

A1 Birtley to Coal House

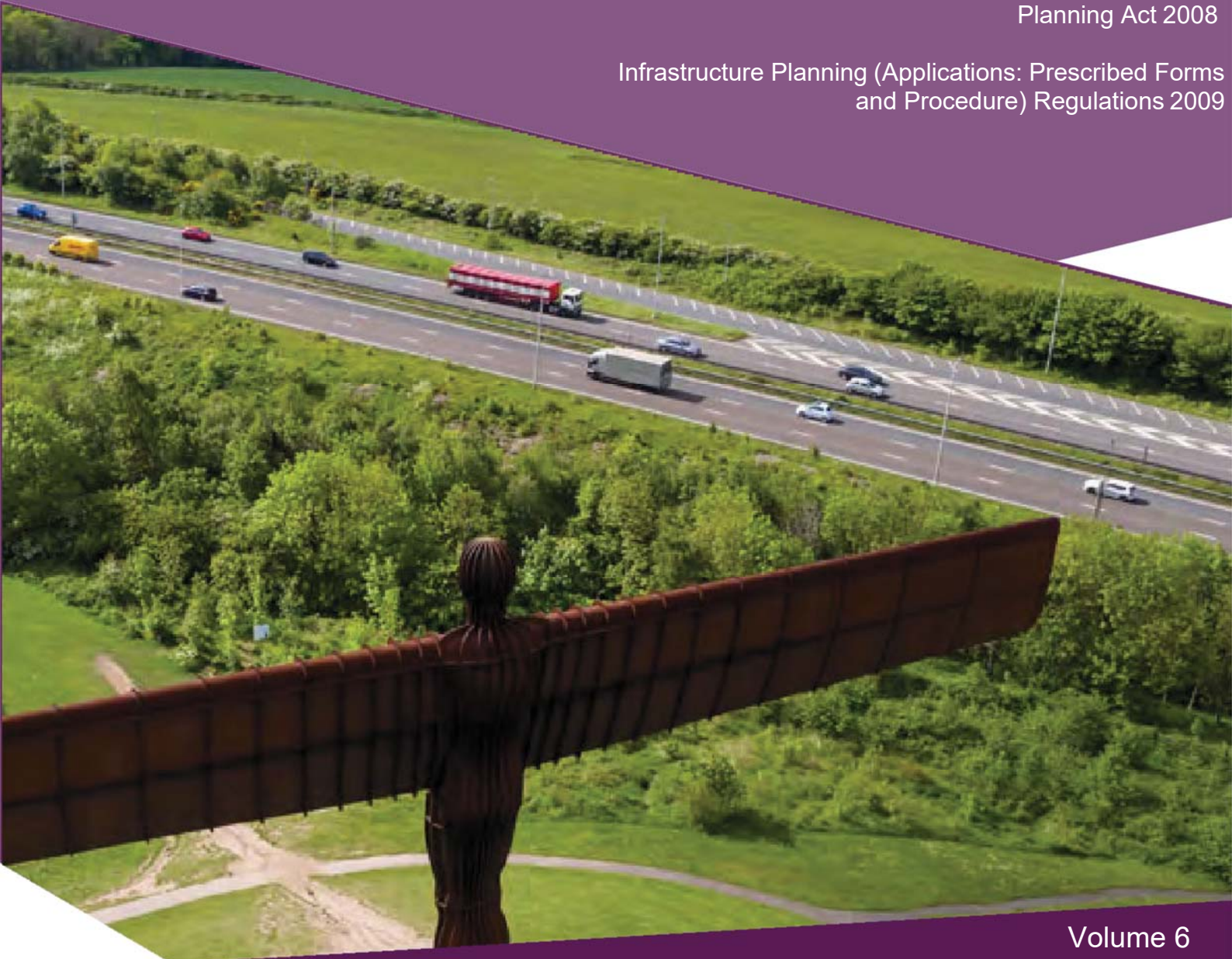
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6.3 Environmental Statement – Appendix 8.13 Biodiversity Net Gain Report

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and Procedure) Regulations 2009



Infrastructure Planning

Planning Act 2008

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**A1 Birtley to Coal House
Development Consent Order 20[xx]**

**Environmental Statement -
Appendix**

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EXECUTIVE SUMMARY

The A1 Birtley to Coal House Scheme, hereafter referred to as 'the Scheme', is 6.5km in length and will include replacement of Allerdene Bridge. Most of the work will take place within the highway boundary, however, some additional land will be required alongside the A1 at certain points to enable the additional lanes to be constructed. Two variants of the Scheme are being considered; 'Viaduct' and 'Embankment'. The footprint of the Scheme, hereafter referred to as 'the Scheme Footprint' is shown in Appendix C. In order to understand the impact of the Scheme on biodiversity, Highways England commissioned WSP to conduct a Biodiversity Net Gain (BNG) assessment of the two variants.

BNG is a quantitative, stepwise process which is applied to development and results in an overall net gain in biodiversity. The principle behind it is that any impacts from development to biodiversity need to be accounted for and compensated with equivalent and additional gains. Applying the BNG process to a development project provides clear, quantifiable outcomes for biodiversity which are backed up by a robust evidence base.

This BNG assessment uses the Defra metric to quantify the biodiversity lost to the Scheme and provide an indication of the biodiversity value of onsite landscaping and ecological mitigation once the Scheme has been built. The red line boundary as shown in Appendix C defines the boundary of the Scheme Footprint and the geographic extent of the onsite landscaping and ecological mitigation. The methodology is detailed in full within the Section 2 of this report. A number of additional assumptions have been made and these are listed in Section 3 of the report.

Highways England produced a Chief Highways Engineer (CHE) memorandum (Highways England, 2018) which guides the standardised reporting of biodiversity information on Highways England projects. The CHE Memo does not follow the full Defra metric and is only for internal Highways England reporting. An assessment in accordance with the CHE memo is included in Appendix D.

AIMS

This report aims to:

- 1 Establish the total number of baseline Biodiversity Units (BU) and Linear Units (LU) within the Scheme Footprint;
- 2 Establish the total number of BU and LU which will be created and / or enhanced under landscape and ecological mitigation proposals; and
- 3 Determine whether the Scheme will result in a net loss, no net loss or a net gain for biodiversity.

This report provides the results of the Biodiversity Net Gain assessment for two options, one including the Embankment and one including the Viaduct.

KEY FINDINGS

The difference between the Viaduct and the Embankment variants of the Scheme are minor from the perspective of the BNG assessment. Neither variant of the Scheme delivers BNG within the Scheme Footprint due to a net loss of biodiversity for area based habitats and watercourses. However, both variants result in a net gain of biodiversity for hedgerows.

Summary of results – Embankment

Source	Baseline	Post-Development	Change in Units	Outcome
BU	404.34	302.22	- 102.12 BU	NET LOSS (25%)
Hedgerow LU	5237	8117	+ 2880 LU	NET GAIN (55%)
Watercourse LU	715	667	- 48 m	NET LOSS (7%)

Summary of results – Viaduct

Source	Baseline	Post-Development	Change in Units	Outcome
BU	404.34	301.94	- 102.40 BU	NET LOSS (25%)
Hedgerow LU	5237	8065	+ 2828 LU	NET GAIN (54%)
Watercourse LU	715	668	- 47 m	NET LOSS (7%)

The loss of units of area habitats is largely down to the loss of woodland and scrub habitats. Although these habitats are recreated in terms of area, fewer biodiversity units are generated post-development owing to the application of risk multipliers. An additional area of approximately 10 ha to 15 ha of woodland habitat creation and enhancement would be needed in order to deliver a net gain for biodiversity.

The two previous assessments showed a greater level of loss, the first requiring almost 30 ha of habitat creation and 6850 m of hedgerow to mitigate the loss and the second requiring

27 ha of habitat creation and 3925 m of hedgerow. The decrease in compensation required between these reports and this assessment demonstrate that the project has followed the mitigation hierarchy, aiming to avoid and mitigate impacts where possible before compensating for any remaining loss.

It is important to recognise that the quantification of biodiversity units is one of a number of factors to be considered when assessing the impact of each stage on biodiversity. The decision as to whether the Scheme can claim biodiversity net gain should be informed by a full biodiversity assessment once the landscape and ecological mitigation plans have been finalised.

1 INTRODUCTION

1.1 BIODIVERSITY NET GAIN

- 1.1.1. Biodiversity net gain (BNG) is the end result of a process applied to development so that overall, there is a positive outcome for biodiversity. The process itself follows the mitigation hierarchy, which sets out that everything possible must be done to first avoid and then minimise and restore / rehabilitate losses of biodiversity on site. Only as a last resort, residual losses are compensated for using biodiversity offsets, which are distinguished from other forms of mitigation in that they are outside the Scheme Footprint and require measurable conservation outcomes.
- 1.1.2. Adopting a BNG approach can account for biodiversity losses not fully covered by legal and planning systems. Whilst some species are extensively protected, many are not; with the consequence that development can be 'legally compliant' but still result in biodiversity loss. The BNG approach guards against this, enabling development to contribute towards the national and global target of halting biodiversity loss by 2020 and towards local and national strategies for conserving and enhancing wildlife.
- 1.1.3. In terms of nature conservation, business as usual for the Scheme (i.e. without BNG) would follow the standard Ecological Impact Assessment (EclA) model of mitigating losses, compensating for losses and then enhancement. Under this model, mitigating losses and impacts required by UK and EU nature conservation legislation is only required for impacts to Important Ecological Features (IEFs) assessed as of local importance or above. BNG therefore goes beyond this, accounting for all direct losses of biodiversity from development.
- 1.1.4. For BNG to be used appropriately and to generate long-term gains for nature, the good practice principles established by the Business and Biodiversity Offset Programme (BBOP) can be used. These principles have been established in the context of UK development by the Construction Industry Research and Information Association (CIRIA), the Chartered Institute for Ecology and Environmental Management (CIEEM) and the Institute of Environmental Management and Assessment (IEMA) (see Appendix A). The BNG process for the A1 Birtley to Coal House assessment adheres to these principles.

1.2 PROJECT CONTEXT

- 1.2.1. The A1 Birtley to Coal House Scheme, hereafter referred to as the Scheme, is 6.5 km in length and will include replacement of Allerdene Bridge. Most of the work will take place within the highway boundary, however, some additional land will be required alongside the A1 at certain points to enable the additional lanes to be constructed. Two variants of the Scheme are being considered; 'Viaduct' and 'Embankment'. Appendix C shows the footprint of the Scheme, hereafter referred to as 'the Scheme Footprint'.
- 1.2.2. The Scheme will provide additional capacity by widening to four lanes between junction 65 and 67 on the southbound carriageway and three lanes with an additional lane to help

manage traffic joining and leaving the A1 between junctions on the northbound carriageway. It also includes a replacement structure of Allerdene Bridge to the immediate south of the current structure, which will tie in to the existing junction 67 Coal House roundabout. The Scheme will also look to install electronic signage to provide driver information along the road.

- 1.2.3. The Scheme has adopted the Defra metric to undertake a baseline and preliminary post-development biodiversity unit (BU) and linear unit (LU) calculation to quantify the biodiversity which will be lost due to the Scheme and provide an indication of the biodiversity which will be replaced through onsite compensation once the Scheme has been built. This information will be used to indicate whether the Scheme is likely to meet no net loss or net gain for biodiversity.
- 1.2.4. The biodiversity assessment provides a quantitative benchmark to inform avoidance, mitigation and compensation measures designed to mitigate for habitat loss due to the Scheme. This includes informing habitat restoration and reinstatement proposals as well as new habitat creation.

1.3 SCOPE OF REPORT

- 1.3.1. This report aims to:
- 1 Establish the total number of baseline BU and LU within the Scheme Footprint (Appendix C);
 - 2 Establish the total number of BU and LU which will be created and / or enhanced under landscape and ecological mitigation proposals; and
 - 3 Determine whether the Scheme will result in a net loss, no net loss or a net gain for biodiversity.
- 1.3.2. Please note that the BNG report does not cover requirements of the Scheme arising from potential impacts on protected species and designated sites. This information will be covered within the biodiversity chapter of the Environmental Assessment Report for the Scheme.

1.4 BIODIVERSITY NET GAIN POLICY

HIGHWAYS ENGLAND

- 1.4.1. Highways England manages England's strategic road network which covers an area of 25,000 ha including around 8,500 miles of road. The road network contains a range of protected habitats including species rich grasslands, woodlands and wetlands. It supports and affects a number of rare and protected flora and fauna, including peregrine falcon, dormouse, rare orchids and other wild plants. In 2015, Highways England published their biodiversity plan, which aims to ensure that the strategic road network positively supports the health of England's wildlife.
- 1.4.2. The biodiversity net gain approach can help avoid, minimise and, as a last resort, compensate for residual adverse impacts on biodiversity arising from a development. The

Government's Road Investment Strategy (RIS) (Department for Transport, 2015) states that by 2020, Highways England must deliver a reduction in the net loss of biodiversity on its estate and reach no net loss of biodiversity by 2025. By 2040 Highways England must deliver a net gain in biodiversity, which is reflected within their biodiversity plan (Highways England, 2015).

- 1.4.3. Highways England's RIS Delivery Plan 2016-2017 (Highways England, 2016) states *"Highways England will achieve a reduction in the net loss of biodiversity by end of the first Road Period (2020) on an ongoing annual basis"; and "be fully transparent about our performance in relation to biodiversity and will produce a report"*.
- 1.4.4. Highways England produced a Chief Highways Engineer (CHE) memorandum (Highways England, 2018) which guides the standardised reporting of biodiversity information on Highways England projects. The CHE Memo does not follow the full Defra metric and is only for internal Highways England reporting. An assessment in accordance with the CHE memo is included in Appendix D.

NATIONAL POLICY STATEMENT FOR NATIONAL NETWORKS

- 1.4.5. The National Policy Statement for National Networks (2014) (NPSNN) paragraph 5.23 states that:
'The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.'
- 1.4.6. Maintaining no net loss of biodiversity as a result of the Scheme is consistent with the policy aims of Paragraph 5.25 of the NPSNN, which states:
'As a general principle, and subject to the specific policies below, development should avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives. The applicant may also wish to make use of biodiversity offsetting in devising compensation proposals to counteract any impacts on biodiversity which cannot be avoided or mitigated. Where significant harm cannot be avoided or mitigated, as a last resort, appropriate compensation measures should be sought.'
- 1.4.7. This sets out that, as a last resort, any loss should be compensated for to achieve no net loss or net gain by replacing habitats, exploring the potential for enhancing them, and managing retained features.

NATIONAL PLANNING POLICY FRAMEWORK

- 1.4.8. Although not currently a legal obligation, the revised National Planning Policy Framework (NPPF) (2019) refers to biodiversity and environmental net gains in the following paragraphs:
- 1.4.9. Transport Infrastructure

Paragraph 102. *“Transport issues should be considered from the earliest stages of plan-making and development proposals, so that:*

*d) the environmental impacts of traffic and transport infrastructure can be identified assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for **net environmental gains.**”*

1.4.10. Planning decisions

Paragraph 118 *“Planning decisions and planning policy should a) encourage multiple benefits from both urban and rural land ... and taking opportunities to **achieve net environmental gains - such as developments that would enable new habitat creation.**”*

Paragraph 170 *“Planning policies and decisions should contribute to and enhance the natural and local environment by: ... d) minimising impacts on and **providing net gains for biodiversity**”*

Paragraph 174 *“To protect and enhance biodiversity and geodiversity plans should b) ... identify and pursue opportunities for securing **measurable net gains for biodiversity.**”*

Paragraph 175 *“When determining planning applications, local planning authorities should apply the following principles: d) ... opportunities to incorporate biodiversity improvements in and around developments, especially where this can secure **measurable net gains for biodiversity.**”*

NATURAL ENVIRONMENT AND RURAL COMMUNITIES ACT

1.4.11. The Natural Environment and Rural Communities (NERC) Act (2006) Section 40 sets out that:

Paragraph 1. *“Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity”;* and that

Paragraph 3. *“Conserving biodiversity includes, in relation to a living organism or type of habitat, restoring or enhancing a population or habitat”.*

1.4.12. The NERC Act (2006) Section 41 sets out that:

Paragraph 1. *“The Secretary of State must... publish a list of the living organisms and types of **habitat ... of principal importance** for the purpose of conserving biodiversity”* based on consultation with Natural England; and that

Paragraph 3a. Every planning authority must *“a) take such steps... to further the conservation of the living organisms and types of habitat included in any list published under this section, or (b) promote the taking by others of such steps”.*

2 METHODOLOGY

2.1 OVERVIEW

2.1.1. The method applied for the BNG assessment of the Scheme followed the six steps of WSP's BNG process, which aligns with the Defra metric (see Appendix B for the full six step process). The work set out in this report is covered by step two. The relevant sections of step two are provided below:

STEP 2 INITIAL BIODIVERSITY ASSESSMENT

- i. **Survey baseline habitats and their condition.** Ideally, a habitat condition assessment is undertaken during Phase 1 Habitat survey. If Phase 1 Habitat data has been collected prior to initiating the BNG process, condition assessment can be undertaken either:
 - a. retrospectively through interpretation of Phase 1 target notes, consultation with surveyors, or employing a number of assumptions; or
 - b. during an additional site visit.
- ii. **Identify irreplaceable habitat.** Following Defra guidance, irreplaceable habitats within the Scheme boundary must be identified and excluded from the biodiversity unit calculations.
- iii. **Calculate baseline biodiversity units using the biodiversity metric.** This calculation includes all habitats (minus irreplaceable habitats) within the Scheme boundary prior to development and is informed by Phase 1 Habitat data and results of the condition assessment. The baseline biodiversity unit calculation may be run on a number of scheme options if the scheme is at options appraisal stage.
- iv. **Calculate post-development biodiversity units using the biodiversity metric.** This calculation accounts for all of the habitats (including retained habitats and habitats lost or created as a result of the development) within the Scheme boundary post-development. The calculation excludes irreplaceable habitats. The calculation is informed by scheme design, landscape plans, and proposed ecological mitigation. The assessment is based upon the target state (type, size and condition) of habitats being created.
- v. **Produce a 'Biodiversity Assessment' report.** The report sets out the BNG process in the context of the Scheme and includes the method and results of initial baseline and post-development biodiversity unit calculations.

IRREPLACEABLE HABITATS

- 2.1.2. It is not possible to fully compensate for the loss of irreplaceable habitats. For this reason, and following Defra guidance, irreplaceable habitats have been excluded from this biodiversity unit calculation. It is important to note that BNG or no net loss cannot be achieved for the scheme as a whole if there is a negative impact on an irreplaceable habitat.

LINEAR HABITATS

- 2.1.3. Defra recognise that hedgerows are a very important feature in terms of biodiversity value: *'Their contribution, by area, to biodiversity in the landscape is far greater than even the most biodiversity rich habitats'* (Defra, 2012a). Hedgerows therefore cannot be treated as other area-based habitats and are considered in terms of LU rather than BU, both are arbitrary units which are not directly comparable with each other.

2.2 BASELINE BIODIVERSITY UNIT CALCULATION

EXTENT AND SOURCES OF BASELINE HABITAT DATA

- 2.2.1. Identification of baseline habitats was based on a digitised Phase 1 Habitat layer produced by WSP. The BNG calculation covered all habitats (linear and non-linear) within the Scheme Footprint (for a map of the Scheme extent within the blue line boundary and Phase 1 Habitat survey data please see Appendix C of this report). The following Phase 1 Habitat typologies present within the Scheme Footprint which, in the context of BNG, are not considered 'habitats':
- Buildings;
 - Hardstanding;
 - Fence; and
 - Dry ditch.
- 2.2.2. These habitat typologies do not generate BU or LU and so are excluded from BNG calculations. However, the total areas of buildings and hardstanding are reported in results tables to show the total area of the Scheme has been considered in both calculations.
- 2.2.3. Running water has also been excluded from the baseline unit calculation at this stage in the BNG process. The reason for this is the lack of available information to undertake accurate condition assessments of these habitats; both in terms of field data for the watercourses in question, and standardised guidance as to the most appropriate means of assessing condition of these habitats. For the baseline and post-development assessment, running water is expressed simply as a length in metres.
- 2.2.4. For area-based habitats, hectares are reported to two decimal places. However, for linear habitats, length is reported to the nearest metre. The reason for this is that 0.01 of a linear unit is equivalent to reporting to 1 cm. This level of detail is superfluous for the purposes of a preliminary BNG assessment.

- 2.2.5. The Phase 1 Habitat survey was undertaken following Joint Nature Conservation Committee (JNCC, 2010) survey methodology and are reported in full within the Phase 1 Habitat survey report for the Scheme (Highways England, 2019).

DEFRA BIODIVERSITY UNIT CALCULATION

- 2.2.6. A baseline biodiversity unit calculation was completed for all areas of permanent and temporary land take within the operational footprint of the Scheme. Habitat area or length, distinctiveness and condition were used to calculate baseline BU and LU, providing a measure of the biodiversity within the Scheme Footprint before development. This calculation is in accordance with Defra’s technical paper, guidance for developers and guidance for offset providers (Defra 2012 a, b and c). This is the standard metric used for calculating BU and LU in the UK.
- 2.2.7. Distinctiveness and condition are given numerical ‘scores’ which are multiplied, together with hectares (ha) or length in metres (m) of habitat to give the number of units.

DISTINCTIVENESS

- 2.2.8. Habitat distinctiveness is defined as a collective measure of biodiversity and includes parameters such as the number and variety of species found within the habitat (richness and diversity), how rare the species are, and how many species the habitat supports that are not common elsewhere.
- 2.2.9. To determine habitat distinctiveness, Phase 1 Habitat types were transposed into the standard habitat distinctiveness typology and bands issued by Defra (‘the Defra habitat type’). For some habitat types, multiple distinctiveness bands can apply, depending on the quality of the habitat. Decisions on which distinctiveness band to assign were based on criteria listed in Appendix C of the Building Research Establishment’s (BRE) Guidance Note 36: BREEAM, CEEQUAL and HQM Ecology Calculation Methodology – Route 2 (BRE Group, 2018). This document enables consistent assessment of distinctiveness for all habitat parcels.
- 2.2.10. Where no directly comparable habitat type was available to match the vegetation recorded by Phase 1 Habitat survey (e.g. tall ruderal vegetation), the closest approximation was selected.
- 2.2.11. The Defra distinctiveness bands and associated scores are described in Table 2-1.

Table 2-1 – Habitat distinctiveness bands and scores

Distinctiveness Band	Distinctiveness Score	Habitat Types Included
High	6	Habitats of principle importance i.e. those which meet the criteria to qualify as habitats of principle importance (JNCC, 2011). This

Distinctiveness Band	Distinctiveness Score	Habitat Types Included
		excludes ancient woodland and other habitats which are irreplaceable.
Medium	4	Other semi-natural habitats that do not fall within the scope of habitats of principle importance definitions, i.e. all other areas of woodland (e.g. non-native coniferous plantation), other grassland (e.g. species poor semi-improved), other uncultivated field margins, road verge and railway embankments (excluding those that are intensively managed).
Low	2	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.

2.2.12. All hedgerows are assumed to be of High distinctiveness because the vast majority of hedgerows will meet Habitat of Principle Importance (HPI) criteria. For this reason, distinctiveness is not included as part of the linear unit calculation. This follows the approach set out by Defra.

CONDITION

2.2.13. Condition, in the context of BNG, is defined as the quality of a particular habitat. For example, a habitat is in poor condition if it fails to support the rare or notable species for which it is valued, or if it is degraded as a result of pollution, erosion, invasive species or other factors.

2.2.14. The Defra metric requires habitat condition to be assessed using the system presented in Natural England's Farm Environment Plan (FEP) manual (Natural England, 2010).

2.2.15. Habitat condition scores were assigned based on the criteria in **Table 2-2**.

Table 2-2 – Habitat condition bands and scores

Condition Band	Condition Score	Criteria for Assigning Condition
Good	3	Any habitat which passes all the FEP criteria.
Moderate	2	Any habitat which fails one FEP criterion.
Poor	1	Any habitat which fails two or more FEP criteria.

DERIVING THE TOTAL NUMBER OF BASELINE BIODIVERSITY UNITS

2.2.16. Following the scoring of all habitat parcels for habitat distinctiveness and condition, the total number of baseline BU was calculated for each area-based using the following formula:

$$\text{Distinctiveness} \times \text{Condition} \times \text{Area (ha)} = \text{BASELINE BIODIVERSITY UNITS}$$

2.2.17. The scores generated by each individual habitat parcel will then be summed to provide the total number of BU generated by the baseline habitat parcels. It is important to set out the BU for the individual habitats so that these can be compared with the post-development BU for the same habitat type.

2.2.18. The number of baseline LU present should be calculated for hedgerows as follows:

$$\text{Length of linear habitats lost (m)} \times \text{Condition} = \text{BASELINE LINEAR UNITS}$$

2.2.19. For the baseline BNG calculation, running water is expressed simply as a length in metres.

2.3 POST-DEVELOPMENT BIODIVERSITY UNIT CALCULATION

2.3.1. BU and LU resulting from Scheme design, including landscape and ecological mitigation design, are referred to as post-development BU / LU.

LINEAR HABITATS

2.3.2. In the post-development calculation, linear habitats have been kept separate from units calculated for area-based habitats; this mirrors the approach for baseline unit calculations. The risk factors described below are only applicable to the area-based habitat calculation. They are not included in the calculation for linear habitats. This is because the risks associated with creating the linear features are considered to be taken into account within the condition multiplier used to calculate the baseline LU.

2.3.3. Post-development LU are therefore expressed simply as the length in metres of new species rich hedgerow or lines of trees created.

$$\text{Length (m)} = \text{POST-DEVELOPMENT LINEAR UNITS}$$

- 2.3.4. For the post-development BNG calculation, running water is expressed simply as a length in metres.

APPLYING RISK FACTORS TO AREA-BASED CALCULATIONS

- 2.3.5. In the post-development calculation, BU are calculated in a similar way to baseline BU. However, in addition to area, condition and distinctiveness of the proposed habitats, the key risks to delivery are taken into account through incorporation of risk factors.
- 2.3.6. The application of risk factors in the calculation of post-development biodiversity units differs depending on if the habitats are created or enhanced:

- **Habitat Creation.** When habitats within the Scheme Footprint are cleared for construction and new habitats created post-development, risk factors are applied to all the potential biodiversity units generated from the newly created habitat. Such that:

$$\begin{aligned} \text{Potential Biodiversity Units} &= \\ &\text{Target Habitat Area (ha)} \times \text{Target Distinctiveness} \times \text{Target Condition} \\ \text{Habitat Creation Biodiversity Units} &= \\ &\text{Potential Biodiversity Units} \times (\text{Risk Factors}) \end{aligned}$$

- **Habitat Enhancement.** When selected habitats within the Scheme Footprint are not cleared as a result of construction operations, they are retained and may be enhanced post-development. In such cases the risk factors are applied to the change in biodiversity value resulting from the enhancement measures. In this scenario, the baseline biodiversity units are subtracted from the potential biodiversity units of the target habitat and then the risk factors are applied to the difference between the two. Such that:

$$\begin{aligned} \text{Baseline Biodiversity Units} &= \\ &\text{Retained Habitat Area (ha)} \times \text{Baseline Distinctiveness} \times \text{Baseline Condition} \\ \text{Potential Biodiversity Units} &= \\ &\text{Retained Habitat Area (ha)} \times \text{Target Distinctiveness} \times \text{Target Condition} \\ \text{Habitat Enhancement Biodiversity Units} &= \\ &(\text{Potential Biodiversity Units} - \text{Baseline Biodiversity Units}) \times (\text{Risk Factors}) \end{aligned}$$

- 2.3.7. The Defra metric sets out three risk factors: distance from scheme (spatial risk); time taken for created or enhanced habitats to reach target condition (temporal risk); and how difficult it is to create or enhance any given habitat (delivery risk).

SPATIAL RISK

- 2.3.8. The spatial risk is the risk associated with delivering compensation for the loss of a habitat at a distance from that loss. The further from the site of the loss, the greater the risk. Spatial risk has not been included in the preliminary post-development calculation as it is assumed that habitat compensation and retention will be delivered within the Scheme Footprint or within the same ecological network as the loss occurs.

DELIVERY RISK

- 2.3.9. Delivery risk is the risk associated with the difficulty to create or restore any specific habitat. Appendix 1 of Defra's Technical Paper (Defra 2012a) provides an indicative guide to broad categories of risk for different habitats. For habitat types not listed in Defra's guidance, Appendix C of the BRE Guidance Note 36 was used to determine the appropriate level of delivery risk. This was informed by delivery risk levels assigned to similar habitat types by Defra. **Tables 2-3 to 2-5** show risk factors assigned to each level of delivery risk and type of habitat on this scheme.

Table 2-3 - Defra delivery risk factors

Difficulty of Recreation or Restoration	Delivery Risk Factor
Very High	0.10
High	0.33
Medium	0.67
Low	1.00

Table 2-4 - Delivery risk for created habitats

JNCC Habitat Type	Difficulty of Creation	Delivery Risk Factor
A1.1.1 Broadleaved woodland - semi-natural	Medium	0.67
A1.1.1 Broadleaved woodland - semi-natural - linear belt	Medium	0.67
A1.1.1 Broadleaved woodland - semi-natural - Woodland Edge	Medium	0.67

JNCC Habitat Type	Difficulty of Creation	Delivery Risk Factor
A1.1.2 Broadleaved woodland - plantation	Low	1
A1.2.2 Coniferous woodland - plantation	Low	1
A1.3.2 Mixed woodland - plantation	Low	1
A2.1 Dense scrub	Low	1
A2.2 Scrub - scattered	Low	1
A3.1 Broadleaved parkland/scattered trees	Low	1
B2.2 Neutral grassland - semi-improved	Low	1
B4 Improved grassland	Low	1
B6 Poor semi-improved grassland	Low	1
C3.1 Other tall herb and fern - ruderal	Low	1
J1.1 Cultivated/disturbed land - arable	Low	1
J1.2 Cultivated/disturbed land - amenity grassland	Low	1

Table 2-5 - Delivery risk for enhanced habitats

Baseline JNCC Habitat Type	Post-Development JNCC Habitat Type	Difficulty of Enhancement	Delivery Risk Factor
A1.1.2 Broadleaved woodland - plantation	A1.1.1 Broadleaved woodland - semi-natural	Low	1
A1.1.2 Broadleaved woodland - plantation	A1.1.1 Broadleaved woodland - semi-natural -	Low	1

Baseline JNCC Habitat Type	Post-Development JNCC Habitat Type	Difficulty of Enhancement	Delivery Risk Factor
A1.1.2 Broadleaved woodland - plantation	A1.1.1 Broadleaved woodland - semi-natural - woodland edge	Low	1
B2.2 Neutral grassland - semi-improved	B2.2 Neutral grassland - semi-improved	Low	1

TEMPORAL RISK

- 2.3.10. In delivering compensation for loss of habitats, the timing of impact may not coincide with the new habitat reaching the required quality or level of maturity which could result in loss of biodiversity for a period of time. This risk is accounted for by applying a 'temporal risk' multiplier to the biodiversity unit calculations.
- 2.3.11. Defra has no set guidance on the time taken to reach a specific condition for each habitat type. Therefore, this information was taken from Appendix C of the BRE Guidance Note 36 as outlined in **Tables 2-6 to 2-8**, using professional judgment as appropriate.
- 2.3.12. For created habitats, an additional three years has been added to time to target condition to account for the fact the habitats will be lost during the three year construction period. This does not apply to enhanced habitats as the baseline habitat will not be lost during the construction period.

Table 2-6 - Temporal risk factors

Years to Target Condition Category	Temporal Risk Factor
Under 1 year	1
1	0.97
2	0.93
3-5	0.83
6-10	0.71
11-15	0.59

16-20	0.50
21-25	0.42
26-30	0.35
32+	0.33

Table 2-7 - Temporal risk for created habitats

JNCC Habitat Type	Years to Target Condition +3 Years	Temporal Risk Factor
A1.1.1 Broadleaved woodland - semi-natural	32+	0.33
A1.1.1 Broadleaved woodland - semi-natural - linear belt	21-25	0.42
A1.1.1 Broadleaved woodland - semi-natural - woodland edge	21-25	0.42
A1.1.2 Broadleaved woodland - plantation	21-25	0.42
A1.2.2 Coniferous woodland - plantation	16-20	0.5
A1.3.2 Mixed woodland - plantation	21-25	0.42
A2.1 Dense scrub	6-10	0.71
A2.2 Scrub - scattered	6-10	0.71
A3.1 Broadleaved parkland/scattered	21-25	0.42
B2.2 Neutral grassland - semi-improved	6-10	0.71
B4 Improved grassland	3-5	0.83
B6 Poor semi-improved grassland	3-5	0.83
C3.1 Other tall herb and fern - ruderal	3-5	0.83

JNCC Habitat Type	Years to Target Condition +3 Years	Temporal Risk Factor
J1.1 Cultivated/disturbed land - arable	3-5	0.83
J1.2 Cultivated/disturbed land - amenity grassland	3-5	0.83

Table 2-8 - Temporal risk for enhanced habitats

Baseline JNCC Habitat Type	Post-Development JNCC Habitat Type	Years to Target Condition	Temporal Risk Factor
A1.1.2 Broadleaved woodland - plantation	A1.1.1 Broadleaved woodland - semi-natural	21-25	0.42
A1.1.2 Broadleaved woodland - plantation	A1.1.1 Broadleaved woodland - semi-natural - linear belt	16-20	0.5
A1.1.2 Broadleaved woodland - plantation	A1.1.1 Broadleaved woodland - semi-natural - woodland edge	16-20	0.5
B2.2 Neutral grassland - semi-improved	B2.2 Neutral grassland - semi-improved	6-10	0.71

2.4 CALCULATING THE CHANGE IN BIODIVERSITY UNITS AS A CONSEQUENCE OF THE SCHEME

2.4.1. The following formula is used to calculate the change in BU as a consequence of the Scheme:

$$\text{Post-Development Biodiversity Units (enhanced, created and retained)} - \text{Baseline Biodiversity Units} = \text{Change in Biodiversity Units}$$

2.4.2. If this resulting score is negative there is a loss in biodiversity for the area-based habitats. If the score is close to zero (with the post-development units being within 95%-104% of the baseline units) there is no net loss of biodiversity. If there is an increase in the BU of 5% or more the project is capable of delivering net gain for biodiversity for the area-based habitats.

The percentage should be rounded to the nearest whole percentage point (0.5 and above is to be rounded up to 1 and anything below 0.5 should be rounded down).

- 2.4.3. The same formula and process applies to calculating the change in linear units and length of watercourse.

3 ASSUMPTIONS AND LIMITATIONS

3.1 BASELINE BIODIVERSITY AND LINEAR UNIT CALCULATIONS

3.1.1. The following assumptions were made for the baseline biodiversity unit and linear unit calculations. Assumptions were made using expert opinion and guided by Appendix C of the Building Research Establishment's (BRE) Guidance Note 36: BREEAM, CEEQUAL and HQM Ecology Calculation Methodology – Route 2.

DISTINCTIVENESS

3.1.2. For habitats types with multiple options of distinctiveness, the following assumptions were made:

- All A1.1.1 Broadleaved woodland – semi-natural is assumed to be of High distinctiveness.
- All A1.1.2 Broadleaved woodland – plantation is assumed to be of Medium distinctiveness.
- All A1.2.2 Coniferous woodland – plantation is assumed to be of Low distinctiveness.
- All A3.1 Parkland/scattered trees – broadleaved is assumed to be of Medium distinctiveness.
- All J1.1 Cultivated/disturbed land – arable is assumed to be of Low distinctiveness.
- All hedgerows are assumed to be of High distinctiveness because the vast majority of hedgerows will meet the HPI criteria. For this reason, distinctiveness is not included as part of the linear unit calculation. This follows the approach set out by Defra.

CONDITION

3.1.3. In cases where primary condition information was unavailable, the following assumptions were made:

- All Low distinctiveness habitats were assigned a condition rating of Poor except where condition assessment data was available;
- All Medium and High distinctiveness habitats were assigned a condition rating of Moderate with the exception of A1.1.1 Broadleaved semi-natural woodland, A1.1.2 Woodland: broadleaved – plantation, A1.3.2 Woodland: Mixed – plantation and A2.2 Scrub: Scattered which were assigned Good condition based on primary condition scores of the same habitat class nearby; and
- All hedgerows were assigned a condition rating of Moderate.

3.2 POST-DEVELOPMENT BIODIVERSITY AND LINEAR UNIT CALCULATIONS

3.2.1. The following assumptions were made for the post-development biodiversity unit and linear unit calculations.

RETENTION, CREATION, RECREATION AND ENHANCEMENT

- 3.2.2. All habitat within the Scheme Footprint is assumed to be cleared for the three year construction period, unless identified as 'retained' in landscape plans. The exception to this assumption is that hardstanding, buildings and bare ground are assumed to be retained rather than lost and recreated if they are not identified as retained in landscape plans and are not being replaced by permanent Scheme design features or landscape planting.
- 3.2.3. Where habitat is temporarily lost during the construction period, it is assumed that it will be reinstated back to the original habitat type on completion of construction. The exception to this is where landscape plans or scheme design identify creation of a different habitat type.
- 3.2.4. Areas of habitat were assumed to be enhanced rather than created where the landscape plan had identified both retained and created habitat in the same location.
- 3.2.5. It is assumed that all habitat creation is being delivered on land which has already been cleared for development. The only exception to this rule is where neutral semi-improved grassland is being created over a scrub habitat outside cleared land. Scrub will need to be removed in order to be replaced by neutral semi improved grassland which means that this habitat is created from scratch rather than enhanced.

TARGET DISTINCTIVENESS

- 3.2.6. For created and enhanced habitats types with multiple options of distinctiveness, assumed target distinctive is as per assumed distinctiveness of baseline habitat types (see **Section 3.1**).

TARGET CONDITION

- 3.2.7. For retained habitats, there was assumed to be no change to baseline condition. For created and enhanced habitats, target condition assumptions are as follows:
- All Low distinctiveness habitats were assigned a target condition rating of Poor.
 - All Medium and High distinctiveness habitats were assigned a target condition rating of Good.

RISK FACTORS

- 3.2.8. It is assumed that all habitat creation, enhancement or retention will be delivered within the Scheme Footprint or within the same ecological network as the loss occurs. Therefore, the spatial risk factor is not included within the post-development biodiversity unit calculations.
- 3.2.9. Assumed multipliers for difficulty risk and temporal risk or created and enhanced habitats are outlined in **Section 2** above.

3.3 LIMITATIONS

- 3.3.1. Any amendments the current landscape and highways design plans used to inform this BNG assessment will necessitate re-running of the biodiversity unit calculations to determine the biodiversity impacts of the Scheme.

- 3.3.2. BU presented within the results section are rounded up to the nearest 0.01 of a unit.
- 3.3.3. The BU and LU calculations do not account for indirect impacts that may happen to habitats outside of the Scheme footprint. Given all required construction compounds and accesses are included within in the Scheme footprint, this limitation is unlikely to have any effect on the BNG calculations.

4 RESULTS OF BASELINE BIODIVERSITY AND LINEAR UNIT CALCULATIONS

4.1 OVERVIEW

4.1.1. **Tables 4-1 to 4-3** show the baseline habitat types and the number of BU and LU attributed to existing habitats within the Scheme Footprint. For a Phase 1 map of the Scheme's baseline habitats, please refer to **Figure 1** in **Appendix C**.

4.2 IRREPLACEABLE HABITATS

4.2.1. There were no habitats within the Scheme Footprint which qualified as irreplaceable habitat types. No areas of the Scheme Footprint fall within statutory designated sites for nature conservation.

4.3 AREA-BASED HABITATS

Table 4-1 – Summary of baseline area-based BU calculation

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (ha)	Baseline BU
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Good (3)	1.66	29.88
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Moderate (2)	2.67	32.04
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Poor (1)	0.10	0.60
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Good (3)	9.02	108.24
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	1.98	15.84
A1.2.2 Coniferous woodland - plantation	Low (2)	Poor (1)	0.18	0.36
A1.3.2 Mixed woodland - plantation	Medium (4)	Good (3)	5.46	65.52
A1.3.2 Mixed woodland - plantation	Medium (4)	Moderate (2)	3.24	25.92

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (ha)	Baseline BU
A2.1 Dense scrub	Medium (4)	Moderate (2)	0.96	7.68
A2.1 Dense scrub	Medium (4)	Poor (1)	0.78	3.12
A2.2 Scrub - scattered	Medium (4)	Good (3)	0.86	10.32
A2.2 Scrub - scattered	Medium (4)	Moderate (2)	0.36	2.88
A2.2 Scrub - scattered	Medium (4)	Poor (1)	0.81	3.24
A3.1 Broadleaved parkland / scattered trees	Medium (4)	Moderate (2)	0.05	0.40
A3.1 Broadleaved parkland / scattered trees	Medium (4)	Poor (1)	0.03	0.12
B2.2 Neutral grassland - semi-improved	Medium (4)	Good (3)	0.24	2.88
B2.2 Neutral grassland - semi-improved	Medium (4)	Moderate (2)	3.1	24.8
B2.2 Neutral grassland - semi-improved	Medium (4)	Poor (1)	4.3	17.2
B4 Improved grassland	Low (2)	Moderate (2)	8.7	34.8
B4 Improved grassland	Low (2)	Poor (1)	0.67	1.34
B6 Poor semi-improved grassland	Low (2)	Good (3)	0.4	2.4
B6 Poor semi-improved grassland	Low (2)	Moderate (2)	0.17	0.68
B6 Poor semi-improved grassland	Low (2)	Poor (1)	0.23	0.46

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (ha)	Baseline BU
C3.1 Other tall herb and fern - ruderal	Low (2)	Poor (1)	1.53	3.06
G2 Running water	N/A	N/A	0.17	N/A
J1.1 Cultivated/disturbed land - arable	Low (2)	Poor (1)	4.1	8.2
J1.2 Cultivated/disturbed land - amenity grassland	Low (2)	Poor (1)	0.63	1.26
J3.6 Buildings	N/A	N/A	0.09	N/A
J4 Bare ground	Low (2)	Poor (1)	0.55	1.10
Hardstanding	N/A	N/A	25.6	N/A
Total			78.64	404.34

4.4 LINEAR HABITATS

Table 4-2 – Summary of baseline hedgerow LU calculation

JNCC Habitat Type	Condition Score	Length (m)	LU
J2.1.2 Hedges - intact - native species-poor	Good (3)	214	642
J2.1.2 Hedges - intact - native species-poor	Moderate (2)	1380	2760
J2.1.2 Hedges - intact - native species-poor	Poor (1)	385	385
J2.2.2 Hedges - defunct - native species-poor	Poor (1)	262	262

JNCC Habitat Type	Condition Score	Length (m)	LU
J2.3.2 Hedges - with trees - native species-poor	Good (3)	280	840
J2.3.2 Hedges - with trees - native species-poor	Moderate (2)	174	348
Total		2695	5237

Table 4-3 – Summary of baseline watercourse length

JNCC Habitat Type	Length (m)
G2 Running water	715
Total	715

5 ALLERDENE EMBANKMENT OPTION – RESULTS OF POST-DEVELOPMENT BIODIVERSITY AND LINEAR UNIT CALCULATIONS

5.1 OVERVIEW

5.1.1. **Section 5** displays the results of the post-development BU and LU calculations for the Embankment variant of the Scheme. These results have been split to show the habitats which are retained, created or enhanced. **Table 5-8** provides a summary of the BU and LU within the Scheme Footprint post-development. For a Phase 1 map of the habitats within the Scheme Footprint post-development, please refer to **Appendix C**.

5.2 RETAINED HABITATS

AREA-BASED HABITATS

5.2.1. **Table 5-1** shows the biodiversity from habitats which are being retained but will not be enhanced post-development. It is important to note that not all retained habitats will be enhanced post-development.

Table 5-1 – Summary of retained area-based habitat BU calculation – Embankment

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (Hectares)	BU Retained
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Good (3)	0.92	16.56
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Moderate (2)	0.63	7.56
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Poor (1)	0*	0*
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Good (3)	4.15	49.8
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	0.16	1.28
A1.3.2 Mixed woodland - plantation	Medium (4)	Good (3)	4.38	52.56

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (Hectares)	BU Retained
A2.1 Dense scrub	Medium (4)	Moderate (2)	0.03	0.24
A2.1 Dense scrub	Medium (4)	Poor (1)	0.02	0.08
A2.2 Scrub - scattered	Medium (4)	Good (3)	0.05	0.6
A2.2 Scrub - scattered	Medium (4)	Moderate (2)	0.12	0.96
A2.2 Scrub - scattered	Medium (4)	Poor (1)	0.17	0.68
A3.1 Broadleaved parkland/scattered trees:	Medium (4)	Poor (1)	0.01	0.04
B2.2 Neutral grassland - semi-improved	Medium (4)	Good (3)	0.08	0.96
B2.2 Neutral grassland - semi-improved	Medium (4)	Moderate (2)	0.22	1.76
B2.2 Neutral grassland - semi-improved	Medium (4)	Poor (1)	0.55	2.2
B4 Improved grassland	Low (2)	Moderate (2)	0.1	0.4
B4 Improved grassland	Low (2)	Poor (1)	2.92	5.84
B6 Poor semi-improved grassland	Low (2)	Good (3)	0.01	0.06
B6 Poor semi-improved grassland	Low (2)	Moderate (2)	0.02	0.08
C3.1 Other tall herb and fern - ruderal	Low (2)	Poor (1)	0.19	0.38

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (Hectares)	BU Retained
J1.1 Cultivated/disturbed land - arable	Low (2)	Poor (1)	0.04	0.08
J1.2 Cultivated/disturbed land - amenity grassland	Low (2)	Poor (1)	0.09	0.18
J3.6 Buildings	N/A	N/A	0.09	N/A
J4 Bare ground	Low (2)	Poor (1)	0.18	0.36
Hardstanding	N/A	N/A	13.57	N/A
Total			28.70	142.66

*Area and resulting BU for Poor condition A1.1.1 Broadleaved woodland - semi-natural are shown as zero. Although there is a small amount of this habitat type retained, it is less than 0.01 ha and generates less than 0.01 BU.

LINEAR HABITATS

Table 5-2 – Summary of retained hedgerow habitat LU calculation – Embankment

JNCC Habitat Type	Condition Score	Length	LU
J2.1.2 Hedges - intact - native species-poor	Good (3)	85	255
J2.1.2 Hedges - intact - native species-poor	Moderate (2)	205	410
J2.1.2 Hedges - intact - native species-poor	Poor (1)	205	205
J2.3.2 Hedges - with trees - native species-poor	Good (3)	47	141
Total		542	1011

Table 5-3 – Summary of retained watercourse length – Embankment

JNCC Habitat Type	Length (Metres)
G2 Running water	162
Total	162

- 5.2.2. It is important to note that 162 m of an existing watercourse is within the Scheme Footprint. This habitat will be retained in its current state so there will be no change to its biodiversity value. As there is currently no established metric for assessing the condition of watercourses, any changes in biodiversity value cannot be quantified.

CREATED AND ENHANCED HABITATS - AREA-BASED HABITATS

Table 5-4 – Summary of post-development created area-based habitat BU calculation – Embankment

JNCC Habitat Type	Distinctiveness	Target Condition	Difficulty Risk	Temporal Risk	Area (Hectares)	Post-Development BU
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Good (3)	Medium (0.67)	32+ yrs (0.33)	4.86	19.34
A1.1.1 Broadleaved woodland - semi-natural - linear belt	Medium (4)	Good (3)	Medium (0.67)	21-25 yrs (0.42)	0.75	2.53
A1.1.1 Broadleaved woodland - semi-natural - woodland edge	Medium (4)	Good (3)	Medium (0.67)	21-25 yrs (0.42)	2.45	8.27
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Good (3)	Low (1)	21-25 yrs (0.42)	3.97	20.01

JNCC Habitat Type	Distinctiveness	Target Condition	Difficulty Risk	Temporal Risk	Area (Hectares)	Post-Development BU
A1.2.2 Coniferous woodland - plantation	Low (2)	Poor (1)	Low (1)	16-20 yrs (0.5)	0.16	0.16
A1.3.2 Mixed woodland - plantation	Medium (4)	Good (3)	Low (1)	21-25 yrs (0.42)	2.69	13.56
A2.1 Dense scrub	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	1.09	9.29
A2.2 Scrub - scattered	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	1.41	12.01
A3.1 Broadleaved parkland/scattered trees	Medium (4)	Good (3)	Low (1)	21-25 yrs (0.42)	0.02	0.10
B2.2 Neutral grassland - semi-improved	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	6.41	54.61
B4 Improved grassland	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	3.67	6.09
B6 Poor semi-improved grassland	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	0.57	0.95

JNCC Habitat Type	Distinctiveness	Target Condition	Difficulty Risk	Temporal Risk	Area (Hectares)	Post-Development BU
C3.1 Other tall herb and fern - ruderal	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	0.89	1.48
J1.1 Cultivated/disturbed land - arable	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	4.06	6.74
J1.2 Cultivated/disturbed land - amenity grassland	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	0.53	0.88
Hardstanding	N/A	N/A	N/A	N/A	16.07	N/A
Total					49.60	156.02

5.2.3. **Table 5-5** shows the value of the habitats which are to be retained and enhanced (the “enhanced habitat baseline BU”) and the BU value which is generated by the proposed enhancements (the “enhanced habitat post-development”). The total post-development BU value of habitats which are retained and enhanced is the sum of the enhanced habitat baseline BU and the enhanced habitat post-development.

Table 5-5 – Summary of post-development enhanced area-based habitat BU calculation – Embankment

Baseline JNCC Habitat Type	Baseline Distinctiveness	Baseline Condition	Baseline BU	Post-Development JNCC Habitat Type	Area (Hectares)	Target Distinctiveness	Target Condition	Delivery Risk	Time to Target Condition	Post-Development BU
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	1.12	A1.1.1 Broadleaved woodland - semi-natural	0.14	High (6)	Good (3)	Low (1)	21-25 yrs (0.42)	0.59
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	0.24	A1.1.1 Broadleaved woodland - semi-natural - linear belt	0.03	Medium (4)	Good (3)	Low (1)	16-20 yrs (0.5)	0.06
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	0.96	A1.1.1 Broadleaved woodland - semi-natural - woodland edge	0.12	Medium (4)	Good (3)	Low (1)	16-20 yrs (0.5)	0.24
B2.2 Neutral grassland - semi-improved	Medium (4)	Moderate (2)	0.24	B2.2 Neutral grassland - semi-improved	0.03	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	0.09
Enhanced habitat baseline BU			2.56	Total area	0.32	Enhanced habitat post-development BU				0.98

LINEAR HABITATS – HEDGEROWS

Table 5-6 – Summary of post-development created hedgerow LU calculation – Embankment

JNCC Habitat Type	Condition Score	Length (Metres)	Post-Development LU
J2.3.1 Hedges - with trees - native species-rich	N/A	1565	1565
J2.1.1 Hedges - intact - native species-rich	N/A	2730	2730
J2.1.2 Hedges - intact - native species-poor	N/A	898	898
J2.2.2 Hedges - defunct - native species-poor	N/A	262	262
J2.3.1 Hedges - with trees - native species-rich	N/A	1255	1255
J2.3.2 Hedges - with trees - native species-poor	N/A	396	396
Total		7106	7106

LINEAR HABITATS – WATERCOURSES

Table 5-7 – Summary of post-development created watercourse length – Embankment

JNCC Habitat Type	Length (Metres)
G2 Running water	505
Total	505

5.3 SUMMARY OF RESULTS – EMBANKMENT

Table 5-8 – Summary of change in area split by habitat type – Embankment

Habitat Type (Distinctiveness)	Baseline Area (HA)	Post-Construction Area (HA)
Woodland & scrub (HIGH)	4.43	6.41
Woodland & scrub (MEDIUM)	23.55	21.76
Woodland & scrub (LOW)	0.18	0.16
Grassland (MEDIUM)	7.64	7.29
Grassland (LOW)	10.17	7.29
Tall herb & fern (LOW)	1.53	1.08
Running water (N/A – biodiversity value accounted for in linear units)	0.17	0
Cultivated / disturbed land & bare ground (LOW)	5.28	4.90
Buildings and hardstanding (N/A – no biodiversity value)	25.69	29.73
Total	78.64	78.62

Table 5.9 – Summary of post-development retention, creation and enhancement calculations – Embankment

	Hedgerow LU	Watercourse Length (Metres)	BU
Retained habitats	1011	162	142.66
Created habitats	7106	505	156.02
Enhanced habitat baseline	N/A	N/A	2.56
Enhanced habitat post-development	N/A	N/A	0.98
Total Post-Development LU/M/BU	8117	667	319.28

6 ALLERDENE VIADUCT OPTION– RESULTS POST-DEVELOPMENT BIODIVERSITY AND LINEAR UNIT CALCULATIONS

6.1 OVERVIEW

6.1.1. **Section 6** displays the results of the post-development BU and LU calculations for the Viaduct variant of the Scheme. These results have been split to show the habitats which are retained, created or enhanced. **Table 6-8** provides a summary of the BU and LU within the Scheme Footprint post-development. For a Phase 1 map of the habitats within the Scheme Footprint post-development, please refer to **Appendix C**.

6.2 RETAINED HABITATS

AREA-BASED HABITATS

6.2.1. **Table 6-1** shows the biodiversity from habitats which are being retained but will not be enhanced post-development. It is important to note that not all retained habitats will be enhanced post-development.

Table 6-1 – Summary of retained area-based habitat BU calculation – Viaduct

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (Hectares)	BU Retained
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Good (3)	0.92	16.56
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Moderate (2)	0.63	7.56
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Poor (1)	0*	0*
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Good (3)	4.39	52.68
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	0.16	1.28
A1.3.2 Mixed woodland - plantation	Medium (4)	Good (3)	4.38	52.56

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (Hectares)	BU Retained
A2.1 Dense scrub	Medium (4)	Moderate (2)	0.03	0.24
A2.1 Dense scrub	Medium (4)	Poor (1)	0.02	0.08
A2.2 Scrub - scattered	Medium (4)	Good (3)	0.05	0.6
A2.2 Scrub - scattered	Medium (4)	Moderate (2)	0.12	0.96
A2.2 Scrub - scattered	Medium (4)	Poor (1)	0.17	0.68
A3.1 Broadleaved parkland/scattered trees:	Medium (4)	Poor (1)	0.01	0.04
B2.2 Neutral grassland - semi-improved	Medium (4)	Good (3)	0.08	0.96
B2.2 Neutral grassland - semi-improved	Medium (4)	Moderate (2)	0.22	1.76
B2.2 Neutral grassland - semi-improved	Medium (4)	Poor (1)	0.55	2.2
B4 Improved grassland	Low (2)	Moderate (2)	0.1	0.4
B4 Improved grassland	Low (2)	Poor (1)	3.60	7.20
B6 Poor semi-improved grassland	Low (2)	Good (3)	0.01	0.06
B6 Poor semi-improved grassland	Low (2)	Moderate (2)	0.02	0.08
C3.1 Other tall herb and fern - ruderal	Low (2)	Poor (1)	0.19	0.38
J1.1 Cultivated/disturbed land - arable	Low (2)	Poor (1)	0.04	0.08

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (Hectares)	BU Retained
J1.2 Cultivated/disturbed land - amenity grassland	Low (2)	Poor (1)	0.09	0.18
J3.6 Buildings	N/A	N/A	0.09	N/A
J4 Bare ground	Low (2)	Poor (1)	0.18	0.36
Hardstanding	N/A	N/A	13.92	N/A
Total			29.97	146.90

*Area and resulting BU for Poor condition A1.1.1 Broadleaved woodland - semi-natural are shown as zero. Although there is a small amount of this habitat type retained, it is less than 0.01 ha and generates less than 0.01 BU.

LINEAR HABITATS

Table 6-2 – Summary of retained hedgerow habitat LU calculation – Viaduct

JNCC Habitat Type	Condition Score	Length	LU
J2.1.2 Hedges - intact - native species-poor	Good (3)	34	102
J2.1.2 Hedges - intact - native species-poor	Moderate (2)	205	410
J2.1.2 Hedges - intact - native species-poor	Poor (1)	205	205
J2.3.2 Hedges - with trees - native species-poor	Good (3)	47	141
Total		491	858

Table 6-3 - Summary of retained watercourse length – Allerdene viaduct option

JNCC Habitat Type	Length (Metres)
G2 Running water	163
Total	163

6.2.2. It is important to note that 163 m of an existing watercourse is within the Scheme Footprint. This habitat will be retained in its current state so is no change to its biodiversity value. As there is currently no established metric for assessing the condition of watercourses, any changes in biodiversity value cannot be quantified.

6.3 CREATED AND ENHANCED HABITATS

AREA-BASED HABITATS

Table 6-4 – Summary of post-development created area-based habitat BU calculation – Viaduct

JNCC Habitat Type	Distinctiveness	Target Condition	Difficulty Risk	Temporal Risk	Area (Hectares)	Post-Development BU
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Good (3)	Medium (0.67)	32+ yrs (0.33)	4.39	17.47
A1.1.1 Broadleaved woodland - semi-natural - linear belt	Medium (4)	Good (3)	Medium (0.67)	21-25 yrs (0.42)	0.75	2.53
A1.1.1 Broadleaved woodland - semi-natural - woodland edge	Medium (4)	Good (3)	Medium (0.67)	21-25 yrs (0.42)	2.44	8.24
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Good (3)	Low (1)	21-25 yrs (0.42)	3.90	19.66

JNCC Habitat Type	Distinctiveness	Target Condition	Difficulty Risk	Temporal Risk	Area (Hectares)	Post-Development BU
A1.2.2 Coniferous woodland - plantation	Low (2)	Poor (1)	Low (1)	16-20 yrs (0.5)	0.16	0.16
A1.3.2 Mixed woodland - plantation	Medium (4)	Good (3)	Low (1)	21-25 yrs (0.42)	2.69	13.56
A2.1 Dense scrub	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	1.09	9.29
A2.2 Scrub - scattered	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	1.55	13.21
A3.1 Broadleaved parkland/scattered trees	Medium (4)	Good (3)	Low (1)	21-25 yrs (0.42)	0.02	0.10
B2.2 Neutral grassland - semi-improved	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	5.94	50.61
B4 Improved grassland	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	4.06	6.74
B6 Poor semi-improved grassland	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	0.57	0.95

JNCC Habitat Type	Distinctiveness	Target Condition	Difficulty Risk	Temporal Risk	Area (Hectares)	Post-Development BU
C3.1 Other tall herb and fern - ruderal	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	0.82	1.36
J1.1 Cultivated/disturbed land - arable	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	4.06	6.74
J1.2 Cultivated/disturbed land - amenity grassland	Low (2)	Poor (1)	Low (1)	0-5 yrs (0.83)	0.53	0.88
Hardstanding	N/A	N/A	N/A	N/A	16.07	N/A
Total					49.04	151.50

6.3.1. **Table 6-5** shows the value of the habitats which are to be retained and enhanced (the “enhanced habitat baseline BU”) and the BU value which is generated by the proposed enhancements (the “enhanced habitat post-development”). The total post-development BU value of habitats which are retained and enhanced is the sum of the enhanced habitat baseline BU and the enhanced habitat post-development.

Table 6-5 – Summary of post-development enhanced area-based habitat BU calculation – Viaduct

Baseline JNCC Habitat Type	Baseline Distinctiveness	Baseline Condition	Baseline BU	Post-Development JNCC Habitat Type	Area (Hectares)	Target Distinctiveness	Target Condition	Delivery Risk	Time to Target Condition	Post-Development BU
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	1.12	A1.1.1 Broadleaved woodland - semi-natural	0.14	High (6)	Good (3)	Low (1)	21-25 yrs (0.42)	0.59
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	0.24	A1.1.1 Broadleaved woodland - semi-natural - linear belt	0.03	Medium (4)	Good (3)	Low (1)	16-20 yrs (0.5)	0.06
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	0.96	A1.1.1 Broadleaved woodland - semi-natural - woodland edge	0.12	Medium (4)	Good (3)	Low (1)	16-20 yrs (0.5)	0.24
B2.2 Neutral grassland - semi-improved	Medium (4)	Moderate (2)	0.24	B2.2 Neutral grassland - semi-improved	0.03	Medium (4)	Good (3)	Low (1)	6-10 yrs (0.71)	0.09
Enhanced habitat baseline BU			2.56	Total area	0.32	Enhanced habitat post-development BU			0.98	

LINEAR HABITATS – HEDGEROWS

Table 6-6 - Summary of post-development created hedgerow LU calculation – Allerdene viaduct option

JNCC Habitat Type	Condition Score	Length (Metres)	Post-Development LU
J2.3.1 Hedges - with trees - native species-rich	N/A	1620	1620
J2.1.1 Hedges - intact - native species-rich	N/A	2726	2726
J2.1.2 Hedges - intact - native species-poor	N/A	948	948
J2.2.2 Hedges - defunct - native species-poor	N/A	262	262
J2.3.1 Hedges - with trees - native species-rich	N/A	1255	1255
J2.3.2 Hedges - with trees - native species-poor	N/A	396	396
Total		7207	7207

LINEAR HABITATS – WATERCOURSES

Table 6-7 - Summary of post-development created watercourse length – Allerdene viaduct option

JNCC Habitat Type	Length (Metres)
G2 Running water	505
Total	505

6.4 SUMMARY OF RESULTS – VIADUCT

Table 6-8 – Summary of change in area split by habitat type – Viaduct

Habitat Type (Distinctiveness)	Baseline Area (HA)	Post-Construction Area (HA)
Woodland & scrub (HIGH)	4.43	5.94
Woodland & scrub (MEDIUM)	23.55	22.06
Woodland & scrub (LOW)	0.18	0.16
Grassland (MEDIUM)	7.64	6.82
Grassland (LOW)	10.17	8.36
Tall herb & fern (LOW)	1.53	1.01
Running water (N/A – biodiversity value accounted for in linear units)	0.17	0
Cultivated / disturbed land & bare ground (LOW)	5.28	4.90
Buildings and hardstanding (N/A – no biodiversity value)	25.69	30.08
Total	78.64	79.33

Table 6-9 – Summary of post-development retention, creation and enhancement calculations – Viaduct

Hedgerow LU	Watercourse Length (Metres)	BU	Hedgerow LU
Retained habitats	858	163	146.90
Created habitats	7207	505	151.50
Enhanced habitat baseline	N/A	N/A	2.56

Hedgerow LU	Watercourse Length (Metres)	BU	Hedgerow LU
Enhanced habitat post-	N/A	N/A	0.98
Total Post-Development LU/M/BU	8065	668	301.94

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 EMBANKMENT

- 7.1.1. **Table 7-1** demonstrates that the Embankment variant of the Scheme does not deliver BNG within the site boundary due to a net loss in biodiversity value of area-based habitats (a decrease of 102.12 BU which equates to a 25% net loss) and a loss of 48 m of watercourse (7% net loss from baseline). However, the Embankment variant of the Scheme does result in a net gain for biodiversity for hedgerow habitats (an increase of 2880 LU which equates to a 55% net gain).

Table 7-1 – Summary of results – Embankment

Source	Baseline	Post-Development	Change in Units	Outcome
BU	404.34	302.22	- 102.12 BU	NET LOSS (25%)
Hedgerow LU	5237	8117	+ 2880 LU	NET GAIN (55%)
Watercourse LU	715	667	- 48 m	NET LOSS (7%)

7.2 VIADUCT

- 7.2.1. **Table 7-2** demonstrates that the Viaduct variant of the Scheme does not deliver BNG within the site boundary due to a net loss in biodiversity value of area-based habitats (a decrease of 102.40 BU which equates to a 25% net loss) and a loss of 48 m of watercourse (7% net loss from baseline). However, the Viaduct variant of the Scheme does result in a net gain for biodiversity for hedgerow habitats (an increase of 2828 LU which equates to a 54% net gain).

Table 7-2 – Summary of results – Viaduct

Source	Baseline	Post-Development	Change in Units	Outcome
BU	404.34	301.94	- 102.40 BU	NET LOSS (25%)
Hedgerow LU	5237	8065	+ 2828 LU	NET GAIN (54%)

Source	Baseline	Post-Development	Change in Units	Outcome
Watercourse LU	715	668	- 47 m	NET LOSS (7%)

7.3 ADHERENCE TO THE MITIGATION HIERARCHY

7.3.1. The Scheme's design has been an iterative and a multidisciplinary collaborative process, with feedback from the impact assessments (including biodiversity and landscape) informing the design. This process has involved the implementation of the mitigation hierarchy (avoid, minimise, reinstate) with the aim of achieving no net loss in biodiversity scheme-wide. Below is a summary of primary actions taken under each stage of the hierarchy:

AVOIDANCE

7.3.2. During design, ecologists and landscape teams have worked together to reduce effects on the baseline biodiversity by:

- Retaining areas of existing vegetation where possible, primarily restricted to areas of woodland and hedgerows;

MINIMISATION

7.3.3. There has also been effort to minimise aspects of the Proposed Scheme which would negatively impact biodiversity on site. This has been achieved by:

- Reducing the size and extent of the scheme or individual elements of the scheme to reduce land-take and the subsequent clearance of habitats;
- Locating temporary compounds within habitats of lower biodiversity value (e.g. arable farmland) rather than other habitats along the scheme; and
- Timing and reducing, where possible, the duration of construction activities to minimise impacts to biodiversity.

REINSTATEMENT

7.3.4. It is not possible to avoid or minimise all impacts on biodiversity during the construction period and as such it is necessary for some habitats to be reinstated post-development as a form of mitigation. Specifically, this has been achieved by:

- Reinstating habitat following the removal of temporary site compounds that are present during construction. This habitat reinstatement follows the principle of like-for-like or better i.e., defunct hedgerows lost to the scheme will be replaced with native species rich hedgerows;
- Reinstating habitats which are required for construction works but are not designated as hardstanding.

7.4 RECOMMENDATIONS

- 7.4.1. There is no difference in the overall outcome of the BNG assessment between the two variants of the Scheme. Recommendations made are therefore applicable to both variants.
- 7.4.2. The loss of units of area habitats is largely down to the loss of woodland and scrub habitats. Although these habitats are recreated in terms of area, fewer biodiversity units are generated post-development owing to the application of risk multipliers. An additional area of approximately 10 ha of woodland habitat enhancement would be needed in order to deliver a net gain for biodiversity.
- 7.4.3. Highways England produced a Chief Highways Engineer (CHE) memorandum (Highways England, 2018) which guides the standardised reporting of biodiversity information on Highways England projects. The CHE Memo does not follow the full Defra metric and is only for internal Highways England reporting. An assessment in accordance with the CHE memo is included in **Appendix D**.
- 7.4.4. It is important to recognise that the quantification of biodiversity units is one of a number of factors to be considered when assessing the impact of each stage on biodiversity. The decision as to whether the Scheme can claim biodiversity net gain should be informed by a full biodiversity assessment once the landscape and ecological mitigation plans have been finalised.

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Appendix A

CIEEM, CIRIA AND IEMA UK BIODIVERSITY NET GAIN GOOD PRACTICE PRINCIPLES



Biodiversity Net Gain

Good practice principles for development

Biodiversity Net Gain is development that leaves biodiversity in a better state than before. It is also an approach where developers work with local governments, wildlife groups, land owners and other stakeholders in order to support their priorities for nature conservation. These ten principles set out good practice for achieving Biodiversity Net Gain and must be applied all together, as one approach.

Principle 1. Apply the Mitigation Hierarchy

Do everything possible to first avoid and then minimise impacts on biodiversity. Only as a last resort, and in agreement with external decision-makers where possible, compensate for losses that cannot be avoided. If compensating for losses within the development footprint is not possible or does not generate the most benefits for nature conservation, then offset biodiversity losses by gains elsewhere.

Principle 2. Avoid losing biodiversity that cannot be offset by gains elsewhere

Avoid impacts on irreplaceable biodiversity - these impacts cannot be offset to achieve No Net Loss or Net Gain.

Principle 3. Be inclusive and equitable

Engage stakeholders early, and involve them in designing, implementing, monitoring and evaluating the approach to Net Gain. Achieve Net Gain in partnership with stakeholders where possible, and share the benefits fairly among stakeholders.

Principle 4. Address risks

Mitigate difficulty, uncertainty and other risks to achieving Net Gain. Apply well-accepted ways to add contingency when calculating biodiversity losses and gains in order to account for any remaining risks, as well as to compensate for the time between the losses occurring and the gains being fully realised.

Principle 5. Make a measurable Net Gain contribution

Achieve a measurable, overall gain¹ for biodiversity and the services ecosystems provide while directly contributing towards nature conservation priorities.

¹ Net Gain has been described as a measurable target for development projects where impacts on biodiversity are outweighed by a clear mitigation hierarchy approach to first avoid and then minimise impacts, including through restoration and / or compensation. Adhering to these Net Gain principles (i.e. pursuing all principles together) will help in under-pinning good practice for achieving and sustaining Net Gain.

Principle 6. Achieve the best outcomes for biodiversity

Achieve the best outcomes for biodiversity by using robust, credible evidence and local knowledge to make clearly-justified choices when:

- Delivering compensation that is ecologically equivalent in type, amount and condition, and that accounts for the location and timing of biodiversity losses
- Compensating for losses of one type of biodiversity by providing a different type that delivers greater benefits for nature conservation
- Achieving Net Gain locally to the development while also contributing towards nature conservation priorities at local, regional and national levels
- Enhancing existing or creating new habitat
- Enhancing ecological connectivity by creating more, bigger, better and joined areas for biodiversity

Principle 7. Be additional

Achieve nature conservation outcomes that demonstrably exceed existing obligations (i.e. do not deliver something that would occur anyway).

Principle 8. Create a Net Gain legacy

Ensure Net Gain generates long-term benefits by:

- Engaging stakeholders and jointly agreeing practical solutions that secure Net Gain in perpetuity²
- Planning for adaptive management and securing dedicated funding for long-term management
- Designing Net Gain for biodiversity to be resilient to external factors, especially climate change
- Mitigating risks from other land uses
- Avoiding displacing harmful activities from one location to another
- Supporting local-level management of Net Gain activities

Principle 9. Optimise sustainability

Prioritise Biodiversity Net Gain and, where possible, optimise the wider environmental benefits for a sustainable society and economy.

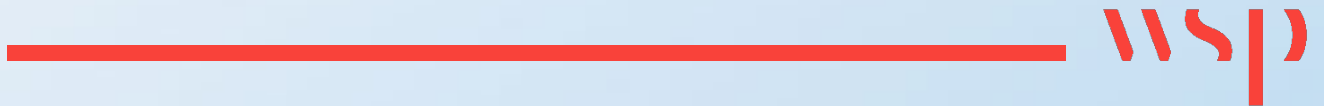
Principle 10. Be transparent

Communicate all Net Gain activities in a transparent and timely manner, sharing the learning with all stakeholders.

² Biodiversity compensation should be planned for a sustained Net Gain over the longest possible timeframe. For development in the UK, the expectation is that compensation sites will be secured for at least the lifetime of the development (e.g. often 25-30 years) with the objective of Net Gain management continuing in the future.

Appendix B

WSP BIODIVERSITY NET GAIN PROCESS



WSP BIODIVERSITY NET GAIN PROCESS

Step 1 – Set the Scope

- i. **Produce a biodiversity net gain (BNG) strategy.** A short memo report setting out client commitments to BNG, scope of the BNG work, and the proposed steps required.
- i. **Workshop 1 or 1-2-1 meetings – strategy meetings.** Early engagement with key stakeholders, likely to include local conservation NGOs, local authorities and government agencies such as Natural England. Early engagement is essential to present, discuss and develop the BNG strategy; including setting the BNG good practice principles into a scheme context and agreeing local priorities for biodiversity.

Step 2 – Initial Biodiversity Assessment

- vi. **Survey baseline habitats and their condition.** Ideally, a habitat condition assessment is undertaken during Phase 1 Habitat survey. If Phase 1 Habitat data has been collected prior to initiating the BNG process, condition assessment can be undertaken either a) retrospectively through interpretation of Phase 1 target notes, consultation with surveyors, or employing a number of assumptions; or b) during an additional site visit.
 - vii. **Identify irreplaceable habitat.** Following Defra guidance, irreplaceable habitats within the scheme boundary must be identified and excluded from the biodiversity unit calculations. It is important to note that biodiversity net gain or no net loss cannot be achieved for the scheme as a whole if there is a negative impact on an irreplaceable habitat
 - viii. **Calculate baseline biodiversity units using the biodiversity metric.** This calculation includes all habitats (minus irreplaceable habitats) within the scheme boundary prior to development, and is informed by Phase 1 Habitat data and results of the condition assessment. The baseline biodiversity unit calculation may be run on a number of scheme options if the scheme is at options appraisal stage.
 - ix. **Calculate post-development biodiversity units using the biodiversity metric.** This calculation accounts for all of the proposed habitats (including retained habitat and habitat lost or created as a result of the development) within the scheme boundary post-development. The calculation is informed by scheme design, landscape plans, and proposed ecological mitigation. The assessment is based upon the target state (type, size and condition) of habitats being created.
 - x. **Produce an ‘Initial Biodiversity Assessment’ report.** The report sets out the BNG process in the context of the scheme and includes the method and results of initial baseline and post-development biodiversity unit calculations.
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Step 3 – Detailed Scheme Assessment

- i. **Inform options appraisal.** If baseline BU have been calculated for a number of scheme options, results will be used to inform options appraisal.
- ii. **Inform the mitigation proposals.** Results of biodiversity unit calculations performed under Step 2 are used to inform the extent and habitat type of on-site ecological mitigation and compensation land required for the scheme to meet no net loss or net gain targets.
- iii. **Update biodiversity unit calculations.** Following finalisation of the scheme design and ecological mitigation proposals, the BU are updated to reflect any changes. Calculations may also be re-run if updated Phase 1 Habitat data becomes available.
- iv. **Estimate the biodiversity compensation required.** The difference between baseline and post-development BU indicates the number of units required for the scheme to deliver no net loss or net gain for biodiversity. This in turn can be used to identify the extent and habitat type of compensation required. A rough cost estimate for potential compensation can be provided at this stage.
- v. **Workshop 2 – compensation/offset workshop.** Work with stakeholders to gather suggestions to identify candidate compensation sites and providers. These sites could be offset sites, which are compensation sites that are situated outside the project boundary. This workshop also provides an opportunity to update stakeholders on BNG progress.

Step 4 – Assessment of Candidate Offset Sites

- i. **Initial assessment of feasibility.** Any candidate offset sites which are considered not feasible for any reason are scoped out at this stage.
 - ii. **Survey candidate offset sites** to identify existing habitat type, extent and condition.
 - iii. **Calculate potential biodiversity unit's deliverable** by each candidate offset. Using the same methods employed for calculating baseline and post-development BU for the scheme as a whole, calculate baseline and post-development BU for offset sites to determine potential BU deliverable.
 - iv. **Hold one-to-one meetings with potential offset providers to:**
 - a) Identify suitable locations for candidate offset sites and determine what habitats and species they could support.
 - b) Determine how offsets can contribute to local biodiversity objectives and fit within ecological networks.
-

- c) Set out the type of agreement that would be acceptable to offset providers (e.g. long term agreement for management of the land).
- d) Collate information to feed in to offset scoring templates and offset summary sheets.
- v. **Score candidate offsets** using the offset scoring template. This takes into account ecological factors, financial factors, and wider benefits and opportunities.
- vi. **Produce offset summary sheets** describing each offset site in its present state and the habitats and species the proposed offsets will support. Details of land ownership, access provisions and proposed management agreements are also included in summary sheets.
- vii. **Panel review of potential offset sites** to include relevant stakeholders. Decisions are made as to which candidate offset sites to take forward.

Step 5 – Completion of Biodiversity Assessment

- i. **Final update of biodiversity unit calculations.** If there have been changes to the scheme design (including environmental mitigation proposals) since calculations were last updated, BU are updated to reflect any changes.
- ii. **Workshop 3 – final workshop.** A third stakeholder engagement workshop is recommended to update all stakeholders on BNG progress since the last workshop and inform them of any decisions made.
- iii. **Produce a ‘Full Biodiversity Assessment’ report and associated GIS data.** This will detail the approach and outcomes of Steps 1 to 4, importantly, how the project has met the BNG good practice principles. It will set out candidate offset sites and enable the client to decide which offsets to support and whether to aim for no net loss or net gain.

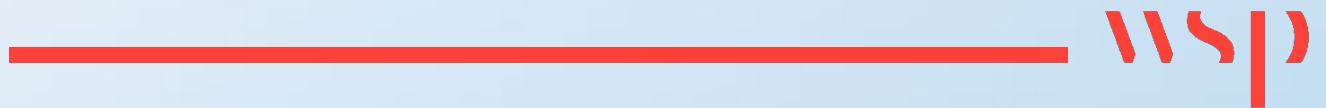
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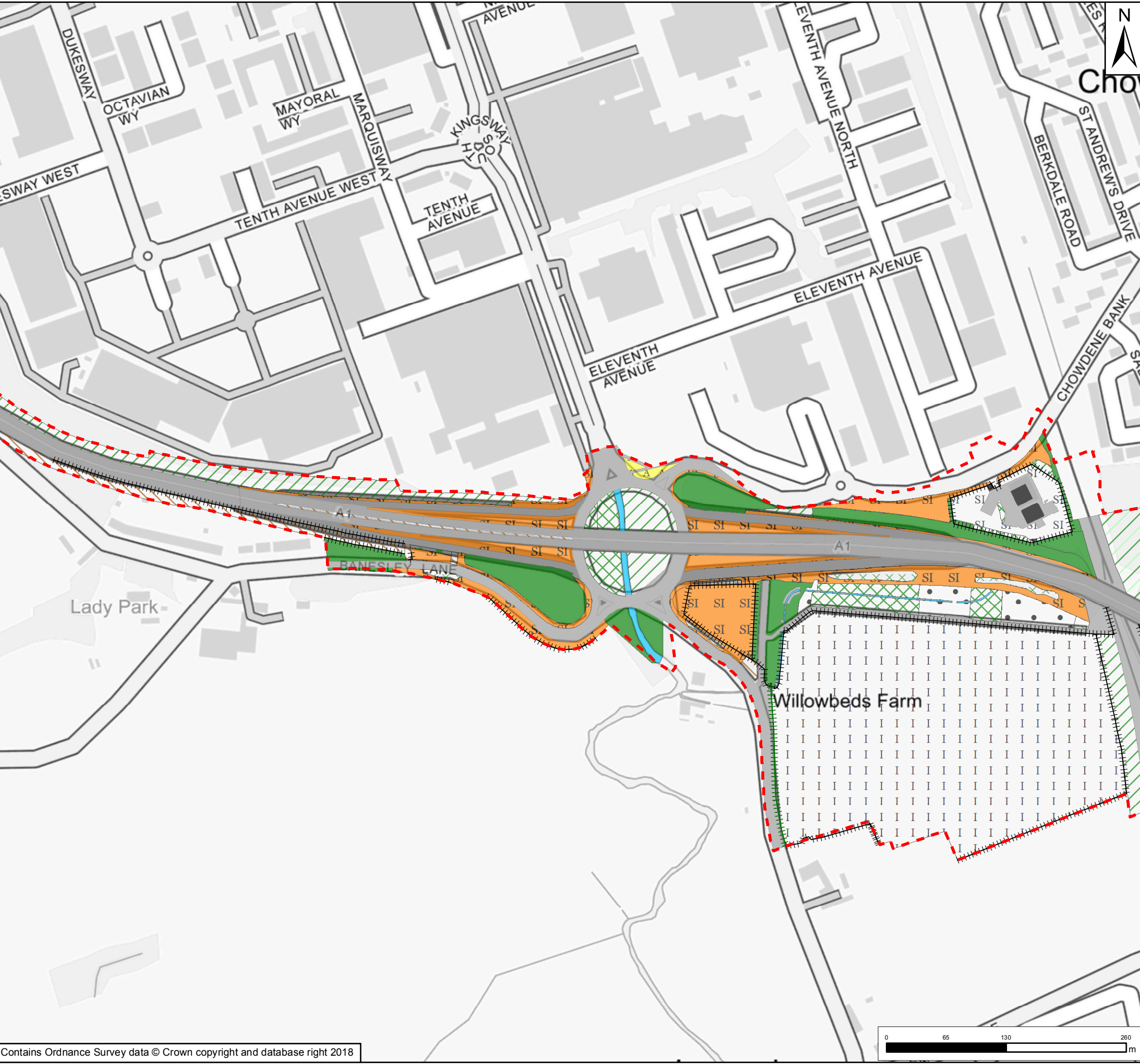
- i. **Implement BNG during the construction phase.** This will involve: updating the biodiversity baseline; including BNG within construction documents; training key staff; reducing the time-lag between losses and gains; acting on risks and opportunities; and collecting evidence and data.
 - ii. **Set up offsets.** Once offset sites to be delivered have been selected, and fine details of the scope of each offset agreed, legal agreements will be set up with offset providers to manage offsets over a set time frame (generally between 15 and 30 years). Further information on the agreement types can be provided on request.
-

- iii. **Monitor and report** to ensure the offsets are delivered to the standard required. Monitoring and reporting is undertaken at key points throughout the management agreement (e.g. once every two or three years).
-

Appendix C

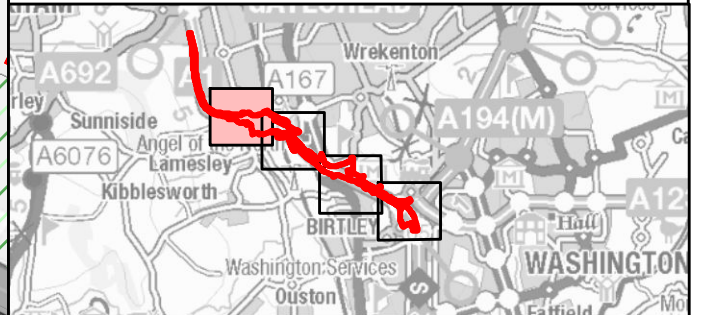
FIGURES





Key

- Site Boundary
- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Mixed woodland - plantation
- Scrub - dense/continuous
- Scrub - scattered
- Broadleaved Parkland/scattered trees
- Neutral grassland - semi-improved
- Improved grassland
- Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Running water
- Hard standing
- Cultivated/disturbed land - amenity grassland
- Buildings
- Bare ground
- Hedge with trees - species-poor
- Fence



Rev	Date	Description	By	Chk'd	App'd
P01	11/09/18	First Issue	GH	NA	KS



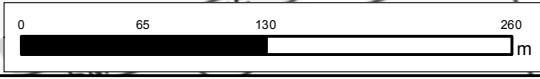
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Drawing Title: Figure 1 Phase 1 Habitat Map
Page 1 of 4

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Drawing Status: For Comment
Suitability: S1

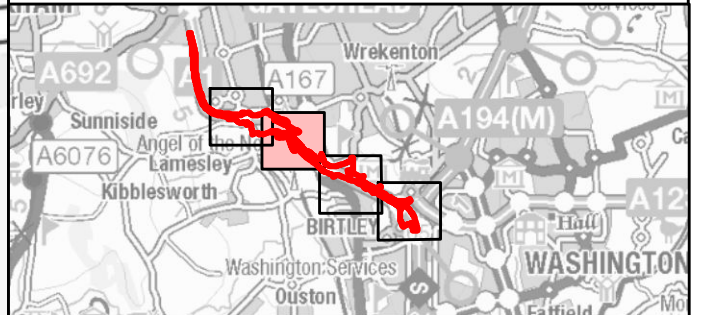
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Revision			P01
B2CH	Location	Type	Role
			Number





Key

- Site Boundary
- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Mixed woodland - plantation
- Scrub - dense/continuous
- Scrub - scattered
- Neutral grassland - semi-improved
- Improved grassland
- Poor semi-improved grassland
- Other tall herb and fern - ruderal
- Running water
- Hard standing
- Buildings
- Bare ground
- Running water
- Intact hedge - species-poor
- Fence



Rev	Date	Description	By	Chk'd	App'd
P01	11/09/18	First Issue	GH	NA	KS



Project Title: A1 Birtley to Coal House Improvement Scheme

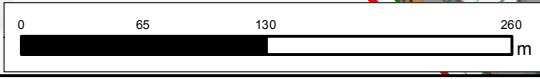
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Page 2 of 4

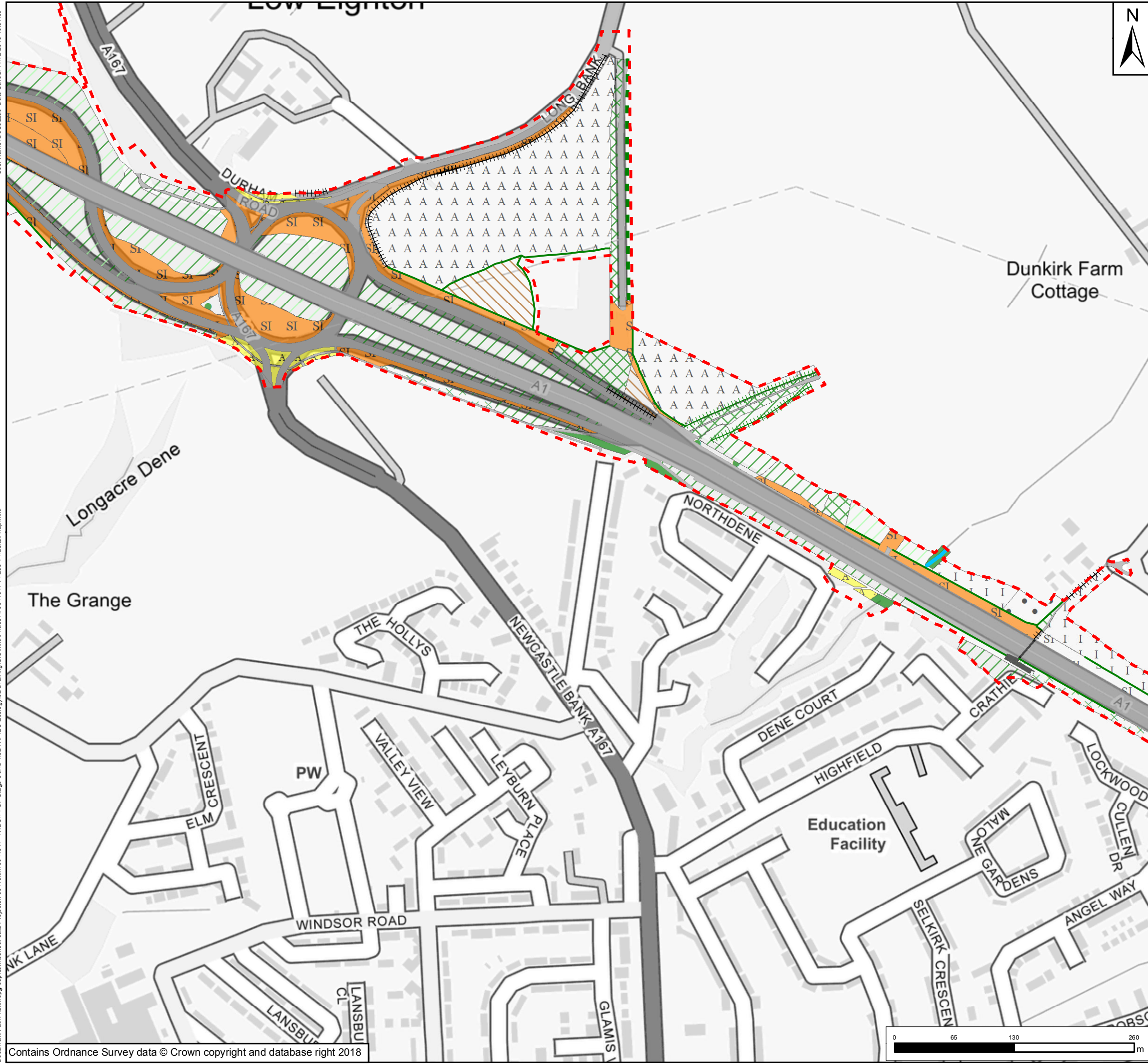
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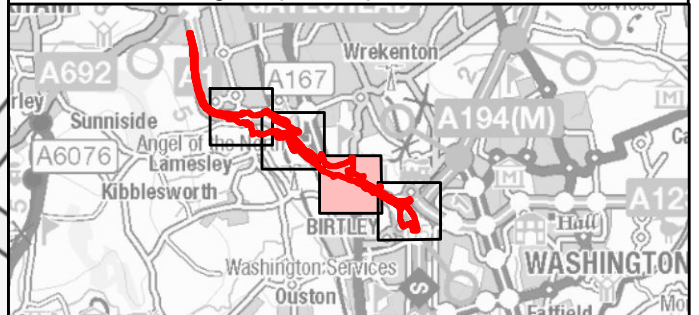
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TR010031		WSP		70041947

B2CH	Location	Type	Role	Number
				P01





- Key**
- Site Boundary
 - Broadleaved woodland - semi-natural
 - Broadleaved woodland - plantation
 - Coniferous woodland - plantation
 - Mixed woodland - plantation
 - Scrub - dense/continuous
 - Scrub - scattered
 - Broadleaved Parkland/scattered trees
 - Neutral grassland - semi-improved
 - Improved grassland
 - Poor semi-improved grassland
 - Other tall herb and fern - ruderal
 - Hard standing
 - Cultivated/disturbed land - arable
 - Cultivated/disturbed land - amenity grassland
 - Buildings
 - Bare ground
 - Running water
 - Intact hedge - species-poor



Rev	Date	Description	By	Chk'd	App'd
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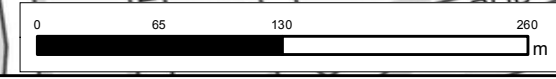


Project Title: A1 Birtley to Coal House Improvement Scheme

Drawing Title: Figure 1 Phase 1 Habitat Map
Page 3 of 4

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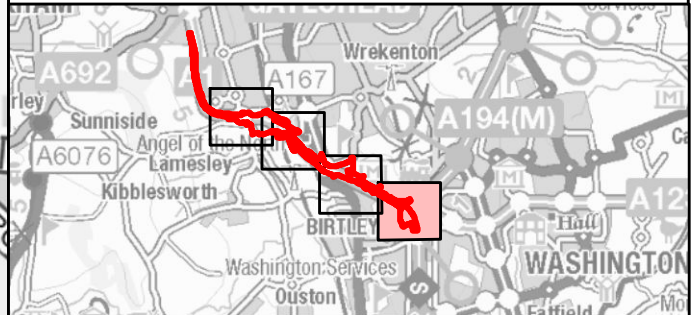


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Key

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- Other tall herb and fern - ruderal
- Hard standing
- Cultivated/disturbed land - amenity grassland
- Intact hedge - species-poor
- Fence
- Dry ditch



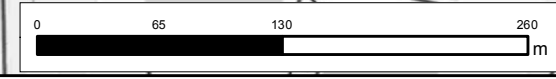
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Rev	Date	Description	By	Chk'd	App'd

Client

Project Title: A1 Birtley to Coal House Improvement Scheme

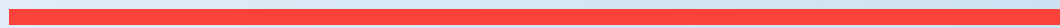
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Page 4 of 4

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Location						Revision				
						P01				



Appendix D

CHE MEMO



INTRODUCTION

In March 2018, Highways England (HE) published the Chief Highways Engineer Memorandum 422/18, Supporting Transparency around our Biodiversity Performance (CHE Memorandum 422/18) which supports the consistent reporting of biodiversity units, where project teams are gathering biodiversity data.

OVERVIEW OF METHODS

The CHE Memorandum 422/18 recommends that projects report on biodiversity units using the following method (page 3):

“1. *Report biodiversity units before works by:*

- *Recording the areas of habitat plots (in hectares) using standard habitat categories listed within Annex B; and*
- *Evaluating and reporting the condition of these habitat plots, using condition assessment stated within Annex B*

2. *Report biodiversity units after work by:*

- *Recording the areas of habitat plots (in hectares) using standard habitat categories listed within Annex B; however*
- *Habitat condition will be assigned by Highways England’s SES Environment Group centrally.”*

The CHE Memorandum 422/18 does not use the Farm Environment Plan (FEP) methodology for assessing condition and has developed criteria for each habitat type which are listed in full within Annex B of CHE Memorandum 422/18. Annex B stipulates that the calculation of biodiversity units before and after development follows this formula:

Distinctiveness score x Condition score x Area (hectares) = Baseline or Post-Development biodiversity units

The method for hedgerow linear units and lengths of watercourse is the same as the method detailed within Section 2 of the main report.

As the Biodiversity Net Gain (BNG) process on the A1 Birtley to Coal House was initiated after the Phase 1 habitat surveys took place, primary condition assessment data was unavailable. Therefore, this assessment uses a variety of assumptions to assign condition to habitats rather than the HE condition assessment within Annex B of CHE Memorandum 422/18.

The assumptions on condition and limitations of this assessment are within Section 3 of the main report. Please note that the post-development CHE memorandum assessment has only been completed for the Embankment option because of the similarities between the two scheme options.

RESULTS

BASELINE BIODIVERSITY UNITS

Tables 1, 2 and 3 show the number of baseline biodiversity units, hedgerow linear units and watercourse metres within the footprint of the Scheme.

Table 1 – Baseline biodiversity units (BU)

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (ha)	Baseline BU
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Good (3)	1.66	29.88
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Moderate (2)	2.67	32.04
A1.1.1 Broadleaved woodland - semi-natural	High (6)	Poor (1)	0.10	0.60
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Good (3)	9.02	108.24
A1.1.2 Broadleaved woodland - plantation	Medium (4)	Moderate (2)	1.98	15.84
A1.2.2 Coniferous woodland - plantation	Low (2)	Poor (1)	0.18	0.36
A1.3.2 Mixed woodland - plantation	Medium (4)	Good (3)	5.46	65.52
A1.3.2 Mixed woodland - plantation	Medium (4)	Moderate (2)	3.24	25.92
A2.1 Dense scrub	Medium (4)	Moderate (2)	0.96	7.68
A2.1 Dense scrub	Medium (4)	Poor (1)	0.78	3.12
A2.2 Scrub - scattered	Medium (4)	Good (3)	0.86	10.32
A2.2 Scrub - scattered	Medium (4)	Moderate (2)	0.36	2.88

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (ha)	Baseline BU
A2.2 Scrub - scattered	Medium (4)	Poor (1)	0.81	3.24
A3.1 Broadleaved parkland / scattered trees	Medium (4)	Moderate (2)	0.05	0.40
A3.1 Broadleaved parkland / scattered trees	Medium (4)	Poor (1)	0.03	0.12
B2.2 Neutral grassland - semi-improved	Medium (4)	Good (3)	0.24	2.88
B2.2 Neutral grassland - semi-improved	Medium (4)	Moderate (2)	3.1	24.8
B2.2 Neutral grassland - semi-improved	Medium (4)	Poor (1)	4.3	17.2
B4 Improved grassland	Low (2)	Moderate (2)	8.7	34.8
B4 Improved grassland	Low (2)	Poor (1)	0.67	1.34
B6 Poor semi-improved grassland	Low (2)	Good (3)	0.4	2.4
B6 Poor semi-improved grassland	Low (2)	Moderate (2)	0.17	0.68
B6 Poor semi-improved grassland	Low (2)	Poor (1)	0.23	0.46
C3.1 Other tall herb and fern - ruderal	Low (2)	Poor (1)	1.53	3.06
G2 Running water	N/A	N/A	0.17	N/A
J1.1 Cultivated/disturbed land - arable	Low (2)	Poor (1)	4.1	8.2
J1.2 Cultivated/disturbed land - amenity grassland	Low (2)	Poor (1)	0.63	1.26

JNCC Habitat Type	Distinctiveness Score	Condition Score	Area (ha)	Baseline BU
J3.6 Buildings	N/A	N/A	0.09	N/A
J4 Bare ground	Low (2)	Poor (1)	0.55	1.10
Hardstanding	N/A	N/A	25.6	N/A
Total			78.64	404.34

Table 2 – Baseline hedgerow linear units (LU)

JNCC Habitat Type	Condition Score	Length (m)	LU
J2.1.2 Hedges - intact - native species-poor	Good (3)	214	642
J2.1.2 Hedges - intact - native species-poor	Moderate (2)	1380	2760
J2.1.2 Hedges - intact - native species-poor	Poor (1)	385	385
J2.2.2 Hedges - defunct - native species-poor	Poor (1)	262	262
J2.3.2 Hedges - with trees - native species-poor	Good (3)	280	840
J2.3.2 Hedges - with trees - native species-poor	Moderate (2)	174	348
Total		2695	5237

Table 3 – Baseline length of watercourse

JNCC Habitat Type	Length (m)
G2 Running water	715
Total	715

POST-DEVELOPMENT BIODIVERSITY UNITS – EMBANKMENT

Tables 4, 5 and 6 show the number of post-development biodiversity units, hedgerow linear units and watercourse metres within the Scheme Footprint, under the Embankment variant.

Table 4 – Post-Development biodiversity units (BU)

JNCC Habitat Type	Retained/Created/Enhanced	Distinctiveness Score	Condition Score	Area (Hectares)	BU
A1.1.1 Broadleaved woodland - semi-natural	R	High (6)	Good (3)	0.92	16.56
A1.1.1 Broadleaved woodland - semi-natural	R	High (6)	Moderate (2)	0.63	7.56
A1.1.1 Broadleaved woodland - semi-natural	R	High (6)	Poor (1)	0	0*
A1.1.2 Broadleaved woodland - plantation	R	Medium (4)	Good (3)	4.15	49.8
A1.1.2 Broadleaved woodland - plantation	R	Medium (4)	Moderate (2)	0.16	1.28

JNCC Habitat Type	Retained/Created/Enhanced	Distinctiveness Score	Condition Score	Area (Hectares)	BU
A1.3.2 Mixed woodland - plantation	R	Medium (4)	Good (3)	4.38	52.56
A2.1 Dense scrub	R	Medium (4)	Moderate (2)	0.03	0.24
A2.1 Dense scrub	R	Medium (4)	Poor (1)	0.02	0.08
A2.2 Scrub - scattered	R	Medium (4)	Good (3)	0.05	0.6
A2.2 Scrub - scattered	R	Medium (4)	Moderate (2)	0.12	0.96
A2.2 Scrub - scattered	R	Medium (4)	Poor (1)	0.17	0.68
A3.1 Broadleaved parkland/ scattered trees	R	Medium (4)	Poor (1)	0.01	0.04
B2.2 Neutral grassland - semi-improved	R	Medium (4)	Good (3)	0.08	0.96
B2.2 Neutral grassland - semi-improved	R	Medium (4)	Moderate (2)	0.22	1.76
B2.2 Neutral grassland - semi-improved	R	Medium (4)	Poor (1)	0.55	2.2
B4 Improved grassland	R	Low (2)	Moderate (2)	0.1	0.4
B4 Improved grassland	R	Low (2)	Poor (1)	2.92	5.84

JNCC Habitat Type	Retained/Created/Enhanced	Distinctiveness Score	Condition Score	Area (Hectares)	BU
B6 Poor semi-improved grassland	R	Low (2)	Good (3)	0.01	0.06
B6 Poor semi-improved grassland	R	Low (2)	Moderate (2)	0.02	0.08
C3.1 Other tall herb and fern - ruderal	R	Low (2)	Poor (1)	0.19	0.38
J1.1 Cultivated/disturbed land - arable	R	Low (2)	Poor (1)	0.04	0.08
J1.2 Cultivated/disturbed land - amenity grassland	R	Low (2)	Poor (1)	0.09	0.18
J3.6 Buildings	R	N/A	N/A	0.09	N/A
J4 Bare ground	R	Low (2)	Poor (1)	0.18	0.36
Hardstanding	R	N/A	N/A	13.57	N/A
A1.1.1 Broadleaved woodland - semi-natural	C	High (6)	Good (3)	4.86	87.48
A1.1.1 Broadleaved woodland - semi-natural - linear belt	C	Medium (4)	Good (3)	0.75	9
A1.1.1 Broadleaved woodland - semi-natural - woodland edge	C	Medium (4)	Good (3)	2.45	29.4
A1.1.2 Broadleaved woodland - plantation	C	Medium (4)	Good (3)	3.97	47.64

JNCC Habitat Type	Retained/Created/Enhanced	Distinctiveness Score	Condition Score	Area (Hectares)	BU
A1.2.2 Coniferous woodland - plantation	C	Low (2)	Poor (1)	0.16	0.32
A1.3.2 Mixed woodland - plantation	C	Medium (4)	Good (3)	2.69	32.28
A2.1 Dense scrub	C	Medium (4)	Good (3)	1.09	13.08
A2.2 Scrub - scattered	C	Medium (4)	Good (3)	1.41	16.92
A3.1 Broadleaved parkland/ scattered trees	C	Medium (4)	Good (3)	0.02	0.24
B2.2 Neutral grassland - semi-improved	C	Medium (4)	Good (3)	6.41	76.92
B4 Improved grassland	C	Low (2)	Poor (1)	3.67	7.34
B6 Poor semi-improved grassland	C	Low (2)	Poor (1)	0.57	1.14
C3.1 Other tall herb and fern - ruderal	C	Low (2)	Poor (1)	0.89	1.78
J1.1 Cultivated/disturbed land - arable	C	Low (2)	Poor (1)	4.06	8.12
J1.2 Cultivated/disturbed land - amenity grassland	C	Low (2)	Poor (1)	0.53	1.06
A1.1.1 Broadleaved woodland - semi-natural	E	High (6)	Good (3)	0.14	2.52
A1.1.1 Broadleaved woodland - semi-natural - linear belt	E	Medium (4)	Good (3)	0.03	0.36

JNCC Habitat Type	Retained/Created/Enhanced	Distinctiveness Score	Condition Score	Area (Hectares)	BU
A1.1.1 Broadleaved woodland - semi-natural - woodland edge	E	Medium (4)	Good (3)	0.12	1.44
B2.2 Neutral grassland - semi-improved	E	Medium (4)	Good (3)	0.03	0.36

Table 5 – Post-development hedgerow linear units (LU)

JNCC Habitat Type	Retained/Created/Enhanced	Condition Score	Length (m)	LU
J2.1.2 Hedges - intact - native species-poor	R	Good (3)	85	255
J2.1.2 Hedges - intact - native species-poor	R	Moderate (2)	205	410
J2.1.2 Hedges - intact - native species-poor	R	Poor (1)	205	205
J2.3.2 Hedges - with trees - native species-	R	Good (3)	47	141
J2.3.1 Hedges - with trees - native species-rich	C	N/A	1565	1565
J2.1.1 Hedges - intact - native species-rich	C	N/A	2730	2730

JNCC Habitat Type	Retained/Created/ Enhanced	Condition Score	Length (m)	LU
J2.1.2 Hedges - intact - native species-poor	C	N/A	898	898
J2.2.2 Hedges - defunct - native species-poor	C	N/A	262	262
J2.3.1 Hedges - with trees - native species-rich	C	N/A	1255	1255
J2.3.2 Hedges - with trees - native species-	C	N/A	396	396

Table 6 – Post-development length of watercourse

JNCC Habitat Type	Length (m)
G2 Running water (retained)	162
G2 Running water (created / restored)	505

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