M5 Junction 10 Improvements Scheme

Environmental Management Plan

Annex B.5 Landscape and Ecological Management Plan

TR010063 – APP 9.5

Regulation 5 (2) (q)

Planning Act 2008

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M5 Junction 10 Improvements Scheme

Development Consent Order 202[x]

Environmental Management Plan

Annex B5 - Landscape and Ecology Management Plan

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B.5.1. Introduction

Purpose

B.5.1.1. This document forms Annex B.5 of the Environmental Management Plan (EMP) (Application document TR010063/APP/7.3). Annex B.5 is a Landscape and Ecology Management Plan (LEMP) (1st iteration) for the M5 Junction 10 Improvements Scheme (the Scheme). This LEMP (1st iteration) will be updated by the appointed Principal Contractor (PC) into a LEMP (2nd iteration), as required by Requirement 3 of the DCO, prior to commencement of works. The LEMP provides a framework for achieving the design objectives and mitigation and compensation measures outlined in the Environmental Statement (ES) (TR010063/APP/6.1-6.15) and shown on the Environmental Masterplan (Application document TR010063/APP/2.13). The LEMP identifies what the landscape and ecology mitigation and compensation measures are; how they will be implemented, managed, maintained and monitored; and who will be responsible for ensuring they achieve their stated functions.

B.5.1.2. This LEMP is based on the commitments set out in the Register of Environmental Actions and Commitments (REAC) (Application document TR010063/APP/7.4).

B.5.1.3. The Environment Act 2021 makes provision for biodiversity net gain (BNG). It requires developments to deliver a minimum of 10% BNG and requires that habitat is secured for at least 30 years via planning conditions or conservation covenants, and appropriate management and monitoring through the production of a Habitat Management and Monitoring Plan (HMMP). BNG is not yet mandatory for Nationally Significant Infrastructure Projects (NSIPs) (it is anticipated that it will become mandatory for such projects in November 2025), but the Scheme has an objective of establishing BNG. As BNG is not yet mandatory for NSIPs a specific HMMP is not required, but the 3rd iteration LEMP will broadly cover the requirements of the HMMP.

B.5.1.4. The Natural England Biodiversity Metric 3.0[1] (hereafter referred to as 'the metric') has been used to undertake the BNG assessment for the preliminary design of the Scheme. Biodiversity Metric 3.1 was published in April 2022, Biodiversity Metric 4.0 was published in March 2023 and the statutory biodiversity metric was published in February 2024. However, for this Scheme, given that metric 3.0 was used to undertake the initial BNG feasibility assessment at the start of 2022, version 3.0 has continued to be used. This is in line with advice from Natural England[2]. Again, as BNG is not mandatory for NSIPs, there is no requirement to use the statutory metric. The BNG assessment presented in Technical Appendix 7.18 – Biodiversity Net Gain (Application document TR010063/APP/6.15) concludes that the Scheme has the potential to achieve a net gain for terrestrial habitats, hedgerows, and watercourses within the Order limits, with the potential to achieve in excess of 10% for all elements.

B.5.1.5. The BNG assessment will be re-run as the Scheme progresses. It is anticipated that the BNG assessment will be re-run based on the final design for the 2nd iteration LEMP when the habitat areas/enhancements will be confirmed, and again at the end of construction for the 3rd iteration LEMP to ensure all design changes are incorporated.

[1] All parts of metric 3.0 have been archived and are available for download here: http://nepubprod.appspot.com/publication/5850908674228224 [accessed 18/10/22]
[2] Natural England Joint Publication JP039 (April 2022) Biodiversity Metric 3.1 Frequently Asked Questions accessed here: http://publications.naturalengland.org.uk/publication/6049804846366720 [Accessed February 2024].

B.5.2. Implementation of the LEMP

Project team roles and responsibilities

B.5.2.1. Roles and responsibilities are set out in Table 2-2 of the Environmental Management Plan 1st iteration. Roles and responsibilities of specialist landscape and biodiversity personnel will be detailed in the next iteration of the LEMP, but additional roles will include as a minimum an Ecological Clerk of Works (ECoW) and a Landscape Clerk of Works (LCoW).

Habitat management and monitoring duration

B.5.2.2. Establishment, maintenance and monitoring operations of all landscape and ecology works are to be carried out by the PC as part of their works up to the end of construction.

B.5.2.3. The PC's aftercare maintenance period starts immediately following planting. The PC shall carry out maintenance and monitoring of the landscape and ecological works for a period of five years.

B.5.2.4. After the five-year maintenance and monitoring period by the PC, Gloucestershire County Council (GCC) and National Highways will have the responsibility for the continued management and monitoring of the landscape and ecological measures that fall within their respective land ownership.

B.5.2.5. Statutory BNG requires that habitats are managed and maintained for at least a 30 year period to ensure the appropriate habitat type and condition is achieved. For the Scheme, the habitat type that will take the longest to reach its target condition is woodland, and this is a period of 30 years. Therefore, although BNG is not yet mandatory for this Scheme, a standard management period of 30 years has been set out. For simpler habitats, the period over which specified management measures are replaced by incorporation into standard maintenance regimes is likely to be shorter than this, and these details will be set out in the 3rd iteration LEMP.

B.5.2.6. All landscape and ecological works shall be carried out by suitably qualified and experienced professionals in landscape and ecological construction activities. Experts will be appointed for specialist activities in horticulture, arboriculture and/or ecology during construction and for maintenance and management activities.

B.5.3. Landscape and ecology context

Landscape context

B.5.3.1. The Scheme is set within a gently undulating vale landscape of agricultural fields and scattered clusters of settlements with the M5, A4019 and electricity pylons being the main 'detractors' in the landscape. The verge hedgerows, arable grasslands, field trees and small blocks of woodland are the major habitats of the area.

B.5.3.2. Key visual receptors are residential properties and Public Rights of Way criss-crossing the area, as well as users of the road network.

B.5.3.3. The Scheme sits within Greenbelt but does not sit within or immediately adjacent to any landscape-specific designation. The Cotswolds National Landscape (previously known as Cotswolds Area of Outstanding Natural Beauty (AONB)) is over 6 km from Junction 10, and as agreed with the Cotswolds Conservation Board, the effect on this area and views from within it are unlikely to be significant.

B.5.3.4. The Scheme is largely within the SV6B Landscape Character Area 'Vale of Gloucester' (a generally rural edge landscape of undulating agricultural landform); with the very eastern end of the Scheme merging into the 'Urban' character of the edge of Cheltenham.

B.5.3.5. The ES concluded that, in terms of landscape, although there would be an increased presence of roads and associated infrastructure, these would essentially be in keeping

with the existing landscape character and context of views within the area. Replanting to roadsides and other embedded and essential mitigation measures would ensure that, in the long term, the Scheme would sit comfortably in the landscape and views, potentially providing an enhancement of the environment to improve the experience for residents, pedestrians, cyclists and vehicles users.

Ecology context

B.5.3.6. There are no sites designated for nature conservation at a national or international level that are adjacent to or overlapped by the Scheme. There are a number of designated sites approximately 2 km or further away from the Scheme that have been considered:

- Severn Estuary Special Protection Area (SPA), Special Area of Conservation (SAC) and Ramsar site (21 km south west of the Scheme, or over 40 km downstream via the shortest hydrological connection) is designated for its internationally important populations of wintering wildfowl, estuarine habitats and fish.
- Walmore Common SPA (17.5 km south-west of the Scheme), designated for its internationally important population of wintering Bewick's swan.
- Wye Valley and Forest of Dean SAC (21 km south-west of the Scheme) is designated for bats.
- The Cotswold Beechwoods SAC (7.4 km south of the Scheme) is designated for its ancient beech woodland and unimproved grassland.
- Coombe Hill Canal Site of Special Scientific Interest (SSSI) (located 1.9 km west of the Scheme) is a disused canal designated for its groups of nationally rare and scarce invertebrates and nationally scarce plants.

B.5.3.7. No non-statutory designated sites for nature conservation have been identified within the Scheme area. Seven non-statutory designated sites are within 200 m of the affected road network.

B.5.3.8. Habitats within and surrounding the Scheme include predominantly arable fields and poor-quality grassland with pockets of broadleaved and mixed plantation woodland, broadleaved semi-natural woodland, scrub, traditional orchard, semi-improved neutral grassland, unimproved neutral grassland and hedgerows. Aquatic habitats are also present, including the River Chelt, the Leigh Brook, a number of ditches and ponds.

B.5.3.9. The presence of protected/priority species within and surrounding the Scheme has been confirmed, including:

- Numerous bat roosts within and surrounding the Scheme, as well as a number of areas of importance for foraging and commuting bats.
- The presence of dormice to the north of the A4019 and east of the M5.
- A number of badger setts.
- The presence of otters on the River Chelt and another unnamed watercourse.
- The presence of priority mammal species including hedgehog, brown hare, polecat and harvest mouse.
- The presence of barn owl close to the Scheme.
- Small numbers of reptile in suitable habitat.
- Great crested newts within ponds to the south of the A4019 and north of the Scheme.
- Notable fish species within the River Chelt.

B.5.3.10. Potential impacts on biodiversity resources include habitat loss, degradation, severance and fragmentation; injury or mortality of protected and priority species; disturbance; and changes to hydrological conditions.

B.5.3.11. Taking into account the mitigation and compensation measures, significant adverse effects in relation to biodiversity resources are not anticipated as a result of the Scheme.

B.5.4. Design principles

During the preliminary design of the Scheme the principles of the mitigation hierarchy, preferentially to avoid, mitigate, and finally compensate, and also to enhance[3] (see Table B 5-1 below), were followed and influenced the Scheme's approach to the engineering and environmental design. Wherever possible measures were taken to avoid impacts on landscape and biodiversity receptors. Only then were mitigation or compensation measures proposed. Finally, the Scheme seeks to provide overall benefits for biodiversity.

Table B 5-1 Mitigation Hierarchy

Action	Description
Avoidance	Seek options that avoid harm to ecological features (for example, by locating on an alternative site)
Mitigation	Negative effects should be avoided or minimised through mitigation measures, either through the design of the project or subsequent measures that can be guaranteed – for example, through a condition or planning obligation.
Compensation	Where there are significant residual negative ecological effects despite the mitigation proposed, these should be offset by appropriate compensatory measures.
Enhancement	Seek to provide net benefits for biodiversity over and above requirements for avoidance, mitigation or compensation.

Table source: CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester. Version 1.2 – updated April 2022.

B.5.4.1. The Scheme design has minimised potential effects by reducing land take and minimising losses of key features, such as high category individual trees, hedgerows, woodland and more valuable grassland; replacing any habitat losses; and creating additional valuable habitat that links with the wider area to create a robust habitat network. The habitat creation will ensure that the Scheme provides more good quality habitat in the long term than is currently available.

B.5.4.2. The landscape design for the Scheme has been developed with the following principles:

- Existing vegetation is to be retained as far as possible. In particular, within areas of land temporarily required for topsoil storage or compounds, boundary features such as hedgerows, and individual trees will be retained.
- Replacement of woodland and scrub along the M5 and around the new junction to reinstate screening effect and integrate back into the landscape.
- Replacement planting along the realigned sections of the A4019 to help embed this route back into the landscape and provide some buffer to the proposed site allocations north of the A4019, as well as ensuring visual amenity for existing visual receptors; typically, this includes roadside hedgerows with trees.

[3] CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester. Version 1.2 – updated April 2022.

- Individual trees to central reserves and verges (where feasible) to integrate the realigned A4019 route and provide connectivity across the road for wildlife.
- Hedgerow along the Link Road with supplementary blocks of wood and individual trees particularly around the bridge to reflect local character of road infrastructure and provide some screening for visual receptors, whilst creating an attractive route for all users.
- Species-rich grass on low nutrient soil to all embankments and verges as far as possible; supplemented with bulb planting in some areas.
- A key area of habitat creation is an area of farmland to the southeast of the motorway junction (referred to as the flood storage area) which will be transformed into an area supporting wetland habitats surrounded by woodland, scrub and species-rich grassland, whilst also fulfilling its role as a flood storage area. The area will incorporate a permanently wet area, plus ephemeral wet grassland pools. A channel will link the outfall of the attenuation basin to the Piffs Elm culvert which will regularly refresh the permanent waterbody to avoid stagnation. Depressions have been designed to include variations in bed topography, with shallow bank slopes to create drawdown zones and marginal shelves. This area will create a habitat mosaic suitable for a range of species.
- Replacement of any habitat losses as a minimum to ensure no net loss of biodiversity, and creation of additional habitat to ensure a net gain in biodiversity.
- Retention of the natural character of the area through planting locally native species, with evergreen where screening is a key function.

B.5.4.3. During the preliminary design, consideration has been given to a number of local policies and guidance. The creation of woodland, hedgerows, planting of individual trees and wetland habitat creation aligns with these policies and guidance as follows:

- Woodland, hedgerows and field boundaries are listed as in need of safeguarding within the relevant National Character Area Profile, and flood plain grassland is noted as a key part of the relevant National Character Area Profile (106 (Severn and Avon Vales))[4].
- A number of blocks of woodland are identified as core woodland habitat in the nature recovery network on Gloucestershire's Natural Capital mapping; much of the Scheme is identified as a tree opportunities area and a wetland opportunity area on this mapping[5].
- Habitat action plans for woodland, species-rich and/or ancient hedgerows and lowland wet grassland are included in the Gloucestershire Biodiversity Action Plan (BAP), and woodland and hedgerows are identified as a key habitat for a number of species with species action plans[6].
- Woodland and hedgerows are identified as a priority/important habitat within the Gloucestershire Highways and Biodiversity Guidance[7].
- Urban trees are key to achieving green infrastructure aims in the Gloucestershire Highways and Biodiversity Guidance[7] and the Gloucestershire Local Transport Plan (LTP) 2020 – 2041[8].

[4] NCA Profile:106 Severn and Avon Vales - NE336. Available from: https://www.gov.uk/government/publications/countryside-stewardship-statement-of-priorities-severn-and-avon-vales-nca106 [Accessed February 2024].
[5] Gloucestershire's Natural Capital mapping, available from: https://naturalcapital.gcerdata.com/ [Accessed February 2024].
[6] Gloucestershire Local Nature Partnership's Biodiversity Action Plan (BAP). Available from: https://www.gloucestershirenature.org.uk/ [Accessed February 2024].
[7] Gloucestershire County Council (May 2022) Gloucestershire Highways Biodiversity Guidance. Available from: ghbg-v32-may2022.pdf (gloucestershire.gov.uk) [Accessed March 2024].
[8] Gloucestershire County Council (2020) Gloucestershire's Local Transport Plan 2020 – 2041 Available from: https://www.gloucestershire.gov.uk/media/p5melmok/ltp-policy-document-final-v132-2.pdf [Accessed March 2024].

- Tree planting aligns with Gloucestershire's tree planting strategy[9].
- Waterbodies are key elements of the green infrastructure aims within the Gloucestershire local Transport Plan 2020 – 2041[8].

B.5.4.4. Road verge planting will follow National Highways Low Nutrient Grasslands policy[10], by removing nutrient-rich topsoil and adding subsoil or bare substrate to promote wildflower growth. The landscape planting will also comply with the Gloucestershire Highways and Biodiversity Guidance[11]. The planting will also be designed and executed in accordance with National Highways Design Manual for Roads and Bridges (DMRB) LD117[12] and Manual of Contract Documents for Highway Works (MCHW)[13].

B.5.4.5. Planting is also to be in accordance with specific guidance from National Highways for major projects within their South West Region[14].

B.5.4.6. The Order limits extend 100 m upstream of the River Chelt culvert, approximately 150 m upstream and 100 m downstream of the Link Road Bridge crossings and approximately 200 m downstream of the Leigh Brook culvert. In these sections, measures will be implemented to improve hydromorphological and ecological diversity.

B.5.4.7. In addition to the landscape design, a number of structures and crossing features have been included in the design. This includes the River Chelt Link Road bridge which will be a clear span structure with set-back abutments, thereby avoiding direct impacts to the in-channel and bank top habitats, ensuring fauna can continue to move along the watercourse unimpeded. The design includes purpose-built structures to compensate for the loss of bat roosts and artificial badger setts to compensate for loss of main badger setts. Underpasses will be constructed under the Link Road and the A4019 to facilitate movement of species, with fencing and/or planting to guide species to these features. An otter ledge will be retrofitted within the existing River Chelt culvert beneath the M5, on the opposite side of the footbridge. Bat 'hop-overs' comprising tall planting (6 m high) will be included at 11 strategic locations across the Scheme to encourage bats to cross the road at height (note that temporary structures may be required to aid this whilst planting matures to correct height). Where lighting is required, the design minimises light spill beyond the road and incorporates dark corridors at key locations.

[9] Gloucestershire Local Nature Partnership (September 2020) Gloucestershire Tree Strategy
[10] Major Projects Delivery Services (October 2020), Low Nutrient Grasslands (version number MPI-85-102020)
[11] Gloucestershire County Council (May 2022, version 3.2) Gloucestershire Highways and Biodiversity Guidance.
[12] Highways England (2020). Design Manual for Roads and Bridges LA 117 Landscape Design (formerly LA 117 revision 1). (March 2020, version 0). Online: https://www.standardsforhighways.co.uk/tses/attachments/82073bde-ec0c-4d4f-8eeb-afe0ace3c639?inline=true [Accessed February 2024].
[13] Online: https://standardsforhighways.co.uk/mchw [Accessed February 2024].
[14] Guidance provided by NH (23/3/22) on planting requirements within or near National Highways estate.
The following species must not be planted on or within 10m of our estate:
1. Blackthorn (*Prunus spinosa*)
2. Goat willow (*Salix caprea*)
3. Crack willow (*Salix fragilis*)
4. Dogwood (*Cornus sanguinea*)
5. Italian alder (*Alnus cordata*)
6. Bird cherry (*Prunus avium*)
7. Quaking Aspen (*Poplus tremulans*)
8. Wild Privet (*Ligustrum vulgare*)

In addition, the following trees must not be planted in a position where at maturity they would be within falling distance of the carriageway or any significant National Highways asset:
9. Silver Birch (*Betula pendula*)
10. Austrian Pine (*Pinus nigra*)
11. Poplar (*Poplus alba, Poplus* hybrid, *Poplus lombardii*)
12. English Oak (*Quercus robur*)

Furthermore, the planting of ash (*Fraxinus excelsior*) and larch (*Larix sp*) is ill advised due to the current diseases they spread and succumb to.

B.5.5. Key Elements of the Register of Environmental Actions and Commitments

B.5.5.1. The following are the commitments included in the REAC (Application document TR010063/APP/7.4) for landscape and biodiversity. Those items that are not covered in this LEMP are shaded grey in the table below, but all are scheme requirements.

Table B 5-2 Landscape and Ecology Management Plan REAC

REAC Ref.	Objective of the commitment	Implementation mechanism
Landscape		
LV1	Avoid damage to existing vegetation	EMP 1st iteration (Application document TR010063/APP/7.3). Landscape and ecology management plan (LEMP) (Application document TR010063/APP/9.5). Environmental Masterplans (Application document TR010063/APP/2.13). Arboricultural Impact Assessment (AIA) (Appendix 9.4, Application document (TR010063/APP/6.15). Tree Protection Plans (TPP) (Appendix C of Appendix 9.4 (Application document (TR010063/APP/6.15).
LV2	Minimise loss of vegetation	EMP 1st iteration Landscape and ecology management plan (LEMP). Environmental Masterplans. Arboricultural Impact Assessment (AIA) (Appendix 9.4). Tree Protection Plans (TPP) (Appendix C of Appendix 9.4).
LV3	Reinstatement of lost vegetation providing a specific screening or amenity function	Environmental Masterplans. EMP 2nd iteration. Landscape and ecology management plan (LEMP).
LV4	Correct maintenance of new vegetation	EMP 1st and 2nd iterations Landscape and ecology management plan (LEMP).
LV5	Minimise lighting impacts	DCO Schedule 2 Requirement 11(1) and Requirement 15.
LV6	Design of noise barriers	EMP 1st iteration. Noise and vibration management plan (Application document TR010063/APP/9.3).
LV7	Use of locally sourced soils to provide appropriate seedbank materials	EMP 1st iteration.

REAC Ref.	Objective of the commitment	Implementation mechanism
		Landscape and ecology management plan (LEMP).
LV8	Consideration of early planting of new vegetation	EMP 1st iteration. Landscape and ecology management plan (LEMP).
Biodiversity		
B1, B2, B3, B4	To ensure legal compliance in relation to bats, dormice, badgers and great crested newts	EMP 2nd iteration. Annex C – precautionary method statements for dormice, bats, badgers and great crested newts. Protected species licences for the respective species.
B5	Minimise adverse ecological impacts and ensure compliance with legislation	EMP 1st 2nd and 3rd iterations. Landscape and ecology management plan (LEMP).
B6	Minimise loss of vegetation and avoid damage to existing vegetation to retain existing biodiversity resource as far as possible (see also LV1 and LV2)	EMP 2nd iteration. Annex C – precautionary method statements for dormice, bats, badgers and great crested newts. Arboricultural Impact Assessment (AIA) (Appendix 9.4). Opportunities to reduce habitat loss reviewed as part of design development, and secured by DCO Schedule 2 Requirement 11(1).
B7, B8	Habitat creation and management (terrestrial and aquatic) to compensate for unavoidable habitat loss and provide enhancements	EMP 1st and 2nd iterations. Landscape and ecology management plan (LEMP). Environmental masterplans. Opportunities for further habitat creation reviewed as part of design development, and secured by DCO Schedule 2 Requirement 11(1).
B9	To achieve Biodiversity Net Gain	EMP 2nd iteration Environmental masterplans
B10	Habitat creation and management to compensate for unavoidable loss of lowland meadow priority habitat	EMP 1st iteration. Landscape and ecology management plan (LEMP). Environmental masterplans.
B11	Habitat creation to compensate for loss of dormouse habitat	EMP 1st iteration.

REAC Ref.	Objective of the commitment	Implementation mechanism
		Landscape and ecology management plan (LEMP). Annex C – precautionary method statements for dormice. European Protected Species (EPS) mitigation licence for dormice. Environmental masterplans.
B12	Habitat enhancement to compensate for loss of dormouse habitat	EMP 1st iteration. Landscape and ecology management plan (LEMP). Annex C – precautionary method statements for dormice. EPS mitigation licence for dormice. Environmental masterplans.
B13	Habitat management to ensure success of newly created habitats for dormouse	EMP 1st iteration. Landscape and ecology management plan (LEMP). Annex C – precautionary method statements for dormice. EPS mitigation licence for dormice. Environmental masterplans.
B14	Structures, boxes and features to compensate for loss of bat roosts	EMP 1st, 2nd and 3rd iterations. Landscape and ecology management plan (LEMP). Annex C – precautionary method statements for bats. EPS mitigation licence for bats.
B15	Additional mitigation measures specifically for bats	EMP 1st iteration. Landscape and ecology management plan (LEMP) 1st iteration. Annex C – precautionary method statements for bats. EPS mitigation licence for bats.
B16	Construction of artificial badger setts to compensate for the loss of two main badger setts and ensure legal compliance	EMP 1st iteration. Landscape and ecology management plan (LEMP). Annex C – precautionary method statements for badgers. Natural England licence for badgers.
B17	Badger sett exclusion and closure to ensure legal compliance	EMP 1st iteration. Landscape and ecology management plan (LEMP). Annex C – precautionary method statements for badgers. Natural England licence for badgers.

REAC Ref.	Objective of the commitment	Implementation mechanism
B18	Construction of the Withybridge (A4019) underpass to provide a safe route for bats and other species	EMP 1st iteration. Landscape and ecology management plan (LEMP). General arrangement plans (Application document TR010063/APP/2.9).
B19	Additional underpasses to allow safe movement of mammals and other species across the Scheme	EMP 2nd iteration. Landscape and ecology management plan (LEMP).
B20	Mammal proof fencing to prevent mammals gaining access to the carriageway, and to direct them to safe crossing locations	EMP 2nd iteration. Landscape and ecology management plan (LEMP). General arrangement plans.
B21	Fitting of an otter ledge within the existing River Chelt culvert beneath the M5 to provide safe passage to otters at times of flood.	EMP 2nd iteration. Landscape and ecology management plan (LEMP).
B22	To minimise adverse impacts from lighting on biodiversity	EMP 3rd iteration. Landscape and ecology management plan (LEMP). General arrangement plans. Lighting design described in Chapter 7 Biodiversity (Application document TR010063/APP/6.5).
B23	To minimise disturbance to migratory fish within the River Chelt	EMP 1st and 2nd iteration. Landscape and ecology management plan (LEMP).
B24	Pre-commencement surveys to update ecological constraints	EMP 1st and 2nd iteration. Landscape and ecology management plan (LEMP) 1st iteration.
B25	Sensitive clearance of structures/vegetation to minimise impacts to protected species	EMP 1st and 2nd iteration. Landscape and ecology management plan (LEMP). Annex C – method statement for site clearance. EPS mitigation licence for the respective protected species.
B26	Installation of bird boxes	EMP 2nd iteration. Landscape and ecology management plan (LEMP).
B27	Ecology surveys of signage locations on the M5 north and south of Junction 10	To be addressed during detailed design.

B.5.6. Landscape and ecology features – broad principles

B.5.6.1. The landscape and ecology features of the Scheme are described below. For each landscape and ecology feature, the corresponding REAC reference is provided, which can be cross referenced with Table B 5-2 above. Broad principles are set out below, followed by individual sections with more details on groups of features.

Habitat retention

Relevant REAC ref: LV1, LV2, B6.

B.5.6.2. Vegetation removal will be kept to the minimum necessary for the works. Opportunities for further reducing habitat loss will be reviewed by the PC during detailed design. and the PC will also consider alternative working methods to further limit loss of vegetation, wherever possible.

B.5.6.3. Habitat retention is fundamental to achieving BNG, and those areas to be retained are shown on the figures that accompany the BNG report (Technical Appendix 7.18 – Biodiversity Net Gain (Application document TR010063/APP/6.15)).

B.5.6.4. Key areas of vegetation to be retained are as follows:

- Within areas of land temporarily required for topsoil storage or compounds, boundary features such as hedgerows will be retained. Individual trees within compound areas should also be retained.
- The Order limits include a number of 'right to flood' areas where no habitat removal including stripping of soil, no storage of materials, no haul roads and no storage of materials will be undertaken.

B.5.6.5. An area of lowland meadow[15] [16] [17] located immediately north of Stanboro Lane will be retained, as well as adjacent hedgerow and strips of woodland in this area. Lowland meadow is listed as a Priority Habitat[18] as it is 'highly threatened, internationally scarce and requires conservation action'.

- Areas of woodland and scrub to the south east and the south west of the junction will be retained.
- All vegetation to boundary and garden of Sheldon Cottages will be retained.
- Majority of vegetation opposite properties at Stanboro will be retained.
- Line of Tree Protection Order (TPO) trees will be retained and protected as far as possible – minor loss is anticipated.

B.5.6.6. Any retained habitat will be clearly demarcated with no allowance of vehicles or storage of materials within these areas. The root zones and canopies of trees and areas of woodland to be retained will be protected during construction. In accordance with the Scheme AIA and TPP, and BS5837[19].

[15] Jefferson, R.G., Smith, S.L.N. & MacKintosh, E.J. (2019). Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 3 Lowland Grasslands. Joint Nature Conservation Committee (JNCC), Peterborough. Online: https://data.jncc.gov.uk/data/cf50f420-1b38-4253-89f8-1cb7ba010f27/SSSI-Guidelines-3-LowlandGrasslands-2019.pdf [Accessed February 2024].
[16] Maddock, A. (ed) (2008) UK BAP Priority Habitat Descriptions - Lowland Meadows. Online: https://data.jncc.gov.uk/data/f0553254-1d47-474a-98e5-37fa163a28b5/UKBAP-BAPHabitats-29-Lowland-Meadows.pdf [Accessed February 2024].
[17] No author information (JNCC). Online: https://data.jncc.gov.uk/data/b0b5e833-7300-4234-8ae5-bdbf326e854c/habitat-types-lowland-grassland.pdf#:~:text=Lowland%20semi-[Accessed February 2024].
[18] Priority habitats are those habitats listed in accordance with Section 41 of the Natural Environment and Rural Communities Act 2006 (as amended) (the NERC Act) as being of principal importance for the conservation of biodiversity in England.
[19] The British Standards Institution (2012) BS 5837: 2012 Trees in relation to design, demolition and construction – recommendations.

Habitat creation and enhancement

B.5.6.7. Table B 5-3 below lists the habitats to be created and enhanced. In the following sections of the LEMP, each habitat type is described with their targets and associated management and monitoring requirements.

B.5.6.8. For each habitat type, the Landscape Element (LE) code in Table 4.2b of (DMRB) LD11712 is provided, along with the UKHab Classification system/metric[20] habitat type. Where there is a commitment to create a specific habitat type to achieve BNG, habitat condition targets are set out. Habitat condition is based on habitats meeting a series of criteria specific to the type of habitat, with habitats passing most or all criteria rating as good condition, those passing few or none rating as poor condition, and those passing some rating as moderate condition. The habitat condition target and criteria required to meet the condition target referred to in this report are based on definitions in the Biodiversity Metric 3.0 Technical Supplement[21]. Should it be decided during detailed design to update the BNG assessment using the statutory metric, it will be necessary to update the condition criteria.

B.5.6.9. Areas of each habitat type to be created and the target condition are shown in Table B 5-3. There will also be enhancement of some existing hedgerows, as well as enhancements to the River Chelt and Leigh Brook, which are described in the relevant sections below.

Table B 5-3 Habitat Creation Areas

Landscape design code/type	UKHab/metric habitat type	Area (ha)/length (km)	Target condition
LE 1.2: Grassland with bulbs	Modified grassland	3.56	Moderate
LE 6.2: Banks and ditches – wet grassland	Modified grassland	5.16	Moderate
LE 6.4: Wet grassland with marginal planting	Other neutral grassland	5.34	Moderate
LE 1.3: Species-Rich Grassland	Other neutral grassland	22.46	Good
LE 2.1: Woodland	Woodland and forest – other woodland; broadleaved	15.98	Moderate
LE 2.2: Woodland edge			
LE 2.4: Linear belts of Shrubs and Trees	Mixed scrub	6.39	Moderate
LE 2.5: Shrubs with intermittent trees			
LE 2.6: Shrub			
LE 2.8: Scrub			
LE 3.1: Amenity tree and shrub planting	Introduced shrub	0.32	Poor

[20] Butcher, B., Carey, P., Edmonds, R., Norton, L. and Treweek, J. (2020) The UK Habitat Classification User Manual Version 1.1 at https://ukhab.org. UKHab is the classification system that Biodiversity Metric 3.0 uses for area-based habitats, with the exception of a small number of UKHab categories that are not directly transferred into the metric.
[21] S, Panks A, N, White., A Newsome., J, Potter., M, Heydon., E, Mayhew., M, Alvarez., T, Russell., SJ, Scott., M, Heaver., SH, Scott., J, Treweek., B, Butcher & D, Stone. 2020. Biodiversity metric 3.0: Auditing and accounting for biodiversity – Technical Supplement. Natural England.

Landscape design code/type	UKHab/metric habitat type	Area (ha)/length (km)	Target condition
LE 5.1: Individual tree	Urban tree	1.04	Moderate
LE 6.1: Waterbodies and associated plants	Non-priority ponds	1.01	Moderate
LE 4.2 Native species hedges (trimmed)	Native Species-Rich Hedgerow	2.52	Moderate
LE 4.3 Native species hedgerows (untrimmed)			
LE 4.4 Native hedgerows with trees	Native Species-Rich Hedgerow with trees	8.77	Moderate
LE 4.4 Native hedgerows with trees	Native Species-Rich Hedgerow with trees, associated with a bank or ditch	0.06	Moderate

B.5.6.10. Habitat creation will occur in suitable planting seasons as early as possible throughout the construction programme to reduce the time lag between habitat loss and habitat planting and establishment, minimising biodiversity and visual impacts and allowing the Scheme to integrate into the landscape sooner. (REAC Ref LV8 (Application document TR010063/APP/7.4)). Areas where early planting is required specifically for protected species is outlined in the relevant sections below.

B.5.6.11. Soil will be tested to ensure that it is of sufficient horticultural quality and properties to support landscaping designs and where possible will be reused on site for woodland/hedge planting areas. All seed and plant material will be of local provenance. (REAC Ref LV7) (Application document TR010063/APP/7.4)) (Soil handling management plan (Application document TR010063/APP/9.2)).

B.5.6.12. In the interests of best practice for biodiversity and the environment, the use of pesticides and herbicides should be minimised where possible. Where appropriate and possible weeds will be removed by hand and pests should only be treated when they are affecting the continued health and thriving of plants.

B.5.6.13. Should an invasive plant species be discovered on site and require management, an Invasive Non-Native Species (INNS) management plan will be produced by a specialist contractor to ensure that the plant is eradicated by the most efficient means possible, by removal, or suitable approved chemical treatment.

B.5.7. Flood storage area

Relevant REAC ref: B7, B9

Context and location

B.5.7.1. An area of farmland to the south east of the motorway junction (referred to as the flood storage area) will be transformed into an area supporting wetland habitats surrounded by woodland, scrub and species-rich grassland, whilst also fulfilling its role as a flood storage area. The area will incorporate a permanently wet area, plus ephemeral wet grassland pools. A channel will link the outfall of the attenuation basin to the Piffs Elm culvert which will regularly refresh the permanent waterbody to avoid stagnation. Depressions have

been designed to include variations in bed topography, with shallow bank slopes to create drawdown zones and marginal shelves.

B.5.7.2. This area will support a mosaic of habitats suitable for a range of species.

Objectives and targets

B.5.7.3. Refer to the relevant sections below (LE 6.1 / ponds (non-priority habitat); LE 6.4 and LE 1.3 / other neutral grassland; LE 2.1 and LE 2.2 / other woodland, broadleaved; and LE 2.8 / mixed scrub.

Creation and management

B.5.7.4. The approach will be to lightly seed the ephemeral areas with wetland grass species and suitable marginal plants, allowing a degree of natural regeneration. Scrub and woodland planting will be designed to complement the wetland areas.

B.5.7.5. The area will be monitored before a prescriptive management plan is produced to ensure that management suits the developing conditions and habitats. This monitoring and production of a detailed management plan will take place during the initial five-year aftercare period and the management details will be included in subsequent iterations of the LEMP.

B.5.8. Grassland with bulbs LE 1.2 / modified grassland

Context and location

Relevant REAC ref: LV4, B7, B9

B.5.8.1. Small areas of this habitat type are located predominantly around the junction. This is generally an amenity grassland type to provide visual interest. Whilst its function is predominantly aesthetic, it still contributes to BNG.

Objectives and targets

B.5.8.2. The relevant Condition Sheet is: Grassland Habitat Type (low distinctiveness) which lists the following seven condition assessment criteria:

- There must be 6-8 species per m^2. Note - if a grassland has 9 or more species per m^2 it should be classified as a moderate distinctiveness grassland habitat type. **NB – this criterion is non-negotiable for achieving good condition.**
- Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.
- Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area. Note - patches of shrubs with continuous (more than 90%) cover should be classified as the relevant scrub habitat type.
- Physical damage evident in less than 5% of total grassland area, such as excessive poaching, damage from machinery use or storage, damaging levels of access, or any other damaging management activities.
- Cover of bare ground between 1% and 5%, including localised areas, for example, rabbit warrens.
- Cover of bracken less than 20%.

B.5.8.3. There is an absence of invasive non-native species (as listed on Schedule 9 of the Wildlife and Countryside Act (WCA), 1981 (As amended)) and undesirable species[22] make up less than 5% of ground cover.

B.5.8.4. As this is typically an aesthetic grassland dominated by grass species, it is unlikely to achieve the non-negotiable criteria of 6-8 species per m^2 to achieve 'good' condition. The target condition for this habitat type is therefore moderate. In order to achieve 'moderate' condition, four or five of the above seven condition assessment criteria must be met, or six of seven criteria excluding non-negotiable criterion.

Creation and management

B.5.8.5. The approach will be to use non-invasive species-rich grassland seed mix suitable for the reused or imported topsoil. Topsoil depths and nutrient levels for the grassland will be reflective of the final choice of mix, Native and/or non-invasive spring and autumn bulbs will be scatter planted in naturalistic drifts within deeper areas of topsoil as appropriate.

B.5.8.6. The management requirements in the first year of establishment will depend on the soil fertility, but the primary aim is to control weeds and reduce competition from grasses and are subject to development in subsequent iterations of the LEMP. Typically, this will require keeping the sward short in the first year until the end of June to reduce competition and stopping mowing in July and August to allow any wildflowers to seed. Thereafter typically two cuts per year will be required in Spring and early Autumn, avoiding wildflower and bulb flowering periods. All arisings will be removed to avoid smothering the sward.

B.5.8.7. Areas will be managed to limit intrusion by scrub and create variety of wildflower, grass and bulbs across the area.

B.5.9. Banks and ditches – wet grassland LE 6.2 / modified grassland

Context and location

Relevant REAC ref: LV4, B7, B9

B.5.9.1. The primary function of the ditch network is control of surface water run-off from the Scheme, to avoid increasing flood risk and to maintain or improve water quality.

B.5.9.2. An additional purpose is to provide benefits for biodiversity, creating ephemeral wet areas and grassland habitats that contribute to BNG. Wet grassland/modified grassland is located within and on the banks of all drainage ditches. This is generally a relatively species-poor, amenity grassland type, although the presence of ephemeral wet areas will be of benefit to biodiversity.

Objectives and targets

B.5.9.3. The relevant Condition Sheet is: Grassland Habitat Type (low distinctiveness) which lists the seven condition assessment criteria detailed 18 paragraph B.5.8.2 above.

B.5.9.4. These areas are unlikely to achieve the non-negotiable criteria of 6-8 species per m^2 to achieve 'good' condition. Furthermore, management is likely to be infrequent and therefore criteria 2 (varied sward) and/or 3 (>20% scrub) are unlikely to be achieved. The target condition for this habitat type is therefore moderate. In order to achieve 'moderate' condition, four or five of seven condition assessment criteria must be met, or six of seven criteria excluding the non-negotiable criterion.

22 Species considered undesirable for this habitat type include: Creeping thistle *Cirsium arvense*, spear thistle *Cirsium vulgare*, curled dock *Rumex crispus*, broad-leaved dock *Rumex obtusifolius*, common nettle *Urtica dioica*, greater plantain *Plantago major*, white clover Trifolium repens, cow parsley *Anthriscus sylvestris*.

Creation and management

B.5.9.5. A seed mix comprising non-invasive species tolerant of wetter conditions will be sown in accordance with supplier recommendations.

B.5.9.6. The management requirements in the first year of establishment will depend on the soil fertility, but the primary aim is to control weeds and reduce competition from grasses and are subject to development in subsequent iterations of the LEMP. Typically, this will require keeping the sward short in the first year until the end of June to reduce competition and stopping mowing in July and August to allow any wildflowers to seed. Thereafter typically two cuts per year will be required in Spring and early Autumn. All arisings will be removed to avoid smothering the sward.

B.5.10. Wet grassland with marginal planting LE 6.4 / other neutral grassland

Context and location

Relevant REAC ref: LV4, B7, B9

B.5.10.1. Wet grassland areas with marginal planting are located within the attenuation basins and within depressions in the flood storage area. These wetter areas will be sown with a damp grassland mix including a relatively diverse mix of forbs, grasses, sedges and rushes.

Objectives and targets

B.5.10.2. The relevant Condition Sheet is: Grassland Habitat Type (medium, high and very high distinctiveness) which lists the following five condition assessment criteria:

- The appearance and composition of the vegetation closely matches characteristics of the specific grassland habitat type (see UKHab definition). Wildflowers, sedges and indicator species for the specific grassland habitat type are very clearly and easily visible throughout the sward.
- Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20 per cent is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.
- Cover of bare ground between 1% and 5%, including localised areas, for example, rabbit warrens.
- Cover of bracken less than 20% and cover of scrub (including bramble) less than 5%.
- There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981). Combined cover of undesirable species (see the Condition Sheet for a list of species) and physical damage (such as excessive poaching, damage from machinery use or storage, damaging levels of access, or any other damaging management activities) accounts for less than 5% of total area.

B.5.10.3. These areas are likely to have infrequent management and are therefore unlikely to meet all 5 condition assessment criteria for other neutral grassland required to achieve ‘good’ (e.g. <5% scrub). The target condition for this habitat type is therefore moderate. In order to achieve ‘moderate’ condition, three or four of the above five condition assessment criteria must be met.

Creation and management

B.5.10.4. A seed mix comprising non-invasive species tolerant of wetter conditions will be sown in the basin area, with a wildflower mix for water edge areas.

B.5.10.5. Typical management and maintenance requirements are listed below, but are subject to development in subsequent iterations of the LEMP, and will be informed by monitoring:

- Weed control by more regular mowing may be required during the establishment period to prevent weeds smothering the slower-growing grasses.
- Once established, maintain the sward as wet meadow, allowing grasses to grow tall. Leave uncut until late September or until all desirable flowers have gone over and then cut to a height of 75 – 150 mm.
- All arisings to be removed and disposed of off-site where possible. Alternatively leave in small heaps in suitable locations under the direction of the ECoW.

B.5.11. Species-rich grassland LE 1.3 / other neutral grassland

Context and location

Relevant REAC ref: LV4, B7, B9, B10

B.5.11.1. Species-rich grassland is the default habitat type for all of the unplanted soft landscape areas such as verges and embankments.

Broad principles for Road Verge Compensation Strategy

B.5.11.2. 22.56 ha of species-rich road verge will be created within the Order limits. This is, in part, to compensate for the loss of approximately 0.1 ha of lowland meadow priority habitat along the A4019.

B.5.11.3. A bespoke compensation strategy (referred to as the Road Verge Compensation Strategy) will be produced for the loss of this area of lowland meadow. The Road Verge Compensation Strategy will include details about the creation and long-term management of the species-rich grassland. It will be produced during detailed design by the PC, in accordance with the broad principles listed below, which have been agreed with Natural England:

- The species-rich grassland areas will have low nutrient / minimal topsoil, to promote wildflower growth[23].
- The approach to habitat creation will be to match the species composition and community to that which will be lost (see below).
- The areas of species-rich road verge (once created) will receive annual maintenance at an appropriate time of year (late July to end of September) and all arisings will be collected and taken off site. This is in line with Gloucestershire Highways and Biodiversity Guidance[23].
- The strategy will be designed and agreed with Natural England and all parties will be signed up to the targets and objectives necessary to achieve ‘good’ condition (further detail provided below).
- The areas will be monitored, and management will be reviewed and adapted as required to ensure the target condition is reached.

Objectives and targets

B.5.11.4. The relevant Condition Sheet is: Grassland Habitat Type (medium, high and very high distinctiveness), which lists the five condition assessment criteria detailed in paragraph B.5.10.2 above.

[23] Gloucestershire County Councils ‘Highways and Biodiversity Guidance’ (May 2022, version 3.2) and National Highway’s ‘Low Nutrient Grasslands policy’ (Major Projects Delivery Services (October 2020), Low Nutrient Grasslands (version number MPI-85-102020).

B.5.11.5. The target condition for this habitat type is 'good' which requires all five of the condition assessment criteria to be met. Whilst ambitious, this target is realistic and achievable based on the broad principles listed above.

Creation and management

B.5.11.6. This habitat type requires low nutrient/minimal topsoil to promote wildflower growth. Soil testing will be undertaken to understand the existing soil conditions and it will likely be necessary to reduce nutrient levels. This can be achieved by topsoil stripping (the existing topsoil is stripped off, leaving minimal or no topsoil in place) or soil inversion (the topsoil is turned over and buried under a layer of subsoil). Note, the latter is not suitable where there are archaeological remains.

B.5.11.7. The approach to habitat creation will be to match the species composition and community to that which will be lost by utilising either collected seed and/or green hay sourced from an appropriate local donor site (potentially through the Glorious Cotswold Grasslands initiative run by the Cotswold Conservation Board). Based on professional judgement the assemblages present suggest an affiliation with the National Vegetation Classification (NVC) communities MG1d and MG1e, false-oat grass grasslands where wild parsnip and common knapweed are widespread components of the vegetation, respectively.

B.5.11.8. Once the ground has been prepared, seeds will be sown evenly by machine or hand and firmed in with a roll or by treading.

B.5.11.9. Consideration will be given to habitat translocation, noting that the success of any translocation relies on habitat being translocated very rapidly to a pre-prepared receptor area. This option therefore may not align with the construction programme.

B.5.11.10. Typical management and maintenance requirements are listed below, but are subject to development in subsequent iterations of the LEMP, and will be informed by monitoring:

- For the establishment period (typically one to three years following seeding) regular inspections will be required to identify, for example any bare patches or weeds.
- Weed control by more regular mowing may be required during the establishment period.
- If the regular inspections identify the need for overseeding, for example if bare patches are identified, this can be carried out in spring or autumn. Similarly, if the need for weed control is identified, spot weed treatments can be carried out in May, June and July, and hand weeding can be carried out at any time.
- Once established, cut and remove arisings annually in late summer following flowering to suppress growth of undesirable species and scrub and encourage a diversity of wildflower species. A further cut may be required in early spring. A cutting regime will be designed during detailed design to ensure that the BNG target is met whilst also ensuring that some areas of taller grassland remain by leaving some areas with a longer rotational cutting regime to provide a refuge for small mammals, reptiles, amphibians and invertebrates.

B.5.12. Woodland LE 2.1 and Woodland edge LE 2.2 / other woodland; broadleaved

Context and location

Relevant REAC ref: LV4, B7, B9, B11, B12, B13

B.5.12.1. As well as within the flood storage area, there will be woodland planting along the embankments of the Link Road, around the junction and along the motorway. In addition, more open areas of woodland will be created within the riparian zone of the River Chelt and Leigh Brook.

B.5.12.2. Broadleaved woodland planting will replace areas of plantation woodland that will be lost as a result of the Scheme and increase the overall area of this habitat type.

B.5.12.3. The intention is to provide high quality habitat supporting a diversity of woodland plants of benefit to a range of species that links with habitat in the wider area. Woodland edge habitat would provide buffer areas, ensuring a smooth ecological transition from climax woodland to field edges and boundaries. Blocks of woodland are characteristic of the local area and will provide visual screening and landscape integration.

B.5.12.4. The area of woodland creation to the north east of the junction is a key feature for dormice. There are also key locations where the planting functions to provide 'hop over' features for bats.

Objectives and targets

B.5.12.5. The relevant condition sheet is: Woodland; and the habitat is assessed against the following indicators:

- Age distribution of trees – higher scores for more three age classes present.
- Wild, domestic and feral herbivore damage – higher scores for no/lower browsing damage.
- Invasive plant species – higher scores for no/lower amounts of invasive plant species.
- Number of native tree species – higher scores for more native tree or shrub species.
- Cover of native tree and shrub species – higher scores for more cover of native species.
- Open space within woodland – higher scores for smaller areas of open space.
- Woodland regeneration – higher scores for three age classes present and presence of saplings, seedlings of coppice regrowth.
- Tree health – higher scores for lower levels of tree mortality/pests/diseases/crown dieback.
- Vegetation and ground flora – higher scores for presence of ancient woodland indicator species.
- Woodland vertical structure – higher score for three or more storeys.
- Veteran trees – higher score for the presence of veteran trees.
- Amount of deadwood – higher score for increased amount of deadwood.
- Woodland disturbance – higher score for lower levels of nutrient enrichment and damaged ground.

B.5.12.6. The target condition for this habitat type is 'moderate' which requires a score of 26 – 32 to be achieved. It will not be possible to score particularly highly against a number of indicators such as age classes, regeneration, recognisable NVC community, vertical structure, veteran trees or deadwood.

Creation and management

B.5.12.7. New woodland will be created using a mixture of native, locally sourced trees. Where appropriate evergreen or semi-evergreen species will be used to enhance the screening effect during the winter months.

B.5.12.8. Habitat surveys identified that woodland within/surrounding the Scheme was dominated by pedunculate oak and ash. Horse-chestnut, sycamore and Scots pine which are not native to England were also recorded. Occasional alder, aspen, beech and silver birch

were also present. Understorey species included blackthorn and hawthorn with hazel, field maple, elder, crab apple and hornbeam.

B.5.12.9. Primary target species will reflect the native species recorded within local woodlands. Ash is not recommended for use in planting due to the risk of importing ash dieback disease and the ability of the species to readily colonise.

B.5.12.10. The area of woodland north east of the junction will be planted with a mixture of species of particular value to dormice including field maple, hornbeam, hazel, common hawthorn, holly, crab apple, blackthorn, dog rose, elder and guelder rose.

B.5.12.11. Wetter areas such as the flood storage area will be planted with appropriate species such as willow and alder.

B.5.12.12. Areas of woodland to be created within the riparian zone along the River Chelt and Leigh Brook will have a more open structure, with a canopy cover of 20% (when trees reach maturity) in order to avoid excessive shading of the watercourses.

B.5.12.13. Woodland mixes required for visual screening or ecological mitigation purposes for bats, will contain a percentage of larger, faster-growing stock such as feathered, standard, and more mature trees. These 'nurse species' will be planted at close spacings (say 1 m) then be thinned out over time as the climax woodland develops as part of ongoing maintenance activities.

B.5.12.14. Trees will be planted in random naturalistic formation, with appropriate individual staking and rabbit protective guards. Where possible plant guards should be non-plastic and biodegradable. Consideration should be given to protecting areas of planting with wire mesh fencing rather than individual guard. Confirmation of the likelihood of deer grazing shall be undertaken and consideration of deer fencing to be used as appropriate to protect new planting.

B.5.12.15. The specific methodology for woodland creation will be developed during detailed design. Typical management and maintenance requirements for the initial five year establishment period are listed below, but are subject to development in subsequent iterations of the LEMP, and will be informed by monitoring.

- Provide irrigation as required during the first five years to ensure plants survive and thrive.
- Replace any dead or damaged trees annually with replacement stock during the next available planting season.
- Check tree/timber stakes/guards/shelters/mulch annually and adjust, repair or replace as necessary.
- Re-firm soil around roots as necessary to ensure plants are supported and upright, especially following periods of extreme winds.
- Keep areas 0.5 m in diameter around each new plant weed free and remove weeds from tubes and shelters.
- Cut grassland between planting (arisings to be spread evenly across the plot) twice a year in early spring and late summer.
- Remove tree protection (stakes, tubes, guards, ties etc) by year five and dispose off-site.

B.5.12.16. Longer term management may include thinning after approximately ten years to maintain and promote a healthy woodland structure, including high canopy trees, understorey scrub vegetation and ground flora, whilst ensuring visual screening is maintained as necessary. Thinning approximately every five years may be appropriate. Consideration will be given to the requirements of protected species, particularly dormice.

B.5.12.17. Felled trees/dead wood from native broadleaves (mixture) will be retained during construction and placed into the woodland areas. Dead wood within woodland will be left in situ and not disturbed as much as possible to provide habitat for invertebrates.

B.5.13. Linear belts of shrubs and trees LE 2.4, shrubs with intermittent trees LE 2.5, shrub LE 2.6 and scrub LE 2.8 / mixed scrub

Context and location

Relevant REAC ref: LV4, B7, B9, B11, B12, B13

B.5.13.1. This habitat type will be created around the edge of the flood storage area, parallel to the M5, along the Link Road and adjacent to blocks of woodland.

B.5.13.2. Scrub planting will replace areas of scrub that will be lost as a result of the Scheme and increase the overall area of this habitat type.

B.5.13.3. The intention is to provide a diversity of plant species and structure which will benefit a range of species that links with habitat in the wider area.

B.5.13.4. Scrub creation to the north east of the junction is a key feature for dormice.

Objectives and targets

B.5.13.5. The relevant condition sheet is: Scrub Habitat Type which lists the following five condition assessment criteria:

- Habitat is representative of UKHab description[20] (where in its natural range). There are at least three woody species, with no one species comprising more than 75% of the cover (except common juniper, sea buckthorn or box, which can be up to 100% cover).
- There is a good age range – all of the following are present: seedlings, young shrubs and mature shrubs.
- There is an absence of invasive non-native species (As listed on Schedule 9 of WCA 1981 (as amended)) and undesirable species make up less than 5% of ground cover.
- The scrub has a well-developed edge with scattered scrub and tall grassland and/or herbs present between the scrub and adjacent habitat(s).
- There are clearings, glades or rides present within the scrub, providing sheltered edges.

B.5.13.6. It may not be possible to achieve well-developed scrub edges as a result of adjacent agricultural land uses. The target condition for this habitat type is therefore ‘moderate’ which requires three or four of the above condition assessment criteria to be met.

Creation and management

B.5.13.7. Scrub will comprise a mix of native species such as such as hazel, hawthorn, dogwood, holly and blackthorn, interspersed with larger tree species such as oak and sweet chestnut.

B.5.13.8. The area of scrub north east of the junction will be planted with a mixture of species of particular value to dormice including hazel, hawthorn, blackthorn, honeysuckle and bramble.

B.5.13.9. The translocation of existing shrubs should be considered during detailed design where practicable to bring forward the establishment of mature scrub.

B.5.13.10. Management and maintenance requirements for scrub planting are as stated above for woodland, and as refined in subsequent iterations of the LEMP.

B.5.14. Amenity tree and shrub planting LE 3.1 / introduced shrub

Context and location

Relevant REAC ref: LV4, B7

B.5.14.1. Amenity tree and shrub planting is located at the northern end of the Link Road, at the junction with the A4019 to provide visual interest.

Objectives and targets

B.5.14.2. In BNG terms, the condition of this habitat type is set at 'poor' and there are no BNG-related habitat condition targets.

Creation and management

B.5.14.3. Management and maintenance requirements for introduced shrub planting are as stated above for woodland, and as refined in subsequent iterations of the LEMP.

B.5.15. Individual tree LE 5.1 / urban tree

Context and location

Relevant REAC ref: LV4, B7, B9

B.5.15.1. Individual trees/urban trees are included along the A4019, both within the central reserve and along the verges to integrate the realigned A4019 route and create an avenue effect. Individual trees are also included along the Link Road, particularly around the bridge, and around attenuation basins to reflect the local character of the road infrastructure and provide some screening for visual receptors.

B.5.15.2. There are also key locations where the planting functions to provide 'hop over' features for bats.

Objectives and targets

B.5.15.3. The relevant condition sheet is: Urban Trees (including street trees) Habitat Type which lists the following six condition assessment criteria:

- More than 70% of trees are native species.
- Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.

More than 50% of trees are mature[24] or veteran.

- There is little or no evidence of an adverse impact on tree health by anthropogenic activities such as vandalism or herbicide use. There is no current regular pruning regime, so the trees retain >75% of expected canopy for their age range and height.
- Management regime has encouraged micro habitat sites for birds, mammals and insects e.g. presence of deadwood, cavities or loose bark etc.
- Trees are immediately adjacent to other vegetation, and tree canopies are oversailing vegetation beneath.

[24] A mature tree in this context is one that is at least 2/3 expected fully mature height for the species.

B.5.15.4. The target condition for this habitat type is 'moderate' which requires three or four of six criteria to be met.

Creation and management

B.5.15.5. Management and maintenance requirements for individual trees/urban trees are as stated above for woodland, and as refined in subsequent iterations of the LEMP.

B.5.16. Waterbodies and associated plants LE 6.1 / non-priority ponds

Context and location

Relevant REAC ref: LV4, B7, B8, B9

B.5.16.1. A permanently wet area will be created within the flood storage area as part of the mosaic of habitats to be created here. This will improve biodiversity and benefit a range of species, particularly invertebrates and amphibians.

B.5.16.2. The outfall from the attenuation basin adjacent to the flood storage will provide a regular supply of water into the excavated area (from highway drainage that has been treated through the attenuation basin). This will supply the permanent body of water located between the outfall from the attenuation basin and the Piffs Elm culvert, and will regularly refresh to avoid stagnation.

Objectives and targets

B.5.16.3. The relevant Condition Sheet is: Pond Habitat Type, which lists the following seven condition assessment criteria:

- The pond is of good water quality, with clear water (low turbidity) indicating no obvious signs of pollution. Turbidity is acceptable if the pond is grazed by livestock.
- There is semi-natural habitat (i.e. moderate distinctiveness or above) for at least 10 m from the pond edge.
- Less than 10% of the pond is covered with duckweed or filamentous algae.
- The pond is not artificially connected to other waterbodies, either via streams, ditches or artificial pipework.
- Pond water levels should be able to fluctuate naturally throughout the year. No obvious dams, pumps or pipework.

B.5.16.4. There is an absence of non-native plant and animal species[25].

- The pond is not artificially stocked with fish. If the pond naturally contains fish, it is a native fish assemblage at low densities.

B.5.16.5. Additional criteria – only applicable to non-woodland ponds:

B.5.16.6. In non-woodland ponds, plants, be they emergent, submerged or floating (excluding duckweeds)[26], should cover at least 50% of the pond area that is less than 3m deep.

- The surface of non-woodland ponds is no more than 50% shaded by woody bankside species.

B.5.16.7. It may not be possible to achieve the criteria around artificial connections. The target condition for this habitat type is therefore 'moderate.' In order to achieve 'moderate' condition six, seven or eight of nine condition assessment criteria must be met.

[25] Any species included on the Water Framework Directive UKTAG GT High Impact Species List should be absent.
[26] If the pond is seasonal (i.e. dries out in most summers) then emergent species along are unlikely to be found.

Creation and management

B.5.16.8. To maximise the biodiversity value of the pond, consideration will be given to the following principles during detailed design:

- Planting an appropriate mix of native aquatic and marginal plants.
- Include a broad, undulating drawdown zone – this is an area of mud and vegetation which is flooded in winter and spring and progressively dries as water levels fall in summer. Broadening the drawdown to create extensive summer marsh and mud habitats can be good for wildlife.
- Create shallow areas by ensuring the pond slopes very gently at the edge, ideally less than 1:5 (12°) but preferably less than 1:20 (3°). Scalloped edges are another good way to increase the area of shallows and the length of pond margins.
- Create underwater bars and shoals to benefit aquatic plants.

B.5.16.9. The pond is within the flood storage area. Like the rest of the flood storage area, it will be monitored before a prescriptive management plan is produced to ensure that management suits the developing conditions and habitats. This monitoring and production of a detailed management plan will take place during the initial five-year aftercare period and the management details will be included in subsequent iterations of the LEMP. Typical management and maintenance requirements could include surveying for and removing any INNS, assessing establishment of marginal vegetation and management as necessary.

B.5.17. Native species hedges (trimmed and untrimmed) LE 4.2 and 4.3 and native hedgerows with trees LE 4.4 / native species-rich hedgerow, native species-rich hedgerow with trees and native species-rich hedgerow with trees, associated with a bank or ditch

Context and location

Relevant REAC ref: LV4, B7, B9, B11, B12, B13

B.5.17.1. New hedgerows will be created throughout the Scheme (totalling 11.35 km), in particular along the Link Road and A4019. In addition, a number of hedgerows to the north of the A4019 will be enhanced (1.21 km in total).

B.5.17.2. The loss of the 0.04km of ‘native species-rich hedgerow with trees – associated with a bank or ditch, which is a ‘Very High’ distinctiveness habitat as defined by BNG, will be compensated through the creation of 0.06 km of species-rich hedgerow with trees associated with a new ditch. This new section of hedgerow is located along the M5, north of the junction, adjacent to Barn Farm and is shown on the Environmental Masterplan (Application document TR010063/APP/2.13).

B.5.17.3. The Scheme design includes species-rich hedgerows (i.e. hedgerow replacement with a minimum of five woody species within each 30 m section of new hedge) for all lengths of new hedgerows planted by the Scheme.

B.5.17.4. Hedgerows fulfil a range of functions, including integrating the Scheme, defining boundaries, providing wildlife habitat and corridors. The hedgerow creation and enhancement to the north east of the junction is a key mitigation and compensation measure for dormice, as detailed in the dormouse licence and later in this document. There are key locations where the hedgerow planting functions to provide ‘hop over’ features for bats.

Objectives and targets

B.5.17.5. The relevant condition sheet is: Hedgerow which lists the following ten condition assessment criteria which the hedgerow either passes or fails:

- A1 Height - >1.5m average along length.
- A2 Width - >1.5m average along length.
- B1 Gap – hedge base – gap between ground and base of canopy <0.5 m for >90% of length (unless line of trees).
- B2 Gap – hedge canopy continuity – gaps make up <10% of total length and no canopy gaps >5 m.
- C1 Undisturbed ground and perennial vegetation - >1m width of undisturbed ground with perennial herbaceous vegetation for >90% of length. Measured rom outer edge of hedgerow and present on one side of the hedge at least.
- C2 Undesirable perennial vegetation – plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground[27].
- D1 Invasive and neophyte species - >90% of the hedgerow and undisturbed ground is free of non-native and neophyte species.
- D2 Current damage – >90% of the hedgerow or undisturbed ground is free of damage caused by human activities.

B.5.17.6. The following additional criteria are applicable to hedgerows with trees only:

- E1 Tree age – at least one mature tree per 30m stretch of hedgerow. A mature tree is one that is at least 2/3 expected fully mature height for the species.
- E2 Tree health – at least 95% of hedgerow trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.

B.5.17.7. ‘Good’ condition may not be achieved as a result of adjacent agricultural land uses which may result in ground disturbance, nutrient enrichment, undesirable species or damage. The condition criteria for maturity of trees may also not be met. The target condition for all hedgerows (created and enhanced) is therefore ‘moderate.’

B.5.17.8. Moderate condition requires no more than four failures in total for hedgerows without trees and no more than five failures in total for hedgerows with trees. In addition, the hedgerow must not fail both attributes in more than one functional group.

Enhancement, creation and management

B.5.17.9. A number of existing, retained hedgerows will be enhanced (for BNG and dormice). Locations are shown on the Environmental Masterplan (Application document TR010063/APP/2.13). Measures include:

- H199, H199a, H200, H201, H205 and H206 are intensively managed hedgerows. As these hedgerows are potential natural dispersal routes, dormice will benefit from reducing the management intensity to being cut no more than once every three years, with their height kept at no less than 3 m.
- H199, H199a, and H200 are currently native hedgerows. The number of native woody species present will be increased to seven through localised coppicing and planting such that they meet the criteria for native species-rich hedgerows in moderate condition.

[27] Key indicators are nettles (Urtica spp._, cleavers (Galium aparine) and docks (Rumex spp.). Their presence, either singly or together, should not exceed the 20% cover threshold.

- H48 is a native hedgerow with trees which leads north away from the Scheme Boundary and is linked to retained suitable habitat. However, there are gaps in the hedge totalling approximately 35 m, and therefore the planting of these gaps with a mixture of valuable species to dormice, especially hazel, pedunculate oak, and honeysuckle, which are currently absent, will increase species diversity, connectivity and food availability to dormice. The intention is that this hedgerow meets the criteria for a native species-rich hedgerow with trees in moderate condition.
- H201 is a native hedgerow that is over managed and has gaps totalling approximately 80 m. Therefore, the planting of these gaps with a mixture of valuable species to dormice, such as hazel, pedunculate oak, honeysuckle, bramble, sallow and hawthorn, will increase species diversity and the suitability of the hedgerow to dormice. The intention is that this hedgerow meets the criteria for a native species-rich hedgerow in moderate condition.
- HT18 is currently a line of trees (poplar sp.), with a bramble, elder and hawthorn understorey. This linear feature will be enhanced by planting species of benefit to dormice such as hazel, pedunculate oak, and honeysuckle to create a dense understorey of plants that will provide food and nesting resources for dormice. The intention is that this line of trees in poor condition reaches the criteria for moderate condition.

B.5.17.10. All new hedgerows will be planted with at least five woody species per 30 m section/s with species such as: field maple, dogwood, hazel, hawthorn, spindle, beech, holly, privet, crab apple, blackthorn, buckthorn and guelder-rose. Honeysuckle, bramble and sallow will be included in locations that form part of the mitigation and compensation package for dormice. 60 – 90 cm whips will be planted in a double row at a spacing of 20 – 30 cm. Plants to be appropriately staked and guarded against rabbits. Individual guards should be biodegradable non-plastic, Consideration should be given to using mesh fencing around hedge sections rather than individual guards to reduce waste where appropriate.

B.5.17.11. Where the hedgerow type is hedgerow with trees, trees such as: field maple, silver birch, hornbeam and pedunculate oak will also be planted at irregular spacings of between 20-30m. These should be planted as larger specimens so are easily identifiable during maintenance of the hedgerow. Trees to be staked appropriately.

B.5.17.12. The translocation of existing shrubs will be considered during detailed design where practicable to bring forward the establishment of hedgerows.

B.5.17.13. The specific methodology for hedgerow creation/enhancement will be developed during detailed design. Typical management and maintenance requirements for the initial five-year establishment period are listed below, but are subject to development in subsequent iterations of the LEMP, and will be informed by monitoring.

- Provide irrigation as required during the first five years of establishment to ensure plants survive and thrive.
- Replace any dead or damaged plants annually with replacement stock during the next available planting season.
- Check timber stakes/guards/shelters/mulch annually and adjust, repair or replace as necessary.
- Re-firm soil around roots as necessary to ensure plants are supported and upright, especially following periods of extreme winds.
- Keep areas full width of hedgerow weed free and remove weeds from tubes and shelters.
- Remove protection (stakes, tubes, guards, ties etc) by year five and dispose off-site.

- Newly planted hedgerows will be trimmed around year three to five to promote bushy growth. They will be cut in an 'A' shape to maintain a wide base. Trees within the hedgerow will be allowed to take a natural form and only pruned back where causing obstruction or safety concerns.
- Beyond year five, hedgerows will be managed on a three-year rotation with one side cut a year to help develop the desired tall (3 m minimum) bushy structure.

B.5.18. Rivers and streams

Context and location

Relevant REAC ref: B8, B9

B.5.18.1. The design includes enhancements to the River Chelt and Leigh Brook. This is to compensate for the loss of approximately 0.2 km of the Leigh Brook due to the extension of the Leigh Brook culvert and adverse impacts to the River Chelt as a result of the Link Road crossing. Measures are proposed to improve hydromorphological and ecological diversity and to achieve BNG.

B.5.18.2. The preliminary design has assumed a requirement for a hard engineered bank reinforcement protection (i.e. rip-rap) on the River Chelt under the proposed clear span bridge to manage erosion risks. However, at the detailed design stage, further assessment (including a scour assessment) will determine the most pragmatic solution and confirm the need for bank protection, specify the materials and general arrangement, which will endeavour to minimise and, where possible, exclude hard bank protection. Where this is not possible, further measures to mitigate for this will be explored, such as naturalised toe frontages comprising wood etc. The preferred approach will be agreed with the Environment Agency through consultation.

Objectives and targets

B.5.18.3. Watercourse condition (for 'priority rivers' and 'other rivers and streams' habitat which falls within the Scheme and is discussed in this section) is informed using the Modular River Physical survey (MoRPh28) method. The MoRPh method is a quantitative visual geomorphological assessment of a river and riparian zone, that records a list of features. Such features include elements such as channel form, in-channel habitats (e.g. riffles and pools), bed substrates and bank material, as well as flow types. Broad aquatic ecological plant community structure and characteristics of the bankside and riparian zone are also recorded. The final condition score produced is either 'Good', 'Fairly Good', 'Moderate', 'Fairly Poor' or 'Poor.'

B.5.18.4. Implementation of the enhancement measures described below, are intended to improve watercourse condition as outlined in Table B 5-4 below.

Table B 5-4 Condition improvements

Watercourse name	Watercourse location	Length (within the Order limits) km	Pre-works condition	Post-works condition
River Chelt	Upstream and downstream of the Link Road Crossing	0.274	Moderate	Fairly good
	Upstream of the River Chelt Culvert	0.1	Fairly poor	Moderate

[28] https://modularriversurvey.org/wp-content/uploads/MoRPh-Manual-ver-12.pdf [Accessed February 2024].

Leigh Brook	Downstream of the Leigh Brook Culvert	0.221	Fairly poor	Moderate

Enhancement measures

B.5.18.5. At the River Chelt, upstream and downstream of the Link Road Crossing, and upstream of the River Chelt culvert, the following enhancement measures will be implemented:

B.5.18.6. Riparian zone – the riparian habitat will no longer be managed for agriculture and will be restored to reflect a more natural habitat, facilitated through open woodland creation[29] and planting of wet grassland species. This will improve watercourse condition as well as reduce encroachment.

- Bank reprofiling – the River Chelt is incised in these locations (upstream and downstream of the Link Road Crossing, and upstream of the River Chelt culvert), therefore, banks will be re-profiled with the aim to create a more natural two-stage channel and facilitate establishment of marginal features (such as berms/benches) and to reconnect it with its floodplain.
- Marginal planting – planting of native aquatic vegetation such as emergent linear leaved and broadleaved species.
- Woody features –trees that have been felled as part of the Scheme will be placed on/in the banks and within the channel to create woody deflectors. The spacing and size of deflectors will be informed by an aquatic ecologist and/or geomorphologist to ensure they are appropriately scaled for the watercourse. This will create refuge for fish species as well as contributing to variability in flow types providing greater habitat diversity for aquatic species more generally. Any deflector installations will be naturalised wherever possible, e.g. tied into the banks with no securing wires/posts showing.

B.5.18.7. Creation of in-channel geomorphological features – coarse substrates (such as gravel/pebble and cobble) will be introduced into the channel where not already present to facilitate the establishment of riffles, with woody features previously described creating scour to maintain pool features. At the Leigh Brook, downstream of the Leigh Brook culvert, the following enhancement measures will be implemented:

- Riparian zone – the riparian habitat will no longer be managed for agriculture and will be restored to reflect a more natural habitat, facilitated through open woodland creation[29] and planting of wet grassland species. A new discharge from an attenuation pond will be an open channel drainage ditch, which will result in increased complexity to the riparian habitat.
- Bank reprofiling – banks will be re-profiled with the aim to create more natural two-stage channel and facilitate establishment of marginal features such as berms/benches.
- Marginal planting – planting of native aquatic vegetation such as emergent linear leaved and broadleaved species.

B.5.18.8. Detailed design of all watercourse enhancements listed in this section will be informed by an aquatic ecologist and geomorphologist to ensure the measures are appropriately designed with respect to the sediments, flows and ecology of the specific watercourse.

B.5.18.9. The watercourse enhancements on the River Chelt and Leigh Brook are expected to meet their target condition of ‘fairly good’ and 'moderate’ within two years of creation.

[29] A definition of woodland in the United Kingdom (which is used for forestry statistics) is land under stands of trees with a canopy cover of at least 20% (or having the potential to achieve this), including integral open space. Source: https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2018/sources/woodland-area-and-planting [Accessed: 27.10.22]

Management

B.5.18.10. The specific methodology for watercourse enhancement design and construction will be developed during detailed design. Typical management and maintenance requirements for an initial establishment period are listed below. These are subject to development in subsequent iterations of the LEMP, and may need to be revised following initial monitoring:

- Undertake post construction inspections to review the constructed design against proposals. This shall include checking each enhancement feature/design element in turn (e.g. deflectors, riparian planting, and bank reprofiling) and confirming presence of the features on the ground and assessing their effectiveness against their objectives. If any features are not working as designed, amendments shall be made to improve their functioning (e.g. re-staking deflectors or changing their angle within the channel).
- Post construction MoRPh survey (two years post construction) to allow for the assessment of the attainment of target conditions and re-evaluation of enhancement feature/design element effectiveness.

B.5.18.11. If target condition has been achieved within the expected timeframes there is not anticipated to be a requirement for ongoing maintenance of the watercourse enhancement measures. These measures shall be designed to be self-sustaining and thus should not require -long-term intervention.

B.5.18.12. If target condition is not met during the expected timeframes, then ongoing monitoring and maintenance shall be required, as directed by an aquatic ecologist and/or geomorphologist, until target condition is achieved.

B.5.19. Ditches

Context and location

Relevant REAC ref: B8, B9

B.5.19.1. The Scheme will act to replace any ditch lost as a result of the Scheme through the creation of new ditches as part of the drainage strategy. Approximately 2.40 km of ditch will be lost as part of the Scheme and 4.793 km of ditch will be created.

Objectives and targets

B.5.19.2. The relevant condition sheet is: Ditch Habitat Type Condition Sheet which lists the following eight condition assessment criteria:

- The ditch is of good water quality, with clear water (low turbidity) indicating no obvious signs of pollution.
- A range of emergent, submerged and floating leaved plants are present. As a guide > 10 species of emergent, floating or submerged plants in a 20 m ditch length.
- There is less than 10 % cover of filamentous algae and/or duckweed (these are signs of eutrophication).
- A fringe of marginal vegetation is present along more than 75 % of the ditch.
- Physical damage is evident along less than 5 % of the ditch, such as excessive poaching, damage from machinery use or storage, or any other damaging management activities.
- Sufficient water levels are maintained; as a guide a minimum summer depth of approximately 50 cm in minor ditches and 1 m in main drains.
- Less than 10 % of the ditch is heavily shaded.

- There is absence of non-native plant and animal species[30].

B.5.19.3. New ditches covered in this LEMP are unlikely to meet a number of these criteria and the target condition is therefore 'poor.' In order to achieve 'poor' condition between zero and five of the eight criteria must be met. New ditches are expected to meet their target condition of 'poor' within the first year of creation.

Design measures

B.5.19.4. Ditch design shall be directed by the Scheme drainage strategy (Appendix 2.1, Application document TR010063/APP/615). However, new ditches shall be sown with wet grassland. Ecologically sensitive design details shall be considered wherever practicable and feasible. This may include:

- Shallow bank profiles.
- Two stage-channels.
- Meandering planforms.
- Variable substrates.
- Provision of pool habitats within the wider ditch feature.
- Aquatic planting.

Monitoring

B.5.19.5. The specific methodology for ditch design and construction will be developed during detailed design. A post construction survey to confirm the as-built designs shall be undertaken. Following this the drainage ditches shall fall under general highways maintenance procedures.

B.5.20. Reinstatement of temporary land take areas

Relevant REAC ref: LV3, B9

B.5.20.1. All areas that lie within the temporary working area of the Scheme will be reinstated to the same habitat type and condition as prior to the works occurring and returned to the landowner. Much of this habitat is cropland and therefore very easy to reinstate.

B.5.20.2. Table B 5-5 below lists the habitats to be reinstated, the area and target condition. Refer to the relevant habitat types above for details of creation and management.

Table B 5-5 Habitats to be reinstated

UKHab/metric Habitat Type	Area (ha)	Target Condition
Modified grassland	0.05	Poor
Modified grassland	3.58	Moderate
Other neutral grassland	0.24	Poor
Other neutral grassland	5.05	Moderate
Cereal crops	33.43	N/A agricultural
Woodland and forest – Other woodland; mixed	0.01	Moderate

[30] Any species included on the Water Framework Directive UKTAG GC High Impact Species List should be absent. This list can be accessed here: http://www.wfduk.org/sites/default/files/UKTAG%20classification%20of%20alien%20species%20working%20paper%20v8.pdf [Accessed February 2024].

UKHab/metric Habitat Type	Area (ha)	Target Condition
Bramble scrub	0.06	Poor
Mixed scrub	0.04	Poor

B.5.21. Monitoring

B.5.21.1. Management, maintenance and monitoring will be required during the initial aftercare maintenance period of five years, to be undertaken by the PC. General targets during this period are that the habitat area matches the commitment in the final BNG assessment; habitats have successfully established; and progress is being made towards habitat condition targets.

B.5.21.2. Longer term monitoring and management will then be undertaken by GCC and National Highways to ensure that the habitats continue to develop to meet condition targets, and that the habitat fulfils its function.

B.5.21.3. Monitoring will be undertaken by a suitably qualified ecologist and landscape architect. A typical management, maintenance and monitoring schedule is outlined in the table below, but monitoring will inform adaptive and reactive management and maintenance and therefore this schedule should be considered to be a flexible document that will require regular review. For example, if upon monitoring any area fails any of the relevant habitat criteria, this will act as a trigger to assess whether any remedial management or maintenance is required. Further detail will be added to the schedule below in subsequent iterations of the LEMP.

Table B 5-6 Typical maintenance and management operations and proposed monitoring

Feature	Task / methodology	Years 1 – 5: initial aftercare period					Years 6 – 30: longer term management
		1	2	3	4	5	6 - 30
Maintenance and management							
General - all habitat types	Regular inspection visits two or three times each year of five-year aftercare period	Y	Y	Y	Y	Y	
	Remove litter/foreign debris from across Scheme and remove off site. Minimum three times per year inspections for litter. Recycling of litter should be undertaken as appropriate.	Y	Y	Y	Y	Y	Y
Grassland habitat types	Regular mowing and remove arisings to prevent weeds (more species-rich grasslands only i.e. LE 6.4 and LE 1.3)	Y					
	Annual cut and remove arisings (more species-rich grasslands only i.e. LE 6.4 and LE 1.3)		Y	Y	Y	Y	Y
	More amenity grassland types and visibility splays to be cut as required	Y	Y	Y	Y	Y	Y
	Weed control	Y	Y	Y	Y	Y	
Woodland, trees, shrub and hedgerow habitat types	Water to establish and ensure survival throughout the year particularly in dry periods	Y	Y	Y	Y	Y	
	Replace any dead or damaged trees annually with replacement stock during next planting season. Replacement stock should be of same size as that lost at time of inspection.	Y	Y	Y	Y	Y	

Feature	Task / methodology	Years 1 – 5: initial aftercare period					Years 6 – 30: longer term management
		1	2	3	4	5	6 - 30
	Check plant and tree shelters and adjust, repair or replace as necessary, re-firm soil and mulch around roots as necessary	Y	Y	Y	Y	Y	
	Keep areas 0.5 m in diameter around each new plant weed free	Y	Y	Y	Y	Y	
	Cut grassland between planting twice a year in early spring and late summer	Y	Y	Y	Y	Y	
	Remove tree protection					Y	
	Longer term woodland management such as thinning						Y after ten years
	Trim newly planted hedgerows around year three to five to promote bushy growth. Cut in an ‘A’ shape to maintain a wide base.				Y		
	Manage on a three-year rotation with one side cut a year to develop the desired tall (3 m minimum) bushy structure						Y
Habitat monitoring							

Feature	Task / methodology	Years 1 – 5: initial aftercare period					Years 6 – 30: longer term management
		1	2	3	4	5	6 - 30
Grassland with bulbs LE 1.2 / modified grassland Banks and ditches – wet grassland LE 6.2 / modified grassland	Monitoring to ensure target condition is met, potentially through fixed point photography. It is anticipated that establishment and the desired target condition will be achieved within five years, and routine maintenance will then be implemented. Therefore, no specific habitat monitoring is required beyond this period.	Y		Y		Y	Not required
Wet grassland with marginal planting LE 6.4/other neutral grassland Species-rich grassland LE 1.3 / other neutral grassland	Monitoring to ensure target condition is met. Botanical surveys to identify the habitat type that is establishing and confirm presence of indicator species. Quadrat sampling to establish the number of species per m2. Estimate sward height, percentage of bare ground, bracken and scrub cover.	Y		Y		Y	Every five years
Woodland LE 2.1 and woodland edge LE 2.2 / other woodland; broadleaved Linear belts of shrubs and trees LE 2.4, shrubs with intermittent trees LE 2.4, shrub LE 2.6 and scrub LE 2.8 / mixed scrub Individual tree LE 5.1 / urban tree	Monitoring to ensure target condition is met. Botanical surveys to identify the habitat type that is establishing and confirm progress is being made towards habitat condition targets. Assess against the relevant indicators. Consider use of fixed-point photography.	Y		Y		Y	Every five years

Feature	Task / methodology	Years 1 – 5: initial aftercare period					Years 6 – 30: longer term management
		1	2	3	4	5	6 - 30
Native species hedges (trimmed and untrimmed) LE 4.2 and 4.3 and native hedgerows with trees LE 4.4 / native species-rich hedgerow, native species-rich hedgerow with trees and native species-rich hedgerow with trees, associated with a bank or ditch	Monitoring to ensure target condition is met. Hedgerow surveys.	Y		Y		Y	Every five years
Waterbodies and associated plants LE 6.1 / non-priority ponds	Monitoring against the set objectives to ensure target condition is met.	Y		Y		Y	Every five years
Rivers and streams	Monitoring against the set objectives to ensure target condition is met and enhancement measures are effective. MoRPh surveys.	Y	Y				
Ditches	Monitoring against the set objectives to ensure target condition is met and channels are constructed as designed.	Y					

B.5.22. Fauna

B.5.22.1. A suite of pre-commencement species surveys will be undertaken by the PC prior to construction in order to update the existing survey data and inform the detail of the mitigation and compensation (relevant REAC ref: B24). The below sections will therefore be refined in subsequent iterations of the LEMP as these pre-commencement surveys progress. All pre-clearance works, vegetation clearance and subsequent works will take account of requirements in relevant licences.

Sensitive clearance of structures/vegetation

Bats

Relevant REAC ref: B1, B5, B25

B.5.22.2. Works which would impact on known or predicted bat roosts will be carried out under a Natural England EPS mitigation licence under supervision of a licensed ecologist and in accordance with the Method Statement agreed with Natural England. This will require avoidance of works between May and August (to avoid the breeding season) and December to February (to avoid the hibernation season).

B.5.22.3. Retained bat roosts will be protected through localised implementation of sensitive timing of works and acoustic barriers to reduce disturbance in key locations.

B.5.22.4. Demolition of structures or felling of trees with bat roost potential but where the likely absence of bats has been confirmed will be completed under a Precautionary Method of Works (PMW) under guidance from an appropriately licensed ECoW. The key sensitive periods above will also be avoided.

B.5.22.5. Trees with confirmed or potential bat roosts will be inspected by a licensed ecologist using an endoscope, or alternatively an emergence/re-entry survey will be undertaken immediately prior to the works to confirm the absence of bats. Trees will then be soft felled.

Dormice

Relevant REAC ref: B2, B5, B25

B.5.22.6. All clearance of habitat suitable for supporting dormice to the north east of the junction will be carried out under a Natural England EPS mitigation licence in accordance with the Method Statement agreed with Natural England. This will require a two-stage approach to vegetation clearance, with the first stage between November and March (inclusive) and the second stage in April/May. Arisings from the first stage of the habitat clearance will be used to create dead hedging to maintain connectivity.

B.5.22.7. Clearance of the most suitable dormouse habitat within the remainder of the Scheme, including the blocks of woodland and more extensive areas of scrub around the junction, will be carried under a PMW.

Badgers

Relevant REAC ref: B3, B5, B17, B25

B.5.22.8. A number of badger setts will be destroyed as a result of the Scheme and require closing under a Natural England licence. Any closure of badger setts will be undertaken in accordance with the timing (usually between 1 July and 30 November, except in exceptional circumstances) and methods specified by the licence for those activities and will be overseen by a suitably qualified and experienced ECoW. Monitoring will be required during and after sett closure to confirm that badgers have not regained access to the excluded setts.

B.5.22.9. A number of additional setts will be retained and protected, with buffer zones set out in the presence of the ECoW.

Nesting birds

Relevant REAC ref: B5, B25

B.5.22.10. In order to avoid destruction of active bird nests, clearance of suitable bird nesting habitat will be undertaken outside of the main bird nesting season (generally March to August inclusive in southern England) as far as possible. Any clearance during the nesting period will be preceded by a nesting bird check and overseen by an ECoW. In the event that active bird nests are found, an appropriate buffer zone will be established around the nest and clearance activities delayed within that zone until the nesting attempt has reached its natural conclusion.

B.5.22.11. In order to prevent disturbance of nesting Schedule 1 bird species (e.g. barn owl and kingfisher), it may be necessary to restrict construction activities in the vicinity of Schedule 1 bird nests while they are active.

Great crested newts

Relevant REAC ref: B4, B5, B25

B.5.22.12. All clearance of great crested newt habitat will be carried out under the District Level Licensing Scheme for great crested newt, which is run by NatureSpace in Gloucestershire.

B.5.22.13. Three conditions will apply to access the District Licensing option when (if) DCO is granted. These conditions are required to be included in the LEMP for submission to and approval by GCC (who hold the District (organisational) Licence (WML-OR138)), in order for the Council to authorise the development.

B.5.22.14. Condition 1 links the development consent and permitted impacts to the relevant District Licence (this requirement must be included in the LEMP or CEMP).

B.5.22.15. Condition 2 requires the developer to submit a NatureSpace certificate (obtained upon second-stage payment) to the Council before the development can be authorised under the District Licence (i.e. the certificate is presented to the planning authority as part of and prior to the LEMP approval process). NB: it is recommended that the developer obtains certification prior to LEMP submission, to avoid the need for this condition.

B.5.22.16. Condition 3 specifies the on-site compensation and mitigation measures: For the red zone locations within the site boundary, this would impose some on-site mitigation measures which would include best practice working methods, restrictions on timing to avoid sensitive periods (relating to hibernation features), fencing and trapping of newts within 250 m of ponds and use of capture methods at suitable habitat features prior to development (refer to the NatureSpace District Licence Report and associated figures).

B.5.22.17. The detailed application of Condition 3 to individual areas of land will be determined by the NatureSpace ecologist assigned to the project.

Migratory fish

Relevant REAC ref: B23

B.5.22.18. To mitigate the potential for disturbance/injury/mortality to migratory fish species present within the River Chelt, the following measures will be put in place by the PC and overseen by a suitably qualified and experienced ECoW:

- All haul roads, lay down areas and compounds will be located at least 10 m from watercourses, except where access is required to specific locations for works to bridges/culverts for example. Where possible, site tracking routes will be arranged to avoid watercourse margins to limit disturbance to watercourse riparian and bankside habitats and fish species.
- Soft start procedures will be implemented to gradually increase the sound/vibration intensity over a period of time. Soft start up methods will be employed on plant being used for any in-channel works and works within 20 m of the River Chelt, including

piling, at the start of each working day to ensure sudden disturbance to fish and other wildlife is minimised as far as practically possible. The soft-start duration should be a period of not less than 20 minutes and should piling cease for a period greater than 20 minutes, the soft start procedure will be repeated.

- Ten piles would be rotary bored on each side of the River Chelt as rotary piling results in less noise and vibration than percussive piling.
- Prior to any in-channel works or de-watering, measures shall be implemented that act to temporarily displace fish from the working area. Measures may include the removal of channel features from the working area that provide cover such as large wood to reduce the overall attractiveness of the working area for fish species. Such in channel features that provide cover will be replaced after the construction works.
- In the event that dewatering is required during the installation of bank protection, only part of the width of the channel will be dewatered. Therefore, continuity of flow and fish passage would be maintained at all times during construction. A fish rescue plan will be developed in consultation with the Environment Agency and Natural England and included in subsequent iterations of the LEMP, which may include the need to relocate lamprey ammocoetes prior to dewatering in order to reduce the potential for injury/mortality. The fish rescue plan will also include a requirement for an ecological watching brief.
- Appropriate screening of any pumping equipment during dewatering activities will be implemented (2 mm screens) to avoid any potential entrainment/mortality of fish during the works.
- Consider the use of temporary stop nets across the channel upstream of the works to prevent fish from becoming entrained in the working area.
- Where possible, works most likely to cause disturbance to migratory species in the River Chelt (i.e., the construction of the new bridge crossing and installation of bank protection associated with the crossing) will be timed to occur outside of the key ecologically sensitive periods for migratory fish species. Due to the range of species potentially present, it may not be practical to avoid all sensitive periods. However, based on the fisheries habitat provision at the crossing and confirmed species presence the migratory and/or spawning periods for European eel, river lamprey and sea/brown trout will be the focus of the timing consideration. February to July and October to November will be avoided as far as possible, as they are the key migratory periods for European eel31, which also avoids the spawning period for lamprey (March to April[32]), sea trout and Atlantic salmon (peaks in October to November). These periods will be confirmed through ongoing consultation with Natural England and the Environment Agency.
- Where works during migratory periods are unavoidable, no night-time (taken to be between 30 minutes prior to sunset until 30 minutes following sunrise) vibration work will be undertaken. If night working is essential, minimal and directional lighting will be used.

Other amphibians and reptiles

Relevant REAC ref: B5, B25.

B.5.22.19. Sensitive vegetation clearance will be required to avoid impacts to reptiles and amphibians. Habitat manipulation, hand and destructive searches will be undertaken as detailed in a PMW and under guidance from an ECoW.

[31] https://www.fishsec.org/2020/05/15/eel-migration-report-provides-insights-but-also-highlights-data-gaps/ [Accessed February 2024].
[32] Maitland, P. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000, Ecology Series No.5. English Nature, Peterborough.

Temporary and permanent features/structures

Alternative bat roost habitat

Relevant REAC ref: B14, B15.

B.5.22.20. Alternative bat roost habitat is required to be in place and functional prior to demolition of any buildings/felling of trees.

B.5.22.21. Two compensatory bat roost structures will be constructed, one north of the A4019 east of Uckington in the eastern quadrant, and one in the southern quadrant within the flood storage area. The design of these structures will be undertaken during detailed design, in accordance with the design parameters and agreed with Natural England. The locations of these are shown on the Environmental Masterplan (Application document TR010063/APP/2.13).

B.5.22.22. The location of the structure in the eastern quadrant has been selected because it is within a dark corridor along the A4019. This structure is located within the adjacent North-West Cheltenham Development Area (Elms Park). Careful consideration has been given to integrating this structure with this future development, and the location of the compensatory bat roost structure is adjacent to a retained hedgerow and within a dark corridor, as identified on the Elms Park masterplan. Landscape planting design includes a minimum of three large trees between the structure and the A4019 to provide a buffer from traffic so ensure that the structure is not lit above 0.2 lux. However, it is envisaged that the structure will require screening using fencing in the short term whilst vegetation establishes. This planting, the fencing and the structure itself will require maintenance / management.

B.5.22.23. One crevice dwelling bat structure will be constructed in the northern quadrant. The precise location and design of this structure will be determined during detailed design in accordance with the design parameters and agreed with Natural England.

B.5.22.24. A number of artificial bat boxes will be installed. The precise location of these will be determined during detailed design.

B.5.22.25. Six tree roosting features will be installed or created. The precise details and location of these will be determined during detailed design and agreed with Natural England.

Planting specifically for bats

Relevant REAC ref: B15.

B.5.22.26. Bat ‘hop-overs’ comprising tall (6 m) planting have been included within the landscape design at 11 strategic locations across the Scheme identified as bat crossing points as shown on the Environmental Masterplan (Application document TR010063/APP/2.13) to encourage bats to cross the road at a greater height. Additional planting within the central reservation is also included where feasible, to effectively create hop-overs over two lanes of traffic. Temporary features will likely be required in these locations while the planting establishes.

B.5.22.27. The landscape planting design incorporates linear planting parallel to the Link Road which will direct bats to the River Chelt, where bats can cross safely beneath the clear span bridge structure.

B.5.22.28. Landscape planting has been designed to guide bats into the Withybridge (A4019) Underpass and connect with suitable habitat to the north and south of the A4019. The entrance of the Withybridge (A4019) Underpass and the landscape planting approaching it must not be more than 0.2 lux to ensure that it is suitable for light averse species of bat. This will be achieved by fitting a bespoke back guard on the luminaire columns adjacent to the underpass. Furthermore, an additional structure will be installed extending over the entrance of the underpass. Without these additional measures the lux levels at the approaches to the underpass are 5 lux. Monitoring will be required to ensure that the required lux levels are achieved. Should 0.2 lux not be achieved, then additional measures will be implemented such as an alternative design to the bespoke back shield

or fencing to shield the underpass entrance and approach. This design refinement process will be continued until 0.2 lux is achieved.

B.5.22.29. Temporary installation of Heras fencing or dead hedging to protect flight lines when key commuting route vegetation is cleared and before new planting matures is required in two key locations: along the M5 north of the River Chelt, and along the River Chelt where the Link Road bridge is located. This will require maintenance / management.

Dormouse habitat/boxes

Relevant REAC ref: B11, B12.

B.5.22.30. A number of existing hedgerows will be enhanced for dormice and additional hedgerow, scrub and woodland habitat will be created. The habitat enhancement and creation of the new hedgerow perpendicular to the A4019 will be undertaken as advance works. The creation, management and monitoring of the habitats is discussed in the relevant habitat section above.

B.5.22.31. Dead hedging will maintain connectivity whilst the newly created habitats establish.

B.5.22.32. Nest boxes will be installed in a number of hedgerows (H48, HT18, H88 and H+WD2 (approximately five in each hedgerow)) during the hibernation period when the first stage of the two-stage vegetation clearance is commencing. These will provide immediate resting and nesting oppourtunites for dormice as new planting develops and once dormice emerge from hibernation.

Artificial badger setts

Relevant REAC ref: B16.

B.5.22.33. Closure of two main setts will require compensation by creation of two replacement artificial setts. The artificial setts are located within 100 m of the current setts, where there is access to existing foraging habitat, as shown on the Environmental Masterplan (Application document TR010063/APP/2.13). Artificial sett creation must take place and be ready for badger habitation ahead of badger exclusions and closure process. Monitoring of the artificial setts will be undertaken on a regular basis following their installation to ensure badgers have found the setts. Exclusion of the main setts will not be undertaken until it can be confirmed that badgers have found the respective artificial sett. Both artificial setts will be planted with a meadow mix and scrub to provide suitable habitat and cover for badgers.

B.5.22.34. Following closure of the main setts, the artificial setts will be checked twice annually throughout construction.

Otter

Relevant REAC ref: B21.

B.5.22.35. An otter ledge will be retrofitted within the existing River Chelt culvert beneath the M5, on the opposite side of the footbridge. Otters currently use the footbridge, but camera footage and observations have identified that it floods. Retro fitting an otter ledge will provide safe passage during times of flood. The design will follow DMRB guidance[33]. The ledge will be 500 mm wide, 150 mm above the highest water level and will allow for 600 mm headroom.

Bird boxes

Relevant REAC ref: B26.

B.5.22.36. Bird boxes will be erected to compensate for the loss of territory suitable for priority hole-nesting species. The precise location will be agreed during detailed design, but will include a minimum of ten nest boxes suitable for displaced hole-nesting species and at least one

[33] Design Manual for Roads and Bridges Nature Conservation Advice in Relation to Otters. Volume 10, Section 4, Part 4. HA 81/99. (February 2001). Online: https://cieem.net/wp-content/uploads/2019/07/ha8199.pdf [Accessed February 2024]

nest box specifically designed for tawny owl (such as that provided by Schwegler or the RSPB) erected in retained woodland at a height of approximately 4 m; and one grey wagtail box, which will be attached to the underside of a bridge on the River Chelt.

B.5.22.37. Enhancements for hole-nesting species of birds in the form of additional nest boxes will be provided on retained mature trees, ideally situated at least 50 m from the construction footprint, and preferably prior to the commencement of any works. The precise location and number of boxes to be provided will be agreed during detailed design, but all boxes will be located on suitable trees between 2 m and 4 m from ground level. The boxes will comprise 20 open-fronted and hole nest boxes made of 'woodcrete' and 'woodstone' and suitable for a range of species associated with woodland and residential areas, such as 1SP Schwegler Sparrow Terrace, 3S Schwegler Starling Nest Box, 1B Schwegler Nest Box and Barcelona Open Nest Box for example.

B.5.22.38. As an enhancement for barn owl, four barn owl boxes will be installed outside of 1.5 km of the Scheme boundary (and 1.5 km from any major road) following appropriate guidance[34].

B.5.22.39. Birds frequently occupy bat boxes, but this can be reduced by the installation of bird boxes close to bat boxes to reduce competition. Therefore, for each bat box installed, an equivalent number of bird boxes will be installed at the same location, where feasible. These boxes are in addition to those listed above.

Refugia

Relevant REAC ref: B7.

B.5.22.40. Natural refugia comprising log piles will be created for small mammals, reptiles and amphibians using cleared vegetation.

B.5.22.41. Unwanted logs from vegetation clearance and stones from ground works will be used to create piles close to newly created waterbodies, which comprise six attenuation basins as well as wetland areas within the flood storage area. Split logs, dead wood, rocks and bricks, loosely filled with topsoil on a gentle slope provide a good refuge and hibernaculum for great crested newts. Careful consideration of placement and design to maximise use and prevent possible flooding, drying out and aesthetic complaints from the public will be necessary. These details will be addressed during detailed design.

Underpasses

Relevant REAC ref: B18, B19.

B.5.22.42. The Withybridge (A4019) underpass will be constructed underneath the A4019 east of Junction 10. This is a large underpass (5 m wide and 4 m high). This will provide mitigation for bats that cross the existing A4019 to the east of the M5, providing a traffic free route for the bats across this road. The Withybridge (A4019) underpass will also provide traffic free access for pedestrians and equestrians across the A4019. Low level lighting will be provided through the underpass, with the lights switched off between sunset and sunrise.

B.5.22.43. The underpass will also allow safe movement of other mammal species, reptiles and amphibians across the A4019 in this location.

B.5.22.44. As described in paragraph B.5.22.28, light levels will be maintained at no more than 0.2 lux at the entrances to the underpass.

B.5.22.45. The following additional underpasses are proposed which will allow safe movement of badgers and otters, as well as other mammals, reptiles and amphibians across the Scheme:

B.5.22.46. To the south of the River Chelt, within 50 m of the watercourse, designed specifically for otters but with the capacity to be used by other species. The design will follow DMRB guidance[33], and will comprise a 900 mm pipe located above possible flood levels.

[34] Such as The Barn Owl Trust (2012) Barn Owl Conservation Handbook. Pelagic Publishing, Exeter.

B.5.22.47. An additional two underpasses are included along the Link Road (one north of the River Chelt and one to the south) at existing hedgerows where badger activity has been identified, designed for use by badger, as well as other mammals, reptiles and amphibians. The design will follow DMRB guidance[35], and will comprise at least 600 mm pipes. The approaches will be 'softened' with appropriate planting.

- In addition, a series of flood relief structures are incorporated underneath the Link Road (Work No. 5(l) and (m)). These are located to the north of the River Chelt and will also function as underpasses for badgers and other species. A ledge has been incorporated in the northern-most culvert to enable use by badgers and otters during flood conditions.

Fencing

Relevant REAC ref: B20.

B.5.22.48. Mammal proof fencing will be installed to direct mammals into the underpasses and prevent them from accessing the carriageway. Fencing design will follow DMRB guidance[35] and will comprise chain link or welded mesh fencing attached to wooden post and rail fences using heavy duty staples.

B.5.22.49. As a minimum standard, this will be at least 1 m high above ground with a lower section of 600 mm buried below ground, 300 mm down into the soil and a further 300 mm turned away from the fence in the direction from which badgers will approach. Where necessary (within 100 m of the River Chelt) badger and otter fencing can be combined, by adding a 300 mm mesh overhang at the top of the fence, angled away from the road.

B.5.22.50. Planting will guide animals to safe crossing locations.

Post-construction monitoring and maintenance

Bats

Relevant REAC ref: B1.

B.5.22.51. The compensatory bat roost structures, bat boxes and tree features will be inspected annually in March for ten years. Any damaged or missing boxes/roost provisions will be replaced with the same or similar versions, as available, that are suitable for the bat species concerned. Any issues will be resolved.

B.5.22.52. Population monitoring of the compensatory bat roost structures, bat boxes and tree features will be undertaken in accordance with the Method Statement that will form part of the final EPS mitigation licence submitted post DCO consent, which will be agreed with Natural England. This will include a presence/absence survey of these features between May and August in year two post development. The maternity boxes will be surveyed between June and August. A static bat detector will be deployed for at least two weeks in the hibernation features within the compensatory bat roost structures between December and February.

B.5.22.53. In addition, further monitoring of lux levels and crossing point features/locations may also be necessary and appropriate and will be agreed with Natural England.

Dormouse

Relevant REAC ref: B2.

B.5.22.54. Post-construction monitoring of the dormouse population will be undertaken in accordance with the Method Statement that will form part of the final EPS mitigation licence submitted post DCO consent, which will be agreed with Natural England. This will

[35] Design Manual for Roads and Bridges Mitigating against effects on badgers. Volume 10, Section 4, Part 2.HA 59/92. (February 2001). Online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/351478/Design_manual_for_roads_and_bridges_--_mitigating_against_effects_on_badgers.pdf [Accessed February 2024]

include three nest box monitoring visits each monitoring year in February/March (to clean and repair or replace dormouse nest boxes), in May/June (pre-breeding) and September/October (post-breeding), for a period of five years following completion of development within the dormouse licence area.

Otter

B.5.22.55. A five-year maintenance period is proposed during which time the otter ledge will be checked (once a year) and any damage will be rectified.

B.5.22.56. A strategy for monitoring otter use of the ledge will be agreed during detailed design.

Bird boxes

B.5.22.57. A five-year maintenance period is proposed during which time the bird boxes will be checked (once a year) and any damaged or lost bird boxes will be replaced.

Refugia

B.5.22.58. A five-year maintenance period is proposed during which time the refugia will be checked (once a year) and any damage will be rectified.

Underpasses and fencing

B.5.22.59. A five-year maintenance period is proposed during which time the underpasses and fencing will be checked (once a year) and any damage will be rectified.

B.5.22.60. Specific details of post-construction monitoring for bats of the Withybridge (A4019) will be agreed with Natural England but will likely include monitoring of this structure for use by bats for approximately five years post-construction.

Overview of species monitoring

B.5.22.61. An overview of the post-construction monitoring for species is presented in the table below. Any monitoring required for temporary features that may need to be maintained into the post-construction phase is also included.

Table B 5-7 Post-construction monitoring for species

Feature	Task	Year after completion of construction									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Compensatory bat roost structures, bat boxes and tree features	Annual inspection in March	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Compensatory bat roost structures, bat boxes and tree features	Presence/absence surveys		Y								
Lux levels around the compensatory bat roost structures and at the entrances to the entrances of the Withybridge (A4019) Underpass	In year 1, subsequent monitoring to be confirmed	Y									

Feature	Task	Year after completion of construction									
Bat crossing point features, including Withybridge (A4019) Underpass	To be confirmed with Natural England	Y	Y	Y	Y	Y					
Dormouse boxes	Monitoring (February/March, May/June and September/October each year)	Y	Y	Y	Y	Y					
Heras fencing/dead hedging/temporary features installed whilst planting matures for bats and dormice	Monitor new planting and remove temporary features when new planting is functional	Y	Y	Y	Y	Y					
Otter ledge	Annual inspection. Specific otter monitoring to be confirmed	Y	Y	Y	Y	Y					
Bird boxes	Annual inspection	Y	Y	Y	Y	Y					
Refugia	Annual inspection	Y	Y	Y	Y	Y					
Underpasses	Annual inspection	Y	Y	Y	Y	Y					
Fencing	Annual inspection	Y	Y	Y	Y	Y					

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