

## **Appendix A**

### **Summary of ecological mitigation commitments**

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
<b>Biodiversity – general measures</b>							
Project -wide	Biodiversity	Construction	General measures	Pollution prevention	Control measures to reduce damage and disturbance arising from dust, lighting, noise, vibration and ground compaction will be implemented during the construction phase. This will include dust suppression methods, lighting measures and control measures for vehicles.	As required	Application of the Code of Construction Practice (CoCP)
Project -wide	Biodiversity	Construction	General measures	Protection of ecological features	Where land take is temporarily required for construction, construction exclusion zones will be incorporated including all sensitive retained features including (but not limited to) ponds, mature trees, watercourses and designated sites. Entry into these areas will be prevented using appropriate fencing and signage.	As required	Application of the CoCP
Project -wide	Biodiversity	Construction	General measures	Protection of ecological features	Ecological Clerks of Works (ECoW) shall be appointed throughout duration of the construction period. They will be responsible for providing technical advice and site assurance of accordance Licence and Precautionary Method of Working requirements.	As required	Application of the CoCP
Project -wide	Biodiversity	Construction	General measures	Protection of fauna	All excavations will be covered overnight. If this is not reasonably practicable, an exit ramp will be provided from exposed trenches or holes.	As required	Application of the CoCP and relevant species licence / Precautionary Method of Working
<b>Designated sites, terrestrial habitats and flora</b>							
Project -wide	Biodiversity	Construction	Habitat loss	Habitat creation / reinstatement	Several Ecological Compensation Sites (ECS) are located along the length of EWR2 adjacent to the railway line. Each ECS has been designed to incorporate a mosaic of terrestrial and aquatic habitats including scrub, wildflower meadow, hedgerow and ponds. Wherever reasonably practicable, subject to landowner negotiation, the	All ECS sites All temporary working area	Project design Application of the CoCP

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Project-wide	Biodiversity	Construction Operation	Habitat loss	Management of created habitat	<p>ECSs will be created in advance of the construction of that section of EWR2 to allow compensatory habitats to establish. Details for each ECS are provided in Appendix 9.13 v2 (in Part II of the FEI).</p> <p>Construction has commenced on the following ECS: A3, A4, A5, A7, B2, B5, B7 and B13.</p> <p>Following completion of the main construction works, a network of hedgerows and other linear planting (scrub and trees) will be planted along the length of the operational railway within the Scheme Area (where reasonably practicable), as detailed on the Environmental Design Drawings in Volume 4 of the ES.</p> <p>Habitat loss and gain for EWR2 is set out in Appendix 9.16 v2 (Part II of the FEI).</p> <p>Each Ecological Compensation Site will be subject to a 30-year maintenance and management plan as part of a legal agreement between NR and the landowner. The habitats created will be subject to appropriate maintenance and monitoring to ensure they remain suitable for a range of species.</p> <p>Ecological management and monitoring plan as outlined in Appendix 9.13 v2 (in Part II of the FEI).</p>	At ECS sites	Application of the CoCP
2B	Railway Bank by Salden Wood LWS	Construction	Habitat loss / effect on LWS	Habitat translocation, reinstatement and creation	<p>Railway Bank by Salden Wood LWS</p> <p>The calcareous grassland turves within the existing track bed, which contain a high species diversity including spiny retharrow (uncommon in Buckinghamshire), will be translocated into ECS B14 (methodology for translocation detailed in Appendix 9.13 v2 in Part II of the FEI).</p> <p>The habitats along northern and southern embankment lost during the construction phase, will be reinstated to neutral grassland to maintain connectivity along the Scheme Area between ECS B14 and the railway corridor (see Appendix 12.4, Volume 3 of the ES).</p>	Within footprint of Railway Bank by Salden Wood LWS and ECS B14	Included within EWR2 design. Management of the ECSs will follow each ECS management plan

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2B	Salden Wood LWS	Construction and operation	Risk of indirect impacts from new / replacement access road	Protection of woodland	As part of detailed design, buffer strips will be created between the new access road and the edge of Salden Wood to protect the edge of the ancient woodland. These will be planted with native species (scrub on the south west edge and woodland and scrub on the southern edge), with species limited to those already present in the ancient woodland.	Land to the south and south west of Salden Wood LWS	Included within EWR2 design. Application of the CoCP.
2E	Waddesdon Station Complex LWS	Construction	Habitat loss / effect on LWS	Habitat translocation reinstatement and creation	Waddesdon Station Complex LWS The species-rich grassland turves which contain a high species diversity including the fine-leaved sandwort, will be translocated into ECS E3 (methodology for translocation detailed in Appendix 9.13 v2 in Part II of the FEI). Following the completion of construction, the habitats along the eastern railway embankment will be reinstated to neutral grassland and scrub to maintain connectivity along the Scheme Area between ECS E1, Waddesdon Common LWS and Sunny Hill Farm LWS (see Appendix 12.4, Volume 3 of the ES and the Environmental Design Drawings, Volume 4 of the ES).	Within footprint of Waddesdon Station Complex LWS and ECS E3	Included within EWR2 design. Management of the ECSs will follow each ECS management plan
2B	Woodland south of Horwood House	Construction	Loss of woodland	Habitat creation, translocation of soil	As part of detailed design, a sensitive working method and corridor will be established to minimise loss of trees or ground flora within the woodland with ancient characteristics and avoid any incursion into woodland outside the working corridor. The soils of this woodland, along with tree and coppice stumps, and protected and notable ground flora, will be translocated within ESC B14, B17, ECS B20 or B23 at the start of construction, where practicable. In addition, trees will be planted within the translocated woodland soils to speed up establishment time of woodland (see Appendix 9.13 v2 in Part II of the FEI).	ECS B14 ECS B17 ECS B20 ECS B23	Included within EWR2 design. Management of the ECSs will follow each ECS management plan
Project-wide	Veteran trees and black poplar	Construction	Loss of trees	Protected and retention of trees,	Veteran trees and native black poplars that fall within the Scheme Area have been identified for retention; during detailed design all reasonably practical efforts	Various locations ECS as	Included within EWR2 design. Management of the

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				replanting	will be made for their retention and their root protection zone. It is not possible to replace veteran trees with new planting. However, planting young trees of similar species to the veteran trees that will be lost will be undertaken with ECS to help compensate for the potential loss of these trees. Where a native black poplar is unavoidably lost within the Scheme Area, 2:1 replanting will occur. The new trees to be planted to compensate for veteran tree and native black poplar loss will be located in the nearest ECS to where the loss occurs. Also, the intact hulks of the veteran trees and native black poplars will be felled and relocated ECS in close proximity to a nearby veteran tree, woodland or parkland area.	required	ECSs will follow each ECS management plan

#### Aquatic habitat and associated aquatic species

Project-wide	Aquatic habitats and associated species	Construction	Disturbance / temporary loss of habitat	Pollution / prevention of damage to habitat	Noise, vibration and light spill will be reduced by working back from the watercourses where reasonably practicable. Construction lighting will be angled away from the watercourse to reduce the potential for disturbance. Where reasonably practicable, percussive (hammer) piling shall be avoided in favour of softer alternatives (e.g. silent sheet piling, vibratory sheet piling). Where this is not reasonably practicable, soft start piling procedures will be used to provide time for fish to move away from the source of disturbance prior to full exposure.  Required in-channel working will be undertaken during low flow periods (i.e. when flows are at or below the mean average) as far as reasonably practicable to reduce the potential for sediment release and risk of scour, and using appropriate methods to reduce the risk of pollution.  As far as reasonably practicable, vegetation clearance from watercourse banks and riparian zones required to facilitate construction works (e.g.	Project-wide	Application of the CoCP
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Project-wide	Aquatic habitats and associated species	Construction	Effects on fish	Method of working	<p>culvert extensions) will be undertaken in an ecologically sensitive manner (i.e. through the avoidance of whole-scale removal of trees, shrubs and their roots, to encourage regrowth).</p> <p>Where watercourses require permanent/temporary dewatering and/or overpumping to permit construction activities, fish will be removed by means of electrofishing and relocated to a suitable location prior to dewatering. Water flow/passage will be sufficiently maintained as to not result in the drying of habitats downstream of crossing locations.</p>	Project-wide as required	Application of the CoCP
Project-wide	Aquatic habitats - linear aquatic features	Construction	Loss of 85.8 m of open watercourse across all route sections	Habitat creation, reinstatement and improvement	<p>Watercourse habitat creation and enhancement works include:</p> <p>Route Section 2A</p> <ul style="list-style-type: none"> <li>Creation of 50m backwater channel on the Langford Brook (AF006).</li> <li>Improvements to watercourse habitats associated with the 300 m realignment of the unnamed tributary of Launton Brook (AF041) and the realignment of Cutters Brook (AF069) to facilitate an offline culvert replacement.</li> </ul> <p>Route Section 2B</p> <ul style="list-style-type: none"> <li>Creation of 190 m wet ditch habitat in ECS B7.</li> <li>Improvements to watercourse habitats associated with the 180 m realignment of the unnamed tributary of Horwood Brook (AF245) and the realignment of the unnamed tributary of Claydon Brook (AF200) to facilitate an offline culvert replacement.</li> <li>Realignment of approximately 100 m of the Horwood Brook (AF229). The realignment design will act to improve habitat conditions over the current situation through ecological sensitive design including the use of existing channel lengths as backwater habitats. Alongside the design mitigation for realignment</li> </ul>	ECS A1, ECS B7, ECS D4 All locations of all realignment and temporary works	Project design Application of the CoCP

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2A	Aquatic habitats - ponds	Construction	8 pond losses (6 complete loss and 2 partial loss)  Complete losses reported for: AF048; AF051; AF059; AF097; AF105 and AF121 Partial losses reported for: AF030 and	Creation of 19 ponds	works, provision will be made to retain and translocate any native aquatic plants and gravels to the realignment channel to accelerate the process of establishment. Route Section 2D <ul style="list-style-type: none"> <li>Implementation of watercourse habitat improvement works along 540 m of the Elstow Brook (AF511) in ECS D4 (to include backwater creation, in-channel gravel addition to create riffles and marginal planting),</li> <li>Improvements to watercourse habitats associated the realignment of 190 m of the Caldecotte Brook (AF349) and 90 m the unnamed tributary of Elstow Brook (AF463).</li> </ul> Route Section 2E <ul style="list-style-type: none"> <li>Incorporation of ditches into the Route Section 2E ECS at a rate equal to, or greater than, the reported permanent open channel losses in 2E of 53 m.</li> <li>Improvements to watercourse habitats associated the 69 m realignment of an unnamed ditch (AF665).</li> </ul> Development of translocation strategies for AF051 and AF059 to mitigate for loss of notable aquatic macroinvertebrate species.  Plus potential inclusion of translocation strategies for any notable assemblages present in AF048 and AF121 should survey programmed for summer 2019 identify a requirement for additional mitigation.	19 ponds created across ECS A3, ECS A4, ECS A5, ECS A7. Plus the construction of further ponds within ECS A6 (number to be confirmed) will take place following the	Project design Application of the CoCP

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2B	Aquatic habitats - ponds	Construction	4 pond losses (2 complete loss and 2 partial loss) Complete losses reported for: AF244 and AF292 Partial losses reported for: AF167 and AF284	Creation of 4 ponds	2 ponds ECS B7 and 2 ponds ECS B13 created summer 2018  Plus potential inclusion of translocation strategies for any notable assemblages present in AF284 and AF292 should survey programmed for summer 2019 identify a requirement for additional mitigation.	TWAO. ECS B7, ECS B13	Project design Application of the CoCP
2D	Aquatic habitats - ponds	Construction	1 pond loss (1 complete loss) Complete losses reported for: AF406	Creation of ponds	At a minimum of a 1 to 1 for reported losses	ECS D1, ECS D2	Project design Application of the CoCP
2E	Aquatic habitats - ponds	Construction	1 pond loss (1 complete loss) Complete losses reported for: AF406	Creation of ponds	At a minimum of a 1 to 1 for reported losses Development of a translocation strategy for AF406 to mitigate for loss of notable aquatic macroinvertebrate species.	To be determined	Project design Application of the CoCP
<b>Otter</b>							
Project-wide	Otter	Construction	Potential effects on otter	Pre-construction surveys	Pre-construction surveys will be carried out on relevant aquatic features to update existing information or gather information for aquatic features not previously accessible.	As required	Application of the CoCP
2B	Otter resting sites	Construction	Potential loss of resting site at Claydon Brook (AF184) and disturbance of resting site at	Creation of artificial holts	Artificial otter holt at ECS B5 (constructed in 2018) will provide a new artificial holt on the Claydon Brook approximately 380 m north of the existing holt on the same watercourse. An artificial holt will also be created at C1, on Water Eaton Brook to provide alternative resting site to the potential resting site	ECS B5 ECS C1	Species/location specific measures will be implemented through application of the CoCP, in accordance with the



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Project-wide	Otter resting site	Construction	Water Eaton Brook (AF286) Loss of holts or resting sites	Creation of artificial holt	recorded on that water course.  If an otter resting site is found during updated survey work prior to or during construction and it cannot be retained, an artificial holt will be provided in advance of any closure (if closure is deemed to be required) of the existing holt on the same watercourse network at least 100 m from any construction activity. Ideally the artificial holt will be constructed in one of the ECS, but this may not be possible as many of the ECS do not contain watercourses suitable for otter. Where this is the case, the location of the artificial holt will be finalised with landowners through legal agreement to confirm that the mitigation can be delivered in order to get a licence from Natural England.  Whilst no resting sites have been recorded in the construction area of Route Section 2A, ECS A1 will include the installation of an artificial otter holt to compensate for the temporary loss of potentially suitable resting sites as a result of localised clearance of riparian cover which may include potential resting site features.	As required in line with description	relevant protected species licences.  Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
Project-wide	Otter resting sites	Construction	Disturbance of otter. Resting sites located within 100 m of the Scheme Boundary at: Water Eaton Brook (AF286) Langford Brook (AF006) Lake near Woburn Sands (AF364)	Avoiding and minimising disturbance	Where otter holts are present within 100 m of the Scheme Boundary but will not be directly lost, an assessment of the likelihood of disturbance of each holt will be made. Where a holt is being used for breeding, works within 100 m of the holt which are likely to disturb otters present will be postponed until breeding activity has ceased. Once breeding activity has ceased, the works in that area will be completed under licence from Natural England, as the otter(s) may still be present post breeding activity.  Where a shelter or non-breeding holt is recorded (including those breeding holts where breeding activity has ceased), a 30 m exclusion zone will be implemented around the holt during all works. If this is not possible, a licence will be obtained from	As required in line with description	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.

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			A further two resting sites located on Langford Brook (AF006) are over 100m from the Scheme Boundary		Natural England to either retain and disturb the shelter/holt, or temporarily or permanently close the shelter/holt if this is the least disturbing activity for the otter(s) concerned. Where permanent closure of a holt is required this will be compensated for with an artificial holt as detailed above. Where a shelter or non-breeding holt is recorded (including those breeding holts detailed above where breeding activity has ceased), a 30 m exclusion zone will be implemented around the holt during all works. If this is not possible, a licence will be obtained from Natural England to either retain and disturb the shelter/holt, or temporarily or permanently close the shelter/holt if this is the least disturbing activity for the otter(s) concerned. Where permanent closure of a holt is required this will be compensated for with an artificial holt as detailed above.		
Project-wide	Otter	Construction	Risk of injury to otter	Otter proof fencing	The need for specific additional measures such as temporary otter proof fencing during any higher risk construction operations (e.g. access routes) will be assessed on a case by case basis and employed where deemed necessary and appropriate to reduce the risk of otter mortality.	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
Project-wide	Otter	Construction	Fragmentation/disturbance of dispersal and foraging routes	Protection of dispersal /foraging routes	To prevent habitat fragmentation during construction, continued passage of otter through construction sites when they are not active will be facilitated, as detailed further in Appendix 9.13 v2 (in Part II of the FEI).	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
2A 2B 2E	Otter	Operation	Risk of injury during spate events	Mammal ledges / mammal passes	Where otter passage is deemed likely to be compromised during spate events, measures to ensure safe mammal passage have been incorporated in the embedded environmental design	2A: Langford Brook (AF006), Launton	Project design Appendix 9.13 v2

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					<p>The provision of safe passage is currently undergoing detailed design but will comprise either a mammal ledge on the associated watercourse structure or where other design requirements do not allow this, an appropriately positioned offline dry mammal pass feature (e.g. dry pipe) which is accessible and unaffected during spate conditions (typically located within 50 m and not more than 100 m from the watercourse) will be provided. Mammal ledge designs would be positioned above the flow conditions of a 100-year flood event.</p> <p>Where such features are provided, the requirement for other proof fencing to encourage safe use of the features will be determined during detailed design. Such fencing and mitigation will follow the specifications within the Design Manual for Roads and Bridges (DMRB) guidance</p>	<p>Brook (AF040) 2B: Padbury Brook (AF172), Unnamed tributary of Loughton Brook (AF281), Unnamed tributary of Horwood, Brook (AF259) 2E: Two unnamed tributaries of Fleet Marston Brook (AF664 and AF676)</p>	
<b>Water vole</b>							
Project-wide	Water vole	Construction	Habitat loss / disturbance	Pre-construction survey	No evidence of water vole has been found on aquatic features accessible for survey. Pre-construction surveys will be carried out on relevant aquatic features to update existing information or gather information for aquatic features not previously accessible.	As required	Application of the CoCP
Project-wide	Water vole	Construction	Habitat loss / disturbance	Methods of working	<p>Where surveys (including pre-construction surveys) find water vole to be absent, construction activities will be carried out under a Precautionary Method of Working.</p> <p>Where pre-construction surveys find water vole are present, mitigation measures will be employed to avoid or minimise the risk of disturbance, harm or mortality and habitat fragmentation for water vole during construction. In summary these measures</p>	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences (if required).

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					<p>include exclusion zones for working near watercourses or water bodies, limiting use of artificial lighting in proximity to watercourses or water bodies, and supervision of works by an ECoW to monitor likely disturbance.</p> <p>Where water voles are present on a given watercourse or waterbody which will be subject to direct loss of habitat, where practicable to do so areas of highest population density will be avoided.</p> <p>Where avoidance is not practicable, the appropriateness of temporary displacement of water vole under Natural England class licence into adjacent habitat unaffected by EWR2 will be assessed.</p> <p>Where displacement is not reasonably practicable, trapping and translocation of individuals (or the population should it be warranted) will be undertaken. Translocation of water vole would be undertaken under licence from Natural England.</p> <p>Where this is the case, the location of the receptor site for water vole will be finalised with landowners through legal agreement to confirm that the mitigation can be delivered in order to get a licence from Natural England.</p>		
Project -wide	Water vole	Construction	Habitat fragmentation	Protection / avoidance of habitat	To prevent habitat fragmentation during construction, continued passage of water voles through construction sites when they aren't active will be facilitated, as detailed further in Appendix 9.13 v2 (in Part II of the FEI).	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
<b>Badger</b>							
Project -wide	Badger	Construction	Damage to setts	Pre-construction survey	As badgers can excavate setts at any time of the year, regular checks will be made prior to and during construction works to record any new setts and to determine the most appropriate course of action to	As required	Specific measures will be implemented through application of the CoCP, in

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					implement for any impacts to such setts, including retention and disturbance of the sett or closure of the sett.		accordance with the relevant protected species licences.
Project-wide	Badger	Construction	Disturbance	Exclusion zone/ monitoring	Measures to reduce the disturbance of retained setts within 50m of EWR2 boundary will be implemented. This will include regular monitoring by ecologists and remote cameras, temporary screening or limiting disturbing activities near the sett as land access allows. The need or otherwise for such measures will be determined on a sett by sett basis as part of a detailed mitigation strategy for badger.	As required	Specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
Project-wide	Badger	Construction	Damage to setts/ harm to individual badgers	Methods of working	Measures to maintain badger welfare will be followed during construction including maintaining fencing to exclude badgers from working areas, covering of open excavations at the end of a shift or inclusion of a means for escape and regular checks for trapped badgers at the start of a shift.	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
2A	Badger	Construction	Damage to setts	Artificial setts pre-construction	There are 10 main setts to be lost along route section 2A. At least 10 artificial setts will be created to mitigate the loss of main setts. Where early land access agreements can be made, artificial setts will be created pre-construction (such as within ECS created in advance of construction). Note: number of main setts may change due to upcoming surveys in 2019.	As required within 100m of existing main sett within known territory.	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
2B	Badger	Construction	Damage to setts	Artificial setts pre-construction	There are 13 main setts to be lost along route section 2B. At least 13 artificial setts will be created to mitigate the loss of main setts. Where early land access agreements can be made artificial setts will be created pre-construction (such as within ECS created in advance of construction). Note: number of main setts may change due to upcoming surveys in 2019.	As required within 100m of existing main sett within known territory.	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.

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Project-wide	Effect on badgers	Construction	Damage to setts	Sett closure	<p>There is currently a total of 116 badger setts within the Scheme Boundary (excluding HS2 Interface and 2E ballast up). Most existing setts within the Scheme Boundary will be lost due to construction. Setts will be closed in accordance with a Natural England licence.</p> <p>Note: number of setts may change due to upcoming surveys in 2019.</p>	As required	Application of the CoCP and in line with relevant licence.
<b>Bats</b>							
Project-wide	Roosting bats - trees	Construction	Damage or destruction of tree roosts	Pre-construction survey / replacement roosting features / measures to protect bats during	<p>Damage or destruction of bat roosts will be avoided wherever practicable by retaining the roosts with an appropriate buffer.</p> <p>As tree roosts can be transient in nature, trees with potential for bats that require removal will be climbed by licensed bat workers (providing that they consider that it is safe to do so) to enable the potential bat roosting features (PRFs) to be inspected with an endoscope. Subject to felling being covered by the licence, if a bat is found to be present it will be relocated if practicable to the agreed receptor location, as agreed in the mitigation licence, by a licensed bat worker. If it is not practicable to remove the bat, an exclusion device will be fitted prior to repeat inspection and subsequent felling. The tree will be felled in sections under the supervision of a licensed bat worker, with lowering of individual limbs to the ground for inspection. All felled timber will be inspected for the presence of bats and any unsound timber will be left on site overnight to enable any undiscovered bats to disperse.</p> <p>Where practicable to do so, dependent upon the proximity to one of the ECS or landowner agreements, tree roost features would be retained by strapping the felled section to a retained mature tree. Additional roosting opportunities would be provided</p>	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.

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Project -wide	Roosting bats - structures	Construction	Damage or destruction of roosts	Protection of roost / replacement roosting features / measures to protect bats during works	<p>in bat boxes.</p> <p>Damage or destruction of bat roosts will be avoided wherever practicable by retaining the roosts with an appropriate buffer. Where impacts to bats cannot be avoided, works will be carried out sensitively under a bat mitigation licence from Natural England. Where damage or destruction of a bat roost is unavoidable, alternative roosting opportunities will be provided specific to the species present and roost status to ensure that the favourable conservation status of the bat species is not adversely affected. Measures would also include sensitive working practices and timing to protect individual bats from killing or injury. Full details of the bat mitigation licence, including detailed mitigation requirements, will be agreed in liaison with Natural England to ensure that the favourable conservation status of local bat populations is maintained.</p> <p>Any structures (e.g. bridges or retaining walls) that require works will undergo a dusk emergence and / or dawn return survey is undertaken (weather permitting), followed by a detailed endoscopic inspection of PRFs. Subject to works being covered by the licence, any bats found will be relocated to the agreed receptor location, as determined by the licence. If this isn't practicable, a process of exclusion of bats and closure of the roost will be undertaken.</p>	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
Project -wide	Roosting bats - unknown roosts	Construction	Damage or destruction of roosts	Pre-construction survey / replacement roosting features	<p>All trees and structures that are to be damaged or lost during construction will be revised and assessed by a licensed bat ecologist to determine their roosting potential.</p> <p>Further survey work will be undertaken in accordance with the latest BCT guidelines, and a licence obtained / measures under mitigation licence followed as appropriate if a roost is confirmed.</p> <p>For trees with potential for bats but no confirmed</p>	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.

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Project-wide	Roosting bats – all known / unknown roosts	Construction	Disturbance of roosting bats	Protection of roost / avoidance measures	<p>roosts following the surveys, works will be carried out under a Precautionary Method of Working.</p> <p>Disturbance to roosting bats will be minimised where practicable through timing of works on a case by case to when bats are unlikely to be present in roosts, or when they are least susceptible to such impacts (i.e. outside of the breeding and hibernation periods).</p> <p>Any lighting will be low-level and directional to avoid illumination of retained habitats. Where lighting is required in proximity to known commuting corridors and foraging areas, baffles will be installed to reduce light spillage.</p> <p>Where disturbance of a bat roost is unavoidable and would constitute a licensable activity, works will be carried out under a bat mitigation licence from Natural England, which will include providing alternative roosting locations as detailed above, if required.</p>	As required	Species/location specific measures will be implemented through application of the CoCP.
2A	Roosting bats – known roosts	Construction	Damage or destruction of roosts	N/A	No known roosts are to be lost. Therefore, no mitigation to compensate for roosts is currently proposed.	As required	Species/location specific measures will be implemented through application of the CoCP.
2A	Roosting bats – unknown roosts	Construction	Damage or destruction of roosts	Pre-construction surveys	<p>Seven bridges with bat roosting potential are located within Route Section 2A:</p> <ul style="list-style-type: none"> <li>• OXD 29 – Low potential – Repairs</li> <li>• OXD 30 – Moderate potential – Repairs</li> <li>• OXD 31 – Moderate potential – Partial Demolition</li> <li>• OXD 32 – Low potential – Partial Demolition</li> <li>• OXD 33 – Low potential – Demolition</li> <li>• OXD 34 – Moderate potential – Repairs</li> <li>• OXD 35 – High potential – Repairs</li> </ul>	As required	Species/location specific measures will be implemented through application of the CoCP.



Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
2A	Roosting bats – known roosts	Construction	Disturbance (≤100 m from Scheme Boundary)	N/A	<ul style="list-style-type: none"> <li>OXD/36 – Low potential – Repairs</li> </ul> <p>The above bridges have been fully surveyed (apart from a single hibernation survey that is still outstanding for OXD 29). Providing that no roosts are confirmed in the outstanding hibernation survey, it is intended that works to these bridges will be carried out under a Precautionary Method of Working. This will depend on the time that elapses before works, and the licenced ecologist will determine whether update surveys are required.</p> <p>Two buildings (EWR2_BU_21688 (424.1_BS1_01) and EWR2_BU_77213) are located within the Scheme Boundary and are likely to be demolished. These buildings could contain roosts of up to moderate conservation significance<sup>1</sup>, on a precautionary basis, but are unlikely to support maternity or hibernation roosts of the rarest species based on the age and structure of the buildings. Further survey work will be undertaken in accordance with BCT guidelines (Collins, 2016). Where bat roosts are confirmed, mitigation will be implemented in accordance with “Project-wide: Roosting bats – structures: Damage or destruction of roosts” above.</p> <p>Mature and semi-mature trees are located within the Scheme Boundary and may be lost to facilitate works. See “Project-wide: Roosting bats – trees: Damage or destruction of roosts” above for more information.</p>	As required	Species/location specific measures will be implemented through application of the CoCP.
					<p>Seven bat roosts are located between &gt;0m and 100m of the Scheme Boundary;</p> <ul style="list-style-type: none"> <li>OXD/36a (bridge, 30m W): common (2) and soprano (1) day roost;</li> <li>174.2_BS_F001 (building, 2m SSE): common</li> </ul>		

<sup>1</sup> Barbastelle and Bechstein's bats favour tree roosts within established woodland, although barbastelle are occasionally found in old buildings. Due to the nature of the buildings present within the Scheme Area, neither of these species are likely to be present within buildings or bridges within the Scheme Area.

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					<p>pipistrelle day roost;</p> <ul style="list-style-type: none"> <li>439.3_BS_F002 (building, 100m S): unknown sp. bat roost;</li> <li>540.1_BS_F001 (building, 15m SE): common pipistrelle day roost (potential maternity based on desk study information);</li> <li>682.1_BS_F001 (building, 57m S): barbastelle day roost and brown long-eared bat maternity roost;</li> <li>82.1_BT_F002 (tree, 30m N): Brandt's bat (potential) maternity roost;</li> <li>173.5_BT_F013 (tree, 92m N): common pipistrelle day roost.</li> </ul> <p>See "Project Wide: Roosting bats – all known / unknown roosts: Disturbance" above for mitigation information.</p>		
2A	Roosting bats – unknown roosts	Construction	Disturbance (≤100 m from Scheme Boundary)	N/A	<p>If further survey work finds additional roosts, these will be protected following the information provided in "Project Wide: Roosting bats – all known / unknown roosts: Disturbance" above.</p>	As required	Species/location specific measures will be implemented through application of the CoCP.
2B	Roosting bats – known roosts	Construction	Loss of roost at Swanbourne Station House	Construction of bat house and measures to protect individual bats during demolition	<p>The demolition of Swanbourne Station House will be compensated for via the construction of a purpose-built bat house located within ECS B14. Bat roosting features will be replaced on a like-for-like basis in terms of functionality for each roosting species, although the exact dimensions may differ due to constraints within the design. The bat house will offer roosting habitat for both crevice-dwelling and loft-dwelling species of bat, as well as provision for both maternity and hibernation roosts.</p> <p>Demolition will follow a method to be agreed in the mitigation licence to minimise risks to individual bats.</p>	ECS B14	Project design Application of the CoCP, in accordance with the relevant protected species licences.
2B	Roosting bats	Construction	Damage /	Retention of	Damage/modification of a common pipistrelle (1)	To be	Project design

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
	– known roosts		modification (repairs) of OXD 6 (bridge) where roost is present	feature / alternative roosting provision.	hibernation roost. As the feature is a hibernation roost, it will be retained within the existing structure. If this is not feasible, alternative roosting provision will be located in suitable habitat as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.	confirmed	Application of the CoCP, in accordance with the relevant protected species licences
2B	Roosting bats – known roosts	Construction	Damage / modification (repairs) of OXD 21 (bridge) where roost is present	Alternative roosting provision.	Damage/modification of a common pipistrelle (5) day roost. Alternative roosting provision will be provided in the form of bat boxes located in suitable habitat as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.	To be confirmed	Project design Application of the CoCP, in accordance with the relevant protected species licences
2B	Roosting bats – known roosts	Construction	Damage / modification (repairs) of OXD 22 (bridge) where roost is present	Alternative roosting provision.	Damage/modification of a common pipistrelle (2) day roost. Alternative roosting provision will be provided in the form of bat boxes located in suitable habitat as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.	To be confirmed	Project design Application of the CoCP, in accordance with the relevant protected species licences
2B	Roosting bats – known roosts	Construction	Potential loss of roost 110.5_BT_F002 (tree)	Retention / reinstatement	Potential loss of a roost of unknown species and status (droppings only). Impacts will be avoided through retention of the roost and implementation of an appropriate buffer, depending on the nature of the works. If retention is not possible, works will be carried out under licence	As close to original roost as possible, within suitable habitat.	Project design Application of the CoCP, in accordance with the relevant protected species licences

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					to remove the roosting feature and relocated it to a suitable retained tree as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.		licences
2B	Roosting bats – known roosts	Construction	Potential loss of roost 163.1_BT_012/12a (tree)	Retention / reinstatement	Loss of a noctule day roost. Impacts will be avoided through retention of the roost and implementation of an appropriate buffer, depending on the nature of the works. If retention is not possible, works will be carried out under licence to remove the roosting feature and relocated it to a suitable retained tree as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.	As close to original roost as possible, within suitable habitat.	Project design Application of the CoCP, in accordance with the relevant protected species licences
2B	Roosting bats – known roosts	Construction	Potential loss of roost 520.1_BT_F056 (tree)	Retention / reinstatement	Potential loss of a roost of unknown species and status (droppings only). Impacts will be avoided through retention of the roost and implementation of an appropriate buffer, depending on the nature of the works. If retention is not possible, works will be carried out under licence to remove the roosting feature and relocated it to a suitable retained tree as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.	As close to original roost as possible, within suitable habitat.	Project design Application of the CoCP, in accordance with the relevant protected species licences
2B	Roosting bats – known roosts	Construction	Potential loss of roost	Retention / reinstatement	Potential loss of a barbastele day roost. Impacts will be avoided through retention of the roost	As close to original roost	Project design Application of the

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
	roosts		596.1_BT1_F0 01 (tree)		and implementation of an appropriate buffer, depending on the nature of the works. If retention is not possible, works will be carried out under licence to remove the roosting feature and relocated it to a suitable retained tree as close to the roost lost as possible. Due to risks of collision mortality associated with the operational rail, roosts will be placed >100 m from the Route Section 2B railway line only if no safe alternative commuting and foraging opportunities are present in the wider landscape.	as possible, within suitable habitat.	CoCP, in accordance with the relevant protected species licences
2B	Roosting bats – unknown roosts	Construction	Damage or destruction of roosts	N/A	<p>An additional thirteen bridges with bat roosting potential are located within Route Section 2B:</p> <ul style="list-style-type: none"> <li>• OXD 4 – Moderate potential – Repairs</li> <li>• OXD 5 – Low potential – Repairs</li> <li>• OXD 8 – Low potential – Demolition</li> <li>• OXD 11 – High potential – Repairs</li> <li>• OXD 13 – High potential – Repairs</li> <li>• OXD 15 – High potential – Repairs</li> <li>• OXD 16 – Moderate potential – Repairs</li> <li>• OXD 17 – Low potential – Repairs</li> <li>• OXD 18 – Low potential – Repairs</li> <li>• OXD 20 – Low potential – Repairs</li> <li>• OXD 23 – High potential – Repairs</li> <li>• OXD 24 – High potential – Repairs</li> <li>• OXD 25 – Moderate potential – Partial Demolition</li> </ul> <p>The above bridges have been fully surveyed and it is intended that works to these bridges will be carried out under a Precautionary Method of Working. This will depend on the time that elapses before works, and the licenced ecologist will determine whether update surveys are required. No additional buildings are located within the Scheme Boundary.</p>	As required	Application of CoCP

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
2B	Roosting bats – known roosts	Construction	Disturbance ( $\leq 100$ m from Scheme Boundary)	Methods of working	<p>Mature and semi-mature trees are located within the Scheme Boundary and may be lost to facilitate works. See "Project-wide: Roosting bats – trees: Damage or destruction of roosts" for more information.</p> <p>Twenty-four bat roosts are located between &gt;0m and 100m of the Scheme Boundary;</p> <ul style="list-style-type: none"> <li>77.68_BS_F001 (building, 23m S): common pipistrelle day roost.</li> <li>141.3_BS_01 (Horwood House, 100m N): common pipistrelle, soprano pipistrelle, brown long-eared bat, Brandt's bat and Natterer's bat maternity roost.</li> <li>525.1_BS_F001 (building, 18m NNW): unknown sp. bat roost;</li> <li>526.1_BS_F001 (building, 10m NNW): brown long-eared bat night roost.</li> <li>527.1_BS_F001 (Station Cottage, 21m NNW): brown long-eared bat maternity roost.</li> <li>530.1_BS_F001 (White House, 48m N): brown long-eared bat maternity roost.</li> <li>534_BS_F001 (building, 20m N): common pipistrelle day roost.</li> <li>571.2_BS_F001 (building, 48m NW): common pipistrelle and brown long-eared bat maternity roost.</li> <li>595.1_BS_F001 (42m SE): Natterer's bat unknown roost.</li> <li>83.2_BT_F001 (tree, 41m NE): Natterer's bat maternity roost.</li> <li>83.2_BT_F002 (tree, 60m NE): Daubenton's bat maternity roost.</li> <li>89.3_BT_F030 (tree, 6m NNW): soprano pipistrelle day roost.</li> <li>110.6_BT_F032 (tree, 25m NW): unknown</li> </ul>	As required	Application of the CoCP, in accordance with the relevant protected species licences

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					<p>roost of unknown sp.</p> <ul style="list-style-type: none"> <li>138.1_BT_F001 (tree, 57m E): Daubenton's bat maternity roost.</li> <li>141.3_BT_F013 (tree, 47m NNW): Myotis sp. unknown roost.</li> <li>141.3_BT_F149 (tree 6m NNW): Daubenton's bat maternity roost.</li> <li>141.3_BT_F168 (tree, 53m NNW): unknown roost of unknown sp.</li> <li>151.1_BT_F002a (tree, 18m N): common pipistrelle day roost.</li> <li>154.1_BT_F001 (tree, 13m NW): unknown roost of unknown sp.</li> <li>520.1_BT_F059 (tree, 20m S): brown long-eared bat maternity roost.</li> <li>520.1_BT_F061 (tree, 23m S): brown long-eared bat day roost.</li> <li>520.1_BT_F063 (tree, 72m S): brown long-eared bat day roost.</li> <li>520.1_BT_F064 (tree, 71m S): brown long-eared bat day roost.</li> <li>520.1_BT_F065 (tree, 79m S): barbastelle day roost.</li> </ul> <p>Disturbance to roosting bats will be minimised where practicable through timing of works on a case by case to when bats are unlikely to be present in roosts, or when they are least susceptible to such impacts (i.e. outside of the breeding and hibernation periods).</p> <p>Any lighting will be low-level and directional to avoid illumination of retained habitats. Where lighting is required in proximity to known commuting corridors and foraging areas, baffles will be installed to reduce light spillage.</p> <p>Where disturbance of a bat roost is unavoidable,</p>		

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					works will be carried out under a bat mitigation licence from Natural England, which will include providing alternative roosting locations as detailed above, if required.		
2B	Roosting bats – unknown roosts	Construction	Disturbance (≤100 m from Scheme Boundary)	N/A	If further survey work finds additional roosts, these will be protected following the information provided in See "Project Wide: Roosting bats – all known / unknown roosts: Disturbance" above.	As required.	Species/location specific measures will be implemented through application of the CoCP.
2C	Roosting bats – known roosts	Construction	Damage / destruction of BFO 152A (Bletchley Flyover) where a roost is present	Reinstatement or alternative roosting provision (4 x bat boxes suitable for crevice-dwelling species)	Impacts to day roosts of common pipistrelle bats (peak counts: 2). Works will be carried out under licence and timed to avoid the time of year when bats may be utilising the structure, with retention of the existing roosts. Where this is not possible, bats will be excluded under licence and bat boxes (e.g. 2 x Schwegler 2F and 2 x Schwegler 2F-DFP) installed on nearby retained mature trees.	As close to original roost as possible, within suitable habitat.	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences
2C	Roosting bats – unknown roosts	Construction	Damage or destruction of roosts	Pre-construction survey; method of working	No works are proposed for the three additional bridges or any of the buildings within Route Section 2C. If future works will impact on these structures, further survey work will be undertaken in accordance with BCT guidelines. Where bat roosts are confirmed, mitigation will be implemented in accordance with "Project-wide: Roosting bats – structures". Mature and semi-mature trees are located within the Scheme Boundary and may be lost to facilitate works. See "Project-wide: Roosting bats – trees: Damage or destruction of roosts" for more information.	As required	Species/location specific measures will be implemented through application of the CoCP.
2C	Roosting bats – known roosts	Construction	Disturbance (≤100 m from Scheme Boundary)	Method of working	No bat roosts have been confirmed between >0m and 100m of the Scheme Boundary. If additional bat roosts are confirmed, the mitigation detailed within "Project Wide: Roosting bats – all	As required	Species/location specific measures will be implemented through application of



Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
2C	Roosting bats – unknown roosts	Construction	Disturbance (≤100 m from Scheme Boundary)	Method of working	known / unknown roosts: “Disturbance” will be implemented. If further survey work finds additional roosts, these will be protected following the information provided in “Project Wide: Roosting bats – all known / unknown roosts: Disturbance” above.	As required	the CoCP. Species/location specific measures will be implemented through application of the CoCP.
2D	Roosting bats – known roosts	Construction	Damage or destruction of roosts	N/A	No known roosts are to be lost. Therefore, no mitigation is proposed.	N/A	Species/location specific measures will be implemented through application of the CoCP.
2D	Roosting bats – unknown roosts	Construction	Damage or destruction of roosts	Construction of bat house, bat boxes / features.	No works are proposed to the bridges within Route Section 2D. If future works will impact on these structures, further survey work will be undertaken in accordance with BCT guidelines (Collins, 2016). Two buildings are located within the Scheme Boundary that will be demolished. <ul style="list-style-type: none"> <li>458.1_BS_F001 (Chuffa Cottage) – Moderate potential – Demolition</li> <li>449.1_BS_F001 (Southview) – Low potential – Demolition</li> </ul> Further survey will be undertaken in accordance with BCT guidelines. Where bat roosts are confirmed, mitigation will be implemented in accordance with “Project-wide: Roosting bats – structures” above. On a precautionary basis, it is assumed that 458.1_BS_F001 (Chuffa Cottage) contains a maternity roost of common/rarer species of bats. On this basis, the demolition of Chuffa Cottage will be compensated for on a like-for-like basis via the construction of a purpose-built bat house located within ECS D3. The bat house will offer roosting habitat for both crevice-dwelling and loft-dwelling species of bat, as well as provision for both day and	ECS D3	Project design Application of the CoCP, in accordance with the relevant protected species licences

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
2D	Roosting bats – known roosts	Construction	Disturbance ( $\leq 100$ m from Scheme Boundary)	Methods of working	<p>maternity roosts.</p> <p>On a precautionary basis, it is assumed that 449.1_BS_F001 (Southview) contains a day roost of common/rarer species of bats. On this basis, the demolition of Southview will be compensated for via the inclusion of new bat roosting opportunities, suitable for use by both crevice-dwelling and loft-dwelling species of bat, such as a bat totem (wooden pole with roosting features) or bat box (e.g. Schwegler 2F or 2F-DFP).</p> <p>Mature and semi-mature trees are located within the Scheme Boundary and may be lost to facilitate works. See “Project-wide: Roosting bats – trees: Damage or destruction of roosts” above for more information.</p> <p>A single bat roost has been confirmed between &gt;0m and 100m of the Scheme Boundary;</p> <ul style="list-style-type: none"> <li>195.1_BS_F003 (building, 45m ESE): soprano pipistrelle (1) day roost.</li> </ul> <p>Disturbance to roosting bats will be minimised where practicable through timing of works on a case by case to when bats are unlikely to be present in roosts, or when they are least susceptible to such impacts (i.e. outside of the breeding and hibernation periods).</p> <p>Any lighting will be low-level and directional to avoid illumination of retained habitats. Where lighting is required in proximity to known commuting corridors and foraging areas, baffles will be installed to reduce light spillage.</p> <p>Where disturbance of a bat roost is unavoidable, works will be carried out under a bat mitigation licence from Natural England, which will include providing alternative roosting locations as detailed above, if required.</p>	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
2D	Roosting bats – unknown roosts	Construction	Disturbance ( $\leq 100$ m from Scheme Boundary)	Pre-construction survey; method of working	<p>The following bridges are located within the Scheme Area of Route Section 2D:</p> <ul style="list-style-type: none"> <li>BBM/6A – Bedford Road</li> <li>BBM/6B – M1 Motorway</li> <li>BBM/6C A507 Salford Road</li> <li>BBM/8A Marston Road</li> <li>BBM/9P RC Box Culvert</li> <li>BBM/9N Kempston By-Pass (Bedford CC)</li> <li>BBM/9E Precast Conc FBr</li> </ul> <p>The following bridges are located along the Route Section 2D railway line, but <math>&gt;100</math>m from the Scheme Area .</p> <ul style="list-style-type: none"> <li>DHF/155A Intersection Bridge</li> <li>BBM/4 Grand Union Canal</li> <li>BBM/05 River Ouzel</li> <li>BBM/5A A5 Trunk Road</li> <li>BBM/6 Occupation</li> <li>BBM/8 Checkleys</li> <li>BBM/9M Under London Bedford Line</li> <li>BBM/9M Under London Bedford Line</li> <li>BBM/10A Elstow Bypass</li> <li>BBM/11 Elstow</li> <li>BBM/36 Amphill Road</li> <li>BBM/37 Cauldwell Street</li> <li>BBM/38 River Ouse</li> <li>BBM/38A Crown Quay Footbridge</li> </ul> <p>No works are proposed to these bridges and no survey work has been undertaken due to access restrictions on live rail. On a precautionary basis, they are considered to offer potential for roosts of up to moderate conservation significance (significant roosts of common and rarer species).</p>	As required	Species/location specific measures will be implemented through application of the CoCP.

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					If further survey work finds additional roosts, these will be protected following the information provided in "Project Wide: Roosting bats – all known / unknown roosts: Disturbance" above.		
2E	Roosting bats – known roosts	Construction	Damage or destruction of roosts	N/A	No known roosts are to be lost. Therefore, no mitigation is proposed.	N/A	Species/location specific measures will be implemented through application of the CoCP.
2E	Roosting bats – unknown roosts	Construction	Damage or destruction of roosts	Pre-construction survey; method of working	<p>Three bridges with bat roosting potential are located within 2E that will be damaged or destroyed:</p> <ul style="list-style-type: none"> <li>MCJ2 175 – Low Potential – Repairs</li> <li>MCJ2 179 Fleet Marston – Moderate Potential – Repairs</li> <li>MCJ2 184A – Moderate Potential – Repairs</li> </ul> <p>An additional bridge (MCJ2 177) will undergo repair works but has been classified as having negligible bat roosting potential.</p> <p>Only a single bat survey has been undertaken of the bridges in 2E due to access restrictions on live rail (1 survey of MCJ2 179). Further survey will be undertaken in accordance with BCT guidelines (Collins, 2016). Where bat roosts are confirmed, mitigation will be implemented in accordance with "Project-wide: Roosting bats – structures" above.</p> <p>No buildings are located within the Scheme Boundary.</p> <p>Mature and semi-mature trees are located within the Scheme Boundary and may be lost to facilitate works. See "Project-wide: Roosting bats – trees: Damage or destruction of roosts" for more information.</p>	As required	Project design
2E	Roosting bats – known roosts	Construction	Disturbance (≤100 m from Scheme	N/A	No bat roosts have been confirmed between >0m and 100m of the Scheme Boundary.	N/A	Species/location specific measures will be implemented through application of

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
2E	Roosting bats – unknown roosts	Construction	Disturbance (≤100 m from Scheme Boundary)	Method of working	<p>If additional bat roosts are confirmed, the mitigation detailed within “Project Wide: Roosting bats – all known / unknown roosts: Disturbance” will be implemented.</p> <p>Four additional bridges are located within the Scheme Area:</p> <ul style="list-style-type: none"> <li>• MCJ2 164 – Low potential – No works</li> <li>• MCJ2 165A – Moderate potential – No works</li> <li>• MCJ2 173 – Negligible potential – No works</li> <li>• MCJ2 174 – Negligible potential – No works</li> </ul> <p>On a precautionary basis, MCJ2 164 is considered to offer roosting potential for non-significant roosts of common and rarer species, while MCJ2 165A is considered to offer roosting potential for significant roosts of common and rarer species.</p> <p>See “Project Wide: Roosting bats – all known / unknown roosts: Disturbance” for mitigation information.</p>	As required	Species/location specific measures will be implemented through application of the CoCP.
2A & 2B	Effect on bats – habitat fragmentation and loss of commuting habitat	Construction	Habitat fragmentation and loss of commuting habitat	Retention, enhancement /creation of alternative habitats, new planting and artificial hedgerows.	<p>Connectivity for bats will be retained as per the following hierarchy:</p> <ul style="list-style-type: none"> <li>• Where existing habitats (woodland, scrub and hedgerows) are located directly adjacent to the Scheme Area, these will be retained and protected from damage and disturbance where practicable, using fencing and protection zones.</li> <li>• Where no adjacent habitats are present to retain, alternative flight lines have been identified and included in the Scheme Boundary to allow enhancements to take place. These enhancements will include new planting to close gaps in existing hedgerows and managing them for the benefit of bats.</li> <li>• Where the above is not possible, new planting will occur within the Scheme Boundary where</li> </ul>	2A & 2B	Project design Species/location specific measures will be implemented through application of the CoCP.

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					<p>no construction works are occurring. The new planting will take place prior to vegetation being removed on the opposite side of the railway corridor to ensure there is no period when vegetation is absent from both sides of the corridor. New planting will include standards 150mm to 180 mm tall to provide as mature as vegetation as reasonably practicable given the constraints of availability and difficulties of establishing newly planted mature vegetation. The vegetation will be replanted with a two-staggered row of native hedgerow to include feathers at 5m intervals.</p> <ul style="list-style-type: none"> <li>In active construction areas that prevent early planting, moveable features will be employed on a nightly basis to ensure continuation of flight lines. These features will include a double line of Heras fencing with cut vegetation attached. The Heras fencing will be moved in to place at least 1 hour before dusk each day, and removed no earlier than 30 minutes after dawn. As construction activities are completed, the Heras fencing will be replaced with the permanent hedgerow planting, as shown on the Environmental Design Drawings, Volume 4 of the ES.</li> </ul>		
Project-wide	Foraging and commuting bats	Construction	Habitat fragmentation and loss of foraging habitat	Artificial fencing / moveable hedgerows	<p>Where crossing point surveys undertaken in 2018 highlight locations within the Scheme Area that are important for bats to cross the existing railway, vegetation will be retained where possible. Where vegetation must be removed to facilitate construction works, moveable features will be employed as detailed above to provide north to south (Route Section 2A and 2B) and west to east (Route Section 2E south of Station Road) connectivity during construction.</p>	Project-wide	Project design Species/location specific measures will be implemented through application of the CoCP.

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
Project-wide	Foraging and commuting bats	Construction	Habitat fragmentation and loss of foraging habitat	Project-wide	In areas of key bat foraging and commuting habitat, attempts will be made to retain as much of the existing vegetation as possible. Where vegetation cannot be retained, only one side of the railway will have vegetation removed at any time. Replacement planting will be put in place as soon as the land is available and free from construction constraints. This may include translocation of mature vegetation from one side of the railway to the other where possible, the planting of larger stock in selected areas, and the filling of gaps with temporary fencing.	Project-wide	Project design Species/location specific measures will be implemented through application of the CoCP.
Project-wide	Foraging and commuting bats	Operation	Risk of collision	Hop-overs, additional mitigation measures in discussion.	Proposed mitigation planting is set back from the railway line to discourage bats from foraging along the operational railway line, while alternative foraging corridors have been sought wherever possible. Where bats are at risk of incidental collision mortality, fast growing tall vegetation (trees and tall shrubs) will be planted or translocated, where materials are locally available, adjacent to the railway line to encourage bats to cross at a safe height. Vegetation within these areas will be maintained at a height of at least 5m from the track to allow clearance over passing trains, which are up to 4.5 m high. Any planting within the NR operational railway must be in accordance with NR's planting species guidelines, as reflected in the Environmental Design Statement (Appendix 12.4, Volume 3 of the ES). The aim of the planting will be to direct bats across the railway at a height above that of the trains. Where not reasonably practicable, planting in such areas will be designed to minimise suitability for foraging bats through provision of scrub or hedgerow habitat of negligible value for foraging bats, taking operational and landscape requirements into account. In areas where key foraging and commuting routes are identified, low levels of bat mortality are	As required	Project design Species/location specific measures will be implemented through application of the CoCP.

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					<p>predicted to occur. A suitable mitigation strategy will be developed in liaison with Natural England to ensure that the favourable conservation status of the species affected is maintained.</p> <p>Alternative habitat suitable for foraging and commuting bats will be created elsewhere along the Scheme Boundary to encourage bats away from the railway; for example, scrub and hedgerow planting in ECS. Existing flight lines and commuting corridors parallel to the Scheme Area will also be enhanced with native, two-staggered hedgerow planting.</p>		
HS2 Interface	Foraging and commuting bats	Operation	Risk of collision to bats roosting in Sheephouse Wood	Extension of HS2 bat mitigation structure	Extension of HS2 Sheephouse Wood bat mitigation structure to cover the MCJ line (as part of HS2 design and construction) past Sheephouse Wood SSSI.	Adjacent to Sheephouse Wood	HS2 to design, consent and construct extended structure. In the absence of certainty, Network Rail seeks powers to take temporary possession of HS2 Sheephouse Wood bat mitigation structure to allow for it to be extended over the MCJ line.
<b>Hazel dormouse</b>							
Project-wide	Hazel dormouse	Construction		Precautionary Method of Working	Hazel dormouse is likely absent from the Scheme Area and avoidance and mitigation measures specifically for hazel dormouse are not required. However, due to the length of time of EWR2 construction, it is appropriate to adopt a Precautionary Method of Working for hazel dormouse throughout clearance of suitable habitats. Where necessary, this will include updated surveys prior to clearance. If hazel dormice are found to have colonised any area, appropriate method of working and/or licence application will be made.	Project-wide	Application of CoCP and Precautionary Method of Working
<b>Great crested newt</b>							



Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
Project-wide	Great crested newts	Construction	All effects on great crested newts	Pre-construction survey	Pre-construction surveys will be carried out as required to update existing survey information as required. This will include survey of ponds within the Scheme Boundary where access permission has not previously been granted (total of seven ponds and 14 linear water bodies) and all other water bodies where access is agreed or updated information is required for mitigation purposes.	As required	Application of the CoCP
Project-wide	Great crested newts	Construction	Killing and injury	Licensing and methods of construction	Where great crested newt populations are present, works will be undertaken under the remit of a great crested newt mitigation licence from Natural England. In summary this may include: <ul style="list-style-type: none"> <li>Use of the new European Protected Species (EPS) licensing policies (Natural England have advised that the great crested newt District Licence for the South Midlands is not available to a major infrastructure scheme which isn't consented under local planning policies)</li> <li>Trapping of great crested newts and translocation to ECSs where compensation under the EPS Policies cannot be provided</li> <li>Staged removal of vegetation within the Scheme Area</li> </ul>	As required	Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
Project-wide	Great crested newt terrestrial habitat	Construction	Terrestrial habitat loss	Habitat reinstatement and creation	Terrestrial habitat suitable for great crested newts will be created in ECS across EWR2. Following construction, habitat will be reinstated along the embankments with grassland and scrub.	Project-wide	Project design. Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
2A	Great crested newt water bodies	Construction	Loss of 7 ponds: GCN_010	Pond creation	Ponds supporting great crested newts (or those assumed to support great crested newts) will be replaced at a minimum ratio of 2:1. A total of 19 ponds to be created in ECS A3, ECS	ECS A3, ECS A4, ECS A5, ECS A6, ECS A7	Project design. Species/location specific measures will be implemented

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
			GCN_014 GCN_023 GCN_027 GCN_034 GCN_494 Partial loss of 2 ponds: GCN_003 GCN_033		A4, ECS A5 and ECS A7. Further ponds may be created in other ECS (such as ECS A6).		through application of the CoCP, in accordance with the relevant protected species licences.
2B/2C	Great crested newt water bodies	Construction	Loss of 1 pond: GCN_108 Partial loss of 1 pond: GCN_105	Pond creation	Ponds supporting great crested newts (or those assumed to support great crested newts) will be replaced at a minimum ratio of 2:1. Total of 9 ponds and one linear waterbody to be created in ECS B7, ECS B9, ECS B10 and ECS B13. A total of 7 ponds will also be created in ECS C1, which lies immediately east of Route Section 2B.	ECS B7, ECS B9, ECS B10, ECS B13  ECS C1	Project design. Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
2D	Great crested newt water bodies	Construction	Loss of 2 ponds: GCN_176 GCN_177	Pond creation	Ponds supporting great crested newts (or those assumed to support great crested newts) will be replaced at a minimum ratio of 2:1. Minimum of 4 ponds will be created in ECS. Detailed design of these ECS has not been completed at this stage.	ECS in Route Section 2D	Project design. Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.
2E	Great crested newt water bodies	Construction	Partial loss of 1 pond: GCN_338 Complete loss of 1 linear water body: GCN_361	Pond creation	Ponds supporting great crested newts (or those assumed to support great crested newts) will be replaced at a minimum ratio of 2:1. Minimum of 6 ponds will be created in ECS. Detailed design of these ECS has not been completed at this stage.	ECS in Route Section 2E	Project design. Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
Project-wide	Great crested newt water bodies	Construction	Loss of aquatic habitat	Pond creation	<p>In the event that further surveys find great crested newts are present in water bodies (including linear water bodies) that have not previously been surveyed and those water bodies are further than 500 m from one of the ECSs that will already provide combined aquatic and terrestrial habitat compensation for great crested newts other ECSs will incorporate suitable terrestrial and aquatic habitat to compensate for any impacts to those populations.</p> <p>Where these water bodies are within 500 m of ECSs that already provide aquatic habitat compensation, further ponds will be created if this is necessary. Ponds supporting great crested newts will be replaced at a minimum ratio of 2:1. Linear waterbodies supporting great crested newts that will be subject to partial loss only will be replaced at a 1:1 ratio.</p>	As required in ECS	<p>species licences.</p> <p>Project design. Species/location specific measures will be implemented through application of the CoCP, in accordance with the relevant protected species licences.</p>
<b>Reptiles</b>							
Project-wide	Reptiles	Construction	Killing and injury	Exclusion and capture of reptiles	<p>Where required to avoid killing and injuring reptiles, temporary fencing will be installed around worksites to prevent reptiles from entering the working area and to aid capture and relocation of reptiles (using artificial refugia). Particular effort will be focused in those areas where adders are present due to their conservation significance. Reptiles will be relocated to the nearest ECS to where they were captured from. Further details are provided in Appendix 9.13 v2.</p>		Species/location specific measures will be implemented through application of the CoCP
Project-wide	Reptiles	Construction	Loss of habitat	Habitat reinstatement /creation	Habitat suitable for reptiles will be reinstated along the railway corridor following completion of construction. Advance creation of habitat suitable for reptiles will take place in ECS along the route of EWR2. These will include sheltering, hibernating and basking features.	Project-wide and ECS	Application of CoCP

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
<b>Birds</b>							
Project -wide	Birds	Construction	Damage to nests	Timing / methods of clearance	Where tree felling and vegetation clearance cannot be achieved outside of the nesting bird season, an inspection of vegetation to be cleared for breeding birds and their occupied nests will be undertaken by a suitably qualified ecologist no more than 24 hours prior to any works being undertaken. If any nesting birds are identified during the survey they will be left in situ for their entire nesting period and alternative approaches to the work proposed. This may include leaving an exclusion zone around the nests to avoid disturbance.	As required in line with description	Application of the CoCP
Project -wide	Birds	Construction	Disturbance of Schedule 1 species	Pre-construction survey / construction methods	Pre-construction surveys will be undertaken to identify the potential presence of Schedule 1 birds that may be at risk of disturbance during the nesting season. Appropriate mitigation measures, including the use of location-specific screening to minimise noise and visual disturbance, will be implemented as necessary to ensure that Schedule 1 birds are not disturbed during the nesting season.	As required	Application of the CoCP
2B	Breeding grey heron	Construction	Disturbance	Timing and method of construction / monitoring	Site clearance works along those parts of Route Section 2B that lie in close proximity to the heronry timed to avoid disturbing birds as they recolonise the nesting site and begin egg-laying. Construction works in the vicinity of the heronry will take place in parallel with dedicated monitoring and, where appropriate, using a system of watching briefs carried out by suitably qualified ecologists. The purpose of this measure would be to identify whether any particular construction activities appear to generate sufficient levels of disturbance to nesting birds that they could risk birds deserting the heronry leading to the failure of nests if continued. If this potential risk were identified during the nest monitoring, further steps would be taken to reduce the levels of disturbance where practicable.	Construction area in proximity to heronry at South Lake	Application of the CoCP and Precautionary Method of Working

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
Project-wide	Birds	Construction	Loss of nesting habitat	Nest boxes	To compensate for the loss of nesting habitat in the short to medium term whilst habitats establish in the ECSs and on the embankments of the railway (< 10 years), nest boxes of varying design will be installed within each ECS to provide nesting opportunities for the species that are most reliant on the woodland and scrub that will have been removed from within the Scheme Area.		Project design. Application of the CoCP
Project-wide	Birds	Construction	Habitat loss	Habitat creation / reinstatement	<p>Embedded landscaping and environmental design measures address habitat loss, including the planting of hedgerow, scattered trees and scrub along the new railway boundaries following the completion of earthworks and creation of ECS adjacent to the railway.</p> <p>All of the ECS will provide habitat suitable for breeding and wintering birds including wildflower meadow, rough grassland, hedgerows, scrub, woodland and ponds. Mitigation measures will be included for some of the rarer species of bird including specific seed/grass mixes for declining farmland birds like turtle dove.</p> <p>Each ECS will be subject to a bespoke management plan which will prescribe specific measures to support and increase local populations of notable bird species, e.g. varied grass cutting regimes (to provide an array of ground-nesting and foraging opportunities) and appropriate hedgerow and scrub management regimes</p>	Project-wide and ECS	Project design. Management of the ECSs will be implemented through application of the CoCP.
<b>Barn owl</b>							
Project-wide	Barn owl nest sites	Construction	Disturbance / loss of nests	Closure of nest sites and replacement nesting opportunities	Wherever barn owl nesting sites are identified within 175 m of the Scheme Boundary the nesting sites will be closed (if unoccupied by nesting barn owl) where possible to do so and replacement nest boxes will be erected in suitable locations (typically farm buildings or mature trees) as close as possible to the existing nest site but at least 200 m from the Scheme Boundary. Nest boxes will be left in situ for the	Project wide	Approach for barn owls will be set out in a mitigation strategy. Species/location specific measures will be implemented through application of the CoCP

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					<p>duration of construction and then removed to discourage barn owls nesting near the operational railway. Nest sites will be closed under the supervision of a barn owl licenced ecologist.</p> <p>Closure of nest sites and erection of new boxes may require land outside of the Scheme Boundary and agreement with landowners. If such agreements can't be made, and the nest site is therefore retained, where required protection zones around each of the nest sites will be implemented whilst the nest is active. Protection zones will be established on a case by case basis, but will be informed using published guidance.</p>		<p>Approach for barn owls will be set out in a mitigation strategy. Species/location specific measures will be implemented through application of the CoCP.</p>
Project -wide	Barn owls	Operation	Collision	Landscape planting	<p>Where potential collision blackspots have been identified (as shown on Figure 9.19 (in Part II of the FEI), where reasonably practicable in these locations, vegetation will be planted parallel to the railway line on both sides. The aim of the planting will be to direct barn owls across the railway at a height above that of the trains. Where not reasonably practicable, planting in such areas will be designed to minimise suitability for foraging barn owls through provision of scrub or hedgerow habitat of negligible value for foraging barn owls, taking operational and landscape requirements into account.</p>		<p>Approach for barn owls will be set out in a mitigation strategy. Project design. Application of the CoCP</p>
				Provision of nest boxes	<p>EWR2 will provide permanent compensatory nest sites to increase barn owl density in the wider landscape. These will be in the form of nest boxes located in farm buildings or attached to trees. These nest boxes will be located over 3km from the Scheme Boundary, and HS2, and other major roads and railways to reduce the risk of future collisions. The location of these nest sites will be agreed with landowners sympathetic to barn owls and determined following a review of Occupied Breeding Sites, potential foraging habitats, and the presence of suitable buildings and trees within/on which to</p>		<p>Approach for barn owls will be set out in a mitigation strategy. Project design. Application of the CoCP</p>

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
<b>Terrestrial invertebrates</b>							
Project -wide	Terrestrial invertebrate assemblages	Construction	Habitat loss for invertebrate assemblages (non-notable species)	Habitat retention, re-instatement and creation	<p>To mitigate for general invertebrate assemblages (non-notable species), the following measures will be implemented:</p> <ul style="list-style-type: none"> <li>Retention of standing dead wood considered important habitat within the Scheme Boundary to support saproxylic invertebrates such as aerial-nesting solitary bees and wasps. Where standing dead wood cannot be retained, if practicable it will be removed intact and relocated to the nearest ECS</li> <li>Retention of wood from felled trees, to be stacked in suitable places within the Scheme Boundary as invertebrate refugia / log piles. This will support saproxylic invertebrates such as ground beetles and woodlice. Where this is not reasonably practicable, log piles will be created in the ECS</li> <li>Retention within the Scheme Boundary of areas of bare earth, sand, chalk exposures or scrapes which may be utilised as basking areas for butterfly species and/or nesting areas for burrowing invertebrate species such as solitary bees and wasps. Where this is not reasonably practicable, these habitats will be created within the ECSs and will have a south-facing or east-facing aspect and incorporate a variety of gradients from flat to vertical</li> </ul>	As required	Species/location specific measures will be implemented through application of the CoCP.
Project -wide	Effect on terrestrial invertebrates	Construction	Habitat loss	Habitat	<p>To mitigate for impacts on notable invertebrate species recorded or presumed to be present within the Scheme Area, the following species-specific mitigation measures will be incorporated:</p> <ul style="list-style-type: none"> <li>Retention within the Scheme Boundary of known larval food plants for notable species of invertebrate (flowers, grasses, shrubs or trees).</li> </ul>		Species/location specific measures will be implemented through application of the CoCP

Route Section	Ecological feature	Project stage	Potential impact requiring mitigation	Mitigation type / feature	Mitigation description	Location	Implementation measure
					<p>Where this is not reasonably practicable, larval food plants will be translocated (if appropriate, as in woody species) to ECS areas, or if translocation is not reasonably practicable, replacement planting (using plants/trees of an age appropriate to support the life cycle of the target species) and inclusion of plant species in seed mixes in both the ECS and the newly regraded embankments will be provided</p> <ul style="list-style-type: none"> <li>• Incorporation of large amounts of bird's foot trefoil (<i>Lotus corniculatus</i>) into the seed mixes of the ECSs, to support butterflies including dingy skipper and grizzled skipper, which have been recorded throughout the Scheme Boundary and its adjacent land parcels</li> <li>• Incorporation of large amounts of meadow vetchling (<i>Lathyrus pratensis</i>), common vetch (<i>Vicia sativa</i>) and bitter vetch (<i>Vicia ervilia</i>) into the seed mixes of the ECSs. This will support the endangered wood white butterfly, which has been recorded within the Scheme Boundary</li> <li>• Retention within the Scheme Boundary, of nectar and pollen sources appropriate to the target invertebrate species. Where this is not reasonably practicable, nectar and pollen plant species will be included in seed mixes in both the ECS and the newly regraded embankments</li> <li>• Where practicable, a search for black hairstreak eggs will be carried out by ECoWs during the removal of blackthorn from Route Section 2B, and eggs moved to suitable retained vegetation</li> </ul>		



