological position in the network is used as part of the biodiversity units calculation for that particular feature. Scores have been allocated against the criteria set out in Appendix A. An entry of 'Null' is used where ecological position in the network is not utilised in the biodiversity units calculation for that particular habitat type.
Post-construction ecological position comment	Eco_Pos_Comment	Post	Where appropriate this provides a text comment to explain the post-construction ecological position in the network score allocated. Where no comment is necessary the field is marked 'Null'
Post-construction habitat area	PostCon_Hab_Area	Post	For post-construction polygon features this field shows the area of the polygon in hectares (ha) 'Null' for linear features
Post-construction habitat condition	PostCon_Hab_Cond	Post	For post-construction features this field records the habitat condition score allocated to the polygon/polyline in question. A weighting of 1, 2, or 3 has been utilised where habitat condition is used as part of the biodiversity units calculation for that particular feature. Scores have been allocated against the criteria set out in Appendix A. An entry of 'Null' is used where distinctiveness is not utilised in the biodiversity units for that particular habitat type.
Post-construction habitat condition comment	Condition_Comment	Post	Where appropriate this provides a text comment to explain the post-construction habitat condition score allocated. Where no comment is necessary the field is marked 'Null'
Post-construction habitat length	PostCon_Hab_Length	Post	For polyline features this field records the length of the post-construction feature in metres (m). For polygon features this field is marked 'Null'.
Post-construction time to target condition	PostCon_Time_TargCond	Post	This field records the allocated time to target condition multiplier used in for the feature in question. Values have been attributed according to the guidance set out in Technical Note: *Methodology for demonstrating No Net Loss in Biodiversity*. Where the time to target condition is not used in the biodiversity units calculation for a feature the field is marked 'Null'
Shape_Length	Shape_Length	Pre/Post	For Linear features this field contains the length of the feature in metres **N.B**. This is an auto-generated field within ArcGIS and are not used directly in the calculation formula.

Field Alias	Field Name	Field relevant to Pre or Post ?	Description
Shape_Length	Shape_Length	Pre/Post	For Polygon features this field contains the perimeter length of the feature in metres **N.B**. This is an auto-generated field within ArcGIS and are not used directly in the calculation formula.
Shape_Area	Shape_Area	Pre/Post	For Polygon features this field contains the area of the feature in metres^2 **N.B**. This is an auto-generated field within ArcGIS and are not used directly in the calculation formula.

Appendix C - Habitat categories used in polygon data analysis

Table 7: Habitat categories used in the polygon data analysis

Habitat category used for data analysis	Phase One habitat categories and CT-06 Proposed Scheme codes that fall within habitat category
Woodland and scrub	A1.1.1 Woodland - Broad-leaved - Semi-natural
	A1.1.2 Woodland - Broad-leaved - Plantation
	A1.2.1 Woodland - Coniferous - Semi-natural
	A1.2.2 Woodland - Coniferous - Plantation
	A1.3.1 Woodland - Mixed - Semi-natural
	A1.3.2 Woodland - Mixed - Plantation
	A1.2.1 Scrub - Dense/continuous scrub
	A1.2.2 Scrub - Scattered scrub
	A1.3.1 Parkland/scattered trees - Broad-leaved
	A1.3.2 Parkland/scattered trees - Coniferous
	A1.3.3 Parkland/scattered trees - Mixed
	K2.1 Woodland habitat creation
	K2. 4 Landscape mitigation planting (scrub/woodland)
Grassland	B1.1.1 Acid grassland - Unimproved
	B1.1.2 Acid grassland - Semi-improved
	B1.2.1 Neutral grassland - Unimproved
	B1.2.2 Neutral grassland - Semi-improved
	B1.3.1 Calcareous grassland - unimproved
	B1.3.2 Calcareous grassland - semi-improved.
	B1.4 Improved grassland
	B1.5 Marsh/marshy grassland
	B1.6 Poor semi-improved grassland
	J1.2 Cultivated/disturbed ground - Amenity grassland
	K2.3 Grassland Habitat Creation
	K2.6 Grassed Areas
	K5.3 Engineering earthworks
Other	All other Phase 1 (J codes) and CT-06 (K codes) habitat types not included within the woodland and grassland habitat categories above.
Other habitat	All other Phase 1 habitat codes and CT-06 codes that are not listed under either 'woodland and scrub' or 'grassland 'habitat categories.

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